

**School of Population Health
Faculty of Health Science**

**“Keep Calm, it's just Vapour”:
A Mixed Methods Investigation of Online E-Cigarette
Discourse and User Perspectives in Western Australia**

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**This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University**

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Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number HRE2017-0144.

The work described in this thesis was undertaken by the author and is original. The study design, ethics approval, data collection and analysis, writing of manuscripts for publication and writing of the thesis were conducted under the supervision of Associate Professor Jonine Jancey, Professor Bruce Maycock, Professor Tama Leaver and Associate Professor Katharina Wolf.

Kahlia McCausland

12 February 2021

Acknowledgement of Country

We acknowledge that Curtin University works across hundreds of traditional lands and custodial groups in Australia, and with First Nations people around the globe. We wish to pay our deepest respects to their ancestors and members of their communities, past, and present, and their emerging leaders. Our passion and commitment to work with all Australians and peoples from across the world, including our First Nations peoples are at the core of the work we do, reflective of our institutions' values and commitment to our role as leaders in the reconciliation space in Australia.

Abstract

Aim

The aim of this research was to understand how electronic cigarettes (e-cigarettes) are promoted, accessed, and used within a tightly regulated environment, by exploring the Australian online e-cigarette discourse, and the perspectives of e-cigarette users residing within the Greater Capital City Statistical Area of Perth, Western Australia. To achieve this aim three substudies were undertaken: a) scoping review, b) Twitter inquiry and c) qualitative inquiry.

Background

E-cigarettes were originally developed as an alternative form of nicotine delivery and potential smoking cessation device. However, in the short period since their inception, they have transformed into high-tech nicotine delivery devices appealing to both non-smokers and youth, an outcome largely stemming from increased investment by the tobacco industry. This investment has contributed to e-cigarettes extending beyond their touted role as a nicotine replacement and tobacco cessation device, to a social, recreational, and sensory delivery device associated with new rituals and social practices. Since the early 1990s, governments in Australia have enacted progressive and comprehensive legislation to reduce the impact of tobacco smoking, and as a result, smoking rates have steadily declined. Conversely, e-cigarette use has increased. In Australia, currently, no national legislation directly applies to e-cigarettes. Instead, several existing laws relating to poisons, therapeutic goods and tobacco control are relied upon. Across all Australian states and territories, it is illegal to sell nicotine-containing e-cigarettes, however, users can legally import nicotine-containing vaporisers through the Personal Importation Scheme. Western Australia (the context of the present study) differs from other Australian states and territories in that those products which resemble tobacco products are banned, effectively prohibiting the sale of e-cigarettes. Advertising of e-cigarettes is also restricted, although exposure to advertising and the promotion of these products does occur in Australia via the internet.

Methods

Scoping review

The scoping review methods were specified in advance in a protocol and adhered to the rigorous scoping review methods manual developed by the Joanna Briggs

Institute. A search strategy was developed by examining MEDLINE for e-cigarette and tobacco internet studies and reviewing the words contained in the title, abstract and index terms of the retrieved articles in consultation with the Curtin University Faculty Librarian. The final search strategy was conducted in five key databases, MEDLINE, Scopus, ProQuest, Informit, Google Scholar, and a manual search of the Journal of Medical Internet Research. Eligible studies were required to be published between 2007 and 2017 and examine and analyse e-cigarette related social media promotions and discussions within the U.S., UK, New Zealand, Canada or Australia. The Endnote and Covidence tools facilitated the screening and review process.

Twitter inquiry

Fifteen e-cigarette related terms were identified in peer-reviewed literature, trending Twitter hashtags, and frequently co-occurring hashtags. These terms were used to collect data (tweets and associated metadata) from 2012, 2014, 2016 and 2018 via TrISMA (Tracking Infrastructure for Social Media Analysis), a contemporary technical and organisational infrastructure for the tracking of public communication by Australian users of social media. A random sample of data were selected and analysed via qualitative content analysis, whereby each tweet was read and assigned codes based upon the concepts presented in the descriptive text, hashtags, and accompanying image. Two content analyses (studies A and B) were undertaken with the data collected, one study analysed only tweets that contained an image, and the other analysed all data whether the tweet contained an image or not.

Qualitative inquiry

Symbolic interaction provided the theoretical framework underpinning the qualitative inquiry. Eligible participants (current or former vapers over 18 years) were purposively recruited from within the Greater Capital Statistical Area of Perth, Western Australia via the internet, word of mouth and snowball sampling. Data were collected through in-depth interviews, and transcripts were thematically analysed. Elements of Strauss and Corbin's interpretive approach to grounded theory (i.e. memoing, open and axial coding, constant comparative method) were used to collect and analyse the data.

Results

Scoping review

The search strategy identified 536 studies. After the removal of duplicate and ineligible studies and screening by title and abstract, 71 full-text articles were

reviewed for eligibility. Twenty-five studies were identified for inclusion. The review found three key messages were being used to promote e-cigarettes: i) as a safer alternative to cigarettes, ii) as an efficacious smoking cessation aid, and iii) for use when and where smoking was prohibited. The most frequently identified marketing strategies were the promotion of innovative flavoured e-liquids and the public performance of vaping (e.g. vape tricks, cloud chasing¹). Discussion and promotion of these devices appeared to be predominantly occurring among the general public (social media users with no apparent e-cigarette/tobacco industry affiliation), retailers and manufacturers. There was a noticeable lack of engagement from the public health and government sector in these social media discussions.

Twitter inquiry

The first Twitter investigation (A) analysed a sample of 1303 tweets and accompanying images. The study found that despite Australia's cautious approach to e-cigarette regulation and the limited evidence supporting e-cigarettes as an efficacious smoking cessation aid, there was a concerted effort by some Twitter users to promote these devices as a health conducive (91/129, 70.5%), smoking cessation product (266/1303, 20.4%). Further, Twitter was being used as a means to circumvent Australian regulations and advocate for a more liberal approach towards personal vaporisers (90/1303, 6.9%). A sizeable proportion of posts were dedicated to selling or promoting vape products (347/1303, 26.6%) and 19.9% (260/1303) were found to be business listings. These posts attempted to expand their business clientele beyond their immediate followers by touting competitions and giveaways, with those wanting to enter having to perform a sequence of steps such as liking, tagging, and reposting, ultimately exposing the post to the user's network and to others not necessarily interested in vaping.

The second Twitter investigation (B) analysed a sample of 4432 tweets. The study found that positive sentiment (3754/4432, 84.7%) dominates the discourse surrounding e-cigarettes. Vape retailers and manufacturers (1161/4432, 26.2%), the general public (1079/4432, 24.4%) and e-cigarette advocates (1038/4432, 23.4%) were the most prominent posters of e-cigarette related content. E-cigarette advocates communicate their beliefs with attempts to frame e-cigarettes as safer than tobacco cigarettes, imply that federal government agencies lack sufficient competence or evidence to support the vaping policies they endorse, and denounce

¹ Cloud chasing is the activity of blowing large clouds of vapour using an electronic cigarette.

as propaganda 'gateway' claims of youth progressing from e-cigarettes to tobacco smoking.

Qualitative inquiry

Thirty-seven current (n=33, 89%) and former (n=4, 11%) adult vapers were interviewed. Seventy percent (n=26) of the sample were male, and the mean age of the sample was 32.5 years. Vapers predominantly started using e-cigarettes to quit cigarette smoking and underwent common experiences during their initiation phase. Subsequently, vapers were found to adopt one of two dominant identities, that of the 'cloud chaser' (n=19, 51%) or the 'substitute' (n=18, 49%), which some users moved between during their vaping lifetime. The social and symbolic meaning of e-cigarettes and vaping were diverse. Cloud chasers connected with the vaper subculture in varying degrees and involved concepts of pleasure, community and performance. However, the aesthetic and performance part of the subculture, in particular, had little appeal to substitute vapers who largely viewed their e-cigarette use as a quit-smoking strategy, and enjoyment did not play a substantive role in their e-cigarette use.

Participants reported that e-cigarette retailers were circumventing Western Australia's ban on the retail sale of e-cigarettes by selling the components of 'open system' devices that do not resemble a tobacco product when sold individually. Further, vapers were circumventing Western Australia's restrictions to obtain e-cigarette products through importation, and local retail stores and home vendors. Some vapers (who were not retailers) were unsure of the legality of importing, accessing and using nicotine and e-cigarettes. The majority of those interviewed, however, continued to use nicotine-containing vaporisers and implemented strategies to avoid detection by law enforcement and safeguard their health. The internet facilitated access to desired products, information on health and safety, and community discussions of personal experiences.

Conclusion

This research comprised three components: a) scoping review, b) Twitter inquiry and c) qualitative inquiry, providing data on the current literature, e-cigarette related discourse on Twitter, and perspectives of e-cigarette users.

The Twitter landscape is dominated by pro-vaping messages disseminated by the vaping industry and e-cigarette proponents, with limited discourse stemming from the public health and government sector. This limited discourse by public health advocates may reflect the sector's cautious approach due to the inconclusive health

evidence and conflicting opinions on e-cigarettes role and safety, or perhaps the agitating nature of the pro-vaper discourse.

Australia is a signatory to the World Health Organization Framework Convention on Tobacco Control (WHO FCTC), a framework designed to protect public health policies from commercial and other vested interests, and applies to the tobacco industry irrespective of the type of products they are selling. However, the borderless nature of social media presents a challenge for the public health sector to counter the online discourse, advertising and promotion of these products, one that will require cross-border co-operation with other WHO FCTC parties.

The interviewed vapers were not a homogeneous group and differed in their motivations for use, association with the vaper subculture and relationship with the vape community. Understanding the complexities of vaping, and the nuanced differences of 'cloud chasers' and 'substitute' vapers may have important implications for health communication, research and policy.

The Australian Therapeutic Goods Administration has recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with other approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vaporiser products from a registered medical practitioner if they want to use them. The results of this study suggest further consideration of regulatory measures are however required to support the different characteristics of vapers and to mitigate the health and safety concerns experienced by e-cigarette users.

Acknowledgements

First and foremost, I would like to thank my Primary Supervisor Associate Professor Jonine Jancey, Co-Supervisor Professor Bruce Maycock, and Associate Supervisors Professor Tama Leaver and Associate Professor Katharina Wolf.

Jonine, where do I start? You have been a mentor to me since I started working at the WA Centre for Health Promotion Research as a Research Assistant fresh out of my undergraduate degree in 2013. Initially, I thought you were scary as hell, but that was until I got to know you, how to navigate your straight shooter personality and the quirky way you operate. Since then, our relationship has grown, both professionally and personally, and I can always count on you for a good laugh and to keep it real. I have learned so much from you over the years and I hope I can continue to do so. Your generosity is second to none, and you have continually offered me opportunity after opportunity, always telling me I can, when I did not think I could. It is for all these things; I wholeheartedly thank you.

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I sincerely hope I might be able to continue my public health research career alongside those listed here. It has been an amazing journey; I have met many wonderful people and created some long-lasting friendships.

I dedicate this work to all of you and hope that it can be used for something good.

Funding and Infrastructure

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Thank you to Curtin University for honouring me with a Research Training Program Scholarship and Research Top-up Scholarship (2017-2019). The scholarships are provided by the Commonwealth of Australia to support the general living costs for students undertaking Research Doctorate studies. Curtin University also awarded the project with a Health Sciences Summer Scholarship (2019) to support the general living costs of an undergraduate student to obtain research assistant work experience and contribute to the development of an academic research paper. Lastly, I thank Curtin University for the Publication and Completion Grant Scholarship (2020) I was awarded, which provided me with funds to contribute to the publication of my final paper in an open-access journal. These Scholarships have provided me with an opportunity to focus on completing my doctoral research, to publish in highly regarded open-access journals and contribute to the national and international debate in a climate which is currently not permitting face-to-face knowledge translation and evidence dissemination activities.

This research was supported by infrastructure provided by the Collaboration for Evidence, Research and Impact (CERIPH), School of Population Health, Curtin University and an Australian Research Council Linkage Infrastructure, Equipment and Facilities scheme.

List of Peer-Reviewed Publications as Part of this Thesis

The following publications are the main component of this thesis. Copies of the publications are provided in the results – section 4.

1. **McCausland, K.**, Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633> [Impact Factor 2.496]
2. **McCausland, K.**, Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/> [Impact Factor 5.048]
3. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Freeman, B., Thomson, K., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. *JMIR Public Health and Surveillance*, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/> [Impact Factor to be released in the Journal Citation Reports June 2021, reported to be >3.5]
4. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. *JMIR Public Health and Surveillance*, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/> [Impact Factor to be released in the Journal Citation Reports June 2021, reported to be >3.5]
5. **McCausland, K.**, Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. *BMC Public Health*, 20:1552. <https://doi.org/10.1186/s12889-020-09651-z> [Impact Factor 2.695]
6. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). “Is it banned? Is it illegal?”: Navigating Western Australia’s regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94:103177. <https://doi.org/10.1016/j.drugpo.2021.103177> [Impact Factor 4.444]

I warrant that I have obtained, where necessary, permission from the copyright owners to use any of my published work (e.g. journal articles) in which the copyright is held by another party (e.g. a publisher). Copyright permissions are detailed in Appendix A.

Statement of Contributions

This research was conducted through the Collaboration for Evidence, Research and Impact in Public Health (CERIPH) within the School of Population Health at Curtin University, and funded by the Western Australian Health Promotion Foundation, Healthway. The PhD Scholar was the manager of the project and active in conceptualising the study design; developing and implementing the research; and the collection, analysis, and interpretation of data. The PhD Scholar was responsible for writing all publications presented as part of the thesis, with input from co-authors as follows.

Associate Professor Jonine Jancey, School of Population Health, Curtin University: contributed as Primary Supervisor and provided close and ongoing support and involvement throughout the study. She contributed to the conceptualisation of the study designs and data collection methods, provided feedback on research findings and structure of publications, and read drafts and provided suggestions for improvement for all six publications.

Professor Bruce Maycock, School of Population Health, Curtin University (years 1–3) and College of Medicine and Health, University of Exeter (year 4): contributed as Co-Supervisor and provided close and ongoing support and involvement throughout the study. He contributed to the conceptualisation of the study designs and data collection methods, provided feedback on research findings and structure of publications, and read drafts and provided suggestions for improvement for all six publications.

Professor Tama Leaver, School of Media, Creative Arts and Social Inquiry, Curtin University: contributed as an Associate Supervisor and was involved throughout the study. He contributed to the conceptualisation of the social media inquiry study designs and data collection methods, provided feedback on research findings and structure of publications, and read drafts and provided suggestions for improvement for publications 2–6.

Associate Professor Katharina Wolf, School of Marketing, Curtin University: contributed as a collaborator (year 2–3) and as an Associate Supervisor (year 4). She contributed to the conceptualisation of the study designs and data collection methods, provided feedback on research findings and structure of publications, and read drafts and provided suggestions for improvement for publications 3–6.

Associate Professor Becky Freeman, School of Public Health, The University of Sydney: contributed as a collaborator and provided feedback on research findings and structure of publications and read drafts and provided suggestions for improvement for publications 3–6.

Katie Thomson, Undergraduate Double Degree Health Promotion/Nutrition student, Curtin University: contributed to substudy 2A by co-developing the coding frame and coding of data. She read and approved the final manuscript for publication 3.

The contribution of each co-author as stated in each of the published papers are included in Appendix B. Signed statements, where possible, of the contribution of each of the co-authors are included in Appendix C.

I would also like to acknowledge the contribution of the following people:

Dr Alkim Ozaygen, School of Media, Creative Arts and Social Inquiry, Curtin University: provided guidance for data collection for substudy 2: Twitter inquiry.

Dr Kevin Chai, Curtin Institute for Computation, Curtin University: assisted with the collection of data for substudy 2: Twitter inquiry.

Associate Professor Yun Zhao, School of Public Health, Curtin University: provided guidance for the statistical analyses of substudy 2: Twitter inquiry.

Dr Ross James, The Bamboo Camel: provided professional editing for the thesis following the Australian standards for editing practice. Dr James's doctoral degree was awarded for research related to health promotion and communication.

List of Conference and Seminar Presentations

1. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. A qualitative exploration of Western Australian vapers process of e-cigarette initiation, continuance, and cessation. 13th Asia Pacific Conference on Tobacco or Health, Bangkok, Thailand, 2–4 September 2020 – postponed until 2021 due to COVID-19 [Accepted oral presentation]
2. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. Vape proponent behaviour on Twitter: A content analysis of vaping related tweets. 13th Asia Pacific Conference on Tobacco or Health, Bangkok, Thailand, 2–4 September 2020 – postponed until 2021 due to COVID-19 [Accepted e-poster]
3. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. “Keep calm, it’s just vapour”: A content analysis of vaping related tweets and associated imagery. 13th Asia Pacific Conference on Tobacco or Health, Bangkok, Thailand, 2–4 September 2020 – postponed until 2021 due to COVID-19 [Accepted e-poster]
4. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. Vape proponent behaviour on Twitter: A content analysis of vaping related tweets. Australian Association for Adolescent Health HDR Student Showcase, Perth, Western Australia, 30 November–4 December 2020 [Oral presentation]
5. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. “Keep Calm, it’s just Vapour”: A mixed-methods investigation of online e-cigarette discourse and user perspectives in Western Australia. Public Health Advocacy Institute of Western Australia (PHAIWA) Advocacy Boot Camp Series #1: From tobacco to e-cigarettes, Perth, Western Australia, 14 October 2020 [Oral presentation]
6. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. “Keep calm, it’s just vapour”: A mixed-methods investigation of online e-cigarette discourse and user perspectives in Western Australia. Healthway Project Advisory Group Seminar, Perth, Western Australia, 27 August 2020 [Oral presentation]

7. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. “Keep calm, it's just vapour”: A mixed-methods investigation of online e-cigarette discourse and user perspectives in Western Australia. School of Public Health, Curtin University Milestone 3, Perth, Western Australia, 5 August 2020 [Oral presentation]
8. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. Vape proponent behaviour on Twitter: A content analysis of vaping related tweets. Preventive Health Conference 2020, Perth, Western Australia, 13–15 May 2020 [Oral presentation]
9. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T., Wolf, K., Freeman, B. Vape proponent behaviour on Twitter: A content analysis of vaping related tweets. The Curtin University Mark Liveris Research Student Seminar, Perth, Western Australia, 11 May 2020 [Oral presentation]
10. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T. Vaping: Where are our opportunities for health promotion intervention? 14th Behavioural Research in Cancer Control Conference, Perth, Western Australia, 15–17 May 2019 [Oral presentation]
11. **Jancey, J., McCausland, K.**, Maycock, B., Leaver, T. Vaping: Where are our opportunities for health promotion intervention? International Union for Health Promotion and Education (IUHPE) 23rd World Conference on Health Promotion, Rotorua, Aotearoa New Zealand, 7–11 April 2019 [Oral presentation]
12. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T. The messages presented in electronic cigarette related social media promotions and discussions: A scoping review. The Curtin University Mark Liveris Research Student Seminar, Perth, Western Australia, 27 March 2019 [Oral presentation and networking session facilitator]
13. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T. Vaping: Where are our opportunities for health promotion intervention? The Curtin University Mark Liveris Research Student Seminar, Perth, Western Australia, 28 September 2018 [Oral presentation and poster]

14. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T. Vaping: Where are our opportunities for health promotion intervention? Australian Health Promotion Association Symposium, Canberra, Australia, 23–24 August 2018 [Oral presentation]
15. **McCausland, K.** Jancey, J., Maycock, B., Leaver, T. Using Tracking Infrastructure for Social Media Analysis (TrISMA) to determine what messages Australian Twitter users are posting on the topic of electronic cigarettes. The Curtin University Mark Liveris Research Student Seminar, Perth, Western Australia, 28 September 2017 [Oral presentation]

Related Works

The following works are relevant to the thesis although do not form part of it.

Peer-reviewed publications

1. Jancey, J., Maycock, B., **McCausland, K.**, Howat, P. (2018). E-cigarettes: Implications for health promotion in the Asian Pacific Region. *Asia Pacific Journal of Public Health*, 30(4):321–327. <https://journals.sagepub.com/doi/10.1177/1010539518762855> [Impact Factor 1.255] (Appendix D)
2. Sharma, A., **McCausland, K.**, Jancey, J. (2021). Adolescent’s health perceptions of e-cigarettes: A systematic review. *American Journal of Preventive Medicine*, 60(5):P716-725. <https://doi.org/10.1016/j.amepre.2020.12.013> [Impact Factor 4.420] (Appendix E)

Conference presentations

1. Wolf, K., Cirillo Woodman, D., Maycock, B., **McCausland, K.** Envisaging a ‘smoke-free’ world: An exploratory study of Philip Morris International’s strategic positioning in Australia. 70th Annual International Communication Association Conference, Goldcoast, Queensland, 21–25 May 2020 [Oral presentation]
2. **McCausland, K.**, Cirillo Woodman, D., Wolf, K., Maycock, B. A case study analysis of Philip Morris International’s attempt to influence e-cigarette policy and debate in Australia. Preventive Health Conference 2020, Perth, Western Australia, 13–15 May 2020 [Oral presentation]

Policy submissions

1. Australian Association for Adolescent Health. Select Committee on Tobacco Harm Reduction. 5 November 2020 (Appendix F) ***McCausland, K.** contributed to the submission and her research is cited within the submission
2. Australian Health Promotion Association. Select Committee on Tobacco Harm Reduction. 5 November 2020 (Appendix F) ***McCausland, K.** contributed to the submission and her research is cited within the submission

3. **McCausland, K.**, Jancey, J., Maycock, B., Leaver, T. Wolf, K., Freeman, B. A briefing note to the Honourable Roger Cook MLA. 19 December 2019 (Appendix G)
4. Jancey, J., Maycock, B., **McCausland, K.** Invited to provide verbal evidence at the Select Committee on Personal Choice and Community Safety, Legislative Council Committee Rooms Ground Floor, 18–32 Parliament Place, West Perth. 27 February 2019
5. **McCausland, K.**, Maycock, B., Howat, P., Jancey, J. Submission to the Select Committee on Personal Choice and Community Safety. 5 October 2018 (Appendix H)

Media

Why do West Aussies vape? (2020). Particle. <https://particle.scitech.org.au/people/why-do-west-aussies-vape/> (Appendix I)

Successful grants

1. Jancey, J., Leaver, T., Maycock, B., **McCausland, K.** (2019). Tracking cross border advertising and promotion in 'new media'. Curtin Institute for Computation Operational Research Support Grant, Curtin University, \$10,000.
2. **McCausland, K.**, Jancey, J. (2019). Health Sciences Summer Scholarship. School of Public Health, Curtin University, \$2,000.
3. Jancey, J., Maycock, B., Leaver, T., Wolf, K., **McCausland, K.** (2018–2020). Vaping: The appeal of e-cigarettes and their online promotion. Healthway Exploratory Research Grant, \$74,997.

Student supervision

1. Narisha Miller (2020) Master of Public Health
Supervisors: Jancey, J., **McCausland, K.**
E-cigarettes: Comparing national regulatory approaches
2. Preeti Ghishing (2020) Master of Public Health
Supervisors: Jancey, J., **McCausland, K.**
Smoke-free air for kids in cars – awareness and compliance

3. Danielle Cirillo Woodman (2019) Master of Public Health
Supervisors: Maycock, B., Wolf, K., **McCausland, K.**
A case study analysis of Philip Morris International's influence in e-cigarette policy and debate in Australia
4. Anupriya Sharma (2019) Master of Public Health
Supervisors: Jancey, J., **McCausland, K.**
A systematic review: The health knowledge and beliefs of adolescents in relation to electronic cigarettes
5. Lucy Scott (2019) Master of Public Health
Supervisors: Jancey, J., **McCausland, K.**, Maycock, B.
An investigation of the e-cigarette retail shop environment in Perth, Western Australia
6. Katie Thomson (2019) Summer Scholarship Research Project
Supervisors: **McCausland, K.**, Jancey, J.
A content analysis of e-cigarette related images on Twitter

Table of Contents

Declaration	i
Acknowledgement of Country	ii
Abstract	iii
Aim.....	iii
Background.....	iii
Methods	iii
Results	iv
Conclusion	vi
Acknowledgements.....	viii
Funding and Infrastructure Acknowledgements	x
List of Peer-Reviewed Publications as Part of this Thesis.....	xi
Statement of Contributions	xiii
List of Conference and Seminar Presentations	xv
Related Works	xviii
Peer-reviewed publications	xviii
Conference presentations	xviii
Policy submissions.....	xviii
Media	xix
Successful grants.....	xix
Student supervision.....	xix
Table of Contents	xxi
List of Figures	xxvi
List of Tables	xxvi
List of Abbreviations	xxvii
1. Exegesis	1
1.1 Introduction	1
1.2 Research Aim and Objectives	6
1.3 Study Overview	7
1.4 Significance of the Research.....	8
1.5 Thesis Organisation	11
2. Review of the Literature	13
2.1 Tobacco Smoking Prevalence.....	13
2.1.1 A summary of the history of tobacco smoking in Australia.....	13
2.1.2 Prevalence of smoking – adults	14
2.1.3 International comparisons of adult smoking prevalence	14

2.1.4	Prevalence of smoking – youth	16
2.1.5	International comparisons of youth smoking prevalence	16
2.2	The Tobacco Industry.....	17
2.2.1	The tobacco industry today	17
2.2.2	Uncovering the truth about the tobacco industry	17
2.2.3	Corporate social responsibility and the birth of good corporate citizenship	18
2.2.4	Tobacco advertising and promotion	19
2.2.5	Tobacco control	22
2.3	The Electronic Cigarette.....	27
2.3.1	Birth and evolution of the e-cigarette.....	27
2.3.2	Shifting product focus	29
2.3.3	The e-cigarette market.....	30
2.3.4	E-cigarette advertising and promotion.....	30
2.3.5	The health and safety debate.....	31
2.4	E-cigarette Use Prevalence.....	33
2.4.1	Prevalence of e-cigarette use – adults	33
2.4.2	International comparisons of adult e-cigarette use	33
2.4.3	Prevalence of e-cigarette use – youth.....	34
2.4.4	International comparisons of youth e-cigarette use	34
2.5	Regulating E-cigarettes	35
2.5.1	Regulatory overview	35
2.5.2	Australian and international health agencies’ position on e-cigarettes.....	37
3.	Research Methods.....	38
3.1	Project Advisory Group.....	38
3.1.1	Stakeholder engagement.....	38
3.2	Ethical Considerations.....	40
3.2.1	Ethical approval	40
3.2.2	Data management	40
3.2.3	Data retention	40
3.3	Substudy 1: Scoping Review.....	41
3.3.1	Protocol	41
3.3.2	Study design.....	42
3.3.3	Title, objective, and question.....	42
3.3.4	Inclusion criteria	42
3.3.5	Search strategy and study selection	43
3.3.6	Extraction of results	44
3.4	Substudy 2: Twitter Inquiry	45

3.4.1 Twitter study A	45
3.4.1.1 Data collection.....	46
3.4.1.2 Developing the coding framework	48
3.4.1.3 Inter-rater reliability testing	49
3.4.1.4 Coding and analysis	49
3.4.2 Twitter study B	53
3.4.2.1 Data collection.....	53
3.4.2.2 Developing the coding framework	53
3.4.2.3 Coding and analysis	54
3.4.3 Ethical considerations	57
3.5 Substudy 3: Qualitative Inquiry	59
3.5.1 Research process.....	59
3.5.1.1 Research paradigm and theoretical perspective	59
3.5.2 Methods.....	61
3.5.2.1 Sampling	61
3.5.2.2 Eligibility	61
3.5.2.3 Recruitment.....	62
3.5.2.4 Informed consent.....	62
3.5.3 Data collection	63
3.5.3.1 Semi-structured interview guide	63
3.5.3.2 Field notes.....	64
3.5.4 Data analysis	64
3.5.4.1 Transcription	64
3.5.4.2 Coding and synthesis	65
3.5.4.3 Reflexivity.....	67
3.5.4.4 Rigour	68
3.5.5 Ethical considerations	70
4. Results	71
4.1 Project Advisory Group	71
4.2 Substudy 1: Scoping Review.....	73
4.2.1 Scoping review protocol.....	73
4.2.2 Scoping review	80
4.3 Substudy 2: Twitter Inquiry	97
4.3.1 Twitter study A.....	97
4.3.2 Twitter study B.....	118
4.4 Substudy 3: Qualitative Inquiry.....	132
4.4.1 Qualitative study A.....	132

4.4.2 Qualitative study B	147
5. Discussion	158
5.1 Reflection on Study Objectives	158
5.1.1 Objective 1: Scoping review	158
5.1.2 Objective 2: Twitter study A	164
5.1.3 Objective 3: Twitter study B	167
5.1.4 Objective 4: Qualitative study A	170
5.1.5 Objective 5: Qualitative study B	175
5.2 Research Strengths	178
5.2.1 Scoping review	178
5.2.2 Twitter inquiry	178
5.2.3 Qualitative inquiry	178
5.3 Research Limitations	179
5.3.1 Scoping review	179
5.3.2 Twitter inquiry	179
5.3.3 Qualitative inquiry	180
6. Implications and Recommendations for Public Health Research, Policy, and Practice	181
7. Conclusion	186
Appendices	188
Appendix A: Copyright permissions	188
Appendix B: Co-author contributions	192
Appendix C: Co-author contribution statements	195
Appendix D: Related works – E-cigarettes: Implications for health promotion in the Asia Pacific Region	201
Appendix E: Related works – Adolescent’s health perceptions of e-cigarettes: A systematic review	209
Appendix F: Related works – Submissions to the Select Committee on Tobacco Harm Reduction	220
Appendix G: Related works – A briefing note to the Honourable Roger Cook MLA	231
Appendix H: Related works – Submission to the Select Committee on Personal Choice and Community Safety	232
Appendix I: Related works – Media	236
Appendix J: Project advisory group terms of reference	240
Appendix K: Ethics approval	242
Appendix L: Recruitment flyers	244
Appendix M: Participant information statement	246
Appendix N: Participant consent form	248

Appendix O: Interview guide.....	249
Appendix P: Field notes proforma	253
Appendix Q: Coding framework.....	254
Qualitative study A.....	254
Qualitative study B.....	258
Appendix R: Level one and two theme refinement	260
Qualitative study A.....	260
Qualitative study B.....	262
Appendix S: Participant demographic and behavioural data.....	263
Appendix T: COREQ checklist	266
Bibliography	268

List of Figures

Figure 1. Overview of study components and associated publications.....	7
Figure 2. Prevalence of daily smoking among the population aged 15+ in OECD countries.....	15
Figure 3. Example of tobacco advertising	20
Figure 4. Tobacco company advertising and promotional spending, 1998-2018 (in billions)	21
Figure 5. E-cigarette and vape pen evolution.....	28
Figure 6. Example e-cigarette advertising.....	31
Figure 7. Prevalence of current nicotine vaping product use by smoking status (weighted %).....	34

List of Tables

Table 1. Altmetric data for peer-reviewed publications.....	10
Table 2. Tobacco legislation and policy timeline	23
Table 3. Twitter study A coding framework	50
Table 4. Twitter study B coding framework: user category	54
Table 5. Twitter study B coding framework: sentiment	55
Table 6. Twitter study B coding framework: themes.....	55

List of Abbreviations

ACCC	Australian Competition and Consumer Commission
ACOSH	Australian Council on Smoking and Health
ACT	Australian Capital Territory
API	Application Programming Interface
AUD	Australian Dollar
BAT	British American Tobacco
CERIPH	Collaboration for Evidence, Research and Impact in Public Health
COREQ	COnsolidated criteria for REporting Qualitative research
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSV	Comma Separated Values
DIY	Do-It-Yourself
DM	Direct Message
E-cigarette	Electronic cigarette
ENDS	Electronic Nicotine Delivery System
FDA	Food and Drug Administration
GIF	Graphic Interchange Format
IRSAD	Index of Relative Socio-economic Advantage and Disadvantage
mg	Milligram
N/A	Not applicable
NDSHS	Australian National Drug Strategy Household Survey
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PCC	Population, Concept and Context
PG	Propylene glycol
PHAIWA	Public Health Advocacy Institute of WA
PRISMA	Preferred Reporting Items for Systematic Reviews
PRISMA-ScR	PRISMA extension for scoping reviews
RT	Retweet
SA	South Australia
TAB	Totalisator Agency Board
TAFE	Technical and Further Education
TrISMA	Tracking Infrastructure for Social Media Analysis
UK	United Kingdom
URL	Uniform Resource Locator

U.S.	United States
USB	Universal Serial Bus
USD	United States Dollar
VG	Vegetable glycerine
WA	Western Australia
WHO FCTC	World Health Organization Framework Convention on Tobacco Control

1. Exegesis

1.1 Introduction

Since entering the American market in 2007 (Grana, Benowitz, & Glantz, 2013), electronic cigarettes (e-cigarettes) have undergone a rapid evolution, with three broad classifications of vaping devices now recognised i) disposable (cig-a-like), ii) closed reusable (vape pen, pod-based), and iii) open reusable (mod) (Levy, Lindblom, et al., 2019). Cig-a-likes closely resemble a cigarette with a glowing tip that lights up upon inhalation and is disposed of once the e-liquid is consumed. Closed reusable systems use replaceable pre-filled cartridges, which tend to be limited in functionality (i.e. inability to adjust the temperature) and were originally designed to resemble a tobacco cigarette. However, the most recent generation of closed reusable vaping devices, pod-based systems, have diverged from cigarettes and now resemble USB sticks (Levy, Lindblom, et al., 2019). Finally, open reusable systems comprise a refillable liquid reservoir or 'tank', which users fill with their preferred choice of e-liquid.

E-cigarettes were originally developed as an alternative form of nicotine delivery and potential tobacco smoking cessation device (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2016). However, over the short period since their inception, they have transformed into high-tech nicotine delivery devices appealing to both non-smokers and youth (Bach, 2019), an outcome largely stemming from increased investment by the tobacco industry (Tobacco Tactics, 2020). This investment has contributed to their use moving beyond their touted role as a nicotine replacement and tobacco cessation device, to a social, recreational, and sensory delivery device (Pokhrel, Herzog, Muranaka, & Fagan, 2015) associated with new rituals and social practices (Keane, Weier, Fraser, & Gartner, 2017).

The rise in popularity of e-cigarettes, and the diversity of devices, has left many governments grappling with how best to regulate these products. At present, 70 countries have enacted e-cigarette specific policy, with other countries applying a range of product classifications to suit existing policies, including 'tobacco products' (57 countries), 'medicinal products' (24 countries), 'consumer products' (18 countries), and 'nicotine as poisons' (4 countries) (Institute for Global Tobacco Control, 2020). Australia has no national legislation that directly applies to e-cigarettes; instead, several existing laws relating to poisons, therapeutic goods and tobacco control apply. Across all Australian states and territories, it is illegal to sell

nicotine-containing e-cigarettes because liquid nicotine is classified as a 'Schedule 7-Dangerous Poison', however, users can legally import nicotine-containing e-cigarettes through the Personal Importation Scheme which states users must obtain a prescription from a physician (Therapeutic Goods Administration, 2019). People who choose to import nicotine-containing products without a medical prescription are not currently actively prosecuted. E-cigarettes that do not contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims. However, in Western Australia, the context of this study, it is an offence under the Tobacco Products Control Act 2006 (Government of Western Australia, 2019) to sell products that resemble tobacco products, regardless of whether they contain nicotine or not, and therefore the sale of e-cigarettes is prohibited. The sale and use of flavoured e-liquids are permitted provided they do not contain nicotine (Greenhalgh, Grace, & Scollo, 2018).

Recently in Australia, several parliamentary inquiries have been undertaken into e-cigarettes to determine how best to regulate these products and to gauge the potential impact on the Australian population should these products be made available. In 2017, the Standing Committee on Health, Aged Care and Sport inquired into the use and marketing of e-cigarettes and personal vaporisers in Australia (Commonwealth of Australia, 2018). The following year, a Select Committee on Personal Choice and Community Safety was convened to inquire into and report on the economic and social impact of measures introduced in Western Australia to restrict personal choice 'for the individual's own good' with particular reference to risk reduction products such as e-cigarettes, e-liquids and heat-not-burn tobacco products, including any impact on the wellbeing, enjoyment and finances of users and non-users (Legislative Council Western Australia, 2020). Lastly, in 2020, the Senate resolved to establish a Select Committee on Tobacco Harm Reduction which inquired into e-cigarette use, impact on tobacco smoking rates, efficacy as a smoking cessation treatment, legislative and regulatory frameworks, and tobacco industry involvement in the selling and marketing of these products (Commonwealth of Australia, 2020). A number of recommendations were made following each of the inquiries, primarily supporting the role and ability of the Therapeutic Goods Administration² to determine what medications (i.e. nicotine) are safe and effective for Australians and to restrict access to nicotine vaporisers.

² The Therapeutic Goods Administration is the regulatory body for therapeutic goods in Australia and is responsible for conducting assessment and monitoring activities to ensure that therapeutic goods available in Australia are of an acceptable standard and that access to therapeutic advances is provided in a timely manner.

While there have been efforts by the tobacco industry (Philip Morris Limited, 2017, 2018, 2019a, 2019b) and individuals in favour of vaping (Henderson, 2020) to weaken Australia's tobacco control laws and to advocate the legalisation of nicotine vaping and heated tobacco products, the Australian Therapeutic Goods Administration recently announced tighter restrictions which will "align the current domestic restrictions under State and Territory law that prohibit the supply of nicotine-containing e-cigarettes in Australia without a valid medical prescription" (Australian Government, 2020b). As of 1 October 2021, smokers who have been unsuccessful in quitting smoking with cessation methods approved by the Therapeutic Goods Administration and wish to use nicotine in a personal vaporiser will be required to obtain a prescription from a medical practitioner to fill at a pharmacy (either a physical community pharmacy or an Australian online pharmacy) or to legally import nicotine-containing e-cigarettes and/or liquid nicotine from overseas using the Personal Importation Scheme (Australian Government, 2020c). Nicotine-containing vaporiser products imported from overseas will be subject to Australian Border Force interrogation and those orders without a valid prescription may be destroyed by the Therapeutic Goods Administration (Australian Government, 2020c). Further, the new requirements (Australian Government, 2020b) necessitate that all liquid nicotine products include child-resistant closures, and in response to concerns regarding the safety and quality of unapproved nicotine e-cigarettes and the need for prescribing guidance, additional resources and standards will be developed before the changes are implemented on 1 October 2021, including:

- public consultation in early 2021 on product safety and quality;
- provision of educational resources to support health professionals; and
- consumer education activities.

Data from the most recent National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2020c) reports 11% of Australians aged over 14 years have ever used, and 3% currently use e-cigarettes, increasing from 9% and 1%, respectively, since 2016. These increases occurred in both smokers and non-smokers and contrast with Australian tobacco smoking rates, which have continued to decline over the last 30 years because of state and territory governments enacting progressive comprehensive legislation (Australian Council on Smoking and Health, 2020a). In 2019, according to the NDSHS (Australian Institute of Health and Welfare, 2020c), the most frequent reason for using e-cigarettes

reported by people over 14 years was 'out of curiosity' (54%), and 23% of e-cigarette users cited using e-cigarettes because they perceived them to be 'less harmful' than tobacco cigarettes (19% in 2016) and 10% believed vaping to be 'more socially acceptable' than tobacco smoking (6% in 2016).

As nicotine-containing e-cigarettes are banned from retail sale in Australia, the advertising of such products is also not permitted. Further, advertising of all types of e-cigarette products and devices, non-nicotine included, is regulated at the state level, with most states prohibiting any form of advertising or promotion (Government of South Australia, 2019; NSW Government, 2019; Queensland Government, 2019; Tasmanian Government, 2019). Australians are, however, exposed to advertising and promotion of these products on the internet (Amin, Dunn, & Laranjo, 2020a; McCausland, Maycock, Leaver, & Jancey, 2019; McCausland, Maycock, Leaver, Wolf, Freeman, et al., 2020), with 20% of respondents to the latest NDSHS who use e-cigarettes reporting they obtained their e-cigarette products online (Australian retailer 9%, overseas retailer 8%, unknown origin 3%) (Australian Institute of Health and Welfare, 2020c).

Digital media, including social media and social networking platforms, has emerged as a popular forum for e-cigarette users and prospective users to learn about and share their experiences with nicotine and vaping devices, for businesses to promote their products, and for e-cigarette advocates to debate regulatory regimes (McCausland et al., 2019; Zhan, Liu, Li, Leischow, & Zeng, 2017), and are increasingly the preferred source of health information and dissemination (Zhao & Zhang, 2017). However, digital media users may be inadvertently exposed to e-cigarette misinformation, disinformation and unregulated advertising (Allem, Cruz, et al., 2019; Allem & Ferrara, 2018). Australia's current regulatory stance has proven to be effective in limiting e-cigarette uptake (Australian Institute of Health and Welfare, 2020c) compared to other countries with more liberal e-cigarette legislation (i.e. U.S. (Cullen et al., 2019; Truth Initiative, 2019) and the UK (Action on Smoking and Health, 2019; Office for National Statistics, 2019)). However, the promotion of vaporiser products on digital media could influence social norms and behaviours (Hébert et al., 2017), and encourage experimentation with e-cigarettes and/or other tobacco products (Chen-Sankey et al., 2019).

E-cigarettes are referred to by users and researchers by a multitude of terms, including personal vaporisers, ENDS (electronic nicotine delivery system), vapes

and mods. Throughout this thesis, the term e-cigarette denotes all the various available consumer products.

1.2 Research Aim and Objectives

The aim of this research was to understand how e-cigarettes are promoted, accessed, and used within a tightly regulated environment by exploring the Australian online e-cigarette discourse, and the perspectives of e-cigarette users residing within the Greater Capital City Statistical Area of Perth, Western Australia.

To achieve this aim, a mixed-methods investigation (Figure 1) was conducted, and the objectives were:

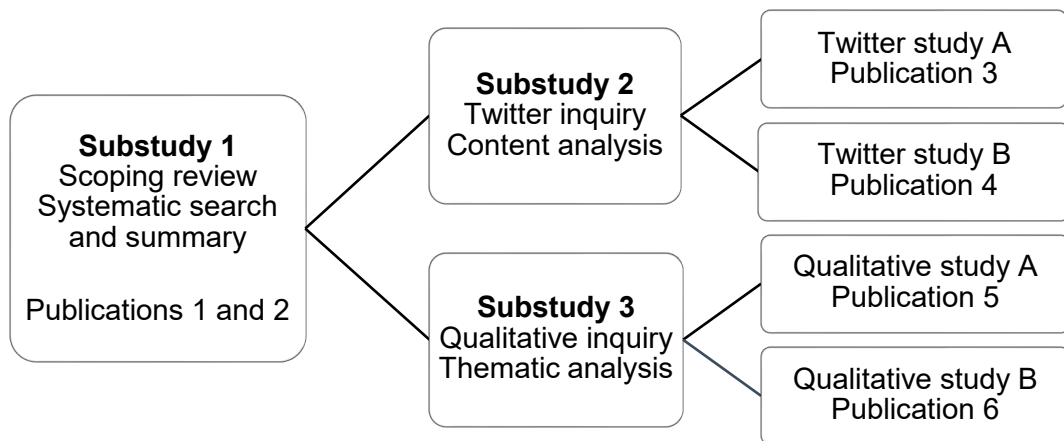
1. To identify and describe the messages presented in e-cigarette related social media promotions and discussions and identify future directions for research, surveillance and regulation (**Publication 1**) (**Publication 2**).
2. To investigate how e-cigarettes are portrayed and promoted on Twitter, and how this portrayal and promotion has emerged and trended over time (2012–2018) within an Australian context (**Publication 3**).
3. To identify key conversation trends and patterns over time (2012–2018), and discern the core voices, message frames and sentiment surrounding e-cigarette discussions on Twitter within an Australian context (**Publication 4**).
4. To examine adult e-cigarette users who reside within the Greater Capital City Statistical Area of Perth, their motivations for e-cigarette use, reinforcing influences, and association with the vapor subculture (**Publication 5**).
5. To examine how adult e-cigarette users residing within the Greater Capital City Statistical Area of Perth, navigate Western Australia's restrictions to access vaping products and the health and safety issues they encounter (**Publication 6**).

1.3 Study Overview

This research comprised three substudies: 1) scoping review (systematic search and summary); 2) Twitter inquiry (content analysis) and 3) qualitative inquiry (thematic analysis). Further, two studies (A and B) were undertaken within substudy 2 and 3. The methods employed in Twitter study A and B differ slightly and are therefore described separately (see sections 3.4.1 and 3.4.2). The methods employed in qualitative study A and B are the same and described in section 3.5.

An overview of the study components and associated publications is provided in Figure 1.

Figure 1. Overview of study components and associated publications



1.4 Significance of the Research

This innovative and timely research was the first to examine Australian e-cigarette promotion on Twitter and investigate e-cigarette use among people residing within Western Australia, providing new insights into this area within the Australian context.

The significance of each substudy, academic outputs and alignment with international tobacco control efforts is reflected upon here:

Scoping review

The scoping review (substudy 1, publications 1 and 2) which identified and described the messages presented in e-cigarette related social media promotions and discussions across the U.S., UK, New Zealand, Canada and Australia, identified no studies from Australia, highlighting the need for Australian based social media investigations.

Twitter inquiry

The Twitter investigations (substudy 2, publications 3 and 4) provide knowledge and understanding of how e-cigarette products and vaping behaviours are discussed and promoted on Twitter in an Australian context, contributing to the research gap identified by the scoping review (substudy 1, publication 2), and demonstrate that although the promotion of e-cigarettes is restricted through traditional mediums, Australians are exposed to local and overseas e-cigarette content on the internet.

Twitter has a 'paid' advertising policy prohibiting the promotion of tobacco products (including e-cigarettes), accessories and branding (Twitter, 2019). The policy, however, does not relate to individual account holders' content, fan pages or groups, and falls short of the standards of the World Health Organization's Framework Convention on Tobacco Control (WHO FCTC) (World Health Organization, 2003). This study highlights the borderless nature of social media that presents a clear challenge for enforcing Article 13 of the WHO FCTC, and the need for further research and action aimed at developing and implementing strategies to counter the advertising and promotion of e-cigarettes in the online milieu.

The Twitter investigations document that a substantial amount of e-cigarette content is being posted to other social media platforms, specifically Instagram and Facebook. These findings have enabled the PhD Scholar and research team to develop several grant applications to extend their investigations into Instagram and, more recently, the rapidly rising platform TikTok.

Qualitative inquiry

The findings from the qualitative investigation (substudy 3, publications 5 and 6) added to the understanding of the varying motives for e-cigarette use and provide new insights into the socialisation process and subsequent identity adoption ('cloud chaser' or 'substitute') of Western Australian vapers. Furthermore, this investigation demonstrates the need for accessible, unambiguous and impartial information about e-cigarettes that will communicate the benefits, risks and current uncertainties to health professionals and the public about e-cigarettes, and the continued support required for nicotine cessation through approved cessation methods.

Findings from this study provide evidence of the health and safety concerns that e-cigarette users in Western Australia face (i.e. importing, storing and handling of liquid nicotine; device handling and safety; buying, selling and trading e-cigarette paraphernalia; product quality and control), due to current e-cigarette regulations, which are not fit for purpose and rely on several existing laws relating to poisons, therapeutic goods and tobacco control. Recommendations stemming from this research are provided to further inform the regulation of e-cigarette products to mitigate said health and safety concerns. Further, this research provides evidence for the need for enhanced surveillance and reporting of e-cigarette use within Australia to contribute to a deeper understanding of the characteristics of e-cigarette users and their reasons for using these devices and to assist policymakers to determine where public health efforts should be focused.

Academic outputs

Findings were disseminated to policy, practice and research stakeholders via research and evaluation networks, six peer-reviewed publications, 15 conference and seminar presentations, four policy submissions (see page xviii) and media coverage (see page xix).

As of 4 January 2021, five published peer-reviewed publications within this thesis carried the following Altmetric data (Table 1). Publication 2: Scoping review, has done particularly well and is ranked within the top 5% of all research outputs scored by Altmetric.

Table 1. Altmetric data for peer-reviewed publications

Publication and date	Altmetric score	Citations	Percent of all research outputs scored by Altmetric	Attention Score³ compared to outputs of the same age	Attention Score compared to outputs of the same age and source
1 (2017)	10	6	Top 25%	High Attention Score (81 st percentile)	Good Attention Score (67 th percentile)
2 (2019)	41	24	Top 5%	High Attention Score (94 th percentile)	High Attention Score (92 nd percentile)
3 (2020)	19	-	Top 25%	High Attention Score (88 th percentile)	-
4 (2020)	7	-	Top 25%	Good Attention Score (73 rd percentile)	-
5 (2020)	20	1	Top 25%	High Attention Score (89 th percentile)	-

The PhD Scholar’s doctoral research and related research outputs have facilitated knowledge and skills of emerging public health and health promotion practitioners and researchers by way of the co-supervision of six students (five postgraduate and one undergraduate). Further, the Scholar has developed and sustained relationships with national and international collaborators who contributed to the development of seven grants (see page xix) to extend the Scholar’s research program.

Alignment with international tobacco control efforts

This research is consistent with Australia’s obligations as a party to the WHO FCTC, which aims to advance international co-operation to protect present and future generations from the preventable and devastating health, social, environmental and economic consequences of tobacco consumption and exposure (World Health Organization, 2008a).

³ The Altmetric Attention Score for a research output provides an indicator of the amount of attention that it has received. The score is derived from an automated algorithm, and represents a weighted count of the amount of attention Altmetric has picked up for a research output.

1.5 Thesis Organisation

This thesis contains the PhD Scholar's six peer-reviewed publications and supporting academic works and activities. These publications inform the three study components: a) scoping review, b) Twitter inquiry and c) qualitative inquiry. The thesis is organised into six chapters. The content of each chapter is described below.

Chapter 1: Exegesis

The content of the exegesis (this chapter) orients the reader to the study.

- Background
- Research aim and objectives
- Significance of the research

Chapter 2: Review of the literature

The literature review provides a summary of tobacco smoking, the tobacco industry, and the development, diffusion and regulation of e-cigarettes in Australia and internationally, with comparisons made between Australia and other English speaking high-income countries.

Chapter 3: Research methods

The research methods of the project advisory group and three substudies are presented in this chapter.

- Project advisory group
- Scoping review (substudy 1, publications 1 and 2)
- Twitter inquiry (substudy 2, publications 3 and 4)
- Qualitative inquiry (substudy 3, publications 5 and 6)

Chapter 4: Results

The results of the project advisory group and three substudies are presented in this chapter.

- Project advisory group
- Scoping review (substudy 1, publications 1 and 2)
- Twitter inquiry (substudy 2, publications 3 and 4)
- Qualitative inquiry (substudy 3, publications 5 and 6)

Chapter 5: Discussion

The content of this chapter reflects upon each of the objectives and the strengths and limitations of each of the three substudies.

Chapter 6: Implications and conclusions

The content of this chapter discusses the implications and recommendations for public health research, policy and practice, and concluding remarks.

2. Review of the Literature

2.1 Tobacco Smoking Prevalence

2.1.1 A summary of the history of tobacco smoking in Australia

Tobacco was first introduced to Australia in the early 1700s by Indonesian fishermen (Brady, 2002) and by 1788 its use was widespread. In the years following colonisation, tobacco smoking was also widely embraced by Indigenous Australians (Walker, 1980). Initially, the supply of tobacco within Australia was unreliable and use among convicts was restricted (Walker, 1980) until consumption started to flourish in the early 1800s which resulted in tobacco being labelled as an essential commodity (Brady & Long, 2003).

Pipe smoking was the most common way of consuming tobacco in nineteenth-century Australia, and to supplement local produce Brazilian and North American tobacco leaf was regularly imported (Walker, 1980). Chewing tobacco, a popular behaviour within the U.S., was never highly adopted within Australia (Walker, 1980). Australians instead opted for the machine and hand-made cigarette. Partially machine and hand-made cigarettes were first established in England in the mid-1800s, with total mechanisation occurring in the 1880s (Walker, 1984). The relatively low cost and convenience of mass-produced cigarettes changed the way Australians used tobacco, with allied armies consumption increasing by 70% compared to pre-war, and attitudes toward women smoking becoming more acceptable (US Department of Health and Human Services, 1980; Walker, 1984).

By the 1920s more women were smoking as a result of years of targeted tobacco advertising aimed at women (Ernster, 1985; US Department of Health and Human Services, 1980). Further, changes in society, namely the increasing participation of women within the paid workforce and commencement of World War II, resulted in additional uptake of smoking among women as a consequence of their increasing social and financial autonomy (US Department of Health and Human Services, 1980; Walker, 1984). Reliable historical Australian smoking prevalence data is scarce, although it was estimated that more than one-quarter of Australian women and three-quarters of adult men were smokers by 1945 (Woodward, 1984).

Cigarette smoking was established as the cause of the lung cancer epidemic in the latter half of the 1900s (Proctor, 2012), however, female smoking rates continued to increase with one-third of women estimated to be smokers by the mid-1970s.

Conversely, male smoking rates peaked after the second world war and started to decline (Gray & Hill, 1975, 1977).

2.1.2 Prevalence of smoking – adults

Smoking rates have been on a long-term downward trend in Australia, with the most recent National Drug Strategy Household Survey (Australian Institute of Health and Welfare, 2020c) reporting that daily smoking rates have more than halved (11%) since 1991 (24%), equating to approximately 2.3 million Australians aged 14 years and older. Males continue to smoke more than females, with 12.2% of males reporting daily smoking in 2019, compared to 9.9% of females. The decline in daily smoking trends has been driven by people not taking up smoking (from 49% in 1991 to 63% in 2019), rather than smokers quitting, with the proportion of ex-smokers remaining stable between 2016 and 2019 (23%).

Aboriginal and Torres Strait Islander people comprise only 3.3% of the Australian population (Australian Bureau of Statistics, 2018b), however, 37% of Aboriginal and Torres Strait Islander peoples (aged 15 years and older) are daily smokers (Australian Bureau of Statistics, 2019b), down from 54.5% in 1994 (van der Sterren, Greenhalgh, Hanley-Jones, Knoche, & Winstanley, 2020). Daily smoking rates are higher among male Aboriginal and Torres Strait Islander peoples (39% vs 36%) and those people living in remote areas (49% vs 35%) (Australian Bureau of Statistics, 2019b). The disproportionate rate of smoking among Aboriginal and Torres Strait Islander populations may be attributed to a number of multifaceted and interrelated factors including socio-economic disadvantage, stress, socialisation and cultural influences (Maddox et al., 2019; van der Sterren, Greenhalgh, Knoche, & Winstanley, 2016).

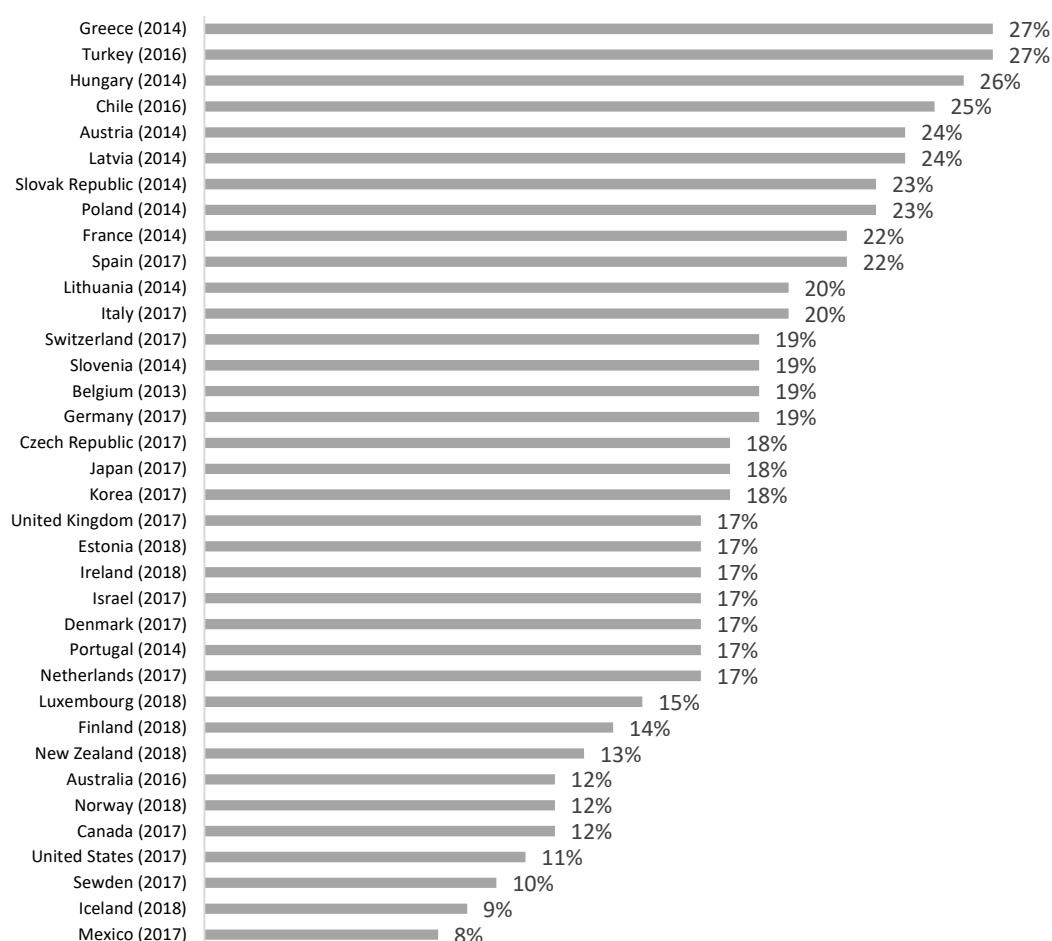
2.1.3 International comparisons of adult smoking prevalence

There were an estimated 1.34 billion smokers worldwide in 2018 (World Health Organization, 2018b). The prevalence of smoking has been generally declining in industrialised countries in northern and western Europe, North America and the western Pacific region, and increasing in some countries in Asia, South America and Africa (Ritchie & Roser, 2019).

Figure 2 presents prevalence data collected by the Organisation for Economic Co-operation and Development (OECD) of its member countries (Organisation for Economic Co-operation and Development and Health Division, 2019) and provides a general global overview of daily smoking prevalence. It is important to note that

data sets between countries are not directly comparable because of differences in sampling (i.e. the year of the survey) and definitions (e.g. daily, regular (daily plus weekly) or current (daily, weekly or less than weekly) smokers), and that overall prevalence may conceal increased smoking levels among particular population sub-groups. Further, studies that only report the smoking of manufactured cigarettes will underestimate tobacco use in countries where tobacco is widely used in other forms, such as in pipes, hand-rolled leaves or chewing tobacco (Greenhalgh, Bayly, & Scollo, 2020). This is a key consideration in countries where alternative methods of tobacco use are prevalent, such as in Sweden (Foulds, Ramstrom, Burke, & Fagerström, 2003) and throughout much of southern and southeast Asia (National Cancer Institute and Centers for Disease Control and Prevention, 2014).

Figure 2. Prevalence of daily smoking among the population aged 15+ in OECD countries⁴



Source: Greenhalgh, Bayly, and Scollo (2020)

⁴ Percentages are rounded and appear to have been adjusted to consider the differing age structures of populations in each country. Prevalence figures for Australia differ from those reported in the National Drug Strategy Household Surveys, which are based on the population age 14 and over (rather than 15)

Canada and New Zealand are two high-income countries with similar gross national income per capita, political environments, legislative frameworks and colonial histories limiting Indigenous people's participation in decision making, to that of Australia (Maddox et al., 2019). Furthermore, each has ratified the World Health Organization Framework Convention on Tobacco Control (World Health Organization, 2003), making those countries natural comparators concerning Indigenous smoking prevalence. The prevalence of commercial tobacco use in the general population of Australia, Canada and New Zealand is 11%, 11.3% and 12.5% respectively (Australian Institute of Health and Welfare, 2020c; Organisation for Economic Co-operation and Development and Health Division, 2019). Conversely, data suggest the prevalence of commercial tobacco use among Aboriginal and Torres Strait Islander peoples in Australia (39%) (Australian Bureau of Statistics, 2016); First Nations (32%), Inuit (39%) and Métis (30%) peoples in Canada (Gionet & Roshanafshar, 2013); and Māori peoples in New Zealand (34%) (Ministry of Health, 2019) is substantially higher than their non-indigenous counterparts.

2.1.4 Prevalence of smoking – youth

It is well established that most adult smokers started smoking in their teenage years, therefore preventing uptake by young people is essential to ending the tobacco epidemic (U.S. Department of Health and Human Services, 2012b). The most recent Australian Secondary Students' Alcohol and Drug Survey (Guerin & White, 2018) showed that the prevalence of smoking among teenagers (12–17 years) was at its lowest since the survey began more than 30 years ago. The lowest proportion of students to have smoked in the past month was among 12-year-olds (2%), and this level rose to 16% among 17-year-olds. A similar pattern was evident among students who had smoked in the past week (i.e. current smokers), from 2% of 12-year-olds to 11% of 17-year-olds. Only around 3% of all students had smoked on three or more days during the past week (committed smokers), with this being highest among 17-year-olds (6%). Committed smoking was similar for both sexes.

2.1.5 International comparisons of youth smoking prevalence

Globally an estimated 24.1 million (approximately 7%) young people aged 13–15 years smoked cigarettes between 2000–2017 (Greenhalgh & Winstanley, 2019). Rates among boys have remained consistent at about 9%–10% for all regions, except in the Eastern Mediterranean Region where it was lower (7%). For girls, the prevalence was substantially higher in the Americas (9.7%) and European regions

(8.6%) than in other regions ($\leq 4\%$) (Greenhalgh & Winstanley, 2019). Countries that have adopted similar tobacco control measures as Australia report the following rates for current smoking among young people: 3.6% of New Zealand youth aged 15–17 years (Ministry of Health, 2019); 3% of Canadian youth aged 12–18 years (Government of Canada, 2019); 5% of Irish youth aged 10–17 years (Költő et al., 2020); 5% of English youth aged 11–15 years (NHS Digital, 2019); and 8% of American youth aged 14–17 years (Gentzke et al., 2019).

2.2 The Tobacco Industry

2.2.1 The tobacco industry today

The global tobacco industry is primarily dominated by five tobacco companies: China National Tobacco Corp (31.5%), British American Tobacco (16.2%), Philip Morris International (15.4%), Imperial Brands (5.8%) and Altria Group (5.7%). Collectively, they control approximately 80 percent of the global tobacco market (IBISWorld Pty Ltd, 2019). Worldwide, there has been a decline in the consumption of tobacco in high-income countries (IBISWorld Pty Ltd, 2019) as awareness of the health effects of tobacco consumption has risen, and increasing regulations and excise taxes have been enforced. In response to decreased uptake, the major tobacco companies have developed innovative smoking and nicotine delivery products including heated tobacco and e-cigarettes to increase revenue and maintain profits (IBISWorld Pty Ltd, 2019). However, the unfavourable environment tobacco companies find themselves in today has led to increasing consolidation and acquisition of smaller companies (IBISWorld Pty Ltd, 2019). In 2020, cigarettes account for the majority of revenue generated by the tobacco industry (USD 677,099.2 million), followed by smokeless tobacco (USD 54,575.5 million), cigars (USD 17,076.9 million) and e-cigarettes (USD 18,657.5 million) (Statista, n.d.).

2.2.2 Uncovering the truth about the tobacco industry

From the outset, the tobacco industry has vigorously disputed any claim that smoking is linked to disease or death:

“There still isn’t a single shred of substantial evidence to link cigarette smoking and lung cancer directly.” R. J. Reynolds, 1954 (Australian Council on Smoking and Health, 2019)

“Despite a never-ending stream of research on the possible health hazards of smoking, there is no proof of a cause and effect relationship between cigarette smoking and various alleged smoking diseases.” Dr L Blackman,

Director of Research and Development, British American Tobacco 1981
(Australian Council on Smoking and Health, 2019)

“So are potatoes. Cancer-causing that is. Tobacco is in the same family. You inhale the fumes of potatoes when you’re cooking them.” R Berryman, Tobacco Institute, Australia, 1989 (Australian Council on Smoking and Health, 2019)

However, during the 1990s millions of pages of internal tobacco industry documentation were made public, mostly as an outcome of litigation against the industry to recover costs for treating tobacco-related diseases (Freeman & Winstanley, 2016). The most well-known example is the 1998 Master Settlement Agreement between 46 U.S. states and several tobacco companies, namely Brown & Williamson, British American Tobacco, Lorillard, Philip Morris, RJ Reynolds, as well as tobacco industry trade groups – Council for Tobacco Research and the Tobacco Institute (Bero, 2003). Analysis of these once-confidential documents substantiated what tobacco control and health advocates had long theorised, that the tobacco industry was well aware of, and had been working hard to cover up, deny, confuse and cast doubt upon the suspected link between smoking and poor health (Bero, 2003). Furthermore, these documents divulged the tobacco industry’s activities, priorities and lobbying strategies, and exposed their marketing practices and specific objective of recruiting youth (Bero, 2003; Francey & Chapman, 2000). Scrutiny of the documents obtained as a result of the Master Settlement Agreement also resulted in an understanding of the tobacco industry’s activities specifically directed at Australia. Chapman, Byrne, and Carter (2003) have published the results of their investigation in the hope that the knowledge of tobacco industry strategies and motivators would assist tobacco control advocacy globally and provide supportive evidence to prospective litigants.

2.2.3 Corporate social responsibility and the birth of good corporate citizenship

As a result of the Master Settlement Agreement and the public humiliation endured upon the release of internal corporate documentation, the tobacco industry could no longer refute that their products were harmful. This, in conjunction with the demand for product regulation, legislation and smoking restrictions compelled the tobacco industry to form and market a new persona, one that publicly acknowledged the harms of tobacco smoking, endorsed ‘sensible’ regulation and supported smoking as an adult’s right to personal choice and freedom (Freeman, Hagan, & Winstanley,

2019). The tobacco industry's very public endeavours at renaissance coincided with the larger movement by transnational corporations toward 'corporate social responsibility', whereby they "account for and redress their adverse impact on society: specifically, on human rights, labour practices, and the environment" (Hirschhorn, 2004, p. 447).

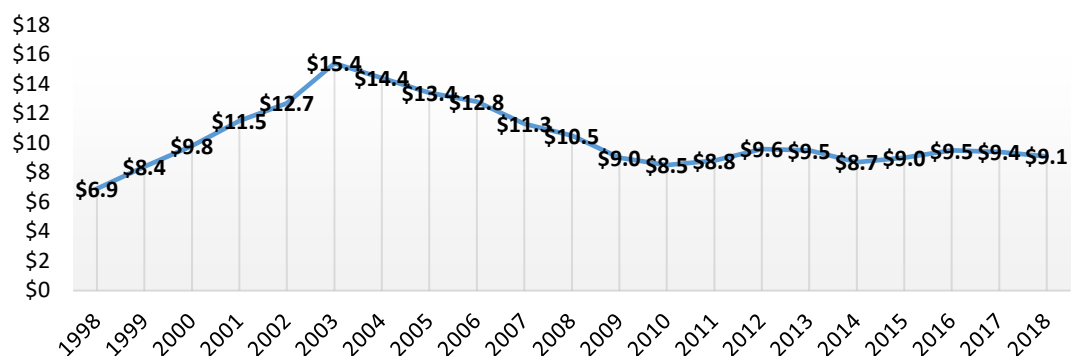
However, the degree to which tobacco corporations are genuine about their transformation to becoming truly socially responsible, versus simply remaking their public image to maintain revenue and investor confidence, is a matter of ongoing debate (Hirschhorn, 2004). For example, Philip Morris International recently re-launched their website to promote their renewed vision of 'delivering a smoke-free future' via their 'reduced-risk products' with the goal of one day replacing cigarettes entirely (Philip Morris International, 2019a). However, Philip Morris continues to pursue legal action against governments that implement tighter regulations on cigarette sales (Freeman et al., 2019), uphold strong opposition to plain packaging laws, and imply that evidence-based tobacco control policies are no longer required. Instead, on their website, they advocate for, "sensible, risk-based regulation of smoke-free products, combined with further restrictions on cigarettes, to help address the harm caused by smoking more effectively – and faster – than plain packaging and other traditional regulatory measures" (Philip Morris International, 2019b).

2.2.4 Tobacco advertising and promotion

Cigarette manufacturers have battled for valuable market share for over two centuries, initially using trade cards, tin tags, and posters as merchandise to promote their product (Pritcher, 2000). However, as advances in technology have arrived, so have new platforms and channels for engagement and marketing, including print, radio, television, sports and events sponsorship, direct-mail advertising and online media, which have enabled the tobacco industry to diversify its product range and target specific demographics, for example, men, women, youth, minority groups (see Figure 3).

advocates have long pointed out that smoking kills two-thirds of its long-term users (Banks et al., 2015) and therefore to stay in business the tobacco industry requires a consistent cohort of new users to take up the habit. The tobacco industry has denied and rebutted these claims (Freeman & Winstanley, 2017), even though there is abundant evidence suggesting marketing pursuits in Australia (Carter, 2003) and internationally (U.S. Department of Health and Human Services, 2012a) have targeted – and continue to focus on the – recruitment of young people to sustain profits.

Figure 4. Tobacco company advertising and promotional spending, 1998-2018 (in billions)



Source: Federal Trade Commission (2019)

The world’s first global public health treaty, the World Health Organization Framework Convention on Tobacco Control (WHO FCTC), was enacted in 2005 and pinpointed tobacco advertising as one of the key factors contributing “to the explosive increase in tobacco use” (World Health Organization, 2003, p. v). Consequently, Article 13 of the WHO FCTC insists signatories to the treaty undertake “a comprehensive ban of all tobacco advertising, promotion and sponsorship” to facilitate the reduction of tobacco consumption (World Health Organization, 2003, p. 11). In 2008 the Conference of the Parties adopted WHO guidelines for the implementation of Article 13 which aim to provide direction to Parties in meeting their obligations under the WHO FCTC (World Health Organization, 2008b).

As the number of traditional channels of marketing available to the tobacco industry has diminished (e.g. television, print media, point of sale), companies have redirected their resources to pursue innovative means to promote their products (e.g. event promotions, marketing to retailers, internet-based marketing, development of corporate websites, mobile phone applications, product placements

in movies and streaming services) (Greenhalgh, Scollo, & Winstanley, 2020b). Only when the remaining promotional channels not protected by marketing bans are eliminated, will the option for substitution also be eradicated.

2.2.5 Tobacco control

Australia is considered a world leader in tobacco control and the tobacco industry's ability to market and sell its products in Australia has been progressively restricted since the 1970s (Grace, 2016). Due to the comprehensiveness of the legislation Australia has imposed, the country was labelled by British American Tobacco Australia officials in 2001 as "one of the darkest markets in the world" (Chapman et al., 2003, p. iii1).

"Australia is one of the darkest markets in the world... it probably is the darkest, I mean ourselves and Canada fight every month for who's got the darkest conditions to do tobacco manufacturing and marketing. And one of the things we can offer the world is what we do best, which is how to work, maximize, proactively drive our market position in a market that's completely dark. Now that takes a different skillset... a different type of learning. We need to export that... we know we have a lot of expatriates who come down to Australia for learning... they can come here and learn these techniques and take them back to Europe or Latin America or to the United States or to Africa... But the other thing that is really good for us is that we are also a huge net exporter of Australian talent... about 30 or 40 people currently off-shore... We do things really differently here than most other BAT [British American Tobacco] organizations." David Crowe, Marketing Director, British American Tobacco Australia

The following timeline (Table 2) demonstrates the progressive and comprehensive tobacco control strategies that Western Australia (and Australia) have implemented, including restrictions on print and broadcast media advertising, sponsorship and point of sale promotions (Grace, 2016, 2018); the development and dissemination of social marketing and public education campaigns (Carroll, Cotter, Purcell, & Bayly, 2019); implementation of smoke-free environments (Grace & Tumini, 2017), graphic health warnings (Grace, 2018), plain packaging (Scollo & Greenhalgh, 2018), and increases in tobacco taxes (Scollo & Bayly, 2020); and the subsequent decline in the prevalence of tobacco smoking.

Table 2. Tobacco legislation and policy timeline

1911	<ul style="list-style-type: none"> Smoking prohibited in theatres in Western Australia.
1916	<ul style="list-style-type: none"> The sale of tobacco products to persons under the age of 18 years prohibited.
1950	<ul style="list-style-type: none"> Publication of research by Doll and Bradford Hill in the United Kingdom and Wynder in the U.S. identified smoking as a cause of lung cancer.
Era 1 (approx. 1962-1973)	
1962	<ul style="list-style-type: none"> The Royal College of Physicians of London publishes its report on Smoking and Health.
1964	<ul style="list-style-type: none"> The U.S. Surgeon General releases the first in a series of landmark reports on the hazards of smoking.
1971	<ul style="list-style-type: none"> Australian Council on Smoking and Health (ACOSH) formed a branch in Western Australia. 39% of Australian adults are regular smokers.
1972	<ul style="list-style-type: none"> The phase-out of cigarette advertising on radio and television began in Australia.
1973	<ul style="list-style-type: none"> The first health warning on cigarette packets was introduced in Australia: 'Smoking is a health hazard'.
Era 2 (1974-1982)	
1974	<ul style="list-style-type: none"> Metropolitan trains, buses and ferries in Perth become smoke-free.
1975	<ul style="list-style-type: none"> The West Australian Government passes legislation requiring persons in the business of selling tobacco to be licensed, enabling the Government to collect revenue from the activity.
1976	<ul style="list-style-type: none"> Advertising of tobacco banned on radio and television in Australia.
1978	<ul style="list-style-type: none"> Enclosed areas of government hospitals become smoke-free. ACOSH Western Australian assumes responsibility for advocacy on smoking and health issues for the nation, but with a focus on Western Australia.
1979	<ul style="list-style-type: none"> U.S. Surgeon General's report noted that in the 15 years since the first report, more than 30,000 scientific papers have provided further irrefutable evidence on the negative health consequences of smoking.
1980	<ul style="list-style-type: none"> 35% of Australian adults are regular smokers.
1981	<ul style="list-style-type: none"> A seminal paper by Japanese epidemiologist Takeshi Hirayama demonstrates the dangers of secondhand smoke.
1982	<ul style="list-style-type: none"> <i>Metropolitan (Perth) Passenger Transport Trust Act 1957-1980</i> prohibits smoking in any vehicle on Transperth premises. Dr Tom Dadour brings a private members bill to prohibit advertisements for smoking and tobacco products; the Bill is narrowly defeated in the Upper House.
Era 3 (1983-2006)	
1983	<ul style="list-style-type: none"> The Western Australian Government substantially increases taxes on allocating \$2 million per year to community education on smoking. The National Heart Foundation starts the first major public education program on smoking-this is the birth of the QUIT campaign, which gains a worldwide reputation as a leader in innovation in advertising and public relations. 35% of Australian adults are regular smokers.
1985	<ul style="list-style-type: none"> Western Australian libraries go smoke-free. National Drug Summit emphasises the impact of smoking on health (Western Australian initiative). Rotating health warning on packs introduced. Persons preparing or displaying food for sale now prohibited from smoking tobacco products while working.
1986	<ul style="list-style-type: none"> Smoking is prohibited on all domestic aircraft. Smoking is phased out in all federal workplaces. Western Australia initiates an agreement by all Health Ministers to introduce strong health warnings. 31% of Australian adults are regular smokers.
1987	<ul style="list-style-type: none"> Stronger health warnings are introduced on cigarette packets under the <i>Tobacco (Warning labels) Regulations 1987</i>: 'Smoking Causes Lung Cancer,' 'Smoking Causes Heart Disease,' 'Smoking Damages Your Lungs,' and 'Smoking Reduces Your Fitness'.
1988	<ul style="list-style-type: none"> Amendment to the <i>Australian Broadcasting and Television Act</i> extends the ban on direct advertising to include all tobacco products. The Australian Public Service converted to a smoke-free workplace.
1989	<ul style="list-style-type: none"> The Western Australian Public Service becomes a smoke-free workplace. 28% of Australian adults are regular smokers. 30% of Western Australian adults are regular smokers.

1990	<ul style="list-style-type: none"> Advertising of cigarettes in magazines and newspapers ceased due to Federal Government legislation under the <i>Smoking and Tobacco Products Advertisements (Prohibition) Act 1989</i>. Smoking on international flights within Australian airspace banned from 1 September. Cinemas, theatres, and concert halls go smoke-free, although smoking still permitted in the foyers and bars. The fine for sales of cigarettes to under 18-year-olds increases to \$5000. Free samples of cigarettes and competitions involving cigarettes banned. All billboard advertising of tobacco products phased out. <i>Tobacco Control Act 1990</i> passed in Western Australia on 1 February. The Western Australia Health Promotion Foundation (Healthway) established to replace tobacco sponsorship of sport and the arts with health messages; Healthway also funds health promotion and research.
1991	<ul style="list-style-type: none"> Enclosed areas of all State Government schools in Western Australia declared smoke-free. TAB agencies⁵ in Western Australia introduce smoke-free policies. All sleeping cars on the Indian Pacific and Trans Australian line smoke-free with smoking areas set aside. Point of Sale Advertising regulations under the <i>Tobacco Control Act 1990</i> further restrict advertising and prohibit tobacco advertising outside of shops or in view of public places. 24% of Western Australian adults are regular smokers.
1992	<ul style="list-style-type: none"> International airline terminals are smoke-free by July. Taxis went smoke-free in January in Perth prohibiting both drivers and passengers from smoking. 27% of Australian adults are regular smokers.
1993	<ul style="list-style-type: none"> Cigarette promotion phased out progressively under the <i>Tobacco Act 1987</i>. The Federal Government announces an increase in excise duty, to be phased in over the next two years, which will result in an 81% increase in cigarette prices. The transdermal nicotine patch became available for sale in Australia.
1994	<ul style="list-style-type: none"> Under the <i>Tobacco Control Act 1990</i>, billboard advertising of tobacco products is banned in Western Australia. The Australian Government bans tobacco sponsorship of sports and arts. The Australian Government increases the minimum age to purchase cigarettes from 16 to 18. 25% of Western Australian adults are regular smokers.
1995	<ul style="list-style-type: none"> New black on white warnings with a description on the back of the pack appears on tobacco packs. Remaining tobacco sponsorships removed, except for events of international significance. 26% of Australian adults are regular smokers.
1996	<ul style="list-style-type: none"> The Smarter than Smoking youth smoking prevention campaign commenced. State and territories agree to use the 131 848 telephone number and the national Quit Line began. Western Australian Government announces the establishment of a Task Force on Passive Smoking in Public Places. Smoking banned on all Australian international flights from July, making Qantas and Ansett smoke-free on all flights.
1997	<ul style="list-style-type: none"> The National Tobacco Campaign launches a series of television commercials, 'Every Cigarette Is Doing You Damage – Lung, Tumour and Artery'. Staff, students, and visitors prohibited from smoking on Education Department premises in Western Australia.
1998	<ul style="list-style-type: none"> 26% of Australian adults are regular smokers.
1999	<ul style="list-style-type: none"> The Commonwealth implements tax by stick rather than by weight, increasing the price of larger packets in particular. In Western Australia, smoking is prohibited in public places where food is served, although exemptions are permitted for specified areas of the hospitality industry.
2000	<ul style="list-style-type: none"> 'Make Smoking History' Campaign (formerly 'Target 15') at the Cancer Council Western Australia established. The goal to reduce the prevalence of smoking among WA adults to 15% or less by 2010.

⁵ The Totalisator Agency Board, universally shortened to TAB or T.A.B., is the name given to monopoly totalisator organizations in Australia and New Zealand. They operate betting shops and online betting. They were originally government owned, but in Australia most have been privatized.

	<ul style="list-style-type: none"> Burswood Casino implements smoke-free gaming areas on the main gaming floor, 50% of video (poker) machines and the Cabaret Lounge. This year marks the 50th anniversary of the first clear and unequivocal evidence of the links between smoking and lung cancer, as proved by Sir Richard Doll and Sir Austin Bradford Hill and documented in the paper Smoking and Carcinoma of the Lung.
2001	<ul style="list-style-type: none"> The Federal Government announces the phase-out of tobacco sponsorship of internationally significant events by 2006. 22% of Australian adults are regular smokers. 23% of Western Australian adults are regular smokers.
2004	<ul style="list-style-type: none"> Australia ratifies the global Framework Convention on Tobacco Control. The Labor Party announces it will no longer accept donations from tobacco companies. The Federal Government decides to implement graphic warnings occupying 30 per cent of the front and 90 per cent of the back of cigarette packets. 20% of Australian adults are regular smokers. 18% of Western Australian adults are regular smokers.
2005	<ul style="list-style-type: none"> The Australian Competition and Consumer Commission (ACCC) reaches an agreement with the tobacco industry to stop the use of misleading product descriptors such as 'light' and 'mild'. The Framework Convention on Tobacco Control enters into force. The Western Australian Government introduces the Tobacco Products Control Bill into Parliament to replace and update the Tobacco Control Act 1990. The Bill contains amendments to the Tobacco Control Act relating to advertising, sponsorships, packaging and labelling, exemptions, sales to minors, licensing, enforcement, administration, interpretations and judicial processes.
2006	<ul style="list-style-type: none"> On 31 July pubs and nightclubs go smoke-free in Western Australia. The Federal Government requires graphic health warnings on all cigarette packets and cartons. <i>Tobacco Products Control Act 2006</i> assented to on 12 April in Western Australia.
Era 4: (2007-present)	
2007	<ul style="list-style-type: none"> Licensing for tobacco retailers in Western Australia comes into force with strict limits on the display of tobacco products at point of sale. The City of Fremantle makes all alfresco dining areas smoke-free. The City of Joondalup makes its 17 kilometres of beaches (from Marmion to Burns Beach) smoke-free. 19% of Australian adults are regular smokers. 17% of Western Australian adults are regular smokers.
2008	<ul style="list-style-type: none"> All Western Australian Department of Health facilities go smoke-free from 1 January 2008. The Perth Royal Show goes smoke-free. State Emergency Ministers and the federal Attorney-General endorse a decision for fire-safe cigarettes. The Minister for Corrective Services makes all enclosed areas (including prisoners' cells) at Greenough Regional Prison smoke-free. Greenough is seen as a pilot for all Department of Corrections facilities becoming smoke-free. Several local governments implement smoke-free policies, including Rockingham, Fremantle, Perth, Joondalup, Vincent, Geraldton/Greenough. The City of Cockburn is the first Western Australian local government to decide on a comprehensive smoke-free policy.
2009	<ul style="list-style-type: none"> The <i>Tobacco Products Control Amendment Bill 2008</i> passes through Western Australian Parliament. Smoking in cars carrying children is prohibited. All tobacco products are to be placed out of sight at point of sale in retail premises. Patrolled beaches are smoke-free. Children's playgrounds are smoke-free. All alfresco dining areas are smoke-free, with an exception for up to 50% of a hotel's alfresco area.
2010	<ul style="list-style-type: none"> The Australian Government commits more than \$100 million to 'Tackling Indigenous Smoking' over four years. The Perth Zoo goes smoke-free. The Australian Government announces a 25% increase in tobacco excise. Fire-safe cigarettes are compulsory in Australia. Significant additional funding is dedicated to tobacco media campaigns.

	<ul style="list-style-type: none"> • 18% of Australian adults are regular smokers. • 18% of Western Australian adults are regular smokers.
2011	<ul style="list-style-type: none"> • Public hearings are held to inquire into the funding of political parties and election campaigns (including donations made by tobacco companies). • The Federal Government proposes new, larger, rotating graphic health warnings on tobacco products.
2012	<ul style="list-style-type: none"> • All tobacco products in Australia are required to be sold in plain packaging as of 1 December. • The Australian Government bans tobacco advertising on the internet. • All universities in Western Australia commit to implementing smoke-free policies; many Technical and Further Education (TAFE) facilities do the same.
2013	<ul style="list-style-type: none"> • Duty-free limits on tobacco substantially drop (from 200 to 50). • The Government announces significant tobacco excise increases over the next three years to follow the 2013 increase. • The new Federal Government commits to the excise increases. • Federal and state election commitments around tobacco control obtained. • The Australian Future Fund, the Governments of ACT (Australian Capital Territory), SA (South Australia) and NSW (New South Wales), and a number of major superannuation funds agree to divest from tobacco funds. • Aboriginal tobacco control workers in Western Australia meet to devise a statewide strategy to address Aboriginal smoking rates and address harm minimisation strategies. • Western Australian State Government's superfund GESB divests from tobacco companies. • City of Perth pedestrian shopping malls go smoke-free. • 15% of Australian adults are regular smokers. • 14% of Western Australian adults are regular smokers.
2014	<ul style="list-style-type: none"> • WA Supreme Court decides that e-cigarettes found to resemble a tobacco product and cannot be sold in Western Australia. The seller of e-cigarettes convicted of this offence. • 12.5% excise increase on 1 September.
2015	<ul style="list-style-type: none"> • The Federal Government announces that the revised Tackling Indigenous Smoking programme will receive a budget of \$116.8 million over 3 years (\$35.3 million in 2015-2016; \$37.5 million in 2016-2017 and \$44 million in 2017-2018). • 12.5% excise increase on 1 September. • Western Australian Corrective Services approves a Smoking Reduction Strategy. • All TAFE campuses in Western Australia become smoke-free.
2016	<ul style="list-style-type: none"> • 12.5% excise increase on 1 September. • Release of the Post Implementation Review of Tobacco Plain Packaging. • The Federal Government announces four 12.5% annual tax increases, pushing the price of cigarettes to \$40 a pack by 2020, duty-free cigarette allowance to be cut from 50 to 25, extra funds to support the defence of plain packaging in trade disputes and \$7.7m to strengthen Border Force to tackle illicit tobacco. • The Supreme Court of Western Australia highlights that products that resemble tobacco products, regardless of whether they contain nicotine or not, cannot be sold in Western Australia and it is an offence under the Tobacco Products Control Act to sell these products. • The Western Australia Minister for Health announces his intention to introduce the <i>Tobacco Products Control Act Bill 2016</i> that includes: prohibiting minors from selling tobacco products, stopping tobacco sales at events such as music festivals and other public events, preventing the inclusion of tobacco purchases in shopping reward schemes, requesting the display of graphic health warnings as part of price boards, prohibiting the sale of fruit and confectionery-flavoured tobacco products, and split pack cigarettes, prohibiting specialist tobacco retailers displaying tobacco products, phased in over two years. • 14% of Australian adults are regular smokers. • 14% of Western Australian adults are regular smokers.
2019	<ul style="list-style-type: none"> • The <i>Tobacco Products Control Act 2006</i> regulations gazetted and effective from 18 March 2019. • Tobacco licences not to be issued for the sale of tobacco products at sporting, cultural or other events, such as music festivals or market stalls. • Updated health warnings to be displayed next to where tobacco information or price signage is publicly displayed, and price boards reduced to no larger than A4. • Specialist tobacco retailers no longer allowed to display tobacco products or smoking implements where they can be seen from a public place outside the premises.

	<ul style="list-style-type: none"> • Smoking not allowed within five metres of a public entrance to an enclosed public place, and within 10 metres of air conditioning intakes. • From 18 September 2020 employees under the age of 18 years will be prohibited from selling tobacco products. • 11% of Australian adults are regular smokers. • 12% of Western Australian adults are regular smokers.
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Source: (Australian Council on Smoking and Health, 2020b; Greenhalgh, Bayly, & M., 2020; Greenhalgh, Bayly, & Scollo, 2020; The Cancer Council Western Australia, 2008)

In response to mounting restrictions placed on tobacco products in Australia (Table 2) and internationally, the tobacco industry has developed the following comprehensive, multifaceted approach to defending its interests:

- developing strategies and arguments aimed at undermining the credibility of the medico-scientific community and public health interests (Freeman, Hagan, Barnsley, & Winstanley, 2018; Freeman & Winstanley, 2018);
- conducting and funding research on tobacco, heated tobacco and e-cigarette use and exposure, as well as on the effectiveness of tobacco control policies (Freeman, Vittiglia, & Winstanley, 2018);
- developing networks of influence throughout the media, business and the political realms (Greenhalgh, Hagan, Freeman, & Winstanley, 2018; Hagan & Barnsley, 2018; Vittiglia & Greenhalgh, 2018);
- actively initiating litigation against governments to obstruct the implementation of evidence-based, effective tobacco control measures (George, Zhou, & Liberman, 2018); and
- mobilising smokers, retailers, hoteliers, trade organisations and others whose interests overlap with those of the tobacco industry (Freeman, Barnsley, & Winstanley, 2018).

2.3 The Electronic Cigarette

2.3.1 Birth and evolution of the e-cigarette

The first concept of an electronic cigarette, more commonly referred to as an e-cigarette, personal vaporiser or vape, was patented in 1965 in the U.S. (Gilbert, 1965). However, it was not until 2003 that the first commercially successful e-cigarette device was developed by Hon Lik, a Chinese pharmacist (Lik, 2008).

E-cigarettes typically comprise four parts (Brown & Cheng, 2014): a battery; heating element; solution cartridge which stores e-liquid, usually a combination of propylene glycol, glycerine, flavourings, additives, nicotine and variable quantities of contaminants (England, Bunnell, Pechacek, Tong, & McAfee, 2015); and a vaporisation receptacle. The heating element is retained in a chamber which also

holds the vaporised e-liquid until the user inhales it (Orellana-Barrios, Payne, Mulkey, & Nugent, 2015).

Since entering the American market in 2007 (Grana et al., 2013), e-cigarettes have undergone a rapid evolution, with three broad classifications (and four generations) of vaping devices now recognised i) disposable (cig-a-like), ii) closed reusable (vape pen, pod-based), and iii) open reusable (mod) (Figure 4) (Levy, Lindblom, et al., 2019). Cig-a-likes closely resemble a cigarette with a glowing tip that lights up upon inhalation and is disposed of once the e-liquid is consumed. Closed reusable systems use replaceable pre-filled cartridges, which tend to be limited in functionality (i.e. inability to adjust the temperature) and were originally designed to resemble cigarettes. However, the most recent generation of closed reusable vaping devices, pod-based systems, have diverged from cigarettes and now resemble USB sticks (Levy, Lindblom, et al., 2019). This latest generation of devices provides higher concentrations of nicotine (2–10 times more) through the use of protonated nicotine, more commonly known as ‘nicotine salts’ (Barrington-Trimis & Leventhal, 2018). Finally, open reusable systems comprise a refillable liquid reservoir or ‘tank’, which users fill with their preferred choice of e-liquid. ‘Mod’ devices were developed based on the desire of users to ‘modify’ their devices and vaping experience, and hence provide users with different functionalities, including adjustable temperature and wattage, and the option to alter nicotine concentration and flavour (Levy, Lindblom, et al., 2019), and may be used to consume other drugs and substances (Giroud et al., 2015).

Figure 5. E-cigarette and vape pen evolution



Source: Stanford Medicine (2019)

E-cigarettes were originally developed as an alternative form of nicotine delivery and potential smoking cessation device (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2016). However, over the short period since their inception, they have transformed into high-tech nicotine

delivery devices appealing to both non-smokers and youth (Bach, 2019), an outcome largely stemming from increased investment by the tobacco industry (Tobacco Tactics, 2020). This investment has contributed to their use extending beyond their touted role as a nicotine replacement and tobacco cessation device, to a social, recreational and sensory delivery device (Pokhrel, Herzog, Muranaka, & Fagan, 2015) associated with new rituals and social practices (Keane et al., 2017).

Smokers cite numerous reasons for starting vaping: to ease nicotine cravings and withdrawal symptoms, to quit smoking or avoid relapse, to use where smoking is prohibited, reduced cost, and the belief that e-cigarettes are less harmful than tobacco (Ayers et al., 2017; Etter & Bullen, 2011; Farsalinos, Romagna, Tsiapras, Kyrzopoulos, & Voudris, 2014; Pepper, Ribisl, Emery, & Brewer, 2014). However, recent research has investigated the rise in 'alternative' e-cigarette use behaviours such as dripping (i.e. applying e-liquid directly on the atomiser) (Kong et al., 2020) and vape tricks (i.e. creating shapes from exhaled aerosol) (Kong et al., 2020; Pepper et al., 2017) which may contribute to the perception that e-cigarettes are 'cool' or to be used for recreational purposes (Pepper et al., 2017).

2.3.2 Shifting product focus

Australia is regarded as a 'mature' tobacco market, meaning, tobacco consumption is in decline. Therefore, to survive in Australia and some other high-income countries tobacco companies have diversified into 'reduced risk' alternate tobacco and nicotine delivery products in the hope of gaining a stronger foothold over the shrinking market (Freeman, Hagan, & Winstanley, 2018). Traditionally dominated by small start-up companies, the e-cigarette market has experienced rapid growth and transition, and more recently, large manufacturers and transnational tobacco companies have come to dominate the market (McCausland et al., 2019). NJOY, a company independent of the tobacco industry was the market leader in e-cigarette sales in 2012 (Bauld, Angus, de Andrade, & Ford, 2016), however, due to mounting debt, it filed for bankruptcy in 2016 (Page, 2016) opening the way for British American Tobacco sales to surge into 2017 (King, Gammon, Marynak, & Rogers, 2018). That was before Juul Labs became the largest e-cigarette brand in the U.S. Juul started as a company independent of the tobacco industry, however, in 2018 tobacco giant Altria invested USD 12.8 billion to acquire a 35% stake in the e-cigarette start-up, increasing Juul's estimated net worth to USD 38 billion (Levy, Sweanor, et al., 2019). Other tobacco companies entering the vaping market by either acquiring e-cigarette companies and brands or developing vaporiser products

include Imperial Brands, Reynolds American, Philip Morris International, and Japan Tobacco (Greenhalgh & Scollo, 2019b).

2.3.3 The e-cigarette market

It has been estimated that approximately 90% of all e-cigarette products sold are produced in China (Greenhalgh & Scollo, 2019b) and 30%–50% of global sales are conducted online (Zhu et al., 2014). The global revenue made from the sale of e-cigarettes in 2012 was estimated to be USD 5,101.6 million (Statista, n.d.). The popularity of e-cigarettes is projected to grow, and global revenue is estimated to reach USD 26,569.9 million in 2025 (Statista, n.d.). North America is by far the largest e-cigarette market, followed by Western Europe, Eastern Europe, Asia Pacific, and then the rest of the world (Shapiro, 2018).

2.3.4 E-cigarette advertising and promotion

Since e-cigarettes entered the retail market, marketing expenditure has increased with estimates suggesting promotional disbursement within the U.S. alone climbed from USD 6.4 million in 2011 (Kim, Arnold, & Makarenko, 2014) to USD 110 million in 2018 (Ali et al., 2020), with products now widely endorsed through banner and video advertisements, social media, print media, television and retail stores (Bauld et al., 2016). As Figure 6 demonstrates, e-cigarette advertising is frequently directed at cigarette smokers by comparing the two products and labelling vaporiser products as healthier, cheaper, more socially acceptable, and for use to circumvent smoke-free policies (McCausland et al., 2019). Further, e-cigarette promotions have been known to embrace celebrity endorsements (Phua, Jin, & Hahm, 2017), cartoons (Allem, Cruz, et al., 2019) and flavours (Soule et al., 2019), and are often marketed towards children and young people (Campaign for Tobacco-Free Kids, n.d.). As a result of the adopted marketing and promotional strategies utilised by the e-cigarette industry, they have been likened to traditional tobacco industry advertising (de Andrade, Hastings, & Angus, 2013). Consequently, the UK's National Institute for Health and Care Excellence (NICE) has expressed apprehension that without appropriate regulation, e-cigarettes may be “marketed in a way that may ultimately promote smoking” (National Institute for Health and Care Excellence, 2013, p. 29).

The global rise in interest and popularity of e-cigarettes has been largely accredited to aggressive internet promotion and marketing (Rom, Pecorelli, Valacchi, & Reznick, 2015). The internet and social media are low-cost promotional tools that e-cigarette companies are utilising to target current and potential users (McCausland et al., 2019). Researchers have therefore begun harnessing data from social media,

particularly Twitter and YouTube, to address information gaps, provide timely insights and inform public health and policy (Allem, Escobedo, Chu, Boley Cruz, & Unger, 2017; Ayers et al., 2017; Brien, Hoffman, Navarro, & Ganz, 2020; Chen, Zhu, & Conway, 2015).

Figure 6. Example e-cigarette advertising



Lorillard, Blu, 2011
'Switch'



Lorillard, Blu, 2012
'Leader of the Pack'



Fin Branding Group, Fin, 2013
'Rewrite the Rules'



Lorillard, Blu, 2013
'Dear Smoking Ban'



Lorillard, Blu, 2014
'Slim. Charged. Ready to Go'



Juul Labs Inc., JUUL, 2015
'Vaporized'

Source: Stanford University (n.d.-b)

2.3.5 The health and safety debate

E-cigarettes have generated debate among the public health community who are perceived to champion opposing opinions on the health and population-level effects of these products (Fairchild, Bayer, & Lee, 2019). However, in reality, it is likely that relatively few of the public health community identify with either of these two polarised stances and rather acknowledge the overlapping views of e-cigarette harm prevention and cigarette harm reduction (Carroll et al., 2020).

Authoritative groups such as the Office of the Surgeon General (2019), World Health Organization (2016), National Health and Medical Research Council (2017), Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Byrne et al., 2018) and the National Academies of Sciences Engineering and Medicine (2018) have undertaken reviews to evaluate the available evidence of the health effects related to e-cigarettes. These groups report that there is substantial evidence to suggest e-cigarettes expose users to potentially toxic substances at significantly lower concentrations than tobacco cigarettes. However, they also concluded that there is substantial evidence indicating e-cigarette aerosols induce acute harm and the long-term health consequences and outcomes of prolonged exposure are uncertain.

Due to the likely reduced health risks associated with vaping compared with tobacco smoking, e-cigarette advocates emphasise their potential benefits for smokers who have been unable or unwilling to quit smoking by switching to a 'reduced risk' product, advocating for a liberal approach to their regulation (Hajek, Etter, Benowitz, Eissenberg, & McRobbie, 2014; Wodak & Mendelsohn, 2020). Conversely, those who oppose liberal regulation of e-cigarettes suggest the application of the 'precautionary principle' which is public health "decision making [principle] that requires decision-makers in cases where there are threats of environmental or health harm not to use 'lack of full scientific certainty' as a reason for not taking measures to prevent such harm" (Jancey, Maycock, McCausland, & Howat, 2018, p. 323). These advocates argue that until such time there is robust evidence to support the safety and efficacy of e-cigarettes these products should not be widely available and are concerned about the potential adverse effects on users, particularly non-smokers and youth who would otherwise not smoke or use nicotine-containing products; the potential of a 'gateway effect' to tobacco smoking; the prospect of sustained e-cigarette use and nicotine addiction, or the 'dual-use' of tobacco and e-cigarette products; discouragement from cessation, whereby smokers take up e-cigarettes while still smoking tobacco cigarettes who might otherwise have quit altogether had they not commenced e-cigarette use; the renormalisation of tobacco smoking; and the potential to reinvolve the tobacco industry in public health policy (Greenhalgh & Scollo, 2020).

2.4 E-cigarette Use Prevalence

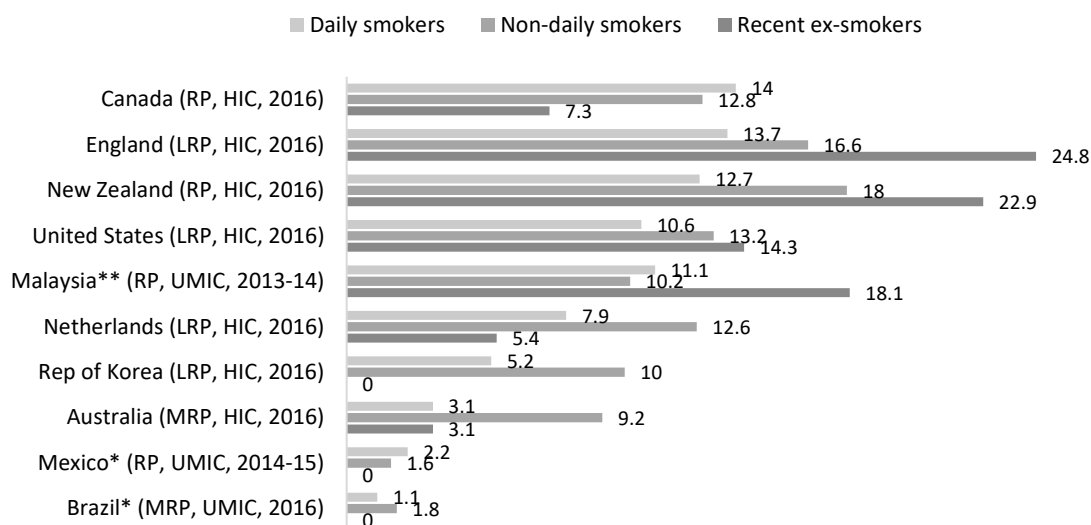
2.4.1 Prevalence of e-cigarette use – adults

The prevalence of vaping in Australia remains relatively low, compared to other high-income countries with more liberal e-cigarette regulations (i.e. U.S. (Cullen et al., 2019; Truth Initiative, 2019) and the UK (Action on Smoking and Health, 2019; Office for National Statistics, 2019)). However, data from the most recent Australian National Drug Strategy Household Survey reported a significant increase in current and lifetime use (Australian Institute of Health and Welfare, 2020c) that contrasts with Australian tobacco smoking rates, which have continued to decline over the last 30 years. The report estimated that 2.6% of the Australian adult population currently use e-cigarettes, up from 1.2% in 2016, with use among smokers (4.4% 2016, 9.6% 2019) more prevalent than non-smokers (0.6% 2016, 1.4% 2019) (Australian Institute of Health and Welfare, 2020a). Among Australian adults who have ever used an e-cigarette, the main reasons cited for use were ‘out of curiosity’ (53.3%), ‘to assist smoking cessation’ (33.8%), to try and ‘reduce cigarette consumption’ (23.5%) and because of ‘perceived reduced harm’ compared to cigarettes (23.1%) (Australian Institute of Health and Welfare, 2020c). In 2013–2014 among a nationally representative sample of Aboriginal and Torres Strait Islander smokers, it was reported that 21% had tried an e-cigarette, 41% had never tried, and 38% had never heard of e-cigarettes (Thomas, Lusic, Van der Sterren, & Borland, 2018).

2.4.2 International comparisons of adult e-cigarette use

Data from the International Tobacco Control Survey reported considerable cross-country variation in e-cigarettes use (Figure 7), which may be attributable to differences in when the data were collected, regulatory status of e-cigarettes within that country and level of regulation enforcement (Gravely et al., 2019). Current use of e-cigarettes among adult never-smokers appears to be generally less frequent than among smokers, with a reported overall prevalence of less than 2 percent in the UK (Action on Smoking and Health, 2019), Australia (Australian Institute of Health and Welfare, 2020c), and New Zealand (Oakly, Edwards, & Martin, 2019). Conversely, recent data from the U.S. (Dai & Leventhal, 2019) and Canada (Reid et al., 2019) reported current e-cigarette use among never-smokers at 4.6% and 15.5% respectively.

Figure 7. Prevalence of current nicotine vaping product use by smoking status (weighted %)



*Unadjusted weighted estimates; ** not adjusted for sex, men only
 MRP = most restrictive policies; RP = restrictive policies; LRP = less restrictive policies; NRP = no regulatory policies
 HIC = high-income country; UMIC = upper-middle-income country; LMIC = lower-middle-income country

Source: Gravely et al. (2019)

2.4.3 Prevalence of e-cigarette use – youth

Data from the Australian Secondary Students’ Alcohol and Drug Survey reported that 13% of students (aged 12–17 years) had ever used an e-cigarette at least once in 2017, and 32% of these students had vaped in the past month (Guerin & White, 2018). Vaping experience increased with age (4% of 12-year-olds, up to 21% of 17-year-olds). At each age, male students were more likely to have tried vaping (Guerin & White, 2018). Students who had vaped most commonly reported acquiring their last e-cigarette from friends (57%), siblings (8%), or parents (7%) and 12% of students reported buying an e-cigarette themselves. Furthermore, students aged 16–17 years were more likely to have bought a vaping device (17%) than younger students (9%) (Guerin & White, 2018). The report concluded that “overall, these results suggest that younger male students were more likely than other student groups to have experimented with vaping and to have become more regular users” (Guerin & White, 2018, p. 21).

2.4.4 International comparisons of youth e-cigarette use

Awareness of and experimentation by young people also appear to be increasing internationally, primarily within high-income countries, and experimentation with e-cigarettes may be more common among non-smoking youth than among non-

smoking adults (Greenhalgh & Winstanley, 2019). A review of e-cigarette use among adolescents found that use was more likely among those who were male, older, had more pocket money, and had more tobacco smoking-related characteristics, such as regular and heavier smoking, and having peers who smoke (Perikleous, Steiropoulos, Paraskakis, Constantinidis, & Nena, 2018).

The U.S., where e-cigarette sales are subject to very few restrictions, recently observed an exponential increase in vaping, particularly among youth, which was referred to as an 'epidemic' (Food and Drug Administration, 2018). Although, the most recent National Youth Tobacco Survey reported a substantial decline in current e-cigarette use since 2019, 3.6 million young Americans (19.6% of high school and 4.7% of middle school students) continue to use e-cigarettes, now preferring flavoured pre-filled cartridges and disposable e-cigarettes (Wang, Neff, et al., 2020).

A study by Bauld et al. (2017) compiled data from five large scale surveys conducted across the UK and found 11–16-year-olds ever use of e-cigarettes was 7% to 18%; regular (at least weekly) use 1% to 3%; among never-smokers, ever e-cigarette use ranged from 4% to 10% with regular use between 0.1% and 0.5%; and among regular smokers, ever e-cigarette use ranged from 67% to 92% and regular use 7% to 38%.

In 2017, 22.8% of Canadian youth (15–19 years) reported ever using an e-cigarette, 6.3% had used one in the past 30 days, and 1.8% reported daily use (Reid et al., 2019). Experimentation with e-cigarettes increased significantly between 2013 and 2017 (19.8% to 22.8%) and prevalence was greater among smokers: 78.2% of current smokers had ever used e-cigarettes in 2017, compared to 18.1% of non-smokers (including former- and never-smokers); and past-month use was 31% among current smokers and 14.2% among non-smokers (Reid et al., 2019).

2.5 Regulating E-cigarettes

2.5.1 Regulatory overview

In Australia, there is no national legislation that directly applies to e-cigarettes, instead, several existing laws relating to poisons, therapeutic goods and tobacco control apply. Across all Australian states and territories, it is illegal to sell nicotine-containing e-cigarettes as liquid nicotine is classified as a 'Schedule 7-Dangerous Poison', however, users can legally import nicotine-containing e-cigarettes through the Personal Importation Scheme which states users must obtain a prescription from a physician (Therapeutic Goods Administration, 2019). E-cigarettes that do not

contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims. However, in Western Australia, the context of this research, it is an offence under the Tobacco Products Control Act 2006 (Government of Western Australia, 2019) to sell products that resemble tobacco products, regardless of whether they contain nicotine or not, and therefore the sale of e-cigarettes is prohibited. The sale and use of flavoured e-liquids are permitted provided they do not contain nicotine (Greenhalgh, Grace, et al., 2018). Advertising of e-cigarettes is also restricted, although exposure to advertising and the promotion of these products does occur in Australia via the internet (Amin et al., 2020a; McCausland, Maycock, Leaver, Wolf, Freeman, et al., 2020; McCausland, Maycock, Leaver, Wolf, Thomson, et al., 2020).

Australian's have access to nicotine-containing e-cigarette products via the internet and those who choose to import nicotine-containing products without a medical prescription are not currently actively prosecuted. Surveillance data reports approximately 70% of Australian e-cigarette purchases are made online (Australian Institute of Health and Welfare, 2020b; Euromonitor International, 2018), and Australian data from the International Tobacco Control Survey found more than 40% of vapers use nicotine-containing products (Yong et al., 2015). While there have been efforts by the tobacco industry (Philip Morris Limited, 2017, 2018, 2019a, 2019b) and individuals in favour of vaping (Henderson, 2020) to weaken Australia's tobacco control laws and to advocate the legalisation of nicotine vaping and heated tobacco products, the Federal Government has recently reinforced its position announcing tighter restrictions for 2021 through enforcement of the nicotine importation law (The Hon Greg Hunt MP, 2020). Under the proposed regulations, smokers who have unsuccessfully quit smoking via other cessation methods approved by the Therapeutic Goods Administration and who wish to use nicotine in a personal vapouriser will be required to obtain a prescription from a medical doctor and order nicotine-containing products through a medical supplier (Australian Government, 2020a). Breaching these processes could result in a fine of up to AUD \$222,000 (Henderson, 2020). Australia is not the only country to effectively ban the sale of nicotine-containing e-cigarettes, with Jamaica, Japan, and Thailand also enacting similar restrictions (Institute for Global Tobacco Control, n.d.).

The rise in popularity of e-cigarettes, and the diversity of devices, has left many governments grappling with how best to regulate these products. To date, the majority of countries do not have specific law relating to e-cigarettes (Greenhalgh, Grace, & Scollo, 2019) with some countries applying a range of product

classifications to suit existing policies such as ‘tobacco products’ (57 countries), ‘medicinal products’ (24 countries), ‘consumer products’ (18 countries), and ‘nicotine as poisons’ (4 countries) (Institute for Global Tobacco Control, 2020). At present, 70 countries have enacted e-cigarette specific policy (Institute for Global Tobacco Control, 2020).

2.5.2 Australian and international health agencies’ position on e-cigarettes

As previously stated, the Australian Government continues to take a precautionary approach to the accessibility and regulation of e-cigarettes, and several Australian government agencies (e.g. Therapeutic Goods Administration (2019), Australian Government Department of Health (2020), Australian Competition & Consumer Commission (2020) (Product Safety Australia), National Health and Medical Research Council (2020), and Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Byrne et al., 2018)) and non-government agencies (e.g. Cancer Council; National Heart Foundation of Australia; Australian Council on Smoking and Health (2020), Australian Medical Association (2020), Public Health Association Australia (2020), Royal Australian College of General Practitioners (2020), Lung Foundation Australia (2020) and the Thoracic Society of Australia and New Zealand (2020)) have released position statements that concur with and support the Government’s position. Conversely, there is a limited number of Australian health agencies that support more liberal e-cigarette regulation (e.g. The Royal Australian and New Zealand College of Psychiatrists (2020)). Similarly, a substantial number of global and overseas health agencies have issued position statements expressing caution until there is enough evidence to suggest e-cigarettes are an efficacious smoking cessation aid that will not destabilise established and effective tobacco control measures (Greenhalgh & Scollo, 2019a).

The tobacco industry remains a formidable force in Australia, and even more so in other countries with less advanced tobacco control policies. They are well resourced, intelligent, insistent, and staunch in their labours to protect their commercial interests, and fend off criticism and regulation (The Cancer Council Western Australia, 2008). Despite the achievements of the public health sector and associated reforms in support of the reduction of tobacco use, there is still a need for ongoing action.

3. Research Methods

This chapter describes the methods of the study's project advisory group and three substudies: a) scoping review, b) Twitter inquiry and c) qualitative inquiry. The methods of the three substudies described here build on and supplement the information presented in publications 1–6.

3.1 Project Advisory Group

Implicit in both health promotion and implementation research approaches is the need to include and work with those “individuals, organisations or communities that have a direct interest in the process and outcomes of a project, research or policy endeavour” (Deverka et al., 2012, p. 5), also known as ‘stakeholders’. With regard to this research, relevant stakeholders represent those responsible for working with the community, organisations, and governments to control tobacco use and associated health consequences. In this present research project, that inclusion was achieved through the creation of a project advisory group. The advisory group, a key component of the project, was a representative, consultative body comprising the following organisations: School of Public Health, University of Sydney; Australian Council on Smoking and Health; Cancer Council (WA Division); Public Health Advocacy Institute of WA; and the Royal Australian College of General Practitioners (WA Division).

3.1.1 Stakeholder engagement

Using the ‘design principles’ for stakeholder engagement set out by Boaz, Hanney, Borst, O’Shea, and Kok (2018), organisational, values and practice processes were adopted throughout the life of the project.

Organisational

- Objectives (i.e. defined expectations and roles) of and resources (i.e. time commitment and engagement strategies) for stakeholder engagement (Hinchcliff, Greenfield, & Braithwaite, 2014) were clarified through the development and ratification of a terms of reference (Appendix J).
- The Melanie Barwick knowledge translation planning template (Barwick, 2013) was used to design how stakeholders might be engaged in ways that help increase the chances of the research being used in policy and practice.

Values

- A shared commitment to the project was established at the outset with stakeholders contributing to the development of the funding and project proposal.
- The relationship between the research producers and research users was nurtured over the project's lifetime to create a shared commitment to sustained and continuous stakeholder engagement.

Practices

- Stakeholder engagement activities were built into the project proposal, and terms of reference.
- Opportunities for stakeholders to provide input and how this input could be gathered were considered.
- It was recognised that the identification and involvement of stakeholders were to be an iterative and ongoing process.

3.2 Ethical Considerations

Ethical considerations relevant to each substudy are discussed within the respective subsection.

3.2.1 Ethical approval

Ethical approval for this study was obtained from the Curtin University Human Research Ethics Committee, approval number: HRE2017-0144 (appendix K). All ethical compliance processes including annual reporting were adhered to.

3.2.2 Data management

Data were stored securely on the university research server, which limited access to those directly involved in the study.

3.2.3 Data retention

All data will be retained for a minimum of 7 years after the date of publication, or 7 years after the conclusion of the project (whichever is later) then destroyed, as per Curtin University's minimum data retention requirements (Curtin University, 2020).

3.3 Substudy 1: Scoping Review

Objective: To identify and describe the messages presented in e-cigarette related social media promotions and discussions and identify future directions for research, surveillance, and regulation.

An accurate understanding of the types of e-cigarette messages social media users are exposed to, and who is disseminating this information, can assist in the development of appropriate surveillance to inform future policy and regulation. A scoping review was, therefore, undertaken. Scoping reviews use a systematic process to map key concepts and types of evidence in an area of research and identify gaps in an existing body of knowledge (Arksey & O'Malley, 2005; Armstrong, Hall, Doyle, & Waters, 2011; Levac, Colquhoun, & O'Brien, 2010). Unlike a systematic review, scoping reviews, typically, do not assess the quality of the studies included (Arksey & O'Malley, 2005; Levac et al., 2010).

The following methods are reported in publications 1 and 2.

1. **McCausland, K.**, Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633>
2. **McCausland, K.**, Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/>

3.3.1 Protocol

The review was prospectively registered with the Joanna Briggs Institute Systematic Reviews Register (The Joanna Briggs Institute, n.d.) which stipulates a protocol must be published or in preparation for publication within six months of registration. A protocol outlining the proposed study was therefore developed and published (publication 1) to prevent unnecessary duplication of work and increase transparency in understanding any deviations from the protocol that occurred during the conduct of the study.

3.3.2 Study design

The review adhered to the methodologically rigorous scoping review methods manual developed by the Joanna Briggs Institute (Peters et al., 2015) which adapted the scoping review frameworks proposed by Arksey and O'Malley (2005) and Levac et al. (2010). The institute's scoping review methodology consists of five parts: (1) title, objective, and question; (2) inclusion criteria; (3) search strategy; (4) extraction of the results and (5) presentation of the results.

3.3.3 Title, objective, and question

The review title: '*The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol*' was guided by the 'PCC' mnemonic (Population, Concept and Context) (Peters et al., 2015). Using the PCC mnemonic enables the title to reflect key information about the focus and scope of the review to impending readers.

The review objective (*This scoping review will identify and describe the breadth of messages presented in online electronic cigarette promotions and discussions*) is congruent with the title and specifies what the review aims to achieve.

The review question (*What messages are presented in online electronic cigarette promotions and discussions?*) includes the PCC elements and guides and directs the development of the inclusion criteria for the scoping review.

3.3.4 Inclusion criteria

Included studies had to examine and analyse e-cigarette related social media promotions and discussions. Studies needed to identify the social media platform under investigation. Studies reporting multiple social media platforms were excluded unless results for each platform were reported separately. This ensured that the results for each social media platform could be extracted and reported, making it possible to identify similarities and differences between the platforms. Studies identifying other tobacco products (e.g. tobacco cigarette, snus, chewing tobacco, or hookah) were excluded unless e-cigarettes were also examined and reported separately. Studies that did not distinguish between e-cigarettes and other forms of tobacco and nicotine delivery were excluded. Studies examining traditional media (e.g. television and newspaper) were excluded unless social media platforms were also examined and reported separately.

Eligible studies were limited to the following countries: the U.S., UK, New Zealand, Australia, and Canada. These countries were selected as they are all high-income

countries and e-cigarette use is well established (International Tobacco Control Policy Evaluation Project, 2016). Further, the review considered only peer-reviewed primary research studies published between 2007 and 2017 in English. This period correlates with the approximate time that e-cigarettes were first introduced to the U.S. and Europe (Consumer Advocates for Smoke Free Alternatives Association, 2017).

3.3.5 Search strategy and study selection

To inform the development of the search strategy an initial search of e-cigarette and tobacco internet studies was undertaken in MEDLINE, followed by an analysis of the text words contained in the title, abstract and index terms of the retrieved articles in consultation with the Curtin University Faculty Librarian.

The final search strategy was:

("electronic cigarette" OR e-cigarette OR "electronic nicotine delivery system" OR "personal vapo?ri?er" OR "electronic nicotine delivery device" OR "vape pen" OR "smokeless tobacco" OR "electric cigarette" OR "electric nicotine delivery system" OR "electric nicotine delivery device" OR e-hookah OR e-juice OR e-liquid OR vaping)

AND

("social media" OR internet OR online OR YouTube OR Facebook OR Instagram OR Twitter OR "online media" OR "digital media" OR "social networking")

AND

("content analysis" OR "content evaluation" OR message OR meaning OR coding OR "media analysis" OR "textual analysis").

The Faculty Librarian identified five key databases to include in the search strategy. As the research question crossed subject areas, MEDLINE, Scopus, Informit and ProQuest databases were identified due to their multidisciplinary nature and broad scope, and Google Scholar provided a sound overview of existing published material on the topic. The search strategy was run through each of the databases and entered as a nested Boolean search into Google Scholar, with the first 200 results examined for eligibility. A manual search of the Journal of Medical Internet Research was also undertaken to ensure a maximum number of relevant studies

met the inclusion criteria because a preliminary search of the journal located several relevant articles.

Retrieved references from each database were imported into EndNote X7 reference management software, with duplicate references removed before being imported into Covidence (Covidence, 2019). Covidence is a web-based software platform that streamlines the production of systematic reviews by supporting the key steps in the review process. Studies were assessed for inclusion, examined initially by title and abstract. Full-text articles were retrieved for those studies that appeared to meet the inclusion criteria or if a further examination was required to determine eligibility. Two reviewers (the PhD Scholar and primary supervisor (JJ)) independently screened all titles and abstracts to determine their eligibility. The PhD Scholar undertook full-text screening. The reference list of all articles subject to full-text review was screened to determine possible inclusion of additional studies and identified studies were assessed for suitability.

3.3.6 Extraction of results

A data extraction pro forma was used to extract the following information: publication title, author/s, publication year, country of study, the aim of the study, social media platform/s under investigation, sample size, study design and methods, and key findings that related to the review question.

Included studies were required to have coded one or more of the following: account type, themes, and/or sentiment. Account type characterises the publisher of the social media post; the theme reflects the domain of the actual content conveyed, such as the categories of health, smoking cessation, and regulation; and sentiment reflects the stance expressed in a social media post toward e-cigarettes, related products, or its users, whether positive, neutral, or negative.

To ensure data extraction consistency, two reviewers (the PhD Scholar and primary supervisor), independent of one another, extracted data from the same five studies using the data extraction proforma. The reviewers then met to determine whether the extraction approach was consistent. The PhD Scholar went on to extract data from the remaining studies unaccompanied.

3.4 Substudy 2: Twitter Inquiry

Substudy 1 (scoping review: publications 1 and 2) identified no eligible studies from Australia, and at the time of publication, there was no published literature examining how e-cigarettes were promoted and discussed in the Australian context. To fill this gap in the literature, the Twitter inquiry, therefore, aimed to investigate how e-cigarettes are portrayed and promoted on Twitter through two largely qualitative content analyses of e-cigarette related tweets posted and retweeted by Australian users (publications 3 and 4).

Twitter was chosen as the social media platform for this investigation over other social media platforms such as Facebook and Instagram because Twitter has been a central social media platform for global sharing, discussion and debate for more than a decade and provides important markers for the circulation of social discourse. Moreover, the research infrastructure (Tracking Infrastructure for Social Media Analysis (TrISMA)) utilised by the PhD Scholar to query and capture Twitter data makes Australian-specific historical data accessible and limits data to Australian users, which no research infrastructure can currently do for other social media platforms due to privacy policies, lack of geographical data in profiles and changes in platforms API (Application Programming Interface). As of January 2019, there were approximately 2.56 million active monthly Australian Twitter users (64% male), which equates to approximately 12% of Australians over the age of 13 years (Hootsuite & We Are Social, 2019). Given the popularity of Twitter (Hootsuite & We Are Social, 2019), the high-speed nature of information dissemination, and the significant influence of Twitter as a driver of web traffic (Bruns & Stieglitz, 2012), insights into how the platform is used, and by whom, to promote and discuss e-cigarettes, is justified.

3.4.1 Twitter study A

Objective: To investigate how e-cigarettes are portrayed and promoted on Twitter, and how this portrayal and promotion has emerged and trended over time within an Australian context.

The following methods are reported in publication 3.

3. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Thomson, K., Freeman, B., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. *JMIR Public Health and Surveillance*, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/>

This content analysis specifically investigated e-cigarette related tweets that contained an image.

3.4.1.1 Data collection

Twitter data were collected via TrISMA (Bruns et al., 2016), a contemporary technical and organisational infrastructure for the tracking, storing, and processing of public social media communication activities of Australian users at very large scale and in close to real-time. By drawing on TrISMA's collection facilities, the present project was able to engage with 'big data' from Twitter in unprecedented detail to respond to the emerging phenomena of vaping in social media discourse. TrISMA was developed through an Australian Research Council Infrastructure, Equipment and Facilities scheme which enables researchers to participate in cooperative initiatives so that expensive research infrastructure, equipment and facilities can be shared between higher education organisations and with industry (Australian Research Council, 2020).

Central to the TrISMA Twitter infrastructure is the Australian Twitter Collection which is hosted on a cloud-based Google BigQuery database and accessed through the data visualisation tool, Tableau. This gathers tweets from all identified Australian accounts continuously and stores them in a database available to accredited TrISMA researchers. By default, Twitter sets new users to a U.S. time zone which must manually be changed by the user if they are aware of this requirement. To account for this occurrence, the Australian Twitter Collection is not limited to accounts providing an Australian geolocation, but draws on a database of Australian Twitter accounts which is updated periodically by filtering the global Twitter user base for accounts that match any of the following criteria: is set to an Australian location, geolocation, or time zone; contains a description field referring to an Australian location, or contains Australia-specific terms. The Australian Twitter Collection filters for known signs of 'bots', such as accounts with numeric strings in the title, accounts with zero followers, and new accounts tweeting or retweeting identical content. The word 'bot' is derived from 'robot' and has been generally defined as "automated agents that function on an online platform" and "that run continuously, formulate decisions, act upon those decisions without human intervention, and are able to adapt to the context they operate in" (Gorwa & Guilbeault, 2020, p. 228). A retweet is a reposting of a tweet. Twitter's retweet feature enables users to quickly share a tweet, either the user's tweet or a tweet from someone else (Twitter, 2020). Sometimes users type 'RT' at the beginning of a

tweet to indicate that they are reposting someone else's content (Twitter, 2020). When retweets are captured by TrISMA, they too begin with RT.

A list of popular e-cigarette related terms was developed based on peer-reviewed literature (Chu, Allem, Cruz, & Unger, 2016; Cortese et al., 2018; Laestadius, Wahl, & Cho, 2016; Laestadius, Wahl, Pokhrel, & Cho, 2018; Lee et al., 2017; Ritter, 2015), trending Twitter hashtags, and frequently co-occurring hashtags (i.e. hashtags that appeared in the same caption as the root term) which resulted in a final list of 15 keywords:

- *cloudchasing*;
- *ecig* (includes ecigarette/s);
- *e-cig* (includes e-cigarette/s);
- *electroniccig* (includes electroniccigarette/s);
- *electronic cigarette* (includes electronic cigarettes);
- *eliquid*;
- *e-liquid*;
- *e-juice*;
- *vape* (includes vaper and vapes);
- *vaping*;
- *vapecommunity*;
- *vapefam*;
- *vapelife*;
- *vapenation*; and
- *vapeporn*.

E-cigarette product names were omitted from the search strategy so as not to bias the results to specific brands (Cole-Lewis et al., 2015).

A preliminary search revealed there was minimal Twitter activity using these keywords before 2012. Notably, Twitter's internal photo-sharing and uploading services were only made available to users in 2011. Two-yearly sampling intervals – 2012, 2014, 2016, 2018 – were chosen to maximise the period covered while still being able to see the emergence and decline of trends in the collected data.

Data (tweets, along with metadata information, for example, username, follower and following count etc.) were collected from public Australian Twitter accounts when a tweet included at least one of the 15 keywords from either specified year. Individual keyword data for each specified year were downloaded in the form of CSV (Comma

Separated Values) files. Social media users tend to include multiple hashtags within their posts which resulted in duplicate tweets being collected. Duplicate tweets within keyword corpora for each year, and across keyword corpora from the co-use of hashtags were removed, resulting in the inclusion of only unique tweets (Unger et al., 2016).

One hundred eligible tweets from each keyword corpus for each year were randomly selected using RANDOM.ORG (RANDOM.ORG, 2019), an online random sequence generator. Selected tweets were checked by the PhD Scholar to determine whether the tweets were written in English and relevant to e-cigarettes and vaping. If any of the originally selected 100 tweets did not fit the inclusion criteria, additional randomly selected tweets were added to the corpus until 100 eligible tweets were reached. If a keyword corpus had less than 100 tweets, then all eligible tweets were included. Each of the eligible tweets were then inspected and if found to contain an image, a screenshot of the whole post (text and image) was saved for further analysis. Eligible images needed to be stationary, that is, not a video, animated GIF (Graphic Interchange Format) or other moving content. Retweets (tweets reposted by users) were included in this study to understand what information was being passed on by Australian users that may have originated in another country.

3.4.1.2 Developing the coding framework

Data were coded using qualitative content analysis. Qualitative content analysis is a systematic procedure for describing symbolic material by assigning data segments to the categories of a coding frame and is a suitable method for describing material that requires some degree of interpretation to arrive at the meaning of that data (Schreier, 2012).

A concept-driven approach (inductive) was utilised to develop an initial coding framework consisting of main categories and subcategories (Schreier, 2012), informed by extant studies (Chu et al., 2016; Cortese et al., 2018; Laestadius et al., 2016; Laestadius et al., 2018; Lee et al., 2017; Ritter, 2015) identified in substudy 1 (scoping review: publication 2). The coding framework was entered into SPSS version 22.0 and independently tested (blind coding) on a random sample of 100 posts by the PhD Scholar and an additional coder (KT – an undergraduate student who was the recipient of an eight-week scholarship). This process functioned to refine initial codes, identify new codes using a data-driven approach (inductive), and amend coding definitions and the structure of the coding framework through discussion (Schreier, 2012). Employing two coders can help to overcome individual

preconceptions and potential biases, and is an important process to confirm consistency and validity (Krippendorff, 2004; Schreier, 2012).

The coding framework was applied to posts based on the content of their accompanying image and any descriptive text and hashtags. Highfield and Leaver (2015) advise that the visual and textual aspects of social media posts be considered together as the study of images can be used to complement and extend the study of health behaviours and may be more valuable than the study of words alone (Allem, Escobedo, Chu, Boley Cruz, et al., 2017).

The two coders coded the data on the dimensions of the coding framework simultaneously. In other words, coders applied the entire framework to the data rather than selecting a few codes and specifically searching for instances where the codes could be applied. Typically, a person can remember and differentiate about 40 codes at the same time (MacQueen, McLellan, Kay, & Milstein, 1998), therefore if the coding framework contains approximately 40 or fewer codes, simultaneous coding can be applied.

3.4.1.3 Inter-rater reliability testing

After the first round of refining the coding framework, the two coders independently applied the modified coding framework to an additional sample of 140 randomly selected posts (approximately 10% of the final sample) using SPSS version 22.0. It has been suggested that testing between 10% and 20% of data constitutes a reasonable trade-off between variability and practicability (Schreier, 2012). Coders' individual coding sheets were combined to create a 'comparative coding sheet' so that the codes applied by each coder were easily comparable. The comparative coding sheet assisted in identifying controversial units of coding and highlighted differences between coders (Schreier, 2012). An inter-rater reliability test was performed on the sample of data coded, determining an average of Krippendorff's $\alpha = .89$ with a range of 0.65–1.0, indicating 'good to perfect' agreement. Any discrepancies in coding were discussed to reach a consensus, followed by the revision of the coding frame accordingly.

3.4.1.4 Coding and analysis

The modified coding framework (Table 3) was applied by the additional coder and checked for consistency and validity by the PhD Scholar. The coders met regularly to discuss questions, further refine coding definitions and rules, and identify any new themes emerging during the coding process.

Table 3. Twitter study A coding framework

Codes and definitions	Coding rule
<p>Product visible 1 = e-cigarette or another vaping device 2 = e-cigarette and another vape/tobacco product 3 = vape accessory (e.g. tank) 4 = vape liquid (e-liquid) 5 = vape liquid and another vape/tobacco product 6 = showcase in a retail store 7 = tobacco product 8 = none</p>	<p>Are any of the following products visible in the image?</p>
<p>Product placement 1 = overt (i.e. shown openly, or plainly apparent, and is the main focus of the image) 2 = covert (i.e. not openly displayed, or hidden, and is not the main focus of the image) 3 = N/A (if no product visible)</p>	<p>How is the vape/tobacco product placed in the image?</p>
<p>Product brand or logo visible 1 = yes 2 = no 3 = N/A (if no product visible)</p>	<p>Is a brand or logo visible on the vape/tobacco product?</p>
<p>Product brand or logo visible anywhere 1 = yes 2 = no</p>	<p>Is a vape/tobacco brand or logo visible anywhere in the image?</p>
<p>E-liquid flavour described 1 = yes 2 = no 3 = N/A (if no depiction of an e-liquid product, or does not describe in text)</p>	<p>Does the post indicate the flavour of e-liquid in the image or the text?</p>
<p>Nicotine level 1 = nicotine level in milligram 2 = nicotine free 3 = multiple products, nicotine level and nicotine-free 4 = no level 5 = N/A (if there is no depiction of an e-liquid product)</p>	<p>Is the nicotine level displayed on either the e-liquid bottle or packaging or stated in the text?</p>
<p>Health or age warning visible 1 = yes 2 = no</p>	<p>Is a health or age warning visible in the image or stated in the text?</p>
<p>People visible 1 = yes 2 = no</p>	<p>Are there people, or part thereof (e.g. hand), visible in the image?</p>
<p>Type of people visible 1 = everyday person 2 = model (i.e. stylised image, or image taken for promotional or media purposes) 3 = celebrity 4 = health professional/academic 5 = other 6 = multiple types 8 = N/A (if no person/face visible)</p>	<p>What type of people are visible in the image? Only code for when a face is visible.</p>
<p>Gender of people visible 1 = female 2 = male 3 = both male and female</p>	<p>What gender are the people that are visible in the image?</p>

Codes and definitions	Coding rule
4 = cannot determine 5 = N/A (if no people visible)	
Age of people visible 1 = less than 18 years 2 = 18 years or older 5 = mixed age groups 6 = N/A (if no person/face is visible)	What age are the people visible in the image? Only code for when a face is visible.
Vapour present 1 = yes 2 = no	Is vapour present in the image?
Person vaping 1 = yes 2 = no	Are people vaping in the image or described in the text?
Vape play 1 = yes 2 = no	Are people performing vape tricks or cloud chasing in the image or described in the text? Cloud chasing is the activity of blowing large clouds of vapour using a vaping device
Setting of product 1 = indoors (including cars) 2 = outdoors 3 = N/A (if no vaping product is displayed or being used)	What setting is the vape product displayed or being used in the image or described in the text?
Association with another product 1 = cannabis (including hemp) 2 = alcohol 3 = none	Are any of the following substances displayed in the image or described in the text and being associated with vaping?
Anti or critical of vaping 1 = yes 2 = no	Is the post anti or critical of vaping?
Product review 1 = yes 2 = no	Is the post alerting viewers to a product review?
Promoting vape product for purchase 1 = yes 2 = no	Is the post promoting a vape product for purchase? Would usually be from a retailer, manufacturer, or product reviewer (does not include posts that are giving away items)
Promotional offer 1 = monetary (any promotional deal that saves you money, lowers the cost of a purchase or changes the cost of the purchase. e.g., coupons, refunds, rebates, two for one deal, and cents-off promotions) 2 = non-monetary (any promotional deal that does not lower the cost of a purchase. e.g., contests, giveaways, sweepstakes, free shipping, or a free gift with purchase) 3 = both 4 = none	Is the post providing monetary or non-monetary offers?
Sale notice 1 = yes 2 = no	Does the post introduce customers to the idea that a discount is being offered without stating what the savings are?
Business listing 1 = yes 2 = no	Is the post a business listing, or a notice advertising vape shops, e-cigarette merchants, brands or online vape groups? The post may also aim to recruit new followers or members by way of retweeting, liking, or tagging.

Codes and definitions	Coding rule
Quit smoking 1 = yes 2 = no	Does the post promote vaping to quit smoking or as an alternative to tobacco cigarettes? Includes related hashtags.
Health 1 = positive health 2 = negative health 3 = no	Does the post reference positive or negative health effects of vaping?
Safety 1 = yes 2 = no	Does the post reference how to use/build e-cigarettes or handle nicotine safely, battery safety, or safety of e-liquid ingredients?
Public health 1 = yes 2 = no	Does the post reference public health professionals, journals or organisations, or net public health gains or losses concerning e-cigarettes?
Youth vaping 1 = yes 2 = no	Does the post refer to youth vaping?
Regulation or policy 1 = yes 2 = no	Does the post reference regulation or policy regarding vaping, whether positive, negative or neutral?
Liberal regulation 1 = yes 2 = no	Does the post support less restrictive e-cigarette regulation/policy, or refer to liberal regulation/policy which has been proposed or enacted?
Restrictive regulation 1 = yes 2 = no	Does the post support restrictive e-cigarette regulation/policy, or refer to restrictive regulation/policy which has been proposed or enacted?
Advocacy 1 = yes 2 = no	Does the post reference advocacy activities or efforts?
Building/DIY 1 = yes 2 = no	Does the post reference modification, or 'building' vape products/accessories?
Cartoon 1 = yes 2 = no	Does the image contain animations or cartoons? This can include on vape product packaging.
Meme 1 = yes 2 = no	Is the post a meme? A meme is an image accompanied by a piece of text which is typically humorous. Memes can be copied and spread rapidly by internet users, often with slight variations.
Selfie 1 = yes 2 = no	Is the image a self-portrait style image, also known as a 'selfie'?
Hand check/product check 1 = yes 2 = no	Is the image of a vape product in a person's hand or is the post showing what product the poster is currently using?
Erotic or sexualised 1 = yes 2 = no	Does the image portray scantily clad people or someone in a suggestive pose?
Identity or community 1 = yes 2 = no	Does the post convey a vaping social identity or shared community affiliation, this includes hashtags (i.e. #vapecommunity, #vapelife)

Codes and definitions	Coding rule
Malfunction 1 = yes 2 = no	Does the post reference e-cigarette devices malfunctioning?

Each code within the coding framework was a variable in SPSS version 22.0 that functioned as a stand-alone item and was evaluated as either 1 for *present* or 2 for *absent*. Statistical comparisons (i.e. between codes and years) were made using Chi-square and Fisher's exact test for categorised variables.

Due to the small sample size of the 2012 data, a sensitivity analysis was performed with statistical comparisons made using Chi-square and Fisher's exact test to assess the robustness of the results by removing the observations in 2012.

3.4.2 Twitter study B

Objective: To identify key conversation trends and patterns over time, and discern the core voices, message frames and sentiment surrounding e-cigarette discussions on Twitter within an Australian context.

The following methods are reported in publication 4.

4. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. *JMIR Public Health and Surveillance*, 6(4):e17543. http://publichealth.jmir.org/2020/4/e17_543/

This content analysis examined tweets that included or did not include an image.

3.4.2.1 Data collection

As described in Twitter study A (publication 3), the data were collected via TrISMA using the same 15 identified keywords.

3.4.2.2 Developing the coding framework

A concept-driven approach (inductive) (Schreier, 2012) informed by extant studies (Allem, Escobedo, Chu, Soto, et al., 2017; Allem, Ferrara, Uppu, Cruz, & Unger, 2017; Ayers et al., 2017; Cole-Lewis et al., 2015; Harris et al., 2014; Huang, Kornfield, Szczypka, & Emery, 2014; Jo, Kornfield, Kim, Emery, & Ribisl, 2016; Kavuluru & Sabbir, 2016; Sowles, Krauss, Connolly, & Cavazos-Rehg, 2016; van der Tempel et al., 2016) identified in substudy 1 (scoping review: publication 2) was utilised to develop a triaxial coding framework to capture the Twitter users account and the sentiment and theme of the tweets they posted. The coding frame was tested on a random sample of 100 tweets, whereby each tweet was read and

assigned codes based upon the concepts presented in the descriptive text, hashtags, and any accompanying images (Highfield & Leaver, 2015). The PhD Scholar undertook this process in NVivo version 11.0, iteratively revising the coding framework to further refine predefined codes, merge others to create broader codes encompassing several related concepts, and identify new codes arising from the data using a data-driven approach (deductive) (Schreier, 2012), which served as a revalidation of earlier coded material (Elliott, 2018) and intracoder reliability testing (Schreier, 2012).

3.4.2.3 Coding and analysis

The modified coding framework (tables 4-6) was transferred to SPSS version 22.0 and applied to the data by the PhD Scholar. The coding descriptor *user category* characterises the sender of the tweet and typically involved a detailed inspection of the associated Twitter profile, including the profile picture, bio description, follower-to-following ratio, and tweet history (i.e. the content of tweets, number of daily tweets, and ratio of original tweets to retweets) to determine who the user was (Harris et al., 2014) (Table 4). Although data were unique, the posters of the data were not necessarily so and could be counted multiple times if their data were collected and selected for analysis.

Table 4. Twitter study B coding framework: user category

User category	Definition
Consumer advocacy group	A group whose main aim is to effect significant social change through the means of mobilisation.
E-cigarette advocate	Group or person whose timelines primary content is related to e-cigarettes. To further distinguish between e-cigarette advocates and the general public, these users may be identified by their admission of being a vaper or vape or THR (tobacco harm reduction) advocate in their Twitter bio.
General public	Twitter account with a reasonable number of posts and followers, and following a reasonable amount of people, (i.e. ratio of followers ⁶ to followees ⁷). Their timeline spans a variety of topics that are not primarily e-cigarette related (Cole-Lewis et al., 2015). Twitter profile information and tweets reflect their individual thoughts and interests.
Government or politician	Government or political figures, groups, or organisations.
Health or scientific group	Reputable health and scientific groups or organisations.
Medical doctor, nurse, or group	A person, group or organisation who identifies as a physician, medical practitioner, medical doctor, or nurse.
News and media sources	Person, group, or organisation that focus on delivering news to the public.
Public health professional, researcher or academic	A person who identifies as a public health professional (besides medical doctor and nurse), researcher or academic.
Vape retailer or manufacturer	Outlets and companies that sell or manufacture e-cigarettes (online or physical store).
Suspected bot	“Accounts that appear to be fake or computerised, that are primarily promoting e-cigarette products (or other products); most accounts are

⁶ Followers are people who receive your tweets. If someone follows you: They'll show up in your followers list. They'll see your tweets in their Home timeline whenever they log in to Twitter.

⁷ Followees are people who you receive their tweets. If you follow someone: They'll show up in your following list. You will see their tweets in your Home timeline whenever you log in to Twitter.

User category	Definition
	disguised to appear as an ‘everyday person’” (Cole-Lewis et al., 2015, p. 3). To further “distinguish between human users and social bots, certain criteria such as information diffusion patterns (based on retweets or mentions), friend features (for example, the ratio of followers to followees), and content (frequency of nouns/verbs/adverbs in a tweet)” (Allem, Ferrara, et al., 2017, p. 2) are used.
Account not active or user suspended	Account has been removed or suspended from Twitter.
Other	Any account that does not fit into the categories listed.

The coding descriptor *sentiment* reflects the stance expressed in the tweet toward e-cigarettes and related products or its users, whether positive, negative, or neutral (Table 5).

Table 5. Twitter study B coding framework: sentiment

Sentiment	Definition
Positive	Tweet is in favour of e-cigarettes and vaping, related products, and use.
Neutral	Tweet is not strong in either direction for or against e-cigarettes and vaping, related products, and use.
Negative	Tweet is against e-cigarettes and vaping, related products, and use.

The coding descriptor *theme* reflects the theme of the actual content conveyed in the tweet (Table 6). The text of each tweet and/or the Twitter user’s handle was entered into Twitter’s search function to find the associated account which enabled the examination of the profile of the user and any comments attached to the tweet to assist with understanding its context.

Table 6. Twitter study B coding framework: themes

Theme	Definition
Addiction	E-cigarettes can be used to break nicotine or cigarette addiction, or reference to continued addiction to nicotine through e-cigarettes.
Advertising or promotion	Advertising, promotion, and endorsement of vape products, brands, retailers, groups or events. Does not specifically need to be selling products to purchase, can include user-generated content of products they are using.
Airport regulation or policy	Reference to, or questions about airport regulation/policy relating to e-cigarettes.
Association with coffee or tea	Mentions or depicts coffee or tea with vaping.
Association with drugs	E-cigarettes mentioned or depicted in association with addictive or illicit substances other than nicotine.
Australian regulation or policy	Reference to, or questions about Australian regulation/policy relating to e-cigarettes.
Big pharma	Reference to the pharmaceutical industry’s involvement in e-cigarette regulation, and e-cigarettes compared to pharmacy cessation products.
Brand name	Mentions or depicts an e-cigarette brand name.
Celebrity use	Mentions or depicts a celebrity using or endorsing e-cigarettes.
Cessation or alternative – negative	Suggests e-cigarettes are not a tool to quit smoking cigarettes or other tobacco products; and should not be used as a substitution for tobacco products.
Cessation or alternative – neutral	Reference to e-cigarettes as a quit-smoking tool or substitution, however, is not strong in either direction, for or against.

Theme	Definition
Cessation or alternative – positive	Suggests e-cigarettes are a tool to quit smoking cigarettes or other tobacco products; and are a substitution for tobacco products.
Challenging current regulation or policy	Challenging or providing information to refute proposed or implemented e-cigarette regulation or policy.
Challenging anti-vaping commentary	Challenging or providing information contrary to negative reporting of e-cigarettes. Includes trolling behaviour.
Cost and savings compared to tobacco	Cost-saving or low cost of e-cigarettes compared to tobacco products.
Community or subculture	Conveys a vaping social identity, shared community affiliation or subculture.
Conspiracy against vaping	Suggests e-cigarettes are not being legalised due to protected tobacco or pharmaceutical trade, or conspired action by government and public health officials.
Craving	Expressing a craving, desire or need to use e-cigarettes.
Customer and retailer interaction	Customers providing feedback or engaging with retailers, and retailers directly engaging with customers.
Difference between e-cigarettes and tobacco	Emphasising the difference between e-cigarettes and tobacco, and as such should not be regulated as tobacco products.
Doctor or nurse endorse or denounce	Medical doctors or nurses endorsing or denouncing e-cigarettes.
E-cigarette cessation	Ceasing e-cigarette use.
E-cigarette use or intent	Mentions or depicts someone using an e-cigarette, or their future intent to do so.
Effect on public health	Net public health gains or losses because of e-cigarettes.
E-liquid components	Mentions or depicts the components or ingredients in e-liquid.
Social promotion and recruitment	Attempts to engage other Twitter users in e-cigarette discussions, or to retweet content.
The U.S. Food and Drug Administration	Any mention of the U.S. Food and Drug Administration.
Flavour	Mention or depiction of e-cigarette flavours.
Misc. e-cigarette information	Miscellaneous information about e-cigarettes.
Getting others started	Offers information on how to start using e-cigarettes or what products to use for beginners.
Giving or asking for advice	Offering or asking for advice about e-cigarettes.
Health and safety – negative	Negative health and safety aspects associated with vaping.
Health and safety – neutral	Health and safety aspects associated with vaping, however, is not strong in either direction, positive or negative.
Health and safety – positive	Positive health and safety aspects associated with vaping.
Hobby and DIY	Vaping as a hobby, building devices or coils, preparing e-liquids.
Humour and sarcasm	The use of humour or sarcasm concerning vaping or its users.
Indoor use	Mentions or depicts someone vaping indoors.
Issue with e-cigarettes	Mentions any issues or problems encountered using e-cigarettes (e.g. batteries, device malfunctions, e-liquid safety).
Marketing tactics	Mentions methods used to promote and market e-cigarettes.
Nicotine	Mention or depiction of nicotine.
Ordering product	A person has placed or received an e-cigarette order or mentions shipping/delivery costs.
Pleasure	Pleasurable vaping experiences.
Price promotion	Coupons, percent off, discount offers, multibuys and give-aways.
Pro advocacy	Use of or describing vigorous campaigning to bring about political or social change regarding e-cigarettes.
Product review	Consumers providing reviews of products, or retailers asking for consumers to review products.
Quality	Positive and negative comments about e-cigarette or associated products quality.
Regulation or policy – cautious	Expresses support for or discusses cautious or restrictive e-cigarette regulation or policy.
Regulation or policy – liberal	Expresses support for or discusses legalisation or liberal e-cigarette regulation or policy.
Regulation or policy – neutral	Mentions e-cigarette regulation/policy, however, is not strong in either direction, for or against.

Theme	Definition
Retailer name	Mentions or depicts an e-cigarette retailer by name.
Secondhand vape	Reference to secondhand smoke or vapour.
Sexualisation	Pairing e-cigarettes with sexually suggestive imagery or text.
Smoke-free	Mention that e-cigarettes are smoke-free or can be used to contravene smoke-free legislation.
Social capital	Explicit or implicit statement of increased or decreased social capital when using/since using e-cigarettes.
Statistics	Any mention of statistics concerning e-cigarettes.
Stigma and dislike e-cigarette user	Expression of dislike for e-cigarettes and their users, or the stigma/dislike some users have experienced.
Tax	Reference to proposed or implemented e-cigarette taxes, and how these taxes are used.
Australian Therapeutic Goods Administration	Any mention of Australia's Therapeutic Goods Administration.
Throat hit	Reference to throat hit - the sensation in the throat caused by nicotine as it is inhaled.
Tobacco or e-cigarette industry	Reference to the tobacco or e-cigarette industry.
Tobacco or e-cigarette initiation	Reference to never-smokers or current smokers initiating e-cigarettes or e-cigarettes being a gateway to tobacco use.
Regulation or policy update	Reference to proposed or implemented e-cigarette regulation or policy.
Use in other populations	E-cigarette use among other populations (e.g. Indigenous, incarcerated).
Vape event	Reference to any event discussing or promoting e-cigarettes (e.g. scientific conference or a vaping convention).
Vape lounge	Space/shop where you can try e-cigarette products.
Vape play	Mentions or depicts vape tricks or cloud chasing. Vape tricks are activities vapers undertake such as blowing smoke rings. Cloud chasing is the activity of blowing large clouds of vapour using an e-cigarette.
Youth use	Reference to underage or youth using e-cigarettes.

URLs embedded within tweets were examined. If the URL was active, it was recorded as linking to either social media (e.g. Instagram, Facebook, or YouTube) or a website (e.g. retail, news, or blog).

Each code within the coding framework was a variable in SPSS version 22.0 that functioned as a stand-alone item and was evaluated as either 1 for *present* or 2 for *absent*. User category and sentiment were mutually exclusive categories (i.e. only one selection could be made per category), while the theme of the tweet and links to social media and websites were not mutually exclusive categories. A Chi-square test (or Fisher exact test if applicable) was used to examine the variation in the content of tweets between years.

3.4.3 Ethical considerations

Social media platforms are becoming increasingly popular field sites for data collection by researchers across diverse disciplines, and as such discussion has emerged regarding the responsibility of researchers to obtain and re-use social media data following the highest possible ethical standards (Townsend & Wallace, 2016). A particularly salient concern among researchers is whether social media

data should be considered public or private data (Townsend & Wallace, 2016). Twitter is a social networking service in which users broadcast their opinions and commonly use a hashtag to associate their thoughts on a subject with users on the same subject, and therefore this data is generally referred to as 'public data' (Townsend & Wallace, 2016). For ethical, privacy and technical reasons, TrISMA does not collect tweets from private accounts (i.e. users who have activated the 'protected tweets' function which limits the user's tweets to only their approved followers (Twitter, 2021)), or direct messages, therefore all data collected in the Twitter inquires were publicly available. The following passage is from Twitter's website:

"Twitter data is unique from data shared by most other social platforms because it reflects information that users choose to share publicly. Our API [Application Programming Interface] platform provides broad access to public Twitter data that users have chosen to share with the world. We also support APIs that allow users to manage their own non-public Twitter information (e.g. Direct Messages) and provide this information to developers whom they have authorized to do so." Twitter Inc. (2020)

3.5 Substudy 3: Qualitative Inquiry

Objective: To examine adult e-cigarette users who reside within the Greater Capital City Statistical Area of Perth, their motivations for e-cigarette use, reinforcing influences, and association with the vaper subculture.

Objective: To examine how adult e-cigarette users residing within the Greater Capital City Statistical Area of Perth, navigate Western Australia's restrictions (i.e. 'ban' on nicotine vaping and the sale of e-cigarettes devices) to access vaping products and the health and safety issues they encounter.

There is a dearth of literature examining vaping in Australia. Therefore, to supplement the findings of the scoping review (substudy 1: publication 2) and the Twitter inquiry (substudy 2: publications 2 and 3) a qualitative inquiry (substudy 3: publications 4 and 5) was undertaken to understand people's vaping experience and whether social media played a part in this practice. Qualitative research is particularly useful when little is known about the topic under investigation and there is a need to understand the issue in greater detail (Liamputtong, 2013) which can only be gained by "talking directly with people ... and allowing them to tell the stories unencumbered by what we expect to find to what we have read in the literature" (Creswell, 2012, p. 48).

The following methods are reported in publications 5 and 6.

5. **McCausland, K.**, Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. *BMC Public Health*, 20:1552. <https://doi.org/10.1186/s12889-020-09651-z>
6. **McCausland, K.**, Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94:103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

3.5.1 Research process

3.5.1.1 Research paradigm and theoretical perspective

The study's research paradigm was interpretivist, comprising a relativist ontology, constructionist epistemology, and symbolic interaction as the theoretical perspective.

Symbolic interactionism is a sociological and social-psychological perspective grounded in the study of the meanings that people learn and ascribe to the objects

and actions that encompass their everyday experiences (Given, 2012). Symbolic interactionism was originally conceived in the early twentieth century by philosopher George Herbert Mead, although it was not until 1934 that Mead's students published in his name their notes from his social psychology courses in a book titled *Mind, Self, and Society* (Given, 2012). In 1937, Herbert Blumer, one of Mead's students, coined the term symbolic interactionism and subsequently consolidated much of Mead's work into a distinct sociological perspective (Given, 2012).

Symbolic interactionism is a micro-level sociological theory, focusing on the interactions between individuals instead of looking at large scale structures (e.g. education) (Charon, 2001). By examining the small scale, symbolic interaction explains the individual in society and their interactions with others, and through that, social order, and change (Charon, 2001). Herbert Blumer (1969) proposed three tenets to explain symbolic interaction, which led him to argue that qualitative inquiry is the only appropriate way to discern how individuals see, understand, and interpret their world:

1. Human beings act toward things based on the meanings they have ascribed to objects.
2. Human beings ascribe meaning to objects based on social interactions with others and society.
3. Human beings create and modify meaning through an interpretative process based on their experiences.

Symbolic interaction, therefore, attempts to understand the interaction of individuals and herein lies the strength of the perspective in relation to public health because this process requires investigation of aspects such as meaning, socialisation and expectation as individuals define a situation and determine their action (Maycock, 2015).

Grounded theory was conceptualised by Glaser and Strauss (classical grounded theory) in the mid-1960s and since then has been adapted by Strauss and Corbin (interpretive grounded theory) and Charmaz (constructivist grounded theory) (Sebastian, 2019). Strauss and Corbin (1990) and others (Crotty, 1998) suggest grounded theory is a complementary methodology of symbolic interaction. In line with the PhD Scholar's chosen epistemological and ontological perspective, elements (i.e. memoing, open and axial coding, constant comparative method

(Sebastian, 2019)) of Strauss and Corbin's interpretive approach to grounded theory were used to collect and analyse the data, as explained in section 3.5.4.2.

3.5.2 Methods

Semi-structured in-depth interviews elicited narratives from vapers. In-depth interviews are commonly employed in sociological research (Allen, 2017) as they "help [to] reconstruct events the researchers have never experienced" (Rubin & Rubin, 2012, p. 3) and aim to explore the 'insider perspective' (Taylor, 2005). In qualitative research, interviews are the most commonly used data collection method (Taylor, 2005) and the semi-structured format is the most frequently used interview technique (DiCicco-Bloom & Crabtree, 2006).

3.5.2.1 Sampling

The study used purposive sampling strategies to purposefully select specific individuals who can provide rich accounts of their experiences relevant to the research aim and objectives (Patton, 2002). Data collection and analysis occurred simultaneously, facilitating appropriate and targeted recruitment. Participants were sampled for maximum variation (Patton, 2002; Seale, 2012) in demographic characteristics within the sampling frame. Those characteristics were sex, age, and Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) which is a ranking derived from the economic and social conditions of people and households within an area (Australian Bureau of Statistics, 2018a).

Snowball sampling was also utilised to access eligible participants, whereby participants were asked to provide the PhD Scholar's contact details to other eligible vapers. Snowball sampling is commonly used with populations who are difficult to access and may be unlikely to participate in research without a referral from others within their network (Rao et al., 2017; Vervaeke, Korf, Benschop, & van den Brink, 2007), which was also the case in this study as some participants were particularly wary of the motivations for the study.

Sampling was terminated when thematic saturation was reached (Morse, 1995), which was determined through the constant comparison of data with preceding data until few new themes were generated.

3.5.2.2 Eligibility

Eligible participants were current (at least weekly vaping) and former vapers (used e-cigarettes within the last 12 months), aged over 18 years residing within the Greater Capital City Statistical Area of Perth, Western Australia (Australian Bureau of Statistics, 2012). There are 16 Greater Capital City Statistical Area regions within

Australia, which provide a stable and consistent boundary that reflects the functional extent of each of Australia's capital cities and includes people who regularly work, shop and socialise within the city, but live in surrounding areas (Australian Bureau of Statistics, 2012).

3.5.2.3 Recruitment

Recruitment (March to November 2018) utilised a multipronged approach, relying heavily on social media. Social media has proven to be an effective recruitment technique, even with historically hard-to-reach groups (Gelinias et al., 2017). Passive recruitment (Gelinias et al., 2017) was undertaken whereby recruitment material (appendix L) was posted to social media to attract interested individuals to contact the PhD Scholar via email or telephone to express their interest in participating, and receive further details about the project and what their participation would entail. Specifically, recruitment material was posted to four online vaping forums (AussieVapers, Vaping in Australia, Vaper Café Australia, and E-Cigarette Forum); seven subreddits on Reddit; and 30 closed vaping groups on Facebook. When a Facebook group is 'closed', only members of the group can see and interact with the content shared within it (Moreau, 2019). Non-members can see that this group exists, however, the content and members are concealed. Facebook groups were accessed by the PhD Scholar by requesting permission from the group moderator to enter the group as a researcher to recruit participants to the study. Adhering to best practice recommendations for social media recruitment (Gelinias et al., 2017), the PhD Scholar was transparent about who they were and their motive for entering the group, using their personal account on each of the social media to recruit participants. Vape retail stores (online, and bricks and mortar) within the Greater Capital City Statistical Area of Perth were contacted via email, social media, and webpage submission forms.

3.5.2.4 Informed consent

Upon contacting the PhD Scholar, participants were sent via email or through social media a participant information statement (appendix M) which explained the research aims and objectives, who was conducting the research, the nature of their involvement and that they were free to withdraw from the study at any time. Participants who agreed to the terms laid out in the participant information statement were then provided with a participant consent form (appendix N) which was either signed and sent back to the PhD Scholar before the interview or completed at the time of the interview. Participants were provided with the contact details of the Chief

Investigator, Ethics Officer, and Manager of Research Integrity who they could speak with to ask any further questions before consenting to participate in the study.

3.5.3 Data collection

The PhD Scholar met with participants at a safe public location (e.g. local café, university campus, vape store) convenient to the participant. Interviews were conducted in English by the PhD Scholar which lasted on average 49 minutes (range 25–86 minutes). Interviews were audio-recorded with participant consent and upon completion of the interview, participants were provided with an AUD 25 gift voucher as an honorarium for the time they provided.

3.5.3.1 Semi-structured interview guide

Interviews were conducted using a semi-structured interview guide (appendix O) which focused broadly on several topic areas (reasons for use, the pathway to e-cigarette use, products used, accessibility, knowledge, attitudes and beliefs, cost, familial and peer attitudes, regulation and policies, advertising and promotion, and emergent subculture). The interview questions were guided by relevant literature (Becker, 1953) and discussions with the research team, and field-tested with two people who were eligible to participate in the study. The field-testing enabled the PhD Scholar to assess the flow and sequencing of questions, confirm the coverage and relevance of the content, receive feedback on the language used and questions asked, and implement changes based on their advice (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). At the time of data collection, the PhD Scholar was not confident that they fully understood the particulars of the vaping process (i.e. different devices, names and actions of device components, jargon) as they were an 'outsider' (Dwyer & Buckle, 2009). The field-testing process, therefore, provided the PhD Scholar with a level of confidence about the interview process and the content covered within.

The semi-structured approach permitted flexibility and adaptability within each interview and the informal environment enabled the PhD Scholar to develop a rapport with the participant, adapt the flow of the conversation, and ask follow-up and probing questions based on the participants' responses to previous questions while ensuring the preconceived areas of inquiry were explored (Turner, 2010). The questions within the interview guide were single-faceted, open-ended, and non-leading, and the guide aimed to stimulate responses from participants that were spontaneous and rich (Kallio et al., 2016). This meant that participants responses reflected their feelings and experiences, and the guide could generate data that

permitted new concepts to emerge with subsequent interviews (Kallio et al., 2016). As new ideas and concepts were identified within the data these data-driven concepts were fed back into the data collection process, and further guided sampling and adaptation of the interview guide (Skeat, 2010).

3.5.3.2 Field notes

Historically, 'scratch notes' or field notes have been a significant element of qualitative research which originally consisted of researchers' private and personal thoughts, ideas, and queries (Phillippi & Lauderdale, 2017). The practice of taking field notes and including them in the analysis is now viewed as an essential component of rigorous qualitative research and important data which assists to contextualise the study (Phillippi & Lauderdale, 2017). Two types of field notes were made, observational (during and post-interview) and personal reflections (post-interview). The PhD Scholar created a field notes proforma (appendix P) which was used to document pertinent information about the interview (e.g. date, time, location) and participant (e.g. identification code, demographics, smoking status and history), and record brief notes throughout the interview. Field notes aided in signposting follow-up questions, highlighting important aspects of the interview (e.g. introduction to new terminology and people of influence) and participant observations (e.g. appearance, demeanour), and were used to develop detailed field notes and personal reflections post-interview. Personal reflections captured the PhD Scholar's impressions pre- and post-interview and connections between participants, and were used to assess the PhD Scholar's performance, biases, and feelings (Mauthner & Doucet, 2003), and inform improvement and refinement of interview techniques (Elo & Kyngäs, 2008). Field notes and photographs were stored with the corresponding participants' audio file and transcripts as separate documents, although were linked by a participant identification code, and were protected from disclosure in the same manner as the audio file and transcripts (Phillippi & Lauderdale, 2017). Photographs were regularly taken of the vaping equipment participants had with them during the interview and of interview settings that were relevant to the study (i.e. vape store, e-liquid manufacturing laboratory).

3.5.4 Data analysis

3.5.4.1 Transcription

All interviews except one (corrupted file) were transcribed verbatim into a Microsoft Word document by an independent professional web-based transcription service (Go Transcript). The detailed notes taken by the PhD Scholar during and after the one interview that was not successfully audio recorded were sent via email to the

participant the following day for them to review for accuracy and validation. Amendments from the participant were returned via email. Transcripts and interpretations were not provided to the other participants for respondent validation.

All transcripts were checked for accuracy by the PhD Scholar which consisted of reading the transcript while simultaneously listening to the audio recording. This process served as an initial stage of analysis as it facilitated familiarisation with the data and participants' narratives (Braun & Clarke, 2006), and provided time to reflect on the interview process and prepare for coding (Liamputtong, 2013).

3.5.4.2 Coding and synthesis

Data analysis occurred simultaneously with data collection to facilitate the assessment of existing data and the creation of strategies to collect subsequent, richer data until saturation (Corbin & Strauss, 2015). Interview transcripts and field notes were anonymised and imported into the qualitative data analysis computer software, NVivo version 12.0, which was used to facilitate data organisation and linkage. The PhD Scholar conducted all coding to allow for a single researcher to be immersed in both the data collection and analysis, thereby ensuring that the coding frame (appendix Q) adequately described the intentions and content of the data (Elliott, 2018).

The analytical process followed the steps proposed by Braun and Clarke (2006) to conduct thematic analysis and drew upon the initial and axial coding process of grounded theory (Corbin & Strauss, 2015). The PhD Scholar played an active role in the analysis by searching for and identifying themes “to theorise the sociocultural contexts, and structural conditions, that enable the individual accounts that are provided” (Braun & Clarke, 2006, p. 85).

Line-by-line analysis was undertaken to look for patterns of meaning and issues of interest to the research questions using NVivo to tag and name sections of text, including surrounding contextual data, to generate a diverse range of initial codes (Corbin & Strauss, 2015). Codes were generated based on the PhD Scholar's theoretical interest and emergent concepts that arose during the Scholar's interaction and interpretation of the data.

The axial coding phase was a process of examining the initial codes at a conceptual level to combine and connect codes to form overarching 'candidate' themes and subthemes in a meaningful way regarding the phenomenon of investigation (Corbin & Strauss, 2015).

Revision of the candidate themes occurred twice and at two levels (appendix R) to identify and refine the concepts that were of relevance to each objective. The first level involved reviewing all the data collated under each candidate theme in NVivo to consider whether the data formed an intelligible pattern (Braun & Clarke, 2006), and in a Microsoft Word document, further interpreting and summarising the data, and noting pertinent points and exemplar quotes. Some themes and subthemes were refined during this process to create new themes/subthemes and separate and combine others (Braun & Clarke, 2006). The second level involved a similar process, whereby the data was reviewed and further refined in a clean Word document. This process, however, concerned the validity of the individual themes in relation to the entire data set to ensure participants' meanings and voice were accurately reflected (Braun & Clarke, 2006).

A detailed analysis was then written for each theme to report the content and meaning of patterns (Braun & Clarke, 2006). Working theme titles were refined to ensure they accurately reflected the respective analysis, and the most vivid quotes were selected to best illustrate the essence of the point being demonstrated (Braun & Clarke, 2006).

A codebook was developed to provide structure and agreement about code definitions, constructs, and themes (Liamputtong, 2013). Throughout the analysis, there were regular discussions among the PhD Scholar and supervisors regarding the Scholar's interpretations of the data and conceptual maps to improve the dependability of the findings (Given, 2008). Records of study processes, decisions, and methods were documented through meeting minutes, ethics amendments and annual reports, field notes, personal reflections and analytic memos, contributing to a rigorous analysis process (Birks, Chapman, & Francis, 2008; Liamputtong, 2013).

To further support analysis, an Excel spreadsheet was populated to capture participants' demographic data and smoking and vaping behaviours (appendix S). The spreadsheet was a significant analytical tool that especially facilitated the construction, understanding and explanation of the vaper typologies (Kluge, 2000) explored in qualitative study A (publication 5). Separate spreadsheets were created for the 'substitute' and 'cloud chaser' typologies, which included participants who displayed common attributes of each identity (Kluge, 2000).

Demographic and behavioural data were analysed using descriptive statistics in SPSS version 26.0.

3.5.4.3 Reflexivity

Reflexivity acknowledges that researchers play a key role in how their data are analysed and presented and is a strategy that makes explicit the views and judgements of the researcher that may affect the research process, including the researcher's background, assumptions, perceptions, values, beliefs, and interests (Carpenter & Suto, 2008). To address reflexivity, the PhD Scholar reflected on their views and judgements before and during data collection with one of the members of the research team, some of which are documented here:

- I am an Australian born and educated, cis-gendered woman. I have a tertiary education, the first person in my family to receive a tertiary qualification. I acknowledge my privilege concerning my sociodemographic and cultural characteristics.
- As a child, my stepfather smoked cigars, however, rarely in front of my sister and me and he quit before I formulated concrete memories of his behaviour.
- I have never been a tobacco smoker and I have not been exposed to smoking as generations before have been because I grew up with the increasing restrictions placed on smoking. These experiences, I believe, have shaped my attitude toward smoking. I do not particularly like the habit nor understand the appeal. In saying that, I am sympathetic to and can recognise some benefits of e-cigarettes for smokers who have been unable to quit using 'conventional' methods (i.e. Therapeutic Goods Administration approved cessation methods). However, I do not agree that these 'unconventional' methods (i.e. e-cigarettes) should be made freely available to the rest of the population when there is uncertainty about the harm they could impose.
- At times I felt conflicted between my allegiance to public health and my sympathy for the people I spoke to who were so passionate about quitting smoking and felt that e-cigarettes were the only way they could do so.
- I was not aware of e-cigarettes before embarking on this research and had a limited understanding of how they worked, how they are marketed or their appeal to users.
- I believe the tobacco industry should not be involved in the development or promotion of e-cigarettes, nor present themselves as 'part of the solution' to ending the tobacco epidemic.

- Although I shared some characteristics (e.g. gender, socio-economic status, education) with the people I interviewed, my status as a privileged, white female, non-smoker may have rendered me an outsider in some people's opinion. I never felt like I struggled to develop a rapport with any participant because I regarded the people I spoke to during this study as 'experts' and I was on a quest for information, knowledge and an understanding of their experiences.

3.5.4.4 Rigour

Trustworthiness has become a significant concept in qualitative research as it permits researchers to describe the qualities of qualitative terms outside of the boundaries that are characteristically concerned with quantitative research (Given, 2008). Trustworthiness can be conceptualised as the strategies that are selectively employed, adapted, and combined to achieve the purpose and to enhance the rigour of qualitative investigations (Liamputtong, 2010). The PhD Scholar followed strategies as described below to ensure that the research was trustworthy, and to enhance rigour.

Study Design

- A rationale has been provided for the methodological decision (see section 3.5.1).
- Records of study processes and decisions (audit trail) were documented through meeting minutes, ethics amendments and annual reports, field notes, personal reflections and memos (Birks et al., 2008; Given, 2008).
- Continuous engagement with relevant literature, social media, news items, stakeholders and their communications were undertaken throughout the life of the project to stay abreast of current knowledge and happenings (Liamputtong, 2013).

Data Collection

- An audio recorder was used to record interviews which were then transcribed verbatim (Liamputtong, 2013).
- Sampling was terminated when thematic saturation was reached and few new data were being generated (Morse, 1995).

Data Analysis

- An in-depth rich description of the research methods through field notes, personal reflections and analytic memos contributed to the rigorous analysis process (Birks et al., 2008; Liamputtong, 2013).
- The creation and use of a codebook to provide structure and agreement about code definitions, constructs, and themes (Liamputtong, 2013).
- Regular discussions with the PhD Scholar's supervisors occurred during analysis about meaning, and the Scholar's interpretations of the data and conceptual maps to improve the dependability of the presentation of the findings (Given, 2008).

Presentation of Findings

- It is acknowledged that the PhD Scholar's presence, etic perspective, and worldview has had some influence on the interpretation and presentation of the findings (Given, 2008).
- Participant verbatim quotations are provided as evidence of how meaning is expressed in the participant's own words to support the PhD Scholar's interpretations (Liamputtong, 2010).
- Participants' experiences and opinions are fully and accurately described and experiences exception to the 'norm' are presented (Given, 2008).
- Findings are compared to the findings of other research to situate the conclusions within the broader research context (Given, 2008).
- Copies are provided of coding frameworks (tables 3–6 and appendix Q) and evidence of theme refinement (appendix R).
- The qualitative studies (substudy 3: publications 5 and 6) are reported following guidance from the COnsolidated criteria for REporting Qualitative research (COREQ) checklist (Tong, Sainsbury, & Craig, 2007) (appendix T).
- Publication of the study findings provided the opportunity for external peer review. Academic peer review is considered the most rigorous form of editorial review for judging what texts are deemed to be of the highest quality and significance, and therefore worthy of publication (Given, 2008).

3.5.5 Ethical considerations

Uncovering illegal activity was not an objective of the study, however, due to the nature of the inquiry the issue of liquid nicotine access and use was invariably discussed. Chapter 4.6 of the *National Statement on Ethical Conduct in Human Research* (The National Health and Medical Research Council the Australian Research Council and Universities Australia, 2007) describes ethical considerations relating to people who may be involved in illegal activities. The study complied with the following requirements and key considerations.

Beneficence

- 1.6.4 Consideration should be given to the use of pseudonyms, or to the removal of links between names and data for participants whose illegal activity may be revealed or discovered in the research.

Respect

- 1.6.5 Researchers may have contact with those participants in other professional roles. Where this is the case, researchers should make every effort to ensure both that the research is not compromised by contact in those other roles, and that other obligations to participants are not compromised by the research activity. In research that is likely, but not designed, to discover illegal activity, researchers should also make clear to participants when a contact or intervention is part of the research and when it is not.
- 1.6.6 In research that may foreseeably discover illegal activity but is not designed to expose it, researchers should explain to participants as clearly as possible:

(a) the likelihood of such discovery and of any resulting legal obligation of disclosure the researcher may incur; and

(b) the extent to which the researcher will keep confidential any information about illegal activity by participants or others, and the response the researcher will make to any legal obligation or order to disclose such information.

4. Results

This section reports on the results of the study's project advisory group and three substudies: a) scoping review, b) Twitter inquiry and c) qualitative inquiry.

4.1 Project Advisory Group

The PhD Scholar and research team met twice yearly across the life of the project (2018–2020) with the project advisory group to discuss the progression of the project, preliminary findings, collective efforts to create change and the strategies to affect change around education, advocacy, policy and practice. This process supported an ongoing collaborative approach between the research generators and the end-users. Between formal meetings, the PhD Scholar kept in contact with members of the advisory group through email and electronic project briefings (n=6) which provided the group with an update of project activities, as well as other e-cigarette related research the team were involved in, and current media and research articles of relevance to tobacco control. Several grant applications to extend the PhD Scholar's doctoral work were developed in collaboration with the advisory group:

1. Submitted to Healthway 2019: *Insta influence: who has it, what is it and how are e-cigarettes promoted?*
2. Submitted to Curtin University 2020: *Analysing social media trends using data analytics and machine learning: E-cigarettes as a test case.*
3. Submitted to the Australian Research Council 2020: *Real-time machine learning social media exploration: E-cigarettes as a test case.*
4. Submitted to Healthway 2020: *Are Instagram and TikTok helping to 'hook' a new generation of nicotine users?*
5. Submitted to Healthway 2020: *Co-designing strategies to prevent youth e-cigarette appeal, access, and uptake.*
6. Submitted to the Australian Research Council 2021: *Exposing electronic cigarette promotion content on social media.*

As a result of the PhD Scholar's and the research team's increasing visibility within tobacco control, engagement in relationship building processes and ongoing connections, relationships were established with additional research centres (Center

for Tobacco Control Research and Education, University of California San Francisco; National Centre for Epidemiology and Population Health, Australian National University; Telethon Kids Institute), organisations (Asthma WA; School Drug Education and Road Aware), and associations (Australian Association for Adolescent Health; Public Health Association of Australia (WA Branch), who became partners on the grants submitted in 2020.

4.2 Substudy 1: Scoping Review

4.2.1 Scoping review protocol

Publication 1: The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol.

Objective: To identify and describe the breadth of messages presented in online e-cigarette promotions and discussions.

Citation: **McCausland, K.**, Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633> [Impact Factor 2.496]

BMJ Open The messages presented in online electronic cigarette promotions and discussions: a scoping review protocol

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ABSTRACT

Introduction Electronic cigarettes have become increasingly popular over the last 10 years. These devices represent a new paradigm for tobacco control offering smokers an opportunity to inhale nicotine without inhaling tobacco smoke. To date there are no definite conclusions regarding the safety and long-term health effects of electronic cigarettes; however, there is evidence that they are being marketed online as a healthier alternative to traditional cigarettes. This scoping review aims to identify and describe the breadth of messages (eg, health, smoking-cessation and price related claims) presented in online electronic cigarette promotions and discussions.

Methods and analysis A scoping review will be undertaken adhering to the methodology outlined in The Joanna Briggs Institute Manual for Scoping Reviews. Six key electronic databases will be searched to identify eligible studies. Studies must be published in English between 2007 and 2017, examine and/or analyse content captured from online electronic cigarette promotions or discussions and report results for electronic cigarettes separately to other forms of tobacco delivery. Studies will be screened initially by title and abstract, followed by full-text review. Results of the search strategy will be reported in a PRISMA flow diagram and presented in tabular form with accompanying narrative summary.

Ethics and dissemination The methodology consists of reviewing and collecting data from publicly available studies, and therefore does not require ethics approval. Results will be published in a peer reviewed journal and be presented at national/international conferences. Additionally, findings will be disseminated via social media and online platforms. Advocacy will be key to informing policy makers of regulatory and health issues that need to be addressed.

Registration details The review was registered prospectively with The Joanna Briggs Institute Systematic Reviews database.

INTRODUCTION

The proliferation of alternate nicotine delivery devices represents a new paradigm for tobacco control, providing smokers with a novel way to inhale nicotine without inhaling tobacco smoke.^{1 2} The increase in nicotine delivery devices, predominantly electronic cigarettes, suggests that these devices may be perceived as a healthier alternative

Strengths and limitations of this study

- This is a nascent area of research in which the scoping review methodology supports the generation of evidence to increase understanding of how the online space is being used to promote and discuss electronic cigarettes.
- The review will adhere to the methodology outlined in the Manual for Scoping Reviews by The Joanna Briggs Institute.
- The review will not assess the quality of the evidence identified from the literature, rather provide an overview of the existing evidence, regardless of quality.
- The heterogeneity of content areas covered by this methodology may provide challenges in synthesising the results into succinct conclusions or recommendations.

to traditional cigarettes.³⁻⁵ However, there remains numerous questions in relation to the public health benefits of these devices. Questions posed are in regard to their facilitation of smoking uptake among youth^{6 7}; their effectiveness as a smoking cessation intervention, with dual use of cigarettes and electronic cigarettes potentially maintaining cigarette addiction⁸⁻¹⁰, the possible harms from device malfunctions^{11 12} and the potential health risks associated with their use.¹³ These questions emphasise the need for research to inform electronic cigarette and emergent nicotine delivery device policy and regulations.

Electronic cigarettes (also commonly known as e-cigarettes) are battery-powered devices that heat a solution, known as juice or e-liquid, typically containing nicotine, which generates a vapour for inhalation.¹⁴ E-liquid is available in a range of flavours including butterscotch, cherry choc and vanilla¹⁵ which appeal to many youth.^{16 17} Studies have found wide variability in the level of nicotine delivered by these products,¹⁸⁻²⁰ device quality (airflow rate, aerosol production, leaking e-liquid cartridges) and labelling,^{19 21} and



have connected electronic cigarette use with nicotine addiction, respiratory damage, aortic stiffness and intake of carcinogenic heavy metals.²²⁻²⁶

The International Tobacco Control Policy Evaluation Project is the first international cohort study of tobacco use.²⁷ The project's objective is to measure the psychosocial and behavioural impact of key national level policies of the WHO Framework Convention on Tobacco Control.²⁸ It is a collaborative effort with international health organisations and policy-makers in more than 25 countries thus far.²⁹ Data from the project have confirmed, as well as extended the understanding of the level of awareness and use of electronic cigarettes in high-income countries.³⁰ The data are consistent with results from the HealthStyles³¹ and ConsumerStyles³² surveys conducted in the USA providing further evidence of increasing levels of electronic cigarette awareness and use over the last decade. Australian data from the International Tobacco Control Project have shown that awareness of electronic cigarettes increased from 20% in 2010 to 66% in 2013, and self-reported use from 1% in 2010 to 7% in 2013,³³ even though the sale, purchase and marketing of electronic cigarettes were (and continues to be) prohibited.³⁴

Regulation of electronic cigarettes differs among countries, ranging from no regulation, licensing as medicines, to complete prohibition.³⁵ For example, as of 2016 across the European Union, electronic cigarettes could not be advertised or promoted directly or indirectly, including via internet and commercial e-mail.³⁶ Similarly, the US Food and Drug Administration recently extended its regulatory power to include electronic cigarettes, meaning they intend to regulate the marketing, labelling and manufacturing of these devices.^{37,38} Despite this, evidence suggests online marketing of electronic cigarettes continues.^{39,40}

There is increasing evidence of substantial financial investment by tobacco and other industry groups using websites, social media and other non-traditional marketing methods to increase the electronic cigarette market.^{7,41,42} In the USA and Canada alone, over \$2 million is spent annually on online electronic cigarette advertising.⁴³ The online social networking service, Twitter, with 328 million active monthly users⁴⁴ is regularly used as a promotional tool by electronic cigarette manufacturers and retail outlets. For example, electronic cigarette tweets were found to increase 10-fold during 2009–2010, of which 93% were classified as advertising.⁴⁵ The rise of new media has enabled the tobacco industry to penetrate channels such as Twitter and YouTube with information offsetting tobacco control denormalisation strategies,^{46,47} of which the electronic cigarette industry is now capitalising on.⁴⁸

Electronic cigarette companies are employing techniques previously used by the tobacco industry to influence young people's decision to use cigarettes.⁴⁹ These include the addition of sweet flavourings to e-liquid and promoting products using youth-resonant themes, such as sex appeal, rebellion, social status and celebrity testimonials.^{50,51} In addition, electronic cigarettes

are being advertised as a harm reduction alternative^{7,41} and promoted in a way to create a vaping culture that appeals to youth (even non-smokers),^{52,53} potentially supporting the creation of a whole new generation of nicotine addicted young people, normalising vaping and renormalising smoking in public places and serving as a gateway to tobacco use.⁵⁴⁻⁵⁶

The development of positive perceptions of electronic cigarettes by consumers contributes to their decision to use these devices, and are often motivated and supported by tobacco industry marketing.⁵⁷ Cyberspace continues to be a prominent media used to promote and market electronic cigarettes and their associated products.⁵⁸ Electronic cigarette retail websites and social media accounts present an assortment of explicit and implicit marketing claims, most commonly with regard to claims of health benefits, being less harmful than tobacco, and being able to assist in quitting smoking.^{43,50,59,60} Assertions that electronic cigarettes are a safe and healthy alternative to traditional tobacco cigarettes may undermine tobacco control efforts while the increased visibility of youth appealing images may provoke tobacco or electronic cigarette uptake.⁵⁰ It is therefore imperative to understand the marketing strategies consumers are exposed to.

Very little is known about this emerging product, and there is a need for systematic research to understand the marketing drivers for the uptake of electronic cigarettes and how they are promoted and accessed online. Only through this understanding can appropriate policies and regulations be developed. This manuscript outlines a proposed methodology for a scoping review which aims to identify and describe the breadth of messages (eg, health, smoking-cessation and price related claims) presented in online electronic cigarette promotions and discussions.

METHODS AND ANALYSIS

Study design

A scoping review will be undertaken to identify and describe the breadth of messages presented in online electronic cigarette promotions and discussions. Scoping reviews use a systematic process to map key concepts and types of evidence in an area of research and identify gaps in an existing body of knowledge.⁶¹⁻⁶⁵ Scoping reviews tend to differ from systematic reviews in a number of ways and typically do not assess the quality of the studies included.^{61,63} This scoping review will adhere to the methodologically rigorous methods manual by The Joanna Briggs Institute (JBI).⁶⁴ The scoping review frameworks proposed by Arksey and O'Malley,⁶¹ and Levac, Colquhoun and O'Brien⁶³ have been drawn on in the development of the JBI methodology for scoping reviews. The JBI scoping review methodology consists of five parts: (1) Title, objective and question; (2) Inclusion criteria; (3) Search strategy; (4) Extraction of the results and (5) Presentation of the results.

A preliminary search of the literature was conducted in the following databases: JBI Database of Scoping



Reviews and Implementation Reports, Cochrane Database of Systematic Reviews, PROSPERO International Prospective Register of Systematic Reviews, Database of Promoting Health Effectiveness Reviews (DoPHER) and Epistemonikos which confirmed that no systematic or scoping review has been published or is currently underway on this topic. The review was prospectively registered with the JBI Systematic Reviews database (5 May 2017). It is anticipated that the scoping review will commence by September 2017 with data extraction completed by November. We aim to submit the findings of the review in the form of a manuscript for peer review by the end of January 2018.

Title, objective and question

Review title: *The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol.* The title was guided by the 'PCC' mnemonic (Population, Concept and Context).⁶⁴ Using the PCC mnemonic enables the title to reflect key information about the focus and scope of the review to impeding readers.

Review objective: *This scoping review will identify and describe the breadth of messages presented in online electronic cigarette promotions and discussions.* The review objective is congruent with the title and specifies what the review aims to achieve.

Review question: *What messages are presented in online electronic cigarette promotions and discussions?* The review objective includes the PCC elements and guides and directs the development of the inclusion criteria for the scoping review.

Inclusion criteria

This scoping review will include studies that have examined and analysed content captured from online electronic cigarette promotions and discussions (eg, social media: YouTube, Facebook, Instagram, Twitter; and websites: retail sites, discussion forums, blogs). The media reported in the study must be clearly identified (eg, analysis of tweets from Twitter). Studies reporting multiple media will be excluded (eg, analysis of tweets and posts from Twitter and Facebook, respectively) unless the results for each media are reported separately. Other tobacco product studies (eg, traditional tobacco cigarette, snus, chewing tobacco or hookah) will be excluded unless electronic cigarettes are also examined in the study and reported separately. In addition, studies that do not distinguish between electronic cigarettes and other forms of tobacco delivery will be excluded. Studies examining promotions or discussions in traditional media (eg, TV, newspaper and magazine) will be excluded unless online media is also examined in the study and reported separately. Studies will be limited to the following countries: UK, USA, New Zealand, Australia and Canada. These countries have been selected as they are all developed countries and electronic cigarette use is well established.²⁹ The review will consider only peer reviewed primary research studies. Systematic

and literature reviews, grey literature, editorials and thesis publications will be excluded.

Search strategy

The search strategy aims to identify peer reviewed primary research studies. Consultation with the Faculty Librarian identified five key databases: Medline, Scopus, ProQuest, Informit and Google Scholar. The research question crosses subject areas, hence the Medline, Scopus, Informit and ProQuest databases were identified due to their multidisciplinary nature and broad scope. Google Scholar will provide a sound overview of what published material exists on the topic. A hand search of the Journal of Medical Internet Research will also be conducted to ensure no studies meeting the inclusion criteria are missed. Preliminary searches have located numerous articles published in this journal that are relevant to the review question. The first 200 results from Google Scholar will be examined for eligibility and subject to the screening process outlined below.

An initial search of Medline was undertaken, followed by an analysis of the text words contained in the title, abstract and index terms used to describe the articles. This informed the development of the search strategy, including identified keywords and index terms. A comprehensive search using all the identified keywords and index terms will be undertaken across all databases. Lastly, the reference list of all articles subject to full text review will be screened for additional studies and assessed for suitability based on the studies title and abstract.

The search will be limited to studies published in English in the last 10 years (2007–2017), this period correlates with the approximate time that electronic cigarettes were first introduced to the USA and Europe.⁶⁵ The primary reviewer (KM) will contact authors of primary research studies if access to full text cannot be obtained. Studies reported as abstracts or for which full texts cannot be identified will be excluded from the review.

The initial search terms are: ('electronic cigarette' OR e-cigarette OR 'electronic nicotine delivery system' OR 'personal vapo?ri?er' OR 'electronic nicotine delivery device' OR 'vape pen' OR 'smokeless tobacco' OR 'electric cigarette' OR 'electric nicotine delivery system' OR 'electric nicotine delivery device' OR e-hookah OR e-juice OR e-liquid OR vaping) AND ('social media' OR internet OR online OR YouTube OR Facebook OR Instagram OR Twitter OR 'online media' OR website OR e-mail OR blog OR 'digital media' OR 'social networking') AND ('content analysis' OR 'content evaluation' OR message OR meaning OR coding OR 'media analysis' OR 'textual analysis'). A transcript of a draft search strategy conducted in Medline is provided in (see online supplementary appendix I).

Retrieved citations from each database will be imported into EndNote X7⁶⁶ reference management software, with duplicate citations removed before being imported into Covidence.⁶⁷ Covidence is a not-for-profit service working in partnership with Cochrane to improve the



production and use of systematic reviews for health and well-being. Covidence is a web-based software platform that streamlines the production of systematic reviews by supporting the key steps in the review process such as citation screening; full text review; risk of bias assessment; extraction of study characteristics and outcomes; and export of data and references.⁶⁷

Study selection

Studies will be assessed for inclusion based on the inclusion criteria, examined initially by title and abstract. Full text articles will be retrieved if they appear to meet the inclusion criteria or if further examination is required to determine eligibility. Two reviewers (KM and JJ) will independently screen all titles/abstracts to determine their eligibility. Full text screening will then be undertaken by the primary reviewer to further determine study eligibility for inclusion in the review. This process will be assisted by the online screening and data extraction tool—Covidence.⁶⁷ Any disagreements will be resolved through discussion with a third reviewer (BM).

Extraction of the results

The relevant content from each study will be extracted using a data extraction proforma (see online supplementary appendix II). Data extracted will include: Author(s), year of publication, origin/country of study, aim/purpose of study, media reported, sample size, study design/methods, results and key findings that relate to the review question. There will be no attempt to contact authors of primary research studies for which extraction information is not reported. Primary outcome data will include the type of media being reported (eg, Twitter or retail website), and the sentiment (positive, negative and neutral) and theme (eg, cessation, flavour, discount) of the messages presented. Reporting on these outcomes will satisfy the aim of this scoping review. Secondary outcome data that will be extracted if reported on is author category (eg, vaping enthusiast or tobacco company).

To ensure inter-rater reliability, two reviewers (KM and JJ) independent of one another will chart the first five studies using the data extraction proforma and meet to determine whether their approach to data extraction is consistent with the research question and purpose. In addition, this process will be used to refine and/or expand the data extraction proforma to ensure all relevant results are being extracted. Any change made to the data extraction proforma will be reported in the results publication. The primary reviewer will then extract data from the remaining studies unaccompanied.

Presentation of the results

The results of the search strategy will be presented in a PRISMA flow diagram indicating the number of articles found via each search method, the number of duplicates removed and the number of studies excluded and included. A list of studies excluded after full text screening will be made available along with the main reason for exclusion.

To illustrate and summarise the main findings, results will be presented in tabular form (as per data extraction proforma), with an accompanying narrative summary describing how the results relate to the review objective and question.

Ethics and dissemination

The scoping review methodology consists of reviewing and collecting data from publicly available peer reviewed articles, therefore this study does not require ethics approval.

The results of the scoping review will be published in a peer reviewed journal and presented at national/international conferences and symposia. Additionally, findings will be distributed via academic, research and community publication, and news and social media platforms, such as The Conversation, Research Gate and Twitter, in order to increase circulation. Advocacy, such as discussions with, and presentations to professional associations will be key to informing policy makers of regulatory and health issues that need to be addressed. The expertise of the research team (health promotion, public health, knowledge translation) will support broad dissemination of the findings.

IMPLICATIONS

Findings from this scoping review will increase understanding of the types of electronic cigarette promotion and discussions occurring online. This may provide evidence that will inform the need for advertising restrictions, as well as stimulate further research to understand and combat the proliferation of this online advertising. Additionally, the findings will inform various components of a research project investigating electronic cigarette discussion among Australian Twitter users. This study will access public Australian Twitter data through Tracking Infrastructure for Social Media Analysis (TrISMA),⁶⁸ a powerful new framework for tracking, storing, and processing social media communication activities of Australian users. The study aims to compare electronic cigarette Twitter discussion in 2012, 2014 and 2016 using a triaxial classification scheme to capture tweet sentiment, theme and author category.

Contributors KM, JJ and BM conceptualised the research. KM drafted the protocol. JJ and BM aided in developing the research question and study methods, contributed meaningfully to editing and approved the final manuscript.

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4.2.2 Scoping review

Publication 2: The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review.

Objective: To identify and describe the messages presented in e-cigarette related social media promotions and discussions and identify future directions for research, surveillance, and regulation.

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Review

The Messages Presented in Electronic Cigarette–Related Social Media Promotions and Discussion: Scoping Review

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Abstract

Background: There has been a rapid rise in the popularity of electronic cigarettes (e-cigarettes) over the last decade, with growth predicted to continue. The uptake of these devices has escalated despite inconclusive evidence of their efficacy as a smoking cessation device and unknown long-term health consequences. As smoking rates continue to drop or plateau in many well-developed countries, transnational tobacco companies have transitioned into the vaping industry and are now using social media to promote their products. Evidence indicates e-cigarettes are being marketed on social media as a harm reduction alternative, with retailers and manufacturers utilizing marketing techniques historically used by the tobacco industry.

Objective: This study aimed to identify and describe the messages presented in e-cigarette–related social media (Twitter, YouTube, Instagram, and Pinterest) promotions and discussions and identify future directions for research, surveillance, and regulation.

Methods: Data sources included MEDLINE, Scopus, ProQuest, Informit, the *Journal of Medical Internet Research*, and Google Scholar. Included studies were published in English between 2007 and 2017, analyzed content captured from e-cigarette–related social media promotions or discussions, and reported results for e-cigarettes separately from other forms of tobacco and nicotine delivery. Database search ceased in October 2017. Initial searches identified 536 studies. Two reviewers screened studies by title and abstract. One reviewer examined 71 full-text articles to determine eligibility and identified 25 studies for inclusion. This process was undertaken with the assistance of the Web-based screening and data extraction tool—Covidence. The review was registered with the Joanna Briggs Institute (JBI) Systematic Reviews database and followed the methodology for JBI Scoping Reviews.

Results: Several key messages are being used to promote e-cigarettes including as a safer alternative to cigarettes, efficacy as a smoking cessation aid, and for use where smoking is prohibited. Other major marketing efforts aimed at capturing a larger market involve promotion of innovative flavoring and highlighting the public performance of vaping. Discussion and promotion of these devices appear to be predominantly occurring among the general public and those with vested interests such as retailers and manufacturers. There is a noticeable silence from the public health and government sector in these discussions on social media.

Conclusions: The social media landscape is dominated by pro-vaping messages disseminated by the vaping industry and vaping proponents. The uncertainty surrounding e-cigarette regulation expressed within the public health field appears not to be reflected in ongoing social media dialogues and highlights the need for public health professionals to interact with the public to actively influence social media conversations and create a more balanced discussion. With the vaping industry changing so rapidly, real-time monitoring and surveillance of how these devices are discussed, promoted, and used on social media is necessary in conjunction with evidence published in academic journals.

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KEYWORDS

electronic nicotine delivery systems; social media; public health; review

Introduction

There has been a dramatic rise in the popularity of electronic cigarettes (e-cigarettes) since the first commercialized product was developed in China in 2003 [1,2]. It is now estimated that there are 35 million e-cigarette users globally (including heat not burn tobacco products) [3], with this rapid growth predicted to continue. According to BIS Research [4], the global e-cigarette industry will experience an annual growth of more than 22% until 2025, reaching a total market value of US \$50 billion dollars at this time.

Since the advent of first generation e-cigarettes, which closely resemble traditional cigarettes in appearance and size, they have been the center of much debate. It has been suggested that these devices may be a less harmful alternative to smoking [5], provide health benefits to smokers who switch completely to them [6], lessen cigarette cravings [7], and facilitate smoking cessation [8]. However, promotion of e-cigarettes may also encourage nonsmokers, particularly young people, to initiate use [9,10], facilitate experimentation with traditional tobacco products [11], and undermine tobacco control efforts [12]. Recent studies also suggest that e-cigarette use is associated with negative health consequences [13,14] and may not facilitate adult smokers to quit at rates higher than smokers who do not use these products [15]. These contrasting arguments are evident in Web-based marketing by e-cigarette retailers and manufacturers [16], along with social media discussions about e-cigarettes [17]. Furthermore, the lack of agreement among countries on the population-level impact of these devices and how they should be regulated [2] (eg, UK Royal College of Physicians identifies e-cigarettes as a public health strategy, whereas the World Health Organization and the US Surgeon General see them as presenting potentially new health problems [18]) may cause confusion among consumers and the public in general. This, therefore, highlights the importance of examining social media as it offers opportunities to attract new users, promote continued use, and build brand loyalty.

Traditionally dominated by small start-up companies, the e-cigarette market has experienced rapid growth and transition, and more recently, large manufacturers and transnational tobacco companies have come to dominate the market. Major tobacco companies have entered the vaping industry by either acquiring e-cigarette companies and brands or developing their own products. Major tobacco companies now involved in the vaping industry include British American Tobacco, Imperial Tobacco, the Altria Group, Reynolds American, Philip Morris International, and Japan Tobacco International [19]. These companies have benefited from large advertising and marketing budgets, which enable promotion across the World Wide Web [20].

A significant portion of e-cigarette business is conducted on the internet [21], with most existing e-cigarette companies operating websites or other Web-based selling systems [22]. Sources suggest that e-cigarette manufacturers are careful to distance

their products from tobacco [23] by using techniques such as aesthetic appeal, including attractiveness, coolness, colors, and innovative packaging and flavor variations. In addition, websites and social media accounts have been found to exhibit price promotions, and competitions and discount coupons; there is also evidence of celebrity endorsements and sports sponsorship [24].

An accurate understanding of the types of e-cigarette messages social media users are exposed to, and who is disseminating this information can assist in the development of appropriate surveillance to inform future policy and regulations. A scoping review was, therefore, undertaken to identify and describe the messages presented in e-cigarette-related social media (Twitter, YouTube, Instagram, and Pinterest) promotions and discussions.

Methods**Scoping Review Overview**

The review was registered prospectively with the Joanna Briggs Institute (JBI) Systematic Reviews database (May 5, 2017) and proposed methods specified in advance in a protocol [25]. The scoping review adhered to the methods manual developed by the JBI [26].

Objectives

This scoping review aimed to identify and describe the messages presented in e-cigarette-related social media (Twitter, YouTube, Instagram, and Pinterest) promotions and discussions and identify future directions for research, surveillance, and regulation.

Inclusion Criteria

Included studies had to examine and analyze e-cigarette-related social media promotions and discussions. Studies needed to clearly identify the social media platform under investigation. Studies reporting multiple social media platforms were excluded unless results for each platform were reported separately. This was so the results for each social media platform could be extracted and reported, making it possible to clearly identify similarities and differences between the platforms. Studies identifying other tobacco products (eg, tobacco cigarette, snus, chewing tobacco, or hookah) were excluded unless e-cigarettes were also examined and reported separately. In addition, studies that did not distinguish between e-cigarettes and other forms of tobacco and nicotine delivery were excluded. Studies examining traditional media (eg, television and newspaper) were excluded unless social media platforms were also examined and reported separately. Studies were limited to the following countries: the United Kingdom, the United States of America, New Zealand, Australia, and Canada. These countries were selected as they are all developed countries and e-cigarette use is well established [27]. The review considered only peer-reviewed primary research studies published in English in the last 10 years (2007-2017); this period correlates with the approximate time that e-cigarettes were first introduced to the United States and Europe [28].

Table 1. Summary of excluded studies subject to full-text review with reason (N=48).

Reason for exclusion	Studies (n)
Excluded at full-text review	
Wrong study design (ie, does not examine a social media platform or code for account type, theme, or sentiment)	12
Does not report electronic cigarettes (e-cigarettes) in the results	7
Results for different social media platforms not reported separately	2
Publication type	4
Country of study	1
Excluded at data extraction	
Wrong study design	14
Results for e-cigarettes not reported separately	2
Results for different social media platforms not reported separately	1
A specific population is examined (ie, people with mental illness)	2
Country of study	3

Search Strategy and Study Selection

Overall, 5 databases were searched (MEDLINE, Scopus, ProQuest, Informit, and Google Scholar) using the following terms:

("electronic cigarette" OR e-cigarette OR "electronic nicotine delivery system" OR "personal vapo?ri?er" OR "electronic nicotine delivery device" OR "vape pen" OR "smokeless tobacco" OR "electric cigarette" OR "electric nicotine delivery system" OR "electric nicotine delivery device" OR e-hookah OR e-juice OR e-liquid OR vaping) AND ("social media" OR internet OR online OR YouTube OR Facebook OR Instagram OR Twitter OR "online media" OR "digital media" OR "social networking") AND ("content analysis" OR "content evaluation" OR message OR meaning OR coding OR "media analysis" OR "textual analysis").

In addition, the search strategy was entered as a nested Boolean search into Google Scholar, with the first 200 results examined for eligibility and subject to the screening process outlined below. Preliminary searches located relevant studies published in the *Journal of Medical Internet Research*, a hand-search of this journal was, therefore, also undertaken.

Retrieved references from each database were imported into EndNote X7 (Clarivate Analytics) [29] reference management software, with duplicate references removed before being imported into Covidence [30]. Covidence is a Web-based software platform that streamlines the production of systematic reviews by supporting the key steps in the review process [30]. Studies were assessed for inclusion, examined initially by title and abstract. Full-text articles were retrieved for those studies that appeared to meet the inclusion criteria or if further examination was required to determine eligibility. Moreover, 2 reviewers (KM and JJ) independently screened all titles and abstracts to determine their eligibility. The primary reviewer (KM) then undertook full-text screening. These processes were assisted by the Web-based screening and data extraction tool—Covidence [30]. Finally, the reference list of all articles subject to full-text review was screened to determine possible

inclusion of additional studies. Identified studies were assessed for suitability based on full-text review undertaken by the primary reviewer. A summary of excluded studies subject to full-text review and the reason for exclusion is provided in Table 1.

Extraction of Results

The relevant content from each study was extracted using a data extraction pro forma, which included title, author, publication year, country of study, aim/purpose of study, social media platform, sample size, study design/methods, results, and key findings that relate to the review question. Included studies were required to have developed coding categories for content including one or more of the following: account type, themes, and sentiment. Account type characterizes the publisher of the social media post; theme reflects the domain of the actual content conveyed, such as the categories of health, smoking cessation, and regulation; and sentiment reflects the stance expressed in a social media post toward e-cigarettes, related products or its users, whether positive, neutral, or negative. To ensure data extraction consistency, 2 reviewers (KM and JJ), independent of one another, extracted data from the same 5 studies using the data extraction pro forma. The reviewers then met to determine whether the extraction approach was consistent. The primary reviewer (KM) then went on to extract data from the remaining studies unaccompanied.

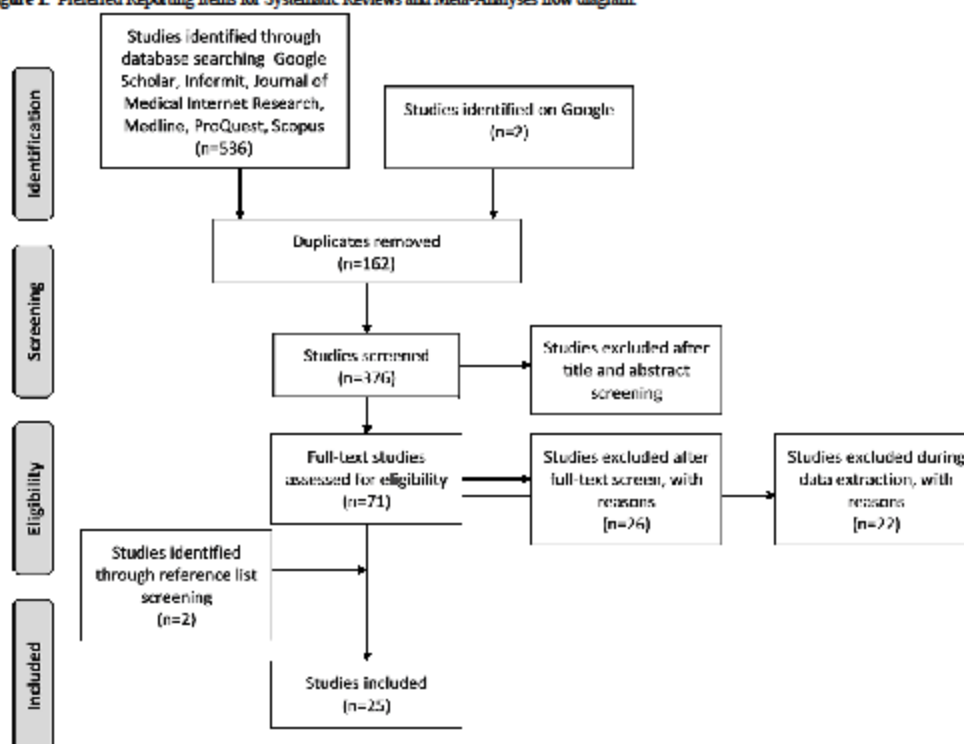
Results

Description of Included and Excluded Studies

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram detailed in Figure 1 presents the number of studies at each stage of the review process.

A total of 25 studies were identified for inclusion in this review. A total of 18 studies analyzed Twitter data [16,17,31-46]; 4 examined YouTube including videos [47-49] and data associated with videos, such as video tags, titles, or descriptions [50]; and 3 studies investigated images on Instagram and Pinterest [51-53].

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.



Twenty-four studies were conducted in the United States [16,17,31-41,43-53] and one in Canada [42] (Table 2).

Sample Size and Data Coding

The sample size of included studies varied widely, even within social media platforms (Twitter, YouTube, Pinterest, and Instagram), with the platform under investigation influencing the coding method used (Table 2). Methods used included hand coding [31,32,36-39,41,42,46-53] or machine learning [44], or a combination of the 2 methods [16,17,33-35,40,43,45]. Hand coding involved one or more human coders categorizing data, whereas machine learning used algorithms to give computers the ability to code data, although hand coding was usually used for an initial subset of data to help refine the algorithm to improve its accuracy [16,33-35,43,45]. Studies that analyzed text (ie, tweets from Twitter and YouTube video descriptions) predominantly employed hand coding for smaller samples (eg, <3000) [31,32,36-39,42,46], and a combination of hand coding and machine learning [16,33-35,40,43,45] or only machine learning [44] for larger samples, the largest being 1,669,123 tweets. Three studies did, however, hand code samples of over 10,000 [17,41,50]. All studies that analyzed images (ie, Pinterest, Instagram, and YouTube) did so by hand coding samples of between 46 and 2208 posts and videos (Table 2).

Account Type

A total of 12 studies [16,31,33,37,39,41-44,47-48,53] used coding to identify the source (account type) of the social media data collected in their sample, most commonly informed by data found in account profiles (eg, bio, location, and profile photo) and preceding social media posts (Table 3). The most common account types coded for were personal [16,31,33,39,41,42,44,47,48,53] and commercial [33,37,39,41,42,44,48,53], of which these account types represented up to 82.68% (104,283/126,127) [44] and 89.73% (66,102/73,672) [33] of some samples, respectively. Overall, 3 studies coded for government, foundation or not for profit organizations, [39,41] and public health and health care [42] accounts. All were studies of Twitter discussions that unanimously reported that tweets from these account types represented less than 3% of their sample size (1.0%, 5/500 for [39]; 0.08%, 8/10,128 for [41], and 1.3%, 4/300 and 3.3%, 10/300 for [42]). Overall, 3 studies coded for fake accounts, of which 2 reported these accounts represented similar percentages of their sample (6.90%, 699/10,128 for [41] and 9.7%, 29/300 for [42]), whereas the third found an overabundance (80.7%, n not provided) [16].

Table 2. Description of included studies, sample size, and coding method.

Authors, year, country	Social media platform	Sample size	Coding method
Burke-Garcia et al, 2017, United States [39]	Twitter	1000 tweets	Hand coding
Lazard et al, 2017, United States [40]	Twitter	4629 tweets	Machine learning and hand coding
Allen et al, 2017, United States [31]	Twitter	2192 tweets	Hand coding
Ayers et al, 2017, United States [17]	Twitter	11,600 tweets	Hand coding
Dai et al, 2017, United States [45]	Twitter	757,167 tweets	Hand coding and machine learning
Clark et al, 2016, United States [16]	Twitter	850,000 tweets	Hand coding, machine learning, and hedonometrics
van der Tempel et al, 2016, Canada [42]	Twitter	600 tweets	Hand coding
Han et al, 2016, United States [35]	Twitter	1,021,561 tweets	Hand coding and machine learning
Jo et al, 2016, United States [36]	Twitter	2847 tweets	Hand coding
Kavuluru et al, 2016, United States [43]	Twitter	224,000 tweets	Hand coding and machine learning
Sowles et al, 2016, United States [37]	Twitter	1156 tweets	Hand coding
Unger et al, 2016, United States [38]	Twitter	1519 tweets	Hand coding
Lazard et al, 2016, United States [44]	Twitter	126,127 tweets	Machine learning
Cole-Lewis et al, 2015, United States [41]	Twitter	10,128 tweets	Hand coding
Kim et al, 2015, United States [34]	Twitter	1,669,123 tweets	Hand coding and machine learning
Harris et al, 2014, United States [32]	Twitter	683 tweets	Hand coding
Huang et al, 2014, United States [33]	Twitter	73,672 tweets	Hand coding and machine learning
Prochaska et al, 2012, United States [46]	Twitter	153 accounts	Hand coding
Sears et al, 2017, United States [47]	YouTube	46 videos	Hand coding
Basch et al, 2016, United States [48]	YouTube	99 videos	Hand coding
Merianos et al, 2016, United States [49]	YouTube	55 videos	Hand coding
Huang et al, 2016, United States [50]	YouTube	28,089 videos tags, titles, or descriptions	Hand coding
Lee et al, 2017, United States [51]	Instagram and Pinterest	1800 images	Hand coding
Chu et al, 2016, United States [52]	Instagram	2208 posts	Hand coding
Laestadius et al, 2016, United States [53]	Instagram	85 posts	Hand coding

Themes

All 25 included studies coded for themes (Table 4). Health, safety, and harms was the most coded for theme in this review [17,31-33,35,38,39,41,43,46-51,53]; however, various descriptions for health, safety, and harms were used (eg, health, harm reduction, and harms encompassing both the health benefits and consequences of e-cigarette use). Additional themes frequently cited were smoking cessation [16,17,33,35,37,39,41-43,46,47,49,50,53]; product types and characteristics [16,17,32-37,39,41,43,49-51]; advertisement, promotion, and

marketing [16,31,38,39,41,42,44,45,48,51,52]; regulation, policy, and government [31,32,35,39-42,49,50]; price promotions, discounts, coupons, giveaways, and competitions [16,33,34,36,37,44,50]; and smoke-free, use indoors or where cigarettes are banned [17,35,40,43,47,49].

Sentiment

Of the 25 studies, a total of 12 coded for sentiment [16,31,32,38-43,45,47,49] (Table 5). Overall, 3 studies made the distinction when coding for message attitude [38,42,45] rather than emotional tone or affective content.

Table 3. Coded category—account type.

Account type	Studies, n (%)	References
Personal (general public, individuals, organic, and user-generated)	10 (40)	[16,31,33,39,41,42,44,47,48,53]
Commercial (marketing, tobacco or electronic cigarette [e-cigarette] company or retailer)	8 (32)	[33,37,39,41,42,44,48,53]
Press, media, or news (verifiable press or other prominent media sources of information, such as blogs)	3 (12)	[41,42,48]
Fake (hacked, bots, and automated)	3 (12)	[16,41,42]
Professional (television studio or network, production company, or organization)	2 (8)	[47,48]
Government, foundation, or not for profit organization	2 (8)	[39,41]
Proponents (sales or marketing agencies and individuals who advocate or specifically identify themselves as vapers)	2 (8)	[43,44]
Celebrity or public figure	2 (8)	[41,42]
Unknown or other	2 (8)	[31,37]
Public health, health care	1 (4)	[42]
Vaping-related handle (vaping-related term in handle name or Twitter bio)	1 (4)	[37]
Personal accounts with industry ties	1 (4)	[42]
E-cigarette community movement	1 (4)	[41]
General entity (company, store, or advocacy group)	1 (4)	[31]

Table 4. Coded category—themes.

Themes	Studies, n (%)	References
Health, safety, and harms	16 (64)	[17,31-33,35,38,39,41,43,46-51,53]
Health	10 (40)	[31,33,38,46-51,53]
Safety	5 (20)	[17,32,33,48,50]
Harms	2 (8)	[48,49]
Harm reduction	2 (8)	[35,43]
Health and safety	1 (4)	[41]
Health and health consequence	1 (4)	[39]
Smoking cessation	14 (56)	[16,17,33,35,37,39,41-43,46,47,49,50,53]
Product types and characteristics	14 (56)	[16,17,32-37,39,41,43,49-51]
Advertisement, promotion, marketing	11 (44)	[16,31,38,39,41,42,44,45,48,51,52]
Regulation, policy, government	9 (36)	[31,32,35,39-42,49,50]
Price promotions, discounts, coupons, giveaways, competitions	7 (28)	[16,33,34,36,37,44,50]
Smoke-free, use indoors or where cigarettes are banned	6 (24)	[17,35,40,43,47,49]
More economical than smoking	5 (20)	[17,42,47,49,53]
Social status, acceptance	4 (16)	[17,38,47,51]
Cleaner than tobacco, environment friendly, no/minimal odor	4 (16)	[17,47,49,53]
First or second person experience, use, opinion, or purchases	4 (16)	[39,42,52,53]
Recreation, customization, tricks	3 (12)	[47,51,53]
Other/unknown	3 (12)	[31,38,39]
Product image	2 (8)	[37,52]
Craving	2 (8)	[41,42]
Illicit substance use in e-cigarettes	2 (8)	[41,51]
Personal opinion	2 (8)	[42,45]
News articles and updates	2 (8)	[42,44]
Tastes good	2 (8)	[42,49]
Getting others started, encouraging use, offering advice	2 (8)	[40,42]
Second-hand smoke	2 (8)	[47,49]
Cessation devices or gateway products for youth to establish nicotine addictions	2 (8)	[44,49]
Text	1 (4)	[52]
Lies/propaganda	1 (4)	[32]
Science (studies)	1 (4)	[32]
Issue salience	1 (4)	[32]
Underage e-cigarette use	1 (4)	[41]
E-cigarette use in association with other addictive substances (eg, alcohol, caffeine)	1 (4)	[41]
Parental e-cigarette use	1 (4)	[41]
Places of use	1 (4)	[34]
Neutral information	1 (4)	[42]
Humor	1 (4)	[42]
Just starting e-cigarettes	1 (4)	[42]
Advocating e-cigarettes	1 (4)	[42]
Attempt to engage other Twitter users	1 (4)	[42]
Using or comparing with other substances/nicotine replacement therapies	1 (4)	[42]

Themes	Studies, n (%)	References
Presence of identity or community	1 (4)	[53]
Technology (modern products, information about science behind the products)	1 (4)	[47]
Celebrity, model	1 (4)	[51]
Meme	1 (4)	[51]
Anti-smoking	1 (4)	[51]
Utilization patterns	1 (4)	[39]
Consumer endorsement	1 (4)	[39]
Money (taxes, small businesses)	1 (4)	[31]
Addiction to e-cigarettes	1 (4)	[49]
Reactions to e-cigarette policies and questions about e-cigarette health risk claims	1 (4)	[44]
Similar to real cigarettes	1 (4)	[49]

Table 5. Coded category—sentiment.

Sentiment	Studies, n (%)	References
Emotional tone or affective content		
Positive or negative	5 (20)	[16,41-43,47]
Positive or negative valence	2 (8)	[39,40]
Pro or anti	2 (8)	[31,49]
Pro- or anti-policy	1 (4)	[32]
Neutral	7 (28)	[31,39,41,42,45,47,49]
Unable to tell	1 (4)	[32]
Message attitude		
Pro or con	1 (4)	[42]
Pro or anti	1 (4)	[38]
Supportive or against	1 (4)	[45]
Neutral or do not know	3 (12)	[38,42,45]

Discussion

Principal Findings

Data Coding

The coding methods used were hand coding, machine learning, or a combination of the two. Compared with hand coding, machine learning can rapidly code large amounts of data; however, hand coding undertaken by humans may more accurately discriminate the complexities and subtleties of language [54]. Although hand coding can be subject to individual bias, the development of codes grounded in literature and achieving acceptable levels of inter-rater reliability can assist to reduce this [55]. Studies that require the determination of subtle differences in language or context may, therefore, be better placed to employ hand coding for a smaller sample of data, whereas studies that rely less on context could employ machine learning to code larger samples [55]. The increased complexity of interpreting visual social media (eg, YouTube, Instagram, and Pinterest) meant all studies of these platforms employed hand coding [47-49,51-53].

Account Type

Personal

Studies included in this review reported dissemination of diverse e-cigarette messaging by predominantly commercial social media accounts [33,53]; however, other studies discovered conversations occurring among personal accounts dominating the social media landscape [31,41,42,44,47,48]. Personal accounts were found to be discussing, endorsing, and promoting various themes, most commonly marketing [41,48,53], smoking cessation [33,42,44], recreation and technology [47,53], and first-person experience and opinion [41,42]. This is particularly important as individuals may be less critical of material posted by other consumers compared with retailers [56,57] and may be more easily persuaded by other individuals they know, given their relative closeness and potentially increased perception of source credibility [58,59].

Commercial

Several key marketing strategies were found to be used by commercial social media accounts. These included the use of popular hashtags that enabled marketing messages to *piggy back*

on trending topics and increase dissemination reach [42], use of fake user accounts to disseminate spam and favorable views [33,42], and the offer of price promotions and product giveaways [33,44,53]. Social media networking and marketing efforts undertaken by the vaping industry may have contributed to the rapid rise in popularity of e-cigarettes, the extent of which has been demonstrated by the findings in this review. It has also been hypothesized by some researchers that the lack of regulatory standards on social media may be playing an ever-increasing role in the diffusion of tobacco products and prosmoking messages [60].

Government, Foundation or Not for Profit Organizations, and Public Health and Health Care

Of the studies that coded for government, foundation, or not for profit accounts [39,41,42], limited public health-related messaging was identified, and activity from these account types represented less than 3% of samples. These findings indicate more action from public health and government to communicate the potential harms and benefits of alternate nicotine delivery products via social media is required to balance the information shared on these platforms.

Fake

Most tweets produced by accounts classified as fake were found to promote e-cigarettes as effective smoking cessation aids, either by emulating first-person anecdotes or linking to news articles or other Web-based media [41,42], with some accounts potentially using computer programs to generate and post content automatically [33,34].

The general tweet structure from an automated bot is provided here [16]:

@USER [I,We] [tried, pursued] to [give up, quit] smoking. Discovered BRAND electronic cigarettes and quit in [#] weeks. [Marvelous,Amazing,Terrific]! URL

@USER It's now really easy to [quit,give up] smoking (cigarettes).—these BRAND electronic cigarettes are lots of [fun,pleasure]! URL

@USER electronic cigarettes can assist cigarette smokers to quit, it's well worth the cost URL

This type of spamming suggests that there are remunerations to be gained by steering potential online consumers to certain retail websites [34].

Themes

Health, Safety, and Harms

All studies that coded for health, safety, and harms reported that e-cigarettes are being referred to as *healthier* and *safer* than traditional tobacco products on social media [17,31-33,35,38,39,41,43,46-51,53]. Provided that scientific evidence about the safety of e-cigarettes is largely inconclusive, marketing claims that use words such as *safer* to describe their products could contribute to confusion about their overall safety, especially among youth. Promoting a product by claiming that it is healthier than tobacco smoking, the leading cause of preventable death, is therefore controversial and may only have

merit when targeting smokers who are contemplating quitting or reducing use [61].

There is indication that an individual's perception of a substance's potential harms and benefits and their behavior of use is influenced by the availability of information discussing the health effects of that substance [62]. A recent analysis reports that 34.20% (8433/24,658) of American youth sampled believe that e-cigarettes are less harmful than cigarettes, and 45.00% (11,096/24,658) are not sure [63].

Example *safety* coded tweets are displayed in the following excerpt [32]:

RT @ChiPublicHealth: Electronic cigs contain a dangerous, addictive drug & should be regulated like other nicotine products #ecigtruths

@ChiPublicHealth it's not about being safe, it's about being SAFER than the alternative #EcigsSaveLives it's about HARM REDUCTION #Casaa

Smoking Cessation

Over half (56%, 14/25) of studies included in this review found evidence of e-cigarettes being promoted as a smoking cessation tool [16,17,33,35,37,39,41-43,46,47,49,50,53], although their efficacy as such is yet to be determined [8]. However, some research indicates much smaller proportions of e-cigarette advertisements are now endorsing these devices as quit aids [37,42], and cited reasons for use by vapers have significantly shifted away from smoking cessation (43.00%, 1247/2900 in 2012 vs 29.00%, 841/2900 in 2015) toward use to increase social image (21.00%, 609/2900 in 2012 vs 37.00%, 1073/2900 in 2015) [17]. Of concern is that these results suggest that e-cigarette uptake is not solely driven by a desire among smokers to quit smoking [64].

Product Types or Characteristics

Overall, 14 studies coded for e-cigarette product characteristics such as brands, flavors, and nicotine content, and of these, the majority (86%, 12/14) [16,17,32,35-37,39,41,43,49-51] coded for the mention or depiction of electronic cigarette juice (e-juice) flavors. Marketing social media posts and videos were most commonly found to promote the vast array of e-juice flavors available on the market [16,35,37,43,49], a strategy historically used to entice new tobacco consumers [65], especially youth [66]. As a result of mounting evidence that flavored tobacco products facilitate youth smoking [67], these products (aside from menthol) were effectively banned in 2009 [68]. However, no such ban currently exists for e-cigarettes with thousands of flavors available for purchase [22]. Some research suggests that flavors appeal to adult smokers and may aid smoking cessation [69,70]; nevertheless, increasing evidence demonstrating that flavors also attract youth to the e-cigarette market is mounting [71-73], which is a cause for concern as nicotine addiction has been found to cause problems with adolescent brain development [74]. Studies have found flavor profiles (eg, tobacco and menthol) that are more appealing to some adults may have minimal appeal to young people [69,75]. It has, therefore, been proposed as a harm reduction strategy that these flavors be promoted to adults to assist tobacco substitution, whereas

restricting those flavors that appeal most to youth (eg, fruits and deserts) [76].

Advertisement, Promotion, and Marketing

A concern of e-cigarette promotion on social media is the high level of cross-platform interaction (ie, using apps to post content across several social media platforms) [33], and given the sizeable youth presence on these platforms [77] provides an avenue to invite nonsmokers, youth in particular, to experiment with and instigate use. However, just because youth are utilizing social media does not inevitably mean they are subjected to e-cigarette marketing, as they would need to *follow* these accounts, be exposed through their social networks (ie, followers or those they are following), or browse via direct searches [34]. Recent studies have, however, found that e-cigarette users learn about vaping and these devices from the internet and social media [78,79]; therefore, monitoring how e-cigarettes are promoted on these platforms is incredibly important.

Regulation, Policy, and Government

Messages against government regulation were found to be most prominent [31], for example:

Wow, CA DPH thinks it acceptable to deceive the ppl it is supposed to serve: #stillblowingmoke? no #notblowingmoke Don't let the FDA go without making your voice heard...#vapecommunity #vape #ecig #notblowingmoke #ecigsalive

Many antiregulation posts expressed concern over the motivations for wanting e-cigarettes regulated, suggesting policy makers were only concerned about these devices because tobacco revenue would decrease if people started using them and that policy represents the teaming of government and industry such that the Food and Drug Administration (FDA) deeming rule would work only to enhance the power of Big Tobacco [31,32,40,42,44]. The uncertainty surrounding e-cigarette regulation expressed within the public health field appears not to be reflected in ongoing social media dialogues [41] and highlights the need for public health professionals to interact with the public to actively influence social media conversations and create a more balanced discussion [40,44].

Price Promotions

This review provides evidence of the existence of e-cigarette marketing on social media, of which a substantial portion includes price promotions, discounts, coupons, free trials, giveaways, and competitions [16,33,34,36,37,44,50]. These types of incentives can persuade potential consumers to make a purchase and assist vendors to create a loyal customer base [80], which has already been demonstrated for tobacco [81,82]. It is well documented that smoking behaviors react to changes in cigarette prices [83], and in response, tobacco control efforts have sought to eradicate the use of these incentives [84]. Similarly, studies have reported that e-cigarette sales are very responsive to price variation, and implementing policy to limit price promotions, free-trials, and giveaways could lead to significant behavior change and uptake [85]. People who use e-cigarettes regularly cite smoking cessation as their motivation for vaping initiation; for this group of people, price promotions that enable affordability of these products longer term could be

viewed as appropriate [37], although evidence supporting the use of these devices as a smoking cessation aid is still out for debate [8].

Smoke-Free and Use Indoors or Where Cigarettes Are Banned

A major drawback of cigarettes is the smoke they emit, which is known to contain thousands of chemicals dangerous to human health [86], and for this reason, cigarettes are now subject to smoking bans and smoke-free policies all over the world [87]. Studies included in this review found that e-cigarette proponents frequently highlight the smoke-free aspect of vaping and that these devices can be used where tobacco is currently restricted [17,35,40,43,47,49]. Marketing that accentuates that e-cigarettes can be used *anywhere* may undermine enforcement of smoke-free policies and tobacco control efforts [12] and expose nonusers to toxins [13]. A survey of a representative sample of American adults found that increased frequency of exposure to e-cigarette advertising was associated with lower support for policies that restrict use in public places [88]. These results suggest the need for more publicly available information regarding the chemical composition and possible health consequences of inhaling second-hand vapor [38].

Recreation

Less commonly coded for, however an important aspect of vaping to recognize is recreation, which was coded for among image-based social media (ie, Instagram, Pinterest, and YouTube) studies [47,51,53]. These studies commonly reported depictions of customization and modification of e-cigarette devices for both functional and aesthetic purposes and of vapers exhaling large plumes of vapor (known as cloud chasing) and performing vape tricks. Depiction of these vaping practices could contribute to the normalization of vaping, as images and videos represent these acts as fun and more commonplace and socially accepted than is in reality [52,89], with many posts accompanied by hashtags signifying community and social identity [53]. For example [31]:

What's your favourite #vaping trick? #VapeTricks #Vapelife #VapeOn #NotBlowingSmoke

Many hashtags emerge from users themselves through an organic user-led process [90], with research suggesting substance-focused hashtags can serve as an “addiction bond” [91].

Social media posts and videos mentioning different product characteristics (eg, flavors, mods, and illicit substances) and displaying consumers’ ability to choose and modify aspects of their vaping experience indicates that customization and recreation largely contributes to e-cigarette discourse on social media and may have contributed to their rapid increase in popularity [47,50-52].

Sentiment

Studies which coded for sentiment and did not specifically state they were coding for message attitude most commonly reported that their sample was positively skewed toward e-cigarettes, their users, and antiregulation [31,32,40-43,47,49], whereas studies that coded for message attitude reported predominantly neutral attitude [38,42,45]. Social media posts from accounts

with vested interests (eg, commercial or automated) and the general public were found to present positive messages related to e-cigarettes [16,41-43,49], whereas news- and health-related accounts provided messages that were least positive or neutral [41,42,49].

Examples of positive, negative, and neutral tweets are provided here [39]:

Medical professionals surveyed. Overwhelmingly prefer #vaping to smoking. #vape #vaphyfe #the
http://t.co/tcKsX6Dc0S http://t.co/tiJBNZjBZa

RT @StopVaping RETWEET this if your not VAPING
today because you want to live.

Vaping in the United States has eclipsed cigarette
smoking in some age groups. #Vaping #eCigarettes
#Rosemont http://t.co/wzgvT0p2C1

The proliferation of social media platforms and *Big Data* analytics provides the opportunity to explore and monitor people's perceptions of e-cigarettes in real time and what fuels opinion over time [41,45]. The studies included in this review could be used to establish a sentiment baseline for public health professionals to develop campaigns and interventions [41] and act as supplementary data to traditional surveys [45].

In agreement with Lienemann et al [55], when coding for sentiment, clarity and comparability across studies could be enhanced by distinguishing between attitude and emotion. For example, social media data can be provaping; however, it can have a negative emotional tone.

Recommendations for Research

Given the volume of personal accounts found to be discussing, endorsing, and promoting various aspects of vaping, further research to determine who the *loudest* social media accounts are in the sense that their material is being seen and shared most frequently and how this material is influencing other social media users' perceptions and use of e-cigarettes is, therefore, warranted [41]. The perceived safety of these products may also be a contributing factor in the increasing trend of vaping among adult never smokers and former smokers [92]. Research is, therefore, required to determine the implications of claims promoting e-cigarettes as a superior product on audience perception and use [47].

The use and depiction of vaping for recreation raises questions about the promotion of these devices as a hobby or socializing opportunity [64]. As such, it may be valuable to investigate the degree to which the vaping industry is targeting nonsmoking youth who may have an interest in vaping for enjoyment or as a hobby rather than a smoking cessation tool [37,93].

Furthermore, the US FDA has recognized the impact of e-cigarettes recently, ratifying a rule (August 8, 2016) that extended their regulatory authority to all tobacco products, including e-cigarettes. These regulations restrict youth access

by prohibiting the sale of e-cigarettes to those aged under 18 years, embargos the use of free samples for promotion, and states e-cigarette products must now require a health warning [94]. These restrictions highlight the need for continued research and monitoring of social media commercialization of these products and for this issue to be placed on public health and policy agendas.

Limitations

The review did not assess the quality of the evidence presented in each study, rather provided an overview regardless of quality as per the methodology outlined in the Manual for Scoping Reviews by JBI [26]. The search strategy included several popular terms used to describe e-cigarettes; however, keywords including emerging and variations of slang terms may have been overlooked and therefore, resulted in an incomplete retrieval of identified research. Furthermore, it is possible that additional studies relevant to the research question may have been identified if alternative databases were searched.

The reviewed material reflects a general bias toward certain social media platforms such as Twitter as its data are mostly public and easily accessible to researchers, whereas Facebook and other platforms are not [95]. This is not an indication that Facebook and other platforms are not spaces where e-cigarettes are discussed, but only that these activities are not visible to researchers.

Conclusions

The social media landscape is being dominated by provaping messages disseminated by the vaping industry and vaping proponents, whereas the uncertainty surrounding e-cigarette regulation expressed within the public health field appears not to be reflected in ongoing social media dialogues. Latest generation e-cigarettes are resembling less and less their first generation *cig-a-like* counterparts and are being promoted not only as a smoking cessation device and safer alternative to smoking but also as a recreational activity whereby you can create your own unique vaping experience with the use of flavors, device modification, and vape tricks. With the industry changing so rapidly, real-time monitoring and surveillance of how these devices are discussed, promoted, and used on social media is necessary in conjunction with evidence published in academic journals. The need for real-time monitoring and surveillance also highlights the need to close the chasm between research and practice [96]. Some government agencies have recognized and are attempting to bridge this gap by introducing research translation initiatives, annual conferences, education programs, and more varied communications [97,98] as they attempt to move evidence through the publication pipeline faster and more efficiently. However, Departments of Health may well have to start thinking about investing in real-time monitoring and surveillance to interact with the public to actively influence social media conversations and create a more balanced discussion with regard to e-cigarettes.

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Authors' Contributions

KM, JJ, and BM conceptualized the research. KM drafted the manuscript, and JJ and BM aided in developing the research question and study methods. All authors contributed meaningfully to editing and approved the final manuscript.

Conflicts of Interest

None declared.

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Abbreviations

e-cigarette: electronic cigarette
e-juice: electronic cigarette juice
FDA: Food and Drug Administration
JBI: Joanna Briggs Institute

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4.3 Substudy 2: Twitter Inquiry

4.3.1 Twitter study A

Publication 3: E-cigarette promotion on Twitter in Australia: Content analysis of tweets.

Objective: To investigate how e-cigarettes are portrayed and promoted on Twitter, and how this portrayal and promotion has emerged and trended over time within an Australian context.

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Original Paper

E-Cigarette Promotion on Twitter in Australia: Content Analysis of Tweets

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Abstract

Background: The sale of electronic cigarettes (e-cigarettes) containing nicotine is prohibited in all Australian states and territories; yet, the growing availability and convenience of the internet enable the promotion and exposure of e-cigarettes across countries. Social media's increasing pervasiveness has provided a powerful avenue to market products and influence social norms and risk behaviors. At present, there is no evidence of how e-cigarettes and vaping are promoted on social media in Australia.

Objective: This study aimed to investigate how e-cigarettes are portrayed and promoted on Twitter through a content analysis of vaping-related tweets containing an image posted and retweeted by Australian users and how the portrayal and promotion have emerged and trended over time.

Methods: In total, we analyzed 1303 tweets and accompanying images from 2012, 2014, 2016, and 2018 collected through the Tracking Infrastructure for Social Media Analysis (TrISMA), a contemporary technical and organizational infrastructure for the tracking of public communication by Australian users of social media, via a list of 15 popular e-cigarette-related terms.

Results: Despite Australia's cautious approach toward e-cigarettes and the limited evidence supporting them as an efficacious smoking cessation aid, it is evident that there is a concerted effort by some Twitter users to promote these devices as a health-conducive (91/129, 70.5%), smoking cessation product (266/1303, 20.41%). Further, Twitter is being used in an attempt to circumvent Australian regulation and advocate for a more liberal approach to personal vaporizers (90/1303, 6.90%). A sizeable proportion of posts was dedicated to selling or promoting vape products (347/1303, 26.63%), and 19.95% (260/1303) were found to be business listings. These posts used methods to try and expand their clientele further than immediate followers by touting competitions and giveaways, with those wanting to enter having to perform a sequence of steps such as liking, tagging, and reposting, ultimately exposing the post among the user's network and to others not necessarily interested in vaping.

Conclusions: The borderless nature of social media presents a clear challenge for enforcing Article 13 of the World Health Organization Framework Convention on Tobacco Control, which requires all ratifying nations to implement a ban on tobacco advertising, promotion, and sponsorship. Countering the advertising and promotion of these products is a public health challenge that will require cross-border cooperation with other World Health Organization Framework Convention on Tobacco Control parties. Further research aimed at developing strategies to counter the advertising and promotion of e-cigarettes is therefore needed.

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KEYWORDS

electronic cigarette; e-cigarette; electronic nicotine delivery systems; vaping; vape; social media; twitter; content analysis; public health; public policy

Introduction

In Australia, the context of the present study, the legal status of electronic cigarettes (e-cigarettes) is determined by existing and overlapping laws relating to poisons, therapeutic and consumer goods, and tobacco control [1]. Liquid nicotine is classified as a “Schedule 7-Dangerous Poison” under the Federal Poisons Standard [2], and, as such, the manufacture, sale, or supply of e-cigarettes containing nicotine without lawful authority (ie, prescription from a medical doctor) [3] is prohibited in all Australian states and territories [4]. However, nicotine-containing e-cigarettes can be imported into Australia, as there is no way to determine whether or not an e-cigarette contains nicotine, short of laboratory analysis, which has implications for law enforcement [4,5]. E-cigarettes that do not contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims, while the sale and use of flavored e-liquid are permitted provided it does not contain nicotine [4].

The World Health Organization Framework Convention on Tobacco Control (WHO FCTC) defines tobacco advertising and promotion as “any form of commercial communication, recommendation or action with the aim, effect or likely effect of promoting a tobacco product or tobacco use either directly or indirectly” and requires signatories to the treaty, of which Australia is one, to “undertake a comprehensive ban on all tobacco advertising, promotion and sponsorship” [6]. As nicotine-containing e-cigarettes are banned from retail sale in Australia; the advertising of such products is also not permitted. Further, advertising of all types of e-cigarette products and devices, nonnicotine included, is regulated at the state level, with most states prohibiting any form of advertising or promotion [7-10].

Data from the most recent National Drug Strategy Household Survey [11] report 11.3% of Australians aged over 14 years have ever used, and 2.5% currently use, e-cigarettes, increasing from 8.8% and 1.2%, respectively, since 2016. These increases occurred in both smokers and nonsmokers and contrast with Australian combustible smoking rates, which have continued to decline over the last 30 years. The most frequent reason for using e-cigarettes reported by people older than 14 years was “out of curiosity” (54.2%). Further, 22.8% cited using e-cigarettes because they perceived them to be less harmful than tobacco cigarettes (19.2% in 2016), and 10.1% believed vaping to be more socially acceptable than tobacco smoking (6.0% in 2016). In addition, 26.9% of respondents reported they obtained their e-cigarette products online (Australian retailer 12.5%, overseas retailer 11.1%, unknown origin 3.3%).

Vaping has become increasingly popular, and awareness, experimentation, and uptake have proliferated both within Australia and globally [12]. Researchers have therefore begun

harnessing data from social media to address information gaps, provide timely insights, and inform public policy and public health [13-15]. As of January 2019, there were approximately 2.56 million active monthly Australian Twitter users (64% male), which equates to approximately 12% of Australians older than 13 years [16]. Given the popularity of Twitter [16], the high-speed nature of information dissemination, and the significant influence of Twitter as a driver of web traffic [17], insights into how Twitter is used to promote and discuss e-cigarettes are warranted.

Social media’s increasing pervasiveness has provided a powerful avenue to market products and influence social norms and behaviors [18]. There is mounting evidence of the volume of e-cigarette promotion on social media [19,20], with studies suggesting adolescents who view e-cigarette social media promotion express greater intention to use e-cigarettes, more positive attitudes toward e-cigarettes, and greater perceptions of e-cigarette use as normative [21,22]. This is concerning, as Australia’s current regulatory stance has proven effective in limiting e-cigarette uptake [11]; however, promotion on social media could bring awareness to and encourage experimentation with e-cigarettes or other tobacco products [23,24]. The health effects of e-cigarette use are not fully understood; however, a growing body of literature has established acute consequences with even short-term use, with [25] or without nicotine [26,27].

A 2019 scoping review [19] that aimed to identify and describe the messages presented in e-cigarette-related social media promotions and discussions across the United Kingdom, United States, New Zealand, Canada, and Australia identified no studies from Australia. At the time of this study, there was no published literature on how e-cigarettes are promoted and discussed online in the Australian context. We, therefore, aimed to investigate how e-cigarettes are portrayed and promoted on Twitter through a content analysis of related tweets posted and retweeted by Australian users and how the portrayal and promotion have trended over time in the Australian context where e-cigarettes are largely prohibited.

Methods**Data Collection**

Twitter data were collected via Tracking Infrastructure for Social Media Analysis (TrISMA) [28], a contemporary technical and organizational infrastructure for the tracking of public communication by Australian users of social media. Central to the TrISMA Twitter infrastructure is the Australian Twitter Collection, which continuously gathers tweets from identified Australian accounts (ie, accounts set to an Australian location, geolocation, or time zone or accounts with a description field referring to an Australian location or containing Australia-specific terms) and stores them in a database available to accredited TrISMA researchers. The TrISMA Twitter

Collection is hosted on a cloud-based Google BigQuery database and accessed through the data visualization tool Tableau.

A list of popular e-cigarette-related terms was developed based on peer-reviewed literature [29-34], trending Twitter hashtags, and frequently co-occurring hashtags (ie, hashtags that appeared in the same caption as the root term), which resulted in 15 keywords: *cloudchasing*, *ecig* (includes ecigarette/s), *e-cig* (includes e-cigarette/s), *electroniccig* (includes electroniccigarette/s), *electronic cigarette* (includes electronic cigarettes), *eliquid*, *e-liquid*, *e-juice*, *vape* (includes vaper and vapes), *vaping*, *vapecommunity*, *vapefam*, *vapelife*, *vapenation*, and *vapeporn*. E-cigarette product names were omitted from the search strategy so as not to bias the results to specific brands [35]. A preliminary search revealed there was minimal Twitter activity using these keywords before 2012. Therefore, 2 yearly sampling intervals starting from 2012 to 2018 were chosen to maximize the period of time covered while still being able to see the emergence and decline of trends in the collected data.

Data (tweets), along with meta-data information (ie, username, user follower count), were collected from public Australian Twitter users when a tweet included at least one of the identified keywords from either respective year. Data were downloaded in the form of comma-separated values files for each keyword and respective year. Social media users tend to include multiple hashtags within their posts, which resulted in duplicate tweets being collected. Duplicate tweets within keyword corpora for each year and across keyword corpora from the co-use of hashtags were removed, resulting in the inclusion of only unique tweets [36].

Data were assigned a number in ascending order, and 100 tweets from each keyword corpus for each year were randomly selected using an online random sequence generator [37]. Selected data were checked by one researcher (KM) to determine eligibility (ie, written in English and relevant to e-cigarettes). If any of the originally selected 100 tweets did not fit the inclusion criteria, further sampling occurred until 100 eligible tweets were reached. If a keyword corpus had less than 100 tweets, then all eligible tweets were selected. Each tweet was inspected, and, if found to contain an image, a screenshot of the whole post (text and image) was saved for further analysis. Eligible images needed to be stationary (ie, not a video, animated graphic interchange format [GIF], or other moving content). Only posts that contained an image were included in this study as the influence of the "picture superiority effect," which specifies pictures and images are more likely to be remembered than words, is widely acknowledged [38]. Social media content that includes associated imagery is also more noticeable, shareable, and engaging to users [39].

Retweets (tweets reposted by users) were included in this study, which facilitated the understanding of what information was being circulated by Australian users, even if it originated in another country.

Ethical Considerations

A particularly salient concern among researchers is whether social media data should be considered public or private data

[40]. Twitter is a social networking service in which users broadcast their opinions and commonly use a hashtag to associate their thoughts on a subject with users on the same subject; therefore, this data is generally referred to as "public data" [40]. For ethical, privacy, and technical reasons, TrISMA does not collect tweets from private accounts or direct messages; therefore, all data collected in this study were publicly available. This study was approved by the Curtin University Human Research Ethics Committee (approval number: HRE2017-0144).

Developing the Coding Framework

A concept-driven approach (inductive) [41] informed by extant studies [29-34] was utilized to develop a coding framework. The coding frame was tested on a random sample of 100 tweets by 2 researchers (KM and KT), whereby each tweet was read and assigned codes based upon the concepts presented in the descriptive text, hashtags, and accompanying image [42]. It is critical to consider the visual and textual aspects of posts together in the analysis [42] as the study of images can be used to complement and extend the study of health behaviors and may be more valuable than the study of words alone [15]. The 2 researchers followed a hybrid inductive/deductive content analysis approach [41] to refine and further develop the coding framework before transferring the modified framework into IBM SPSS Statistics (v22).

Interrater Reliability Testing

The 2 researchers applied the modified coding framework to a sample of 140 randomly selected posts (approximately 10% of the final sample), and an interrater reliability test was performed. Interrater reliability was determined using Krippendorff alpha, and an average score of $\alpha=.89$ was obtained, with a range of .65-1.0, indicating good to perfect agreement [43]. Any discrepancies were discussed to reach consensus, and the coding framework was revised accordingly.

Coding and Analysis

The final coding framework (Multimedia Appendix 1) was applied by KT and checked for consistency and validity by KM. The coders met regularly to refine coding rules and discuss questions and emergent themes. Each code within the coding framework was a variable in SPSS that functioned as a standalone item and was evaluated as either 1 for present or 2 for absent. Statistical comparisons (ie, between codes and years) were made using chi-square tests or Fisher exact tests, if applicable. Data were analyzed using IBM SPSS Statistics (v22). Due to the small sample size of the 2012 data, a further sensitivity analysis was performed with statistical comparisons made using chi-square and Fisher exact tests to assess the robustness of the results by removing the observations in 2012.

Results

Sample of Posts

Of the 4437 randomly selected tweets, 1553 contained an image, and an eligible sample of 1303 tweets was retained for analysis (Table 1).

Table 1. Number of posts selected for analysis.

Year of post	Random sample of posts (n=4437), n	Posts containing an image (n=1553), n	Posts eligible for analysis (n=1303), n
2012	570	12	12
2014	1,196	289	246
2016	1,378	658	540
2018	1,293	594	505

Sensitivity Analysis

After performing the sensitivity analysis, all associations, except for one, remained significant when removing the 12 observations from 2012. After the removal of the 2012 data, the “quit smoking” association did not retain its significance ($P=.213$). The results of the sensitivity analysis indicate that, overall, the results were not substantially influenced by the small number of data in 2012.

Frequency and Description of Codes**Overview**

In total, 1303 tweets and accompanying images (collectively referred to as posts) were analyzed: 12 from 2012, 246 from 2014, 540 from 2016, and 505 from 2018.

People

Of the images that contained a person, 60.0% (326/543) portrayed a man, and the majority of people appeared to be over the age of 18 years (300/313, 95.8%; Table 2). The largest proportion of people visible in these images was classified as “everyday people” (283/543, 52.1%).

Table 2. Frequency statistics for each year corpus and the total sample within the “people” domain.

Associated codes	2012 (N=12), n (%)	2014 (N=246), n (%)	2016 (N=540), n (%)	2018 (N=505), n (%)	Total (N=1303), n (%)
People visible	4 (33.3)	115 (46.7)	209 (38.7)	215 (42.6)	543 (41.7)
Type of people visible					
Everyday person	2 (50.0) ^a	65 (56.5) ^b	120 (57.4) ^c	96 (44.6) ^d	283 (52.1) ^e
Model	1 (25.0) ^a	39 (33.9) ^b	59 (28.2) ^c	78 (36.3) ^d	177 (32.6) ^e
Celebrity	1 (25.0) ^a	4 (3.5) ^b	9 (4.3) ^c	15 (7.0) ^d	29 (5.3) ^e
Health professional/academic	0 (0) ^a	0 (0) ^b	3 (1.4) ^c	12 (5.6) ^d	15 (2.8) ^e
Other	0 (0) ^a	7 (6.1) ^b	11 (5.3) ^c	4 (1.9) ^d	22 (4.1) ^e
Multiple types	0 (0) ^a	0 (0) ^b	7 (3.3) ^c	10 (4.6) ^d	17 (3.1) ^e
Gender of people visible					
Female	1 (25.0) ^a	39 (33.9) ^b	44 (21.0) ^c	39 (18.1) ^d	123 (22.7) ^e
Male	3 (75.0) ^a	58 (50.4) ^b	134 (64.1) ^c	131 (60.9) ^d	326 (60.0) ^e
Both	0 (0) ^a	7 (6.1) ^b	15 (7.2) ^c	23 (10.7) ^d	45 (8.3) ^e
Cannot determine	0 (0) ^a	11 (9.6) ^b	16 (7.7) ^c	22 (10.2) ^d	49 (9.0) ^e
Age of people visible (years)					
<18	0 (0) ^f	0 (0) ^g	3 (2.6) ^h	4 (3.2) ⁱ	7 (2.2) ^j
≥18	2 (100.0) ^f	72 (100.0) ^g	111 (95.7) ^h	115 (93.5) ⁱ	300 (95.8) ^j
Mixed	0 (0) ^f	0 (0) ^g	2 (1.7) ^h	4 (3.2) ⁱ	6 (1.9) ^j

^aN=4.^bN=115.^cN=209.^dN=215.^eN=543.^fN=2.^gN=72.^hN=116.ⁱN=123.^jN=313.**Product Placement and Visibility**

A vaporizer product was visible in 70% (913/1303) of images, and most commonly (497/1303, 38.14%) these were e-cigarette or other vaping devices (eg, e-hookah, e-cigar; Table 3).

E-cigarette liquids (also known as e-liquid or e-juice) were present in 11.82% (154/1303) of images. In posts that depicted a vaporizer product, the product was placed overtly within the image in 92.7% (846/913) of posts.

Table 3. Frequency statistics for each year corpus and the total sample within the “vape and tobacco products” domain.

Associated codes	2012 (N=12), n (%)	2014 (N=246), n (%)	2016 (N=540), n (%)	2018 (N=505), n (%)	Total (N=1303), n (%)
Product placement^a					
Overt	8 (88.9) ^b	179 (94.2) ^c	373 (93.5) ^d	286 (90.8) ^e	846 (92.7) ^f
Covert	1 (11.1) ^b	11 (5.8) ^c	26 (6.5) ^d	29 (9.2) ^e	67 (7.3) ^f
Product visible					
E-cigarette or another vaping device	3 (25.0) ^b	116 (47.2) ^c	199 (36.9) ^d	149 (35.4) ^e	497 (38.1) ^f
E-cigarette and another vape/tobacco product	2 (16.7) ^b	37 (15.0) ^c	79 (14.6) ^d	37 (7.3) ^e	155 (11.9) ^f
Vape accessory	0 (0) ^b	11 (4.5) ^c	28 (5.2) ^d	22 (4.4) ^e	61 (4.7) ^f
Vape liquid (e-liquid)	1 (8.3) ^b	17 (6.9) ^c	84 (15.6) ^d	52 (10.3) ^e	154 (11.8) ^f
Vape liquid and another vape/tobacco product	1 (8.0) ^b	0 (0) ^c	0 (0) ^d	5 (1.0) ^e	6 (0.5) ^f
Showcase in a retail store	0 (0) ^b	6 (2.4) ^c	4 (0.7) ^d	5 (1.0) ^e	15 (1.2) ^f
Tobacco product	2 (16.7) ^b	3 (1.2) ^c	4 (0.7) ^d	14 (2.8) ^e	23 (1.8) ^f
Setting					
Indoors	4 (66.7) ^g	94 (77.7) ^h	173 (71.2) ⁱ	107 (60.1) ^j	378 (69.0) ^k
Outdoors	2 (33.3) ^g	27 (22.3) ^h	70 (28.8) ⁱ	71 (39.9) ^j	170 (31.0) ^k

^aOnly coded for if a product was visible in the post.

^bN=9.

^cN=190.

^dN=399.

^eN=315.

^fN=913.

^gN=6.

^hN=121.

ⁱN=243.

^jN=178.

^kN=548.

Promotional Practices and Strategies

In 26.63% (347/1303) of posts, purchase of e-cigarette products was promoted, and 9.67% (126/1303) of posts provided Twitter users with a promotional offer (Table 4). Promotional offers could be monetary or nonmonetary, of which nonmonetary offers were most prevalent (86/126, 68.3%). Nonmonetary promotional offers did not lower the cost of a purchase; they instead promoted contests, giveaways, and sweepstakes or offered free shipping or a free gift with purchase. Rather than aiming to sell specific e-cigarette products, some posts promoted vape businesses, brands, and online groups. These posts were categorized as “business listings” and comprised 19.95% (260/1303) of the total sample (Figure 1). Some business listings and promotional posts used methods to increase their visibility

and expand their market, such as operating competitions to win e-cigarette products. However, to enter a competition, Twitter users were required to undertake a series of steps including following the account, and liking, commenting, re-tweeting, or tagging others in the post (Figure 2).

Of posts that displayed or discussed e-liquid products, 71.1% (226/318) described the flavor of the product through either words or images (eg, images of candy or fruits; Figure 3). Creative flavor names (eg, King Cookie Dough, Show me the Honey) and descriptive flavor descriptions (eg, “Grab a sweet and spicy cup of tea from the Chai Wallah as he makes the rounds on an overcrowded train slowly making its way to Varanasi”) were commonly depicted in image captions and on product packaging.

Table 4. Frequency statistics for each year corpus and the total sample within the “promotional practices and strategies” domain.

Associated codes	2012 (N=12), n (%)	2014 (N=246), n (%)	2016 (N=540), n (%)	2018 (N=505), n (%)	Total (N=1303), n (%)
E-liquid flavor described (yes) ^a	3 (100.0) ^b	33 (58.9) ^c	144 (90.0) ^d	76 (76.8) ^e	226 (71.1) ^f
Product brand or logo visible (yes) ^g	4 (44.4) ^h	83 (43.7) ⁱ	230 (57.6) ^j	144 (45.7) ^k	461 (50.5) ^l
Product brand or logo is visible anywhere	4 (33.3)	128 (52.0)	275 (50.9)	211 (41.8)	618 (47.4)
Promoting vape product for purchase	2 (16.7)	80 (32.5)	164 (30.4)	101 (20.0)	347 (26.6)
Business listing	2 (16.7)	61 (24.8)	101 (18.7)	96 (19.0)	260 (20.0)
Vapor present	1 (8.3)	60 (24.4)	104 (19.3)	89 (17.6)	254 (19.5)
Promotional offer					
Monetary	0 (0) ^m	11 (42.3) ⁿ	15 (31.9) ^o	7 (7.8) ^p	33 (26.2) ^q
Nonmonetary	1 (100.0) ^m	14 (53.8) ⁿ	29 (61.7) ^o	45 (86.5) ^p	89 (70.6) ^q
Both	0 (0) ^m	1 (3.8) ⁿ	3 (6.4) ^o	0 (0.0) ^p	4 (3.2) ^q
Vape product review	0 (0)	7 (2.8)	36 (6.7)	29 (5.7)	72 (5.5)
Cartoon	1 (8.3)	8 (3.3)	31 (5.7)	18 (3.6)	58 (4.5)
Sale notice	0 (0)	3 (1.2)	11 (2.0)	1 (0.2)	15 (1.2)

^aOnly coded for if the post displayed or discussed an e-liquid product.

^bN=3.

^cN=56.

^dN=160.

^eN=99.

^fN=318.

^gOnly coded for if a vaping-related product was visible in the post.

^hN=9.

ⁱN=190.

^jN=399.

^kN=315.

^lN=913.

^mN=1.

ⁿN=26.

^oN=47.

^pN=52.

^qN=126.

Figure 1. Example within the business listing category of the "promotional practices and strategies" domain.



Figure 2. Example within the nonmonetary promotional offer category of the "promotional practices and strategies" domain.



Figure 3. Example of a flavor within the "promotional practices and strategies" domain.



Health, Safety, and Product Claims

The potential health benefits and consequences (Figure 4) of e-cigarettes were detailed in 9.90% (129/1303) of posts, of which 70.5% (91/129) conveyed the perceived benefits associated with e-cigarette use (Table 5). These posts compared e-cigarette products to their presumed more harmful counterpart, combustible cigarettes, by listing the alleged harmless ingredients found in vaporizer products (eg, nicotine, propylene

glycol, glycerin, flavoring; Figure 5) compared to the toxic ingredients found in tobacco cigarettes (eg, ammonia, carbon monoxide, lead), labelled e-cigarettes as “smoke-free,” publicized that e-cigarettes provide a “safe” or “safer” smoking experience, and included testimonials from people who had quit smoking through the use of e-cigarettes and their subsequent positive changes in health. Further, a significant proportion of posts promoted e-cigarettes as an effective smoking cessation aid (266/1303, 20.41%; Figure 6).

Figure 4. Example of health consequences being explained within the “health, safety, and product claims” domain.



Table 5. Frequency statistics for each year corpus and the total sample within the “health, safety, and product claims” domain.

Associated codes	2012 (N=12), n (%)	2014 (N=246), n (%)	2016 (N=540), n (%)	2018 (N=505), n (%)	Total (N=1303), n (%)
Quit smoking	7 (58.3)	52 (21.1)	96 (17.8)	111 (22.0)	266 (20.4)
Health					
Total	1 (8.3)	15 (6.1)	34 (6.3)	79 (15.6)	129 (9.9)
Positive	1 (100.0)	13 (86.7)	22 (64.7)	55 (69.6)	91 (75.2)
Negative	0 (0)	2 (13.3)	12 (35.3)	24 (30.4)	38 (29.5)
Safety	0 (0)	8 (3.3)	30 (5.6)	24 (4.8)	62 (4.8)
Public health	0 (0)	2 (0.8)	18 (3.3)	30 (5.9)	50 (3.8)
Youth vaping	0 (0)	3 (1.2)	8 (1.5)	31 (6.1)	42 (3.2)
Health warning or age restriction visible	0 (0)	3 (1.2)	8 (1.5)	14 (2.8)	25 (1.9)
Nicotine^a					
Nicotine level (mg)	0 (0) ^b	4 (8.7) ^c	27 (18.1) ^d	3 (3.9) ^e	34 (12.4) ^f
Nicotine-free	1 (50.0) ^b	1 (2.3) ^c	9 (6.0) ^d	9 (11.7) ^e	20 (7.3) ^f
Multiple products: nicotine and nicotine-free	0 (0) ^b	2 (4.3) ^c	2 (1.3) ^d	1 (1.3) ^e	5 (1.8) ^f
No nicotine level visible	1 (50.0) ^b	39 (84.8) ^c	111 (74.5) ^d	64 (83.1) ^e	215 (78.5) ^f

^aOnly coded for if the post displayed an e-liquid product.

^bN=2.

^cN=46.

^dN=149.

^eN=77.

^fN=274.

Figure 5. Example of an explanation of e-liquid ingredients within the "health, safety, and product claims" domain.

WHAT'S IN E-CIGARETTE LIQUID?

Propylene Glycol
Food additive (E1520)
Has been a food additive for over 50 years. Non-toxic and considered generally safe for consumption by the US FDA. Used in ice-cream, confectionery, hand creams, cosmetics and pharmaceuticals.

Vegetable glycerol
Food additive (E422) derived from plants, usually soybeans or palm. Used in food and beverages, toothpaste, mouthwash, gel tablets, glycerol soap and widely in pharmaceutical formulations.



Food flavouring
E-liquid alone has little taste, so flavour concentrates such as vanilla, mint, fruit, beverage, confectionery, tobacco and spices are usually added.

Nicotine
Stimulant found in tomatoes, eggplant, cauliflower and especially tobacco leaf. Typical e-liquid contains a 1 to 3% concentration of nicotine. A drop of typical e-liquid contains 0.5 to 1mg of nicotine (compared to nicotine gum with 2 to 4mg).

Figure 6. Example of describing e-cigarettes as a smoking cessation aid within the "health, safety, and product claims" domain.

What's an effective alternative for smokers who can't quit?



There is clear evidence that vaping has helped millions of smokers to quit

Australian Tobacco Harm Reducer Association

Only 1.92% (25/1303) of posts contained a health warning or age restriction. Health warnings were commonly displayed on e-cigarette product packaging (Figure 7). Age restrictions indicating products were not to be used by those under the age of 18 years were commonly asserted by a small icon, similar to

that found on alcoholic beverages in Australia. Of the posts that portrayed an e-liquid product, 21.5% (59/274) identified whether the product contained nicotine (eg, 2 mg) or was nicotine-free (eg, 0 mg).

Figure 7. Example of a health warning within the “health, safety, and product claims” domain.



Behaviors and Practices

Over half (709/1303, 54.41%) of all posts indicated the presence of a vaping community or shared social identity or addiction bond, commonly through the use of hashtags. Popular hashtags that accompanied these posts included #vapecommunity, #vapefam, #vapenation, and #vapelife. One user posted:

#vape #vapefam #WeVapeWeVote #vapenation As a show of solidarity, I will add your #THR [tobacco

harm reduction] medal to your profile pic[ture] if you'd like. Simply send me a DM [direct message] w/ [with] the picture and it can be done quickly.

“Hand check/product check” posts (255/1303, 19.57%) often appeared as simple photographs of an e-cigarette device or liquid in the hand of its user (Figure 8) or standalone (Table 6). These images were commonly taken in people’s homes, cars, and other outdoor locations and were frequently accompanied by the hashtag #handcheck.

Figure 8. Example of a hand check post within the “behaviors and practices” domain.



Table 6. Frequency statistics for each year corpus and the total sample within the “behaviors and practices” and “association with another substance” domains.

Associated codes	2012 (N=12), n (%)	2014 (N=246), n (%)	2016 (N=540), n (%)	2018 (N=505), n (%)	Total (N=1303), n (%)
Behaviors and practices domain					
Identity or community	0 (0)	142 (57.7)	341 (63.1)	226 (44.8)	709 (54.4)
Hand check/product check	4 (33.3)	45 (18.3)	127 (23.5)	79 (15.6)	255 (19.6)
Selfie	0 (0)	17 (6.9)	24 (4.4)	14 (2.8)	55 (4.2)
Building/DIY ^a	1 (8.3)	10 (4.1)	21 (3.9)	18 (3.6)	50 (3.8)
Meme	0 (0)	4 (1.6)	17 (3.1)	26 (5.1)	47 (3.6)
Vape play	0 (0)	12 (4.9)	21 (3.9)	10 (2.0)	43 (3.3)
Person vaping	1 (8.3)	71 (28.9)	99 (18.3)	90 (17.8)	261 (20.0)
Erotic or sexualized	0 (0)	7 (2.8)	11 (2.0)	1 (0.2)	19 (1.5)
Association with another substance domain					
Cannabis (including hemp)	0 (0) ^b	1 (25.0) ^c	11 (61.1) ^d	11 (91.7) ^e	23 (67.6) ^f
Alcohol	0 (0) ^b	3 (75.0) ^c	7 (38.9) ^d	1 (8.3) ^e	11 (32.4) ^f

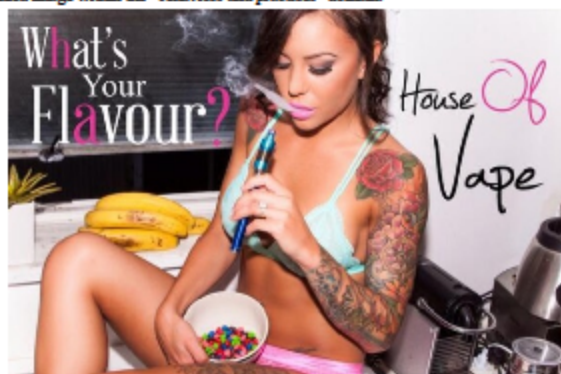
^aDIY: do-it-yourself.^bN=0.^cN=4.^dN=18.^eN=12.^fN=34.

Men were more often represented in selfies (40/55, 73%; $P<.001$), and in posts of people vaping (139/261, 53.3%; $P<.001$) and performing vape tricks (25/43, 58%; $P<.001$; Figure 9) than women (selfies: 12/55, 22%; vaping: 84/261, 32.2%; performing vape tricks: 8/43, 19%). Furthermore, men more frequently posted “hand check/product checks” (98/255, 38.4%; $P<.001$) and posts that indicated a connection with the vape

community or vaper identity (199/709, 28.1%; $P=.05$) than women (12/255, 4.7% and 60/709, 8.5%, respectively). A person was present in 18 of the 19 “erotic or sexualized” posts, of which 16 (89%) images contained women scantily dressed and suggestively posed (Figure 10). The remaining 2 images portrayed a man and woman together.

Figure 9. Example of male representation within the “behaviors and practices” domain.

Figure 10. Example of a sexualized image within the "behaviors and practices" domain.



Regulation and Advocacy

E-cigarette regulation and policy were discussed in 10.74% (140/1303) of posts (Table 7). An almost equal proportion of posts was found to be discussing or in favor of liberal (90/1303,

6.91%) versus restrictive (87/1303, 6.68%; Figure 11) e-cigarette policies. Advocacy efforts were encouraged in 4.99% (65/1303) of posts, of which 60% (39/65) supported liberal e-cigarette regulation (Figure 12).

Table 7. Frequency statistics for each year corpus and the total sample within the "regulation and advocacy" domain.

Associated codes	2012 (n=12), n (%)	2014 (n=246), n (%)	2016 (n=540), n (%)	2018 (n=505), n (%)	Total (n=1303), n (%)
Regulation or policy	0 (0)	9 (3.7)	43 (8.0)	100 (19.8)	140 (10.7)
Liberal regulation	0 (0)	6 (2.4)	26 (4.8)	58 (11.5)	90 (6.9)
Restrictive regulation	0 (0)	2 (0.8)	27 (5.0)	58 (11.5)	87 (6.7)
Advocacy	0 (0)	3 (1.2)	16 (3.0)	46 (9.1)	65 (5.0)

Figure 11. Example of a restrictive policy within the "regulation and advocacy" domain.



Figure 12. Example of advocacy within the "regulation and advocacy" domain.



Discussion

Promotional Practices and Strategies

The use of several promotional practices and strategies was documented in this study, namely the promotion of positive perceptions of e-cigarette use, implicit and explicit marketing of e-cigarette products and businesses, and the use of promotional offers (monetary and nonmonetary). These findings are consistent with those reported in a recent systematic review of e-cigarette marketing communication [44] and are known and effective strategies utilized by the tobacco industry for decades [45]. These promotional practices coupled with the ease in which consumers can purchase products online through the click of a link have resulted in the exponential growth of online e-cigarette sales worldwide [46]. Investigations into youth online purchasing have confirmed the ease with which young people can purchase e-cigarette products due to the lack of appropriate age detection processes [47-49].

The promotion of e-liquid flavors through images, detailed flavor descriptions, and appealing product packaging was common and is supported by other social media-based investigations [50,51]. E-cigarette users commonly report the importance of flavored e-cigarette products in facilitating smoking abstinence and enhancement of their vaping experience [52]. Subsequently, e-cigarette manufacturers and retailers have adopted the promotion of flavored e-cigarette products as a major marketing strategy [53]. However, evidence indicates the promotion of flavored e-liquid may be particularly attractive to young people [54] and serve as one of the main reasons for e-cigarette initiation [55]. Furthermore, youth have been found to perceive fruit-flavored e-liquids to be less harmful than tobacco-flavored products [56], and fruit-flavored e-liquids have been linked to greater perceived enjoyment [57].

Health, Safety and Product Claims

It is not uncommon to find posts on social media claiming e-cigarettes are safer than cigarettes and can be used as a cessation tool, with limited or no validation [35]. Only a very

small proportion of posts in this study was accompanied by or depicted a health warning or age restriction, and an increasing proportion of posts was found to be promoting the positive health effects of vaping. Furthermore, a substantial proportion of posts promoted e-cigarettes as a replacement or alternative to cigarettes, similar to that found by Laestadius and colleagues [30]. Risk perception plays an important role in product use decision making, and a commonly cited reason for e-cigarette uptake among adults and young people is the belief that they are less harmful than cigarettes [58-60]. Youth who perceive e-cigarettes as harmless or less harmful than cigarettes are at increased susceptibility of uptake compared to youth with more negative views towards vaping [61,62].

Behaviors and Practices

A common post found in this study, the "hand check/product check," is significant because these posts reflect the variety and wide range of vaporizer and e-liquid products and accessories that exist. As vaporizers continue to evolve, with users able to customize and create unique devices, users are increasingly turning to social media to share the products they are using and creating. Similarly, Chu and colleagues [29] found a large proportion of product-based images posted to the social media platform Instagram exhibiting the hashtag #handcheck. The authors expressed concern regarding this increasing trend, as these images act as unpaid marketing of e-cigarette products and viewers may interpret these devices to be commonplace and socially acceptable.

The inclusion of hashtags such as #vapecommunity, #vapelifelife, #vapenation, and #cloudchaser demonstrate the existence of a vaping identity and community on Twitter, which has also been found in prior vaping-related social media investigations [30,63]. Inclusion of such hashtags may function to create an internalization of social bonding and a vape-related identity [63]. This internalization may help one to define who they are and create their own identity and values within a society that has normalized values and practices. This has led to the formation of unique online and face-to-face "vaper"

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JMIR Public Health Surveill 2020 | vol. 6 | iss. 4 | e15577 | p. 14
(page number not for citation purposes)

communities and identities [64,65], which some people are now adopting and associating with rather than the identity of being a “cigarette smoker” or “ex-smoker.” The application of hashtags to social media posts is a form of folksonomy, and the initiating adopters of these electronic tags and subsequent uptake by imitators can be explained by Roger’s Diffusion of Innovation Theory, which seeks to explain how, why, and at what rate new ideas and technology spread [66]. It has therefore been suggested by some that these vaping-related discussions may be occurring within some networks as an “echo chamber,” whereby the ideas and beliefs of those within the network are strengthened, resulting in the normalization of vaping within these communities [63]. Research examining Australian Twitter users using network analysis methods could provide an Australian perspective on this hypothesis. Further, research that examines how nicotine addiction is represented on social media may assist to understand evolving perceptions of addiction and identity.

Implications for Policy and Research

This investigation demonstrates that a number of Australian Twitter users are purposefully (commercial) and also inadvertently (through posts by vapers) promoting the use of e-cigarettes. Twitter has a “paid” advertising policy prohibiting the promotion of tobacco products, accessories, and branding (including e-cigarettes) [67]. The policy, however, does not relate to individual account holder’s content, fan pages, or groups. The boundaries between owned, paid, earned, and shared content have become increasingly more blurred [68], with evidence suggesting influencers are being used to circumvent social media policies [69,70]. In the absence of regulations controlling online promotions and formal gateways restricting access to content, posts on social media platforms such as Twitter can reach and potentially influence both e-cigarette users and nonusers alike [51]. Exploring opportunities to further restrict the commercial promotion of these devices (ie, unpaid promotion from commercial accounts) on Twitter and other social media platforms is required, and working with social media platforms to voluntarily employ these restrictions is one possible solution [71].

This study found the proportion of posts specifically promoting e-cigarette products for purchase decreased in 2018 (Multimedia Appendix 1), although this correlates with a relative decline in Twitter use by Australians in comparison to other larger and growing platforms. Due to the increased popularity of Instagram over recent years, and more recently TikTok, it would be valuable to investigate e-cigarette-related promotional content posted to these platforms. Instagram and TikTok are primarily photo and video-sharing social networking services; therefore, these platforms may be more desirable and more highly accessed than Twitter to share this type of content.

A product for therapeutic use, such as smoking cessation or alleviation of nicotine withdrawal, must be registered with the

Therapeutic Goods Administration to be sold lawfully in Australia [2]. At present, no heated tobacco nor nicotine vaporizer has been approved by the Therapeutic Goods Administration and therefore should not be promoted as a smoking cessation product. Continued monitoring of Australian e-cigarette retailers to ensure misleading health and smoking cessation claims are not being made is therefore important so as not to contribute further to the confusion regarding e-cigarette safety and efficacy.

Limitations

Several limitations need to be considered when interpreting the results of this study. This study reflects data from one social media platform, Twitter, as its data are mostly public and easily accessible to researchers, whereas some other social media platforms are not as readily accessible [72]. However, the TrISMA infrastructure makes Australian-specific historical Twitter data accessible in a way most other social media platforms do not. This is not an indication that other social media platforms are not spaces where e-cigarettes are discussed by Australians, but only that these activities are not always as visible to researchers. The search strategy included several popular terms used to describe e-cigarettes and vaping practices; however, emerging and variations of slang terms may have been overlooked. The investigation focused only on tweets that included an image. Therefore, these results may not be reflective of all tweets by Australian users. Lastly, we relied on TrISMA’s programmed bot filtering processes occurring at the level of the user before tweets were collected to remove questionable accounts. Future studies examining Twitter data are encouraged to apply denoising techniques after data collection [73].

Conclusions

Despite Australia’s cautious approach toward e-cigarettes and the limited evidence supporting e-cigarettes as an efficacious smoking cessation aid, it is evident that there is a concerted effort by some Twitter users to promote these devices as a harmless, health-conducive, smoking cessation product. Further, Twitter is being used in an attempt to circumvent Australian regulation and advocate for a liberal approach to personal vaporizers. The borderless nature of social media presents a clear challenge for enforcing Article 13 of the WHO FCTC. Evidence suggests a relationship exists between e-cigarette advertising exposure and uptake, and social media is now being used to generate favorable attitudes towards vaporizer products. As “digital media” consumption has increased, content that was previously inaccessible due to conventional advertising regulations, such as tobacco advertising, is now visible, and traditional tobacco control regulations are no longer adequate. The internet is the perfect platform to promote e-cigarettes and novel nicotine products, even in a highly regulated country such as Australia. Countering the advertising and promotion of these products is a public health challenge that will require cross-border cooperation with other WHO FCTC parties.

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JMIR Public Health Surveill 2020 | vol. 6 | iss. 4 | e15577 | p. 15
(page number not for citation purposes)

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living costs for students (KM) undertaking Research Doctorate studies. This research was also supported by the Faculty of Health Sciences, Curtin University 2019 Health Sciences Summer Scholarship Initiative. The scholarship is provided to support the general living costs of undergraduate students (KT) to undertake a research project. All funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; and in the decision to publish the results. This research was also supported by infrastructure provided through the Australian Research Council-funded project *TrISMA: Tracking Infrastructure for Social Media Analysis* (LIEF grant LE140100148).

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Authors' Contributions

JJ, BM, TL, KW, and KM acquired the funding. KM, JJ, BM, TL, and KW conceptualized the study and methodology. KM performed project administration, curated the data, and wrote the original draft of the manuscript. JJ, BM, and TL supervised the study. KM and KT performed the formal analysis. Review and editing of the manuscript was performed by BF, JJ, BM, KW, and TL.

Conflicts of Interest

BF is a member of the NHMRC Electronic Cigarettes Working Committee (May 2020). She has received consulting payment for e-cigarette policy review for the New South Wales National Heart Foundation (December 2019). She had travel expenses (flight and registration) reimbursed to attend Oceania Tobacco Control Conference 2017 to present on e-cigarette and cessation. She provided her opinion (unpaid) at the Australian Parliament's Standing Committee on Health, Aged Care and Sport public hearing into the Use and Marketing of Electronic Cigarettes and Personal Vaporisers (September 8, 2017). She led a contract on e-cigarette regulation in Australia for the Commonwealth Department of Health (2016). She had travel expenses reimbursed by National Taiwan University for presenting on e-cigarette regulation (2016). The other authors have no conflicts to declare.

Multimedia Appendix 1

Coding framework.

[\[DOCX File, 20 KB-Multimedia Appendix 1\]](#)

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Abbreviations

e-cigarette: electronic cigarette

GIF: graphic interchange format

TRISMA: Tracking Infrastructure for Social Media Analysis

WHO FCTC: World Health Organization Framework Convention on Tobacco Control

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4.3.2 Twitter study B

Publication 4: E-cigarette advocates on Twitter: Content analysis of vaping-related tweets.

Objective: To identify key conversation trends and patterns over time, and discern the core voices, message frames and sentiment surrounding e-cigarette discussions on Twitter within an Australian context.

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Original Paper

E-Cigarette Advocates on Twitter: Content Analysis of Vaping-Related Tweets

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Abstract

Background: As the majority of Twitter content is publicly available, the platform has become a rich data source for public health surveillance, providing insights into emergent phenomena, such as vaping. Although there is a growing body of literature that has examined the content of vaping-related tweets, less is known about the people who generate and disseminate these messages and the role of e-cigarette advocates in the promotion of these devices.

Objective: This study aimed to identify key conversation trends and patterns over time, and discern the core voices, message frames, and sentiment surrounding e-cigarette discussions on Twitter.

Methods: A random sample of data were collected from Australian Twitter users who referenced at least one of 15 identified e-cigarette related keywords during 2012, 2014, 2016, or 2018. Data collection was facilitated by TrISMA (Tracking Infrastructure for Social Media Analysis) and analyzed by content analysis.

Results: A sample of 4432 vaping-related tweets posted and retweeted by Australian users was analyzed. Positive sentiment (3754/4432, 84.70%) dominated the discourse surrounding e-cigarettes, and vape retailers and manufacturers (1161/4432, 26.20%), the general public (1079/4432, 24.35%), and e-cigarette advocates (1038/4432, 23.42%) were the most prominent posters. Several tactics were used by e-cigarette advocates to communicate their beliefs, including attempts to frame e-cigarettes as safer than traditional cigarettes, imply that federal government agencies lack sufficient competence or evidence for the policies they endorse about vaping, and denounce as propaganda "gateway" claims of youth progressing from e-cigarettes to combustible tobacco. Some of the most common themes presented in tweets were advertising or promoting e-cigarette products (2040/4432, 46.03%), promoting e-cigarette use or intent to use (970/4432, 21.89%), and discussing the potential of e-cigarettes to be used as a smoking cessation aid or tobacco alternative (716/4432, 16.16%), as well as the perceived health and safety benefits and consequences of e-cigarette use (681/4432, 15.37%).

Conclusions: Australian Twitter content does not reflect the country's current regulatory approach to e-cigarettes. Rather, the conversation on Twitter generally encourages e-cigarette use, promotes vaping as a socially acceptable practice, discredits scientific evidence of health risks, and rallies around the idea that e-cigarettes should largely be outside the bounds of health policy. The one-sided nature of the discussion is concerning, as is the lack of disclosure and transparency, especially among vaping enthusiasts who dominate the majority of e-cigarette discussions on Twitter, where it is unclear if comments are endorsed, sanctioned, or even supported by the industry.

KEYWORDS

electronic nicotine delivery systems; electronic cigarettes; e-cigarette; infodemiology; infoveillance; vaping; Twitter; social media; public health; content analysis

Introduction

The global e-cigarette market was worth US \$11.26 billion in 2018 [1] and is predicted to eclipse tobacco sales by 2023 [2]. Facilitating this growth is the increasing trend toward online retailing and social media consumption [3]. Social media has emerged as a popular forum for e-cigarette users (vapers) and prospective users to learn about and share their experiences with nicotine and vaping devices, for businesses to promote their products, and for e-cigarette advocates to debate regulatory regimes [4,5]. Digital media, including social media and social networking platforms, are increasingly preferred sources for health information and dissemination [6]. However, users may be inadvertently exposed to misinformation, disinformation, and unregulated advertising [7,8].

With its 330 million users [9], real-time content updates, and rapid information dissemination, Twitter contributes to e-cigarette marketing and information sharing [10]. As the majority of Twitter content is publicly available, the platform has become a rich data source for public health surveillance providing insights into emergent phenomena, such as vaping [11]. Recent investigations have shown that Twitter users are overwhelmingly exposed to positive messages about vaping, most notably marketing and promotion, and that public health messaging is particularly absent from communications [4]. Although there is a growing body of literature that has examined the content of vaping-related tweets [4,12], less is known about the people who generate and disseminate these messages, and the role of e-cigarette advocates in this promotion.

In Australia, the context of this study, the legal status of e-cigarettes is determined by existing and overlapping laws relating to poisons, therapeutic and consumer goods, and tobacco control [13]. Liquid nicotine is classified as a “Schedule 7-Dangerous Poison” under the Federal Poisons Standard [14], and, as such, the manufacture, sale, or supply of e-cigarettes containing nicotine without lawful authority (ie, prescription from a medical doctor) [15] is prohibited in all Australian states and territories [16]. However, nicotine-containing e-cigarettes are imported into Australia as there is no way to determine whether an e-cigarette contains nicotine without a laboratory analysis, which has implications for law enforcement [16,17]. E-cigarettes that do not contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims.

As of January 2019, there were approximately 2.56 million active monthly Australian Twitter users (64% male), which equates to approximately 12% of Australians over 13 years of age [18]. Given the popularity of Twitter [18], the ease of which information disseminates among its users, and the power of Twitter to traffic users to external webpages [19], insights into how the platform is used (and by whom) to promote and discuss

e-cigarettes are warranted. This study aimed to identify key conversation trends and patterns over time and discern the core voices, message frames, and sentiment surrounding e-cigarette discussions in an Australian context. Investigating these public conversations can contribute to understanding trends in knowledge, attitudes, and behaviors; identify marketing strategies; inform public health and public policy; and pave the way for interventions delivered via social media [20-23].

Methods**Data Collection**

Twitter data were collected via TrISMA (Tracking Infrastructure for Social Media Analysis) [24], a contemporary technical and organizational infrastructure for the tracking of public communication by Australian users of social media. Central to the TrISMA Twitter infrastructure is the Australian Twitter Collection, which continuously gathers tweets from identified Australian accounts (ie, accounts set to an Australian location, geolocation, or time zone, or accounts with a description field referring to an Australian location or containing Australia-specific terms) and stores them in a database available to accredited TrISMA researchers. The TrISMA Twitter Collection is hosted on a cloud-based Google BigQuery database and is accessed through the data visualization tool Tableau. The Australian Twitter Collection filters for known signs of bots, such as accounts with numeric strings in the title, accounts with zero followers, and brand new accounts tweeting or retweeting identical content.

A list of popular e-cigarette-related terms was developed based on peer-reviewed literature [25-30], trending Twitter hashtags, and frequently co-occurring hashtags (ie, hashtags that appeared in the same caption as the root term), which resulted in the following 15 keywords: *cloudchasing*, *ecig* (includes e-cigarette/s), *e-cig* (includes e-cigarette/s), *electroniccig* (includes electroniccigarette/s), *electronic cigarette* (includes electronic cigarettes), *eliquid*, *e-liquid*, *e-juice*, *vape* (includes vaper and vapes), *vaping*, *vapecommunity*, *vapefam*, *vapelife*, *vapenation*, and *vapeporn*. E-cigarette product names were omitted from the search strategy so as not to bias the results to specific brands [22]. A preliminary search revealed there was minimal Twitter activity using these keywords before 2012. Two yearly sampling intervals starting from 2012 to 2018 were therefore chosen to maximize the period of time covered while still being able to see the emergence and decline of trends in the collected data.

Data (tweets), along with metadata information (ie, user name and user follower count) were collected from public Australian Twitter users when a tweet included at least one of the identified keywords from each respective year. Data were downloaded in the form of CSV (comma separated value) files for each keyword and respective year. Social media users tend to include

multiple hashtags within their posts, which resulted in duplicate tweets being collected. Duplicate tweets within keyword corpora for each year and across keyword corpora from the co-use of hashtags were removed, resulting in the inclusion of only unique tweets [31]. Data were assigned a number in ascending order and 100 tweets from each keyword corpus for each year were randomly selected for analysis, using an online random sequence generator [32]. Selected data were checked by one researcher (KM) to determine eligibility (ie, written in English and relevant to e-cigarettes). If any of the originally selected 100 tweets did not fit the inclusion criteria, further sampling occurred until 100 eligible tweets were reached. If a keyword corpus had less than 100 tweets, all eligible tweets were included. Retweets (tweets reposted by users) were included in this study, which facilitated the understanding of what information was being circulated by Australian users, even if it originated in another country.

Ethical Considerations

A particularly salient concern among researchers is whether social media data should be considered public or private data [33]. Twitter is a social networking service in which users broadcast their opinions and commonly use a hashtag to associate their thoughts on a subject with users on the same subject, and therefore, these data are generally referred to as “public data” [33]. For ethical, privacy, and technical reasons, TriSMA does not collect tweets from private accounts or direct messages; therefore, all data collected in this study were publicly available. This study was approved by the Curtin University Human Research Ethics Committee (approval number: HRE2017-0144).

Developing the Coding Frame

A concept-driven approach (inductive) [34] informed by extant studies [22,23,35-42] was utilized to develop a triaxial coding framework to capture the account users, and the sentiment and theme of the tweets they posted. The coding frame was tested on a random sample of 100 tweets, whereby each tweet was read and assigned codes based upon the concepts presented in the descriptive text, hashtags, and any accompanying images [43]. One researcher (KM) undertook this process in NVivo (v11; QSR International), iteratively revising the coding framework to further refine predefined codes, merge others to create broader codes encompassing several related concepts, and identify new codes arising from the data using a data-driven approach (deductive) [34], which served as a revalidation of earlier coded material [44].

Coding and Analysis

The modified coding framework was transferred to IBM SPSS Statistics (v22; IBM Corp) and applied to the data by the same researcher. The coding descriptor *user category* characterizes the sender of the tweet and typically involved a detailed inspection of the associated Twitter profile, including the profile picture, bio description, follower-to-following ratio, and tweet history (ie, the content of tweets, number of daily tweets, and

ratio of original tweets to retweets) to determine who the user was (Multimedia Appendix 1) [39]. Although data were unique, the poster's of the data were not necessarily so and could be counted multiple times if their data were collected and selected for analysis. The coding descriptor *sentiment* reflects the stance expressed in the tweet toward e-cigarettes and related products or its users, whether positive, negative, or neutral (Multimedia Appendix 2). The coding descriptor *theme* reflects the theme of the actual content conveyed in the tweet (Multimedia Appendix 3). The text of each tweet and/or the Twitter user handle were explored via Twitter's search function to examine the profile of the user and any comments attached to the tweet to assist with understanding its context. URLs embedded within tweets were followed. If the URL was active, it was recorded as linking to either social media (eg, Instagram, Facebook, and YouTube) or a website (eg, retail, news, and blog). Each code within the coding framework was a variable in SPSS that functioned as a stand-alone item and was evaluated as either 1 for *present* or 2 for *absent*. *User category* and *sentiment* were mutually exclusive categories (ie, only one selection could be made per category), while the *theme* of the tweet and links to social media and websites were not. The chi-square test (or Fisher exact test if applicable) was used to examine the variation in the content of tweets between years.

Results

Sample of Posts

In total, 4432 tweets were analyzed. There were 570 (12.86%) tweets in 2012, 1196 (26.99%) in 2014, 1377 (31.07%) in 2016, and 1289 (29.08%) in 2018.

Retweets

Of the sample, 25.86% (1146/4432) were retweets, and of these, 79.23% (908/1146) were categorized as having a positive sentiment toward e-cigarettes. Posts by vape retailers or manufacturers (254/1146, 22.16%), e-cigarette advocates (248/1146, 21.64%), and the general public (219/1146, 19.11%) were most often retweeted. The content of the most frequently retweeted posts reflected advertising or promotion of vaping-related paraphernalia, groups, brands, retailers, or manufacturers (374/1146, 32.64%); posts mentioning an e-cigarette brand (248/1146, 21.64%); and posts discussing regulation or policy (246/1146, 21.47%) and the health and safety of e-cigarettes (204/1146, 17.80%).

Reporting of the following results includes both original tweets and retweets unless otherwise specified.

Sentiment

The vast majority of tweets (3754/4432, 84.70%) reflected positive perceptions toward e-cigarettes and related products or its users. Positive sentiment, however, decreased over time as negative sentiment increased (Table 1).

Table 1. Sentiment of data.

Sentiment	Year				Total (N=4432), n (%)
	2012 (N=570), n (%)	2014 (N=1196), n (%)	2016 (N=1377), n (%)	2018 (N=1289), n (%)	
Positive	515 (90.35)	1041 (87.04)	1197 (86.93)	1001 (77.66)	3754 (84.70)
Neutral	36 (6.32)	69 (5.77)	96 (6.97)	125 (9.70)	326 (7.36)
Negative	19 (3.33)	86 (7.19)	84 (6.10)	163 (12.65)	352 (7.94)

User Category

Vape retailers and manufacturers (1161/4432, 26.20%), the general public (1079/4432, 24.35%), and e-cigarette advocates (1038/4432, 23.42%) posted 73.96% (3278/4432) of the data analyzed (Table 2). The number of tweets posted by vape retailers and manufacturers peaked in 2014 and gradually

declined in subsequent years. Similarly, tweets posted by e-cigarette advocates peaked, however, later in 2016 and declined in 2018. The number of tweets posted by news and media sources and public health professionals, researchers, and academics gradually increased over time. Tweets posted by suspicious (suspected "bot") accounts progressively declined since 2012.

Table 2. Twitter user category.

User category	Year				Total (N=4432), n (%)
	2012 (N=570), n (%)	2014 (N=1196), n (%)	2016 (N=1377), n (%)	2018 (N=1289), n (%)	
Vape retailer or manufacturer	147 (25.79)	451 (37.71)	310 (22.51)	253 (19.63)	1161 (26.20)
General public	164 (28.77)	303 (25.33)	286 (20.77)	326 (25.29)	1079 (24.35)
E-cigarette advocate	89 (15.61)	235 (19.65)	439 (31.88)	275 (21.33)	1038 (23.42)
News or media source	1 (0.18)	22 (1.84)	48 (3.49)	147 (11.40)	218 (4.92)
Suspected bot	104 (18.25)	54 (4.54)	46 (3.34)	3 (0.23)	207 (4.67)
Other	36 (6.32)	58 (4.85)	73 (5.30)	34 (2.64)	201 (4.54)
Public health professional, researcher, or academic	2 (0.35)	11 (0.92)	35 (2.54)	127 (9.85)	175 (3.95)
Account not active or user suspended	13 (2.28)	46 (3.85)	73 (5.30)	24 (1.86)	156 (3.52)
Consumer advocacy group	13 (2.28)	1 (0.83)	33 (2.40)	50 (3.88)	97 (2.19)
Health or scientific group	0 (0)	6 (0.50)	22 (1.60)	34 (2.64)	62 (1.40)
Medical doctor, nurse, or group	1 (0.18)	7 (0.59)	6 (0.44)	8 (0.62)	22 (0.50)
Government or politician	0 (0)	2 (0.17)	6 (0.44)	8 (0.62)	16 (0.36)

Sentiment by User Category

Tweets by the general public (845/1079, 78.31%), suspected bot accounts (185/207, 89.4%), e-cigarette advocates (1007/1038, 97.01%), consumer advocacy groups (95/97, 98%), and vape retailers and manufacturers (1158/1161, 99.74%) were predominantly positive (Table 3). Tweets posted by health and

scientific groups (32/62, 52%) and medical doctors and nurses (12/22, 54%) were mostly negative, which contrasts with the proportion of positive tweets posted by other members of the public health community (ie, public health professionals, researchers, and academics [106/175, 60.6%]). Tweets by news and media accounts were mostly neutral (97/218, 44.5%).

Table 3. Twitter user category and sentiment of data.

User category	Sentiment			Total, n (%)
	Positive, n (%)	Neutral, n (%)	Negative, n (%)	
Vape retailer or manufacturer	1158 (99.74)	0 (0)	3 (0.26)	1161 (26.20)
Consumer advocacy group	95 (97.94)	1 (1.03)	1 (1.03)	97 (2.19)
E-cigarette advocate	1007 (97.01)	23 (2.22)	8 (0.77)	1038 (23.42)
Suspected bot	185 (89.37)	13 (6.28)	9 (4.35)	207 (4.67)
General public	845 (78.31)	115 (10.66)	119 (11.03)	1079 (24.35)
Other	150 (74.63)	27 (13.43)	24 (11.94)	201 (4.54)
Public health professional, researcher, or academic	106 (60.57)	18 (10.29)	51 (29.14)	175 (3.95)
Government or politician	9 (56.25)	1 (6.25)	6 (37.50)	16 (0.36)
Health or scientific group	19 (30.65)	11 (17.74)	32 (51.61)	62 (1.40)
News or media source	48 (22.02)	97 (44.50)	73 (33.49)	218 (4.92)
Medical doctor, nurse, or group	3 (13.64)	7 (31.82)	12 (54.55)	22 (0.50)
Account not active or user suspended	129 (82.69)	13 (8.33)	14 (8.97)	156 (3.52)
Total	3754 (84.70)	326 (7.36)	352 (7.94)	4432 (100)

Themes Reflected in the Data

The following narrative reflects on some of the most prevalent themes found in the data. Refer to [Multimedia Appendix 4](#) for all themes.

Advertising or Promotion

Almost half (2040/4432, 46.03%) of all data were classified as advertising or promotion. The number of advertising and promotional tweets collected peaked in 2014 and displayed a downward trend in subsequent years ([Table 4](#)). These tweets promoted vaping-related paraphernalia, groups, brands, events, and retailers and manufacturers. Strategies used to further promote vape products included providing coupons, discount offers, multibuy, and giveaways. These strategies were collectively coded as price promotions and were present in 19.46% (397/2040) of tweets categorized as advertising or promotion. In 2016, the number of these tweets collected doubled compared with the number collected in other years. E-cigarette retailers and manufacturers (990/2040, 48.53%) and

e-cigarette advocates (412/2040, 20.20%) posted the largest proportion of advertising and promotional tweets ([Figure 1](#)). Tweets by e-cigarette retailers and manufacturers commonly advertised vaping paraphernalia to purchase as follows:

Have you seen the NS Pen by @VandyVape? Slim and elegant design, and good battery capacity for its size... A great starter kit AVAILABLE in store 📍 and online! #VandyVape #VapePen #eCig #VapeKit #Vaping #VapeLife #Soulblu

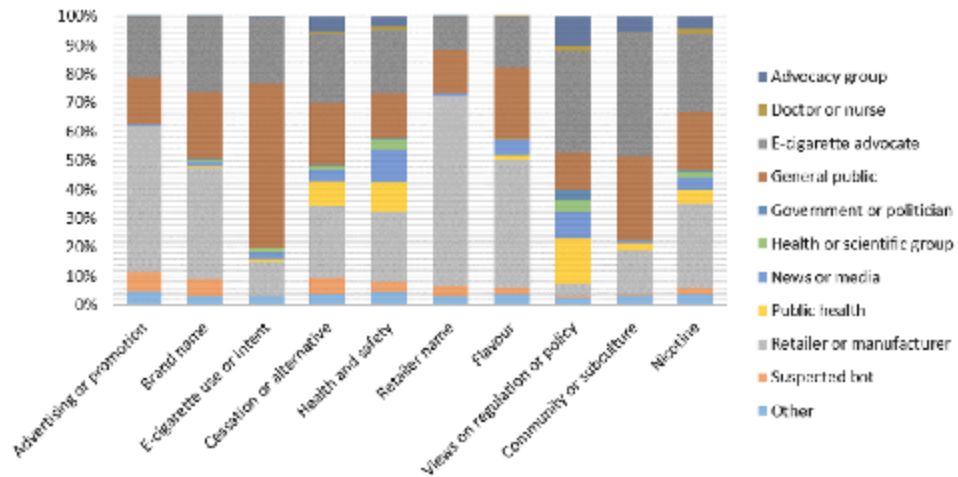
On the other hand, the general public and e-cigarette advocates were inclined to promote and publicize products they were currently using or testing as follows:

Shout out to @VapourvibesNZ you guys always look after me with my regular order of #alpinecloudco #Kosciuszko & your #heisenberg (which honestly is the best I've tried) #loyalcustomer dhl delivery takes 3days & boom my order is here!! #vapefam #vapegirl #vapourvibesnz THANKYOU 🙏👉

Table 4. The 10 most prevalent themes.

Tweet content	Year				Total (N=4432), n (%)
	2012 (N=570), n (%)	2014 (N=1196), n (%)	2016 (N=1377), n (%)	2018 (N=1289), n (%)	
Advertising or promotion	268 (47.02)	685 (57.27)	633 (45.97)	436 (33.82)	2040 (46.03)
Price promotion	77 (28.73)	80 (11.68)	152 (24.01)	88 (20.18)	397 (19.46)
Brand name	124 (21.75)	302 (25.25)	448 (32.53)	364 (28.24)	1238 (27.93)
E-cigarette use or intent	76 (13.33)	254 (21.24)	358 (26.00)	282 (21.88)	970 (21.89)
Cessation or alternative	105 (18.42)	182 (15.23)	136 (9.88)	293 (22.75)	716 (16.16)
Positive	100 (95.24)	176 (96.70)	130 (95.59)	274 (93.52)	680 (94.97)
Negative	1 (0.95)	4 (2.20)	2 (1.45)	13 (4.44)	20 (2.79)
Neutral	4 (3.81)	2 (1.14)	4 (2.94)	6 (2.05)	16 (2.24)
Health and safety	67 (11.75)	161 (13.46)	139 (10.09)	314 (24.38)	681 (15.37)
Positive	51 (76.12)	114 (70.81)	91 (65.47)	198 (63.06)	454 (66.66)
Negative	10 (14.93)	36 (22.36)	36 (25.90)	101 (32.17)	183 (26.87)
Neutral	6 (8.96)	11 (6.83)	12 (8.63)	15 (4.77)	44 (6.46)
Retailer name	78 (13.68)	234 (19.57)	136 (9.88)	201 (15.61)	649 (14.64)
Flavor	39 (6.84)	145 (12.12)	139 (10.09)	184 (14.29)	507 (11.44)
Views on regulation or policy	6 (1.05)	45 (3.76)	64 (4.65)	192 (14.91)	307 (6.97)
Liberal	3 (50.00)	36 (80.00)	58 (90.63)	151 (78.65)	248 (80.78)
Cautious	3 (50.00)	6 (13.33)	5 (7.81)	40 (20.83)	54 (17.60)
Neutral	0 (0)	3 (6.66)	1 (1.56)	1 (0.52)	5 (1.63)
Community or subculture	18 (3.16)	48 (4.01)	84 (6.10)	155 (12.03)	305 (6.88)
Nicotine	19 (3.33)	42 (3.51)	89 (6.46)	143 (11.10)	293 (6.61)

Figure 1. User category contribution in the 10 most prevalent themes.



A Smoking Cessation Aid or Tobacco Alternative

Overall, 16.16% (716/4432) of tweets discussed the potential of e-cigarettes to be used for tobacco smoking cessation or used as a tobacco alternative. The vast majority of tweets in this category maintained that e-cigarettes could be used to help tobacco smokers quit or reduce their tobacco consumption (680/716, 95.0%), and were most prevalent in 2018 (Table 4). E-cigarette retailers and manufacturers (176/680, 25.9%), e-cigarette advocates (169/680, 24.9%), and the general public (139/680, 20.4%) contributed the largest proportion of tweets supporting the use of e-cigarettes as a smoking cessation product. For example, one retailer posted the following statement:

Thousands of people loosing [sic] their lives because of #Smoking annually. Why don't you #Vape instead of #Smoking which is much safer, in fact it is not at all harmful. Make a move now! #VapeOn #SteamLite

Health and Safety

Overall, 15.37% (681/4432) of tweets discussed the perceived health and safety benefits (eg, increased physical stamina and financial wellbeing) and consequences (eg, device malfunction and exacerbation of respiratory diseases) of e-cigarette use. The majority (454/681, 66.7%) of these tweets stated the benefits of using e-cigarettes, peaking in 2018. Similarly, the number of negative health and safety tweets increased over time (Table 4). Tweets considering the positive health and safety aspects of e-cigarettes were dominated by vape retailers and manufacturers (158/454, 34.8%) and e-cigarette advocates (120/454, 26.4%). One post was as follows:

I've been smoke free for almost 5 years now, and have had huge improvements in my health. BECAUSE of switching to vaping, that makes me a criminal in Aus [Australia]. I'll take vaping any day over toxic pharma garbage like pills and gums. Inhaling air is potentially harmful, so is ignorance.

On the other hand, those expressing negative views were news and media sources (52/183, 28.4%), the general public (29/183, 15.8%), and public health professionals, researchers, and academics (27/183, 14.8%). One post was as follows:

As vaping products and their promotion become more prevalent, health professionals are warning that e-cigarettes are not as safe as many people believe.

Views on Regulation and Policy

Overall, 6.93% (307/4432) of tweets discussed e-cigarette regulation or policy (Table 4). The majority of the data expressed positive sentiment toward liberal e-cigarette regulation (248/307, 80.8%), and these posts were dominated by e-cigarette advocates (105/248, 42.3%) and public health professionals, researchers, and academics (40/248, 16.1%). One post was as follows:

Long time supporter and campaigner for #vaping I campaigned and worked hard to prevent further restrictions on #vapes. Sadly couldn't convince the 3 major parties. Abbreviated policy here <https://www.reasonvic.org.au/policy/> #votereason

Consistent with those supporting liberal regulation or legalization, e-cigarette advocates most often provided commentary that challenged the implementation of restrictive e-cigarette policies, provided testimonies as to why e-cigarette regulation should be relaxed, and challenged other Twitter users expressing antivaping views (123/263, 46.8%). One post was as follows:

Anti- #vaping advocates often compare the lack of absolute safety of #cigs with accepting the precautionary principle as being applicable. Of course this is facile and silly. They ignore the risk of causing harm by blocking innovation by doing nothing.

Links to Websites and Social Media Platforms

Overall, 44.29% (1963/4432) of posts included at least one embedded URL to an external website. Tweets most frequently included URLs that linked to news (536/1963, 27.31%) and retail websites (415/1963, 21.14%), blogs (326/1963, 16.61%), and scholarly articles and reports (79/1963, 4.02%). Almost half (530/1146, 46.25%) of retweets contained at least one URL that linked to an external website, and the most common were news (169/530, 31.9%) and retail (79/530, 14.9%) websites.

Overall, 18.55% (822/4432) of tweets linked to another social media platform, also known as cross-platform posting. Posts most commonly linked to Instagram (550/822, 66.9%) and Facebook (120/822, 14.6%). Additionally, 22.69% (460/2027) of tweets that were categorized as advertising or promotion were linked to Instagram.

Discussion

Principal Findings

This study analyzed 4432 vaping-related tweets from 2012, 2014, 2016, and 2018, posted and retweeted by Australian users. Analysis of the data indicated that positive sentiment continues to dominate the e-cigarette discourse on Twitter, and the ongoing polarized debate among the public health community is not reflected. Largely, a one-sided perspective is being presented by vape retailers and manufacturers, e-cigarette advocates, the general public, and select public health professionals, researchers, and academics.

Twitter users with vested interests in e-cigarettes (ie, retailers and manufacturers), e-cigarette advocates, and the general public were found to tweet a very high proportion of positive tweets (>70%). News and health-related accounts provided messages that were the least positive and/or neutral; however, these tweets comprised a small proportion of the total sample. Our findings concur with recent studies [4,45]. However, we found that some vocal provaping public health professionals, researchers, and academics are skewing the conversation, which is not the view of the wider Australian and international public health communities [46].

E-cigarette advocates, along with a small number of vocal public health professionals, researchers, and academics, were predominately positive in their discussions and were found to challenge other Twitter users who expressed antivaping views

or were deemed to be “misrepresenting the facts” concerning e-cigarettes. Some Australian public health academics, who do not support the use of e-cigarettes until they are proven to be a safe and efficacious smoking cessation aid, have documented their relentless struggles with provaping advocates on Twitter [47,48], with one stating that the collective abuse received from other interest groups, such as smokers’ rights advocates, antivaccinationists, and climate change denialists, pales into insignificance compared with the volume of abuse received from vaping advocates. Several tactics were used by e-cigarette advocates to communicate their beliefs, including attempts to frame e-cigarettes as safer than tobacco cigarettes, imply that federal government agencies lack sufficient competence or evidence for the policies they endorse about vaping, and denounce as propaganda “gateway” claims of youth progressing from e-cigarettes to tobacco cigarettes. Australian e-cigarette advocates were also found to use a range of tropes to justify their support for vaping, which have been identified in international research [49], including encouraging an “us versus them” mentality, attacking those opposed to e-cigarettes, relying on personal anecdotal evidence, minimizing side effects, normalizing use, and emphasizing the benefits of e-cigarettes. These tactics may impact the proportion of the public health community and other Twitter users who are willing to express contradictory views [50], thereby skewing the commentary and possibly shaping the views and risk perceptions of vulnerable populations such as youth [51]. This notion is supported by our findings, with only 7.94% (352/4432) of tweets categorized as negative and 7.36% (326/4432) as neutral.

Groups who are usually viewed as health experts or opinion leaders, such as medical doctors and nurses, reputable scientific organizations, and government organizations and politicians, collectively posted only 2.26% (100/4432) of tweets analyzed in this study. A great deal of health information is now distributed and sourced online, which has resulted in less of a reliance upon these traditional knowledge brokers in offline settings [52]. In the online environment, “the multiplicity of sources involved in information dissemination, their possible anonymity, the absence of standards for information quality, the ease in manipulating and altering content, the lack of clarity of the context, and the presence of many potential targets of credibility evaluation (ie, the content, the source, and the medium)” [52] make the assessment of information an often complex task. As a result, individuals are now burdened with the responsibility of information evaluation that was once the responsibility of professional gatekeepers [53]. The health literacy levels of the Australian population are generally low [54,55], and investigating methods to assist internet users in assessing the credibility of online information is therefore particularly important, as well as the dissemination of evidence-based information by respected experts and opinion leaders.

Our results support previous vaping-related Twitter investigations reporting that the Twitter landscape is dominated by tweets from industry and commercial users championing e-cigarettes as a healthier tobacco alternative and as a successful cessation aid [11,23,41]. These views are contrary to Australia’s regulatory approach to e-cigarettes, which aims to safeguard

public health and control the drivers of negative e-cigarette use (ie, use among youth and nonsmokers and unfettered marketing) [56]. Australia is a signatory to the World Health Organization Framework Convention on Tobacco Control, which is designed to protect public health policies from commercial and other vested interests [57]. Until there is adequate evidence that e-cigarettes are safe and an efficacious smoking cessation product, they should not be promoted as such.

A substantial proportion of tweets used sales techniques, such as price promotions, which have historically been successfully employed by the tobacco industry, to influence cigarette uptake and consumption [58]. These findings have implications for the marketing of e-cigarettes on other social media platforms, in particular Instagram, owing to the level of cross-platform interaction found in this investigation, which is worth further examination. Given the substantial youth presence on social media, the marketing of e-cigarettes on these platforms may entice nonsmokers and youth, in particular, to experiment with and initiate vaping [59]. Data from the most recent National Drug Strategy Household Survey [60] reports 11.3% of Australians aged over 14 years have ever used and 2.5% currently use e-cigarettes, with increases of 2.5% and 1.3%, respectively, since 2016. These increases occurred in both smokers and nonsmokers and contrast with Australian combustible smoking rates, which have continued to decline over the last 30 years. The most frequent reason for using e-cigarettes reported by people over 14 years was “out of curiosity” (54.2%). Others (22.8%) cited using e-cigarettes because they perceived them to be less harmful than tobacco cigarettes (19.2% in 2016), and 10.1% believed vaping to be more socially acceptable than tobacco smoking (6.0% in 2016). Further, 26.9% of respondents reported that they obtained their e-cigarette products online (Australian retailer 12.5%, overseas retailer 11.1%, unknown origin 3.3%), a trend that should be closely monitored [61].

Implications for Public Health

The practice of public health relies on evidence and clear communication between practitioners and the communities they serve [62], and in the absence of balanced evidence-based dialogue, personal opinion and marketing of e-cigarettes dominate the Twitter landscape. The scientific community is generally still a highly trusted source of information [63]. However, if disinformation and misinformation continue to be disseminated online, this could pose a legitimate threat to public health, as evidenced by the propaganda circulated during the 2014 Ebola outbreak [64] and 2020 coronavirus pandemic [65]. These realities require action, with a combination of regulation and health groups contributing to peer reviewed evidence and working with social media platforms to recognise and abate health information and disinformation. Offline, medical, and public health practitioners and researchers can work to dispel misinformation and disinformation directly through their built and trusted relationships and networks [63].

There are known and trusted strategies for addressing misinformation and disinformation in the field of health communication, but more research is needed to fully understand how well these translate into a social media context, how this

information spreads online, and how to develop data-driven solutions to this growing threat [62,63,66]. It is important to assess the extent of misinformation and disinformation related to vaping, considering its potential to generate negative public health consequences. Deployment of innovative methods on a broader scale is needed, including natural language processing, assisted data mining, social network analysis, and online experimentation to track the spread of this content [62]. Surveillance endeavors must be agile and adaptable and require both researchers and practitioners to establish relationships with computer science professionals to stay abreast of the rapidly changing technology.

Limitations

Coding using the triaxial classification system relied on the researchers' subjective assessment, although the investigation of each tweet and user profile was particularly thorough and included examination of associated commentary to facilitate the understanding of the tweet context and examination of the user's profile page including profile photo, bio, and recent activity. TrISMA's programmed bot filtering processes were relied upon to remove data posted by questionable accounts. However, through our manual investigation some Twitter users were signposted as "suspected bot" accounts. Bot accounts have become more sophisticated over time, better aligning with human activity on Twitter [67], and as such, it was particularly difficult in some instances to ascertain whether some accounts were genuine users or not.

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Authors' Contributions

Funding acquisition: JJ, BM, TL, KW, and KM; conceptualization: KM, JJ, BM, TL, and KW; project administration: KM; supervision: JJ, BM, and TL; data curation: KM; formal analysis: KM; methodology: KM, JJ, BM, TL, and KW; Writing—original draft: KM; Writing—review and editing: BF, JJ, BM, KW, and TL.

Conflicts of Interest

BF is a member of the NHMRC Electronic Cigarettes Working Committee (May 2020). She has received consulting payment for e-cigarette policy review for the NSW National Heart Foundation (December 2019). She had travel expenses (flight and registration) reimbursed to attend Oceania Tobacco Control Conference 2017 to present on e-cigarette and cessation. She provided her opinion (unpaid) at Australian Parliament's Standing Committee on Health, Aged Care and Sport public hearing into the Use and Marketing of Electronic Cigarettes and Personal Vaporisers (September 8, 2017). She led a contract on e-cigarette regulation in Australia for the Commonwealth Department of Health (2016). She had travel expenses reimbursed by National Taiwan University for presenting on e-cigarette regulation (2016). The other authors have no conflicts to declare.

Multimedia Appendix 1

Coding framework: user category.

[\[DOCX File, 15 KB-Multimedia Appendix 1\]](#)

Multimedia Appendix 2

Coding framework: sentiment.

[\[DOCX File, 12 KB-Multimedia Appendix 2\]](#)

Multimedia Appendix 3

Coding framework: themes.

[\[DOCX File, 21 KB-Multimedia Appendix 3\]](#)

Multimedia Appendix 4

Results: all themes.

[\[DOCX File, 25 KB-Multimedia Appendix 4\]](#)

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Abbreviations

TrISMA: Tracking Infrastructure for Social Media Analysis

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4.4 Substudy 3: Qualitative Inquiry

4.4.1 Qualitative study A

Publication 5: Motivations for use, identity, and the vaper subculture: A qualitative study of the experiences of Western Australian vapers.

Objective: To examine adult e-cigarette users who reside within the Greater Capital City Statistical Area of Perth, their motivations for e-cigarette use, reinforcing influences, and association with the vaper subculture.

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RESEARCH ARTICLE

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Motivations for use, identity and the vaper subculture: a qualitative study of the experiences of Western Australian vapers

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Abstract

Background: Vaping is a relatively new practice, and therefore its symbolic meanings and social practices are yet to be fully understood, especially within Australia where the practice is strictly regulated. This study aimed to examine vapers motivations for use, reinforcing influences, and association with the vaper subculture.

Methods: Working from a constructivist epistemology and a symbolic interaction framework, in-depth interviews were conducted with a purposive sample of 37 current (89%) and former (11%) adult vapers, 70% male, mean age of 32.5. Data was analysed via thematic analysis.

Results: Vapers largely started vaping to quit smoking and underwent common experiences during their initiation phase. Subsequently, vapers tended to adopt one of two dominant identities, that of the 'cloud chaser' or the 'substitute', which some users moved between during different stages of their vaping career. The social and symbolic meaning of e-cigarettes and vaping varied and involved concepts of harm reduction, addiction, pleasure, stigma and community, and for some, connection to the vaper subculture.

Conclusions: Understanding the complexities of vaping, and the nuanced differences of 'cloud chasers' and 'substitute' vapers may have important implications for health communication, research and policy. E-cigarette users within this sample were not a homogeneous group and differed in their motivations for use, association with the vaper subculture and relationship with the vape community. These findings provide new insights into the socialisation process and subsequent identity adoption of vapers within the unique regulatory environment of Western Australia.

Keywords: E-cigarettes, Vapers, Qualitative, Identity, Subculture, Australia

Background

Since entering the American market in 2007 [1], e-cigarettes have undergone a rapid evolution, with three broad classifications of vaping devices now recognised i) disposable (cig-a-like), ii) closed reusable (vape pen, pod-based), and iii) open reusable (mod) [2]. Cig-a-likes closely resemble a cigarette with a glowing tip that lights up upon inhalation and is disposed of once the e-liquid

is consumed. Closed reusable systems use replaceable pre-filled cartridges which tend to be limited in functionality (i.e. inability to adjust the temperature) and were originally designed to resemble cigarettes. However, the most recent generation of closed reusable vaping devices, pod-based systems, have diverged from cigarettes and now resemble USB sticks [2]. Finally, open reusable systems comprise a refillable liquid reservoir or 'tank', which users fill with their preferred choice of e-liquid.

E-cigarettes were originally developed as an alternative form of nicotine delivery and potential smoking cessation device [3]. However, over the short period since

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their inception, they have transformed into high-tech nicotine delivery devices appealing to both non-smokers and youth [4], an outcome largely stemming from increased investment by the tobacco industry [5]. This investment has contributed to their use moving beyond their touted role as a nicotine replacement and tobacco cessation device, to a social, recreational and sensory delivery device [6] associated with new rituals and social practices [7].

Smokers cite numerous reasons for starting vaping, these include: to ease nicotine cravings and withdrawal symptoms; to quit smoking or avoid relapse; to use e-cigarettes where smoking is prohibited; reduce cost; and the belief that e-cigarettes are less harmful than tobacco [8–11]. However, recently, research has investigated the rise in 'alternative' e-cigarette use behaviours such as drip-ping (i.e. applying e-liquid directly on the atomiser) [12] and vape tricks (i.e. creating shapes from exhaled aerosol) [12, 13] which may contribute to the perception that e-cigarettes are 'cool' or to be used for recreation [13].

Research from Europe has explored e-cigarette users' motivations, self-identity as vapers and involvement in vaping subcultures. Farrimond [14] identified differing motivations for use of, and varying political engagement in, vaping regimes among a sample of vapers in the United Kingdom (UK) and constructed three main typologies to describe these users: vaping for pleasure, vaping as medical treatment and ambivalent e-cigarette use, suggesting that the motives of vaping may be linked to different social identities. Similarly, a study of Norwegian vapers identified two dominant vaper identities, who Tokle and Pedersen [15] labelled 'cloud chasers' and 'substitutes'. Cloud chasers were dedicated vapers who identified with symbols and values in the subculture, many of whom were politically engaged in improving e-cigarette regulation, describing a sense of belonging to the vape community. Whereas substitute vapers were former daily smokers who used e-cigarettes for smoking cessation, to improve their health, escape the stigma of smoking and manage nicotine addiction. These studies echo other international research pointing to the symbolic and identity aspects of vaping [16–19].

Vaping is a relatively new practice, and therefore its symbolic meanings and social practices are yet to be fully understood. However, it appears that through the uptake of vaping, personal and collective identities have been established and a vaping subculture has emerged [14, 15, 20]. Considering the limited extant research investigating e-cigarette use within Australia, this study aimed to examine vapers motivations for use, reinforcing influences, and association with the vaper subculture within Western Australia.

In Australia, liquid nicotine is classified as a 'Schedule 7-Dangerous Poison' under the Federal Poisons Standard [21]. Hence, the only legal avenue for obtaining it is through a

personal importation scheme [21], which states the user must have a prescription from a physician. E-cigarettes that do not contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims. However, in Western Australia, the context of this study, it is currently an offence under the Tobacco Products Control Act 2006 [22] to sell products that resemble tobacco products, regardless of whether they contain nicotine or not.

Since the early 1990s, Governments in Australia have enacted progressive comprehensive legislation to reduce the impact of tobacco [23], and as a result, smoking rates have steadily declined. The 2019 National Drug Strategy Household Survey (NDSHS) [24] reports daily tobacco smoking rates in Australia have more than halved (11.0%) since 1991 (24.3%), and the daily use of tobacco products is most common among people aged 40–59 years (31.7%). Conversely, e-cigarette use has increased and current use is most common among those aged 18–29 (32.4%). During the time this study was undertaken the number of vape retail stores within the Greater Capital City Statistical Area (GCCSA) of Perth, Western Australia, had multiplied exponentially [25], which has resulted in increased exposure and access to these products, and perhaps reflects an increase in demand.

Vaping devices are referred to by users and scholars by a multitude of terms, including e-cigarette, ENDS (electronic nicotine delivery device), vape and mod. In this paper, the term e-cigarette is used to represent all of the various consumer products available.

Methods

Theoretical framework

Symbolic interactionism is a micro-level sociological theory providing the theoretical framework underpinning this study [26]. Symbolic interactionism is situated in a constructivist epistemology, focussing on the interactions between individuals rather than large scale social structures, examining how people navigate their interactions with others and allocate meanings based on their interpretation of those interactions [26, 27]. Symbolic interactionism has a history of being used to investigate drug use, the creation of deviance, and the exploration of meaning associated with new phenomena [28–30]. The symbolic interaction framework, therefore, assists in understanding a society (e-cigarette users) which is created through the repeated interactions between vapers [26, 27].

Sampling

Participants were purposively sampled for maximum variation in demographic characteristics (i.e. sex, age, Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) - a ranking derived from the economic and social conditions of people and households within an area [31]) within the sampling frame. Data collection

and analysis occurred simultaneously (March – November 2018), facilitating appropriate and targeted recruitment. Eligible participants were current and former (vaped within the last 12 months) vapers, aged over 18 years residing within the GCCSA of Perth, Western Australia [32]. Eligibility criteria were stipulated on all recruitment material.

Recruitment

A multipronged approach to recruit participants was utilised. Recruitment flyers and posts were placed on four online vaping forums (AussieVapers, Vaping in Australia, Vaper Café Australia and E-Cigarette Forum); seven subreddits on Reddit; and 30 closed vaping Facebook groups. The lead author created personal accounts on each of the forums and social media. Facebook groups were accessed by requesting permission to enter the group as a researcher to recruit study participants. Vape retail stores, online and bricks and mortar, within the GCCSA of Perth were contacted via email, social media and webpage submission forms. Snowball sampling was also utilised.

Interested individuals were invited to contact the lead author via email or telephone to express their interest in participating and receive further details about the project and what their participation entailed. After reading the participant information statement and providing informed consent, interviews were arranged at convenient safe public locations (e.g. local café, university campus). Interviews were conducted in English by the lead author who has experience in qualitative data collection. Interviews lasted on average 49 min (range 25–86 min) and were audio-recorded with participant consent. Participants were provided with an AUD\$25 gift voucher at completion of the interview as an honorarium for their time.

Data collection

A semi-structured interview guide was developed to allow flexibly and adaptability within each interview [33], and pilot tested with two participants. The interview guide addressed the following topic areas: reasons for vaping; pathway to using; knowledge, attitudes, and beliefs associated with e-cigarette use; devices and products used; means of accessing products; attitudes of friends, family and society towards vaping and their use; and emergent subculture (see Additional file 1). As new ideas and concepts were identified within the data these data-driven concepts were fed back into the data collection process and further guided sampling and adaption of the interview guide [34]. Sampling was terminated when thematic saturation was reached [35], which was determined through the constant comparison of data with preceding data until few new themes were generated.

Analysis and interpretation

All interviews except one (file corrupt) were transcribed verbatim by an independent professional transcription service and checked for accuracy by the lead author. The detailed notes taken by the lead author during and after interviews were sent via email to the participant the following day to review for accuracy and validation. Amendments from the participant were returned via email. Transcripts and interpretations were not provided to participants for respondent validation. Interview transcripts and detailed notes were anonymised and imported into NVivo (v12) to facilitate data organisation and linkage. The lead author conducted all coding, allowing for a single researcher to be immersed in both the data collection and analysis, thereby ensuring that the coding frame adequately described the intentions and content of the interviews [36].

The analytical process followed the steps proposed by Braun and Clarke [37] for thematic analysis and drew upon the initial and axial coding process of grounded theory [38]. The lead author played an active role in the analysis by searching for and identifying themes “to theorize the sociocultural contexts, and structural conditions, that enable the individual accounts that are provided” [37] (p. 85). Line-by-line analysis was undertaken to look for patterns of meaning and issues of interest important to the research objective and to generate a range of initial codes [38]. Codes were developed based on theoretical interest and emergent concepts that arose during interaction with and interpretation of the data. Axial coding examined the initial codes at a conceptual level to combine and connect codes to form overarching ‘candidate’ themes and subthemes in a meaningful way for the phenomenon under investigation [38]. Revision of the candidate themes then occurred at two levels. Level one involved reviewing all the data collated under each candidate theme to consider whether the data formed an intelligible pattern [37]. Some themes and sub-themes were refined during this process to create new themes/subthemes and to separate and combine others [37]. Level two involved a similar process, whereby the data were reviewed and further refined. This process, however, concerned the validity of the individual themes in relation to the data set ensuring participants meanings and voices were accurately reflected [37]. A detailed analysis was then written for each theme to report the content and meaning of patterns [37]. Working theme titles were reviewed to ensure they accurately reflected the respective analysis and the most vivid quotes were selected that best illustrated the essence of the point being described [37].

Strategies to enhance the rigour of the research included the use of a codebook to provide structure and agreement about code definitions, constructs, and themes; in-depth rich description of the research methods through field notes, personal reflections and

analytic memos [39]; and discussions with team members about meaning and interpretation of findings and conceptual maps [40].

Demographic and behavioural data were analysed using descriptive statistics (SPSS v26). The reporting of this study is guided by the consolidated criteria for reporting qualitative research (COREQ) checklist [41] (see Additional file 2).

Results

Participants

Thirty-seven interviews were conducted with current ($n = 33$, 89%) and former vapers ($n = 4$, 11%) (Table 1), with a mean of age of 32.5 ($SD = 7.411$, range 20–45 years). Thirty-two participants (87%) were current or former cigarette smokers and five (13%) were vaping despite having never been a regular smoker. Five participants were dual users of tobacco and e-cigarettes. Former ($n = 24$, 65%) and current ($n = 8$, 22%) smokers had been using tobacco on average for 14 years ($SD = 8.268$, range 3–38 years). In comparison, participants had been vaping on average for 2.4 years ($SD = 2.011$, range 1 month – 7 years).

Two identities and approaches to vaping emerged from the data, which we labelled 'substitute' vapers and 'cloud chasers' after the dominant vaper identities constructed by Tolde and Pedersen [15]. Cloud chasing is the act of expelling large amounts of vapour using an e-cigarette, we use the term in a broader, more symbolic sense. As such, the 'cloud chaser' identity is formed by the experiences articulated by 19 dedicated vapers who connect with at least some aspect of the vaper subculture, whether that be engaging with hobbyist activities, the trick culture or technological aspects of vaping. Whereas the experiences of the 'substitute' vaper are derived from 18 vapers who primarily viewed vaping as a means to manage their nicotine addiction and quit smoking. The identity prescribed to each user was not 'fixed' as some participants described their movement between the two identities over time as the meaning they attributed to vaping changed (i.e. hobby to primarily smoking cessation).

Findings

The narrative summary describes the commonalities experienced by vapers and then the experiences unique to the 'substitute' and 'cloud chaser' identity. Quotes from participants are provided in italics, followed by their pseudonym, attributed identity and age.

The common experience

"Can I have a go of that?": an introduction to vaping

Participants were predominantly introduced to e-cigarettes through work colleagues, friends, and during their time abroad in locations where e-cigarettes were more readily available (e.g. the UK). For the majority of participants, this introduction marked the first occasion

they had seen or heard about e-cigarettes. Subsequently, participants asked if they could "have a go on that" or the e-cigarette user suggested they try their vape. No one spoke of being pressured into trying their first e-cigarette with experimentation occurring spontaneously, either alone with the user or in the company of friends. Rarely did participants report communal experimentation where the vape was passed around to multiple people, rather it was most commonly a discrete encounter. Participants were mostly curious to try this device which in most instances functioned like a cigarette, however, were told it was not. Participants regularly reported coughing upon trying their first vape which could be attributed to several factors including the type of device (e.g. first/second versus third/fourth-generation device), device functionality (e.g. variable temperature, wattage, airflow or resistance), nicotine concentration, and the users smoking history, if any. Those who were smokers described this experience as being similar to that of their first drag of a cigarette, whereas non-smokers had difficulty articulating their experience as they had nothing to compare it to.

"As a non-smoker, it was really hard for me to grasp the concept. Everyone was trying to explain it to me like it's either like a cigarette or a bong. I was like, 'I don't know what you're talking about.' They were like, 'mouth-to-lung, or direct-to-lung' and I still can't even understand the concept. If I had to explain to you what I do, I don't know what I do. I press the trigger, I breathe it in, it comes out." Karis, cloud chaser [33]

The inhalation of vapour reportedly took some time to get used to as the vapour from the e-cigarette was "moist" compared to the "dry heat" of a cigarette. Participants went on to purchase an e-cigarette for themselves after enjoying their first experience, or after disliking the encounter chose not to pursue it until another opportunity arose, years later in some instances.

"I was a silly teenager": motivations for vaping

Thirty-two users were tobacco smokers for many years and described themselves as being "very addicted" which had resulted in several failed quit attempts. Participants had tried multiple methods to quit smoking, including going 'cold turkey', hypnotherapy, and nicotine replacement and drug therapies. The increasing cost of tobacco, real and feared deterioration of their health, and encouragement from loved ones to quit smoking were other significant drivers to commence and subsequently maintain vaping. For those users who had never been committed smokers, their motivations for initiating vaping were varied and included socialisation with other vapers, to appease food cravings, and as a diversion from alcohol or illicit drugs.

Table 1 Summary of participant's demographic, smoking and vaping characteristics

Characteristics	Total (n = 37)	Cloud chasers (n = 19)	Substitutes (n = 18)
Age (years)			
20–29	15 (40%)	8 (42%)	7 (39%)
30–39	15 (40%)	7 (37%)	8 (44%)
40–49	7 (20%)	4 (21%)	3 (17%)
Sex			
Male	26 (70%)	15 (79%)	11 (61%)
Female	11 (30%)	4 (21%)	7 (39%)
Education			
<High school certificate	6 (16%)	6 (31%)	–
High school certificate	8 (22%)	4 (21%)	4 (22%)
Technical (TAFE) certificate	14 (38%)	6 (31%)	8 (45%)
University degree	9 (24%)	3 (16%)	6 (33%)
Employment status			
Employed	33 (90%)	18 (95%)	15 (83%)
Unemployed	2 (5%)	–	2 (11%)
Full-time student	2 (5%)	1 (5%)	1 (6%)
IRSAD ranking			
Most disadvantaged	9 (24%)	5 (26%)	4 (22%)
Disadvantaged	5 (14%)	3 (16%)	2 (11%)
Median	13 (35%)	5 (26%)	8 (44%)
Advantaged	2 (5%)	2 (11%)	–
Most advantaged	8 (22%)	4 (21%)	4 (22%)
Vaping status			
Current vaper	33 (89%)	18 (95%)	15 (83%)
Former vaper	4 (11%)	1 (5%)	3 (17%)
Nicotine vaping			
Yes	26 (70%)	11 (58%)	15 (83%)
No	11 (30%)	8 (42%)	3 (17%)
Average vaping duration			
	2.4 years range 0.08–7 SD = 2.011	2.7 years range 0.08–7 SD = 2.052	2.1 years range 0.25–7 SD = 1.971
Smoking status			
Current smoker	8 (22%)	4 (21%)	4 (22%)
Former smoker	24 (65%)	13 (68%)	11 (61%)
Never smoker	5 (13%)	2 (11%)	3 (17%)
Average smoking duration			
	14.0 years range 3–38 SD = 8.268	13.5 years range 4–25 SD = 6.718	14.5 years Range 3–38 SD = 9.963
Dual use^a			
Yes	5 (14%)	4 (21%)	1 (6%)

^aFour participants started with nicotine, nicotine-free at the time of the interview

^bUsing both cigarettes and e-cigarettes

“On their way to their vaping journey”: starting off Most participants opted to start their “vaping journey” with a disposable (cig-a-like) or pen-style closed-system device which introduced them to vaping at a

rudimentary level, as explained by River [42] “... something basic, where you push the button, you suck on it...”. Most, however, described these devices as unsatisfying (e.g. mute flavour, inadequate throat hit), poorly

fabricated and not producing enough vapour. Subsequently, most participants progressed to an open-system device which provided functionalities to enhance and personalise their flavour profile, adjust temperature, voltage, resistance, airflow and nicotine concentration, and comprised a refillable tank and rechargeable batteries. These features were particularly important for tobacco smoking participants, and were conducive to replicating the "throat hit" they were accustomed to.

"It [e-liquid] had no nicotine in it, as is Australian rules. I ended up actually putting my own [nicotine] in it because it was just, too smooth basically, you could taste it, but you couldn't feel it which is what I want, I want to feel it [throat hit]." Brody, substitute [34]

Transitioning to vaping from "analogue cigarettes" was a daunting process for some, and more so for those who had never been committed smokers. Participants explained that other vapers had tried to describe to them how they were required to inhale to achieve the desired throat hit and experience the best flavour.

"My friends were kind of just like, 'Just pull it in. You'll cough if you do it hesitantly.' I was super scared of just going-- [inhales], on this thing that's firing. The first few times that I did it, I don't think I was doing it properly because I was firing it for a really short amount of time, taking like really small puffs. Then when I did do it properly, I was like, oh this is what it's meant to feel like and taste like." Karina, substitute [24]

For those who were smokers, they described the inherent challenges, actions and processes of transitioning from cigarettes to e-cigarettes which took perseverance, including no longer lighting a cigarette, maintaining a charged device, importing, mixing and storing liquid nicotine, and accepting the physicality of the device compared to the slender profile of a cigarette.

*"Filling it up, charging it up, carrying it around, because it f***ing weighs a ton, as well. It just became too hard filling it up. It was always leaking and it's not as simple as clicking a button and smoking it. You have to set it to what you want and all that." Jonathan, substitute [27]*

"A bit of a learning curve": gaining knowledge and understanding The majority of users reported being proactive in conducting intensive 'self-learning' through the internet and social networking platforms, other

vapers, and to a lesser extent, retail stores, to acquire relevant skills (i.e. nicotine strength, mixing and safety; steeping; inhalation style "direct-to-lung" or "mouth-to-lung"; building and changing coils), information on health and safety, the meaning of vaping specific language and jargon, and troubleshooting techniques. Vape forums, social media (i.e. Facebook) and content sharing platforms (i.e. YouTube) were usually the first resources accessed to acquire knowledge and support. Participants reported simultaneous active (i.e., contributing content) and passive (i.e., viewing content posted) engagement in multiple local and international vaping groups and forums to discuss personal experiences, exchange information, and obtain new knowledge. Passive engagement provided newcomers with an opportunity to observe the online community and its rules, whereas more established vapers kept their "finger on the pulse" by monitoring the rise of new products. Conversely, active contribution to these fora provided opportunities for learning among 'newbies' and mentorship for more experienced vapers.

*"Well, that's where I got most of my knowledge from [online vaping groups]. It's hard to explain, it's a little family sort of thing, like whether it's starting off fresh or you know plenty of s*** you can always go there, get the advice that you need. That's definitely a helpful thing as well. ... You've got people in those groups that have been vaping for 10 or so years, like starting off when it was just a tiny industry, a fresh industry. Then you've got people that are trying to get off the smokes and they ask for advice from there." Timothy, cloud chaser [20]*

"There is something for everyone": finding the right product During the transition phase from cigarettes to vaping, some respondents reportedly struggled to quit smoking, relapsing on occasion, and/or dual using with cigarettes until they found the right combination of flavour, nicotine concentration and device. Finding the right combination was the moment many sensed they could quit smoking, citing the sophisticated features of the second (closed reusable) and third-generation (open reusable) devices most effective for smoking cessation.

"For me, it was getting used to the action but also ... finding the right flavours and then it was getting the nicotine level right, then it was finding the right device that was going to satisfy my intake, my draw in and my exhale... I'd buy one and go 'Oh it's a bit crap. I still want a cigarette. Why do I still want a cigarette?' Then eventually I found another device which was a bit more powerful and I found flavours

that I actually liked and so when I found that flavour I can tell you it was 48 hours between finding this particular flavour blend to when I had my last cigarette." Ursula, cloud chaser [43]

"I haven't quit I've upgraded": from one addiction to another Smoking cessation was viewed very differently to nicotine cessation, with the majority of users opting to continue using nicotine in their vapouriser to keep them from relapsing to cigarettes. Three of the five users who had never been committed smokers chose to use nicotine in their vapouriser after being introduced to it by a romantic partner or friend. All three users described themselves as not being addicted and that they could easily give it up if they tried. The end goal for many participants was not to be reliant on nicotine at all, and they explained how they were, or had, implemented strategies to reduce the concentration of nicotine they were using, such as alternating between nicotine and nicotine-free vapourisers and gradually tapering down the nicotine concentration. Four users had successfully quit smoking and were continuing to vape nicotine-free. Those users who were happy to continue to use nicotine in a "cleaner" and "healthier" form (e-cigarettes), or felt they were not ready to "wean" themselves off for fear of relapsing to smoking, recognised that they had completely transferred the behavioural and sensorimotor aspects of smoking to vaping. However, they believed because they were no longer smoking any potential ill-health inferred by vaping seemed inconsequential.

"As it stands, I have no intention of stopping [vaping] because whilst I'm using that [vapouriser] I have no intention to have a cigarette. That's how passionately I don't want to smoke again, but I'm not prepared to risk it at this time, but who knows? ... Do you know what, I often think I probably do need to cut back a little bit and I think, well I'm not smoking?" Ursula, cloud chaser [43]

Previous cigarette users observed that vaping fit nicely into their routine, which was once occupied by cigarettes (i.e. driving, coffee). Vaping allowed them to continue to enjoy the social aspects of smoking (i.e. drinking alcohol) and to placate feelings of stress or anxiety.

"Yeah, I still make a point of, especially when I first quit, of keeping that routine of going outside to smoke, or vape, just so it felt a little bit more like I was having a cigarette. It wasn't such a drastic change. You know like straight after a meal or things like that, my trigger moments. I would still get up, keep it to that little bit of a

routine. Get up, go outside, have my vape, go back inside." Ella, substitute [41]

Socialising with other vapers and smokers was said to reinforce and maintain their use of e-cigarettes. Even amongst those who were never committed smokers and those who were now vaping nicotine-free.

"I'm not a smoker. I'm a vaper": breaking free of tobacco In general, users referred to their device as a vape, themselves as a vaper, and the practice as vaping. Some felt the term 'e-cigarette' too closely aligned with smoking discourse and supported associations with negative connotations of death and disease. Vape products were generally not considered to be tobacco products, especially with the evolution of vaping devices and how they no longer resembled a cigarette, as earlier generations had.

"They need to stop calling them e-cigarettes because they're not cigarettes. That s**ts me up the wall, they're not cigarettes." Ian, cloud chaser [29]

Several users documented how they had experienced the "ignorance" of both smokers and non-vapers, and many seized the opportunity to "educate" these people. They highlighted the features which distinguished vaping from smoking, such as not containing tobacco and the production of vapour, not smoke, and the perceived positive changes to their health they had experienced since starting vaping, in the hope of reducing the stigma and the estrangement they felt.

"... people will say, 'why don't you just smoke cigarettes?' which I think is a strange thing to say. People just misunderstanding the health risks." Julia, substitute [26]

For some, they could not escape their internalised feelings of smoking-related stigma, and as a result, avoided vaping in public.

"I generally try not to vape in public because it is not stealthy unless you're using a little stealthy device ... People can see you a mile away, and I get really embarrassed. But I used to hide when I was a smoker as well. At least when I was a smoker I could hide in my car. Even with my vape, I get in my car and there's big clouds coming out." Ursula, cloud chaser [43]

The substitute vaper

"A means to an end": Vaping to quit smoking For those 'substitute' vapers who were former smokers, they viewed their vaping experience as a practical means to

quit smoking and valued the positive effect vaping had on their health and wallet. They were aware of the existence of more enthusiastic vapers, however, at the time did not associate with the vaper subculture as 'cloud chasers' did.

"I see people, and it's kind of a sport for them, they make big clouds ... I don't really buy into that. ... It's not where my mindset is. For me, yeah it [vaping] really is a means to an end [nicotine/smoking cessation]." Ella, substitute [41]

"It's just a revolving circle": stigma Although many acknowledged the stigma they had endured as a smoker in Western Australia, some vapers holding the 'substitute' identity now projected these same negative feelings to fellow vapers associated with the 'cloud chasers' subculture, perpetuating the circle of stigma.

*"People think that people smoking vapes think they're 'cool'. Sitting in their car and they've got big clouds coming out of the car. Even I do it. When I see clouds like that I think 'You d***head. You think you're cool vaping like that?' ... Like I've seen the way people blow out their clouds I'm like, 'You're one of these d***heads who's overclocking the battery'" Milo, substitute [36]*

"It is not stealthy": managing vaping in public Vaping is notorious for producing large vapour clouds (although some products such as JUUL are very discrete), and as such some 'substitute' vapers spoke of how they disliked the attention vaping brought them from bystanders, and spent energy devising strategies to manage their e-cigarette use in discreet ways, such as vaping alone. This was especially pertinent for some young women:

"It is a bit showy because like there's a lot more vapour. I guess the only place in public that I do it and feel kind of safe is like just at the park when I'm taking a walk or something." Karina, substitute [24]

The cloud chasers

"I've gone full enthusiast": the vaper subculture This group of respondents shared the view that e-cigarettes are a healthier alternative to smoking, however, more importantly, vaping also offered social and symbolic functions not provided by "analogue cigarettes".

Vaping was differentiated from smoking, with some describing it as a hobby, which at times could be all-consuming and expensive. Nevertheless, many genuinely

enjoyed customising their experience through the collection of various flavoured liquids and coloured devices, experimenting with the creation of their own juices, engaging in the technological aspects of vaping and building accessories, such as coils.

"I play around with them [making coils], I do all my own, I build all the things, I use all the rebuildable stuff. So yeah, it has become a bit of a hobby, which is why I think it appeals to certain people, because it has that sort of community aspect where it becomes like a hobby ... they all sort of get together..." Wade, cloud chaser [28]

A minority of vapers reported attending "build days" and "vape meets" where users got together to learn about Ohm's law and battery safety, how to build coils, and to meet new people and socialise, as the Western Australian vape community was reportedly not as established as others in the Eastern States of Australia.

Participants commented on the various 'types' of vapers (i.e. hobbyist, flavourist) and 'levels' (i.e. novice, advanced user, expert, veteran) one could progress to. Participants categorised themselves by comparing their preferences and level of experience with others, which was influenced by various factors including vaping duration, type of device they were capable of safely using (regulated vs unregulated (no circuit board and runs directly off a battery)), possessing an online profile or presence, and experience in the retail industry.

"[I'm] close to the expert stage. An advanced user, I'd say. When you start using mechanical mods, that's when you're an advanced user." Zadie, cloud chaser [27]

"I've gone full enthusiast ... I want to have the experience. I'm also hoping to get a job in one of the vape shops in Perth because I'm really enthusiastic about health or being able to help people." Quade, cloud chaser [24]

A small proportion of 'cloud chasers' were highly immersed in the vaping subculture and were actively involved in, or managed specialised vape groups, provided product reviews to YouTube, Instagram and Facebook, and some were even 'sponsored' by local or international e-cigarette brands to promote their products on social media. Relationships between these vapers and their sponsors were established by one of them contacting the other, usually through social media.

"I'm part of this group called Cloud Kings Australia. Cloud Kings are basically all over the world. There's

a group of them in Sweden, Mexico, Germany, France, Amsterdam, mostly in Europe. We get sponsored by companies, get free product from those companies, and then we represent those companies."
Zadie, cloud chaser [27]

Few were also deeply entrenched in the vape trick culture:

"Absolutely, there's an absolute technique [to vape tricks]. We've got it down to a really fine art. There's names of [tricks] that you can do like specialised ones and stuff like the DNA, the double, oh it's crazy. So we go all out. Like you've got to wet the table, make it stick, and you've got to layer it. So we do layer upon layer upon layer of smoke. No one's allowed to breathe. If you breathe, you're dead."
Clara, cloud chaser [33]

"Vaping brings people together": for the cause and the community The vape community, especially the online community, was described as "free of judgement" and provided for many a sense of connection and belonging. Participants described how their communication with like-minded vapers gave them the forum and permission to "nerd out" and voice their struggles and triumphs with a group who they felt would listen and be responsive, which some users did not feel they were able to do with their non-vaping friends and family. For those who were more experienced vapers, they felt it was important to give back to the community and chose to mentor new vapers through the initiation process.

"I'm in a lot of Australia-wide groups ... and it's community-minded. ... It's a way to quit smoking, sure, it's a health choice, but it's also a hobby for a lot of people, so I think these groups are both support networks and hobbyists. ... I think it is important because there's nowhere else to get that support to quit smoking. For me that's what vaping is all about, it's about quitting smoking and staying off the cigarettes. ... For people like myself who have tried everything ... It is important for me to give back, so I give a lot of advice to people that say 'Hey I don't know what to do.' I try and give people the advice that I didn't get but also just making friends Australia-wide, getting to know people. It's awesome. It's a pretty cool community, yeah." Ursula, cloud chaser [43]

Further, some participants had turned vaping into a business; were currently working, or aspiring to work in the retail industry; or were creating a social media presence (i.e. reviewing products, seeking sponsorship) for

themselves. Some of these participants who were heavily involved in the online community and/or retail industry expressed frustration with the "childish" and "bitchy" behaviour displayed by some of the vape community online, especially among local and inter-state retailers. Instances of online users "dobbing" on people to the authorities who were selling nicotine and/or devices were described, as well as general unsocial behaviour as illustrated by one local business owner:

"They're [vape retailers] just very childish, ... and because it's still quite a small community, everything's a personal attack against someone else. Like, if so and so were to have a sale and then he'd think that it was a direct attack on him. It is very clicky and very immature a lot of the time, I don't know why. I don't really bother doing much with Facebook groups because that's just where it all is. When it's in-store and stuff and it's all very professional, everyone's very eager to help, it's just everyone seems to become a keyboard warrior online." Wade, cloud chaser [28]

Users who heavily invested in the culture or hobbyist ethos were inclined to perceive their device as an accessory, or a status symbol which was dependent on having the very latest and greatest device. For these vapers, vaping not only encompassed their passion and desire to help others quit smoking but their livelihood, which now strongly aligned with their core values.

"All my life I've had trouble [working] in retail because I have an ethical code where I can't sell something that I don't believe in and I believe 100% in the industry of vaping and what their motives are. I think it's good. It is entirely good and all the people that I've met who also promote it and stand behind it have good intentions, and their sole drive is to see people get well and stop smoking. We want to make smoking history just as much as the non-smokers. That's the thing ... almost all vapers are reformed smokers..." Quade, cloud chaser [24]

Discussion

The Australian NDSHS has been regularly conducted since 1985, and first provided limited data about e-cigarette use in 2013. Data from the most NDSHS [24] reports the most prevalent e-cigarette users are male current and former smokers, which is reflective of our sample population. Data does not distinguish whether users use nicotine in their vapourisers, nor what type of device they use. Enhanced surveillance and reporting of e-cigarette use within Australia would contribute to a deeper understanding of the population using e-cigarettes, the reasons for using and devices used among

this cohort, and would assist policymakers to determine where public health efforts should be focussed.

Thirty-two vapers in this sample were committed smokers for several years and five participants were dual users of tobacco and e-cigarettes. The primary reason for initiating vaping was to quit smoking, citing less than optimal successes with other TGA (Therapeutics Goods Administration¹) approved smoking cessation aids, as also described by a sample of American vapers [44]. Vaping was considered more satisfying and therefore more supportive of successfully quitting smoking compared to other methods due to its similarity with conventional smoking, namely the inhale and exhale of vapour, nicotine hit, and the hand-to-mouth action, as also documented in other international research [16, 18, 43]. Furthermore, vaping does not expect one to relinquish the rituals and habits connected to smoking [45]. The conclusions surrounding the effectiveness of e-cigarettes as a smoking cessation aid and their harm reduction potential, however, are varied and depend on several factors, such as whether the smoker switches completely to e-cigarettes, becomes a dual user with cigarettes, and whether the user becomes a sustained and persistent vaper [42].

The majority of vapers in this sample were former smokers, however, several respondents had taken up the practice despite having never smoked. Understanding how vapers 'make sense' of their health practices [46] is required to understand the processes by which vapers make health behaviour choices, such as choosing to vape, so that appropriate tailored communication on the risks and benefits of e-cigarette use can be developed [47]. Limiting vaping uptake by non-smokers is essential and the supportive role Australia's strict regulation plays in limiting this uptake and exposure to marketing is discernibly apparent when compared with vaping prevalence within countries with more liberal regulation (i.e. United States (US) [48, 49] and UK [50, 51]).

Participants within this study generally exhibited limited knowledge of the potential health effects of e-cigarettes. However, as reported by vapers abroad [52, 53], they expressed many positive attitudes towards e-cigarettes, held very strong opinions that vaping offered them an alternative means to consume nicotine, and based their decision to use e-cigarettes on perceived harm reduction compared to cigarettes. For them, the individual health benefits experienced and the tangible sense of satisfaction since ceasing smoking outweighed the potential health risks of maintaining vaping. Furthermore, continued nicotine addiction was largely perceived as unproblematic so

long as it helped maintain a cigarette-free lifestyle, also documented by others [43, 54]. This concept has been studied by Oakes and Chapman [55] who explored the rationalisations smokers use to explain their justification of continued smoking and suggest a series of self-exempting beliefs may provide smokers with a false sense of security and ultimately block them from exploring the importance of quitting. Given the complexity of nicotine and addiction, and the assortment of information presented on e-cigarettes, it is not unexpected that users in this study and overseas [56] rely on their own experiences, and that of others, to inform their behaviour and decision-making processes [18]. This highlights the need for accessible, clear and impartial information about e-cigarette use which communicates the benefits, risks and current uncertainties to health professionals and the public about e-cigarettes [43] and continued support for nicotine cessation through approved cessation methods.

Participants mostly described positive reactions from friends and family to their e-cigarette use, particularly when their goal was to abstain from smoking. In this sample of vapers, few had close friends who vaped and therefore sought camaraderie through online fora and vape retail stores. As found in other qualitative inquiries [16], the notion of a vaping community was recurrent. However, participating in a community that accepts the practice may make it difficult for individuals to quit and therefore contribute to sustained use [57]. These findings suggest that social norms surrounding e-cigarette use have a potentially powerful influence on initiation and maintenance and that understanding social networks is integral to prevention efforts.

Although tobacco smoking is legal in Australia, the decline in prevalence combined with the denormalisation of smoking and societal aversion has fated the behaviour to be predominantly relocated to the fringes of society and viewed as a deviant and marginalised behaviour [58]. For some smokers in this study, feeling stigmatised for being a tobacco smoker was the catalyst for them to redefine themselves as 'vapers', as supported by findings from Barbeau and Burda [16], making the language used (i.e. not referring to vaporises as e-cigarettes) incredibly important in an attempt to escape the stigma attached to cigarette smoking [44]. This redefinition and transition from smoker to non-smoker has been argued to play a key role in supporting successful smoking cessation [59]. However, through the quest to obtain the socially desirable non-smoker status, smokers have adopted another behaviour that maintains addiction and deviates from current societal norms, an unapproved and unconventional means to quit smoking.

Two approaches to vaping emerged from our data, that of the 'cloud chaser' and the 'substitute'. Vapers within this sample displayed similar subcultural elements

¹The Therapeutic Goods Administration is the regulatory body for therapeutic goods in Australia and is responsible for conducting assessment and monitoring activities to ensure that therapeutic goods available in Australia are of an acceptable standard and that access to therapeutic advances is in a timely manner.

and practices to those reported in the international literature examining the motivations of e-cigarette users, identity formation and involvement in the vaping subculture [14, 15] which could be diffused via global structures such as social media. However, some subcultural elements are localised to Australian vapers due to the unique social conditions under which the behaviour has evolved. For example, the vaping subculture which has emerged in the US is more encompassing than in Australia, which may be attributed to differences in the countries regulatory contexts [60], access to nicotine products, and exposure to mass marketing [61] and subcultural practices (e.g. vaping conventions [62] and abundant vape stores [63]).

Supported by Farrimond [14] and McQueen and Tower [64], 'cloud chasers' perceived their affiliation and connection with the vape community in the online and offline milieu as a positive source of support and reinforcement. Moreover, vaping was regarded as an integral part of their social identity, influencing how they behaved and the social and political activities they engaged in. Given the loss of identity and social engagement reported by individuals who quit smoking, the social opportunities, and group and community experience of vaping may be a particularly appealing aspect of the endeavour [6, 16, 53]. Furthermore, vaping was explicitly differentiated from cigarette smoking and referred to by many 'cloud chasers' as a hobby. Several dimensions of 'pleasure' were identified, including the sensory experience (i.e. flavours) and electronic and technological aspects of vaping [6, 65]. Such descriptions of enjoyment are not usual in the substance-use discourse [66] due to the dominance of the 'pathology paradigm' which marginalises the idea of pleasure concerning drug use [67].

The assessment that e-cigarettes are a tool to manage nicotine addiction among 'substitute' vapers may explain why these users did not strongly identify with, or actively rejected connection with the social identity of vaping, and enjoyment did not play a substantive role in their use and maintenance [14]. Research suggests that cessation goal-oriented vapers may be less likely to become persistent e-cigarette users compared with vapers who do not stipulate future intentions to quit [68, 69]. The nuanced differences in experiences of 'cloud chasers' and 'substitute' vapers may, therefore, contribute important insights for health communication. Australia has implemented a suite of effective strategies [23] to combat tobacco smoking that could be applied to e-cigarettes, such as supplementing health communications with legislation (e.g. health warnings, plain packaging, smoke-free laws that include e-cigarette use), until there is scientific evidence regarding their safety and efficacy as a tobacco cessation therapy [70].

E-cigarettes are both technically complex devices, which novice users may find difficult to spontaneously

start, and a non-medical consumer product, which has resulted in the need for many aspiring users to look to other vapers as their experts, building a vast and international social network of shared knowledge and identity [14]. A common experience among this cohort of vapers was their use of e-cigarette forums and social media groups to discuss personal experiences, exchange information, and obtain new knowledge, similarly reported by vapers in New Zealand [18]. Seasoned vapers and newcomers disclosed periods of both active and passive engagement (also known as 'lurking' [71]). Lurking served newcomers with an opportunity to observe the community and its rules [72], whilst it provided more established vapers with the opportunity to monitor changes in the industry and the development of new products. Conversely, active contribution to these fora provided opportunities for learning among 'newbies' and mentorship for more experienced vapers. Some research suggests that joining and actively participating in e-cigarette-related social media communities [13, 73, 74] may play an important role in the development of ones vaping identity [14, 18] and can exert a significant influence on attitudes and behavioural intentions toward e-cigarettes [75]. The investigation of dedicated vaping fora, therefore, may be valuable to study interactions among users and how these interactions shape e-cigarette knowledge, attitudes and behaviours.

These findings were gathered from a small purposive sample within a specific geographical context and time, and therefore may not be generalisable to the broader vaping community or e-cigarette users abroad due to Australia's regulatory environment, absence of mass media advertising and lack of Government endorsement as a smoking cessation aid [76]. However, the consistency with other research suggests our findings are not atypical. All participants in this study were adults, therefore these results may not be generalisable to younger vapers.

Conclusion

Few studies have explored vapers motivations for use, reinforcing influences, and association with the vaper subculture, especially within the unique regulatory context of Australia. We found that our sample of vapers largely started vaping to quit smoking and underwent common experiences during their initiation phase. Subsequently, vapers tended to adopt one of two vaper identities, that of the 'cloud chaser' or the 'substitute', which some users moved between during different stages of their vaping career. The social and symbolic meaning of e-cigarettes and vaping were diverse. 'Cloud chasers' connected with the vaper subculture in varying degrees and involved concepts of pleasure, community and performance. However, the aesthetic and performance part of the subculture, in particular, had little appeal to

'substitute' vapers who largely viewed their use of e-cigarettes as a means to quit smoking, and enjoyment did not play a substantive role in their use. Understanding the complexities of vaping, and the nuanced differences of 'cloud chasers' and 'substitute' vapers may have important implications for health communication, research and policy. Our findings add to the understanding of the varying motives for use and provide new insights into the socialisation process and subsequent identity adoption of Western Australian vapers.

Supplementary information

Supplementary information accompanies this paper at <https://doi.org/10.1186/s12889-020-09651-z>.

Additional file 1. Data collection guide. The data collection guide includes the information recorded about the interview, participants' demographic and behavioural information and the interview guide.

Additional file 2. COREQ checklist. A checklist of items that should be included in reports of qualitative research.

Abbreviations

E-cigarette: Electronic cigarette; ENDS: Electronic Nicotine Delivery Device; COREQ: Consolidated criteria for Reporting Qualitative research; GCCSA: Greater Capital City Statistical Area; IRSD: Index of Relative Socio-Economic Advantage and Disadvantage; NDSS: National Drug Strategy Household Survey; TGA: Therapeutic Goods Administration; US: United States; UK: United Kingdom

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Authors' contributions

Conception and design of the work: JJ, BM, RM, TL, KW; Data acquisition and analysis: KM; Data interpretation: KM, BM; Writing – original draft: RM; Writing – review and editing: JJ, BM, BF, KW, TL. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Participants gave written (at the time of the interview, or via email), and in one case verbal consent before participating in a face-to-face ($n = 35$) or telephone ($n = 2$) interview. All procedures were performed in compliance with relevant laws and institutional guidelines and the study protocol was approved by the Human Research Ethics Committee of Curtin University (HRE2017-0144).

Consent for publication

Not applicable.

Competing interests

BF is a member of the NHMRC Electronic Cigarettes Working Committee (May 2020). She has received consulting payment for e-cigarette policy

review for the NSW National Heart Foundation (December 2019). She had travel expenses (flight and registration) reimbursed to attend Oceania Tobacco Control Conference 2017 to present on e-cigarette and cessation. She provided her opinion (unpaid) at Australian Parliament's Standing Committee on Health, Aged Care and Sport public hearing into the Use and Marketing of Electronic Cigarettes and Personal Vapourers (September 8, 2017). She led a contract on e-cigarette regulation in Australia for the Commonwealth Department of Health (2016). She had travel expenses reimbursed by National Taiwan University for presenting on e-cigarette regulation (2016). The other authors have no conflicts to declare.

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4.4.2 Qualitative study B

Publication 6: Navigating Western Australia's regulatory environment for e-cigarettes.

Objective: To examine how adult e-cigarette users residing within the Greater Capital City Statistical Area of Perth, navigate Western Australia's restrictions (i.e. 'ban' on nicotine vaping and the sale of e-cigarettes devices) to access vaping products and the health and safety issues they encounter.

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Research paper

“Is it banned? Is it illegal?”: Navigating Western Australia’s regulatory environment for e-cigarettes



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ABSTRACT

Background: In Australia, there is no Federal legislation that directly applies to e-cigarettes, instead, several existing laws relating to poisons, therapeutic goods and tobacco control apply. Across all Australian States and Territories, it is illegal to sell nicotine-containing e-cigarettes, however, users can legally import nicotine-containing vaporisers through the Personal Importation Scheme. Western Australia differs from other Australian States and Territories in that products which resemble tobacco products are banned, effectively prohibiting the use of e-cigarettes. This study aimed to understand how e-cigarette users navigate Western Australia’s regulatory environment to access vaping products and the health and safety issues encountered.

Methods: Working from a constructionist epistemology and a symbolic interaction framework, in-depth interviews were conducted with a purposive sample of 37 current (89%) and former (11%) adult vapers (70% male, mean age of 32.5). Data was analysed via thematic analysis.

Results: Vape retailers were said to be circumventing Western Australia’s e-cigarette restrictions by selling the components of ‘open system’ devices that do not resemble a tobacco product when sold individually. Participants were unsure of the legality of importing, accessing and using nicotine and e-cigarettes, however, the majority continued to use nicotine-containing vaporisers and implemented strategies in an attempt to avoid detection and safeguard their health. The internet facilitated access to desired products, information on health and safety, and discussions of personal experiences.

Conclusion: The Australian Therapeutic Goods Administration has recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with other approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vaporiser products from a registered medical practitioner. The results of this study suggest further consideration of regulatory measures are however required to support the different characteristics of vapers and to mitigate the health and safety concerns experienced by e-cigarette users.

Background

Electronic cigarettes (also referred to as e-cigarettes, personal vaporisers and vapes) have generated intense debate amongst the public health community who are perceived to champion opposing opinions on the health and population-level effects of these products (Fairchild, Bayer, & Lee, 2019). However, in reality, it is likely that relatively few of the public health community categorise themselves within either of these two polarised stances and rather acknowledge the

overlapping views of e-cigarette harm prevention and cigarette harm reduction (Carroll et al., 2020). Those who oppose relaxed regulation of e-cigarettes are concerned by the potential adverse effects on users, particularly non-smokers and youth who would otherwise not smoke or use nicotine-containing products (Burnell et al., 2015); and the prospect of sustained e-cigarette use amongst ‘dual users’ (Miller, Smith, & Goniweicz, 2020). Conversely, e-cigarette advocates emphasise the potential benefits of smokers who are unable or unwilling to quit smoking

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switching to a 'reduced risk' product (Hajek, Etter, Benowitz, Eissenberg, & McRobbie, 2014).

Authoritative groups such as the National Health and Medical Research Council (2017); Office of the Surgeon General (2019); World Health Organization (2016), Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Byrne et al., 2018) and the National Academies of Sciences Engineering and Medicine, 2018 have undertaken reviews to evaluate the available evidence of the health effects related to e-cigarettes. These groups report that there is substantial evidence to suggest e-cigarettes expose users to potentially toxic substances at significantly lower concentrations than tobacco cigarettes. However, they also conclude that there is substantial evidence indicating e-cigarette aerosols induce acute harm and the long-term consequences and outcomes of prolonged exposure are uncertain.

The rise in popularity of e-cigarettes, and the diversity of devices, has left many Governments grappling with how best to regulate these products. At present, 70 countries had enacted e-cigarette specific policy, with other countries applying a range of product classifications to suit existing policies, including 'tobacco products' (57 countries), 'medicinal products' (24 countries), 'consumer products' (18 countries), and 'nicotine as poisons' (4 countries) (Institute for Global Tobacco Control, 2020). In Australia, there is no Federal legislation that directly applies to e-cigarettes, instead, several existing laws relating to poisons, therapeutic goods and tobacco control apply. Across all Australian States and Territories, it is illegal to sell nicotine-containing e-cigarettes because liquid nicotine is classified as a 'Schedule 7-Dangerous Poison', however, users can legally import nicotine-containing e-cigarettes through the Personal Importation Scheme which states users must obtain a prescription from a physician (Therapeutic Goods Administration, 2019). E-cigarettes that do not contain nicotine can be sold in some Australian jurisdictions, provided manufacturers do not make therapeutic claims. However, in Western Australia, the context of this study, it is an offence under the Tobacco Products Control Act 2006 (Government of Western Australia, 2019) to sell products that resemble tobacco products, regardless of whether they contain nicotine or not, and therefore the sale of e-cigarettes is prohibited. The sale and use of flavoured e-liquids are permitted provided they do not contain nicotine (Greenhalgh, Grace, & Scollo, 2018). Advertising of e-cigarettes is also restricted, although exposure to advertising and promotion of these products does occur in Australia via the internet (Amin, Dunn, & Laranjo, 2020; McCausland et al., 2020a,b).

Australian's have access to nicotine-containing e-cigarette products via the internet and those who choose to import nicotine-containing products without a medical prescription are not currently actively prosecuted. Surveillance data reports approximately 70% of Australian e-cigarette purchases are made online (Australian Institute of Health & Welfare, 2020b; Euromonitor International, 2018), and Australian data from the International Tobacco Control Survey found more than 40% of vapers use nicotine-containing products (Yang et al., 2015). While there have been efforts to weaken Australia's tobacco control laws and reclassify nicotine to legalise nicotine vaping and heated tobacco products (Henderson, 2020; Philip Morris Limited, 2017, 2018, 2019a, 2019b), the Australian Therapeutic Goods Administration recently announced tighter restrictions which will "align the current domestic restrictions under State and Territory law that prohibit the supply of nicotine-containing e-cigarettes in Australia without a valid medical prescription" (Australian Government, 2020a). As of 1 October 2021, smokers who have been unsuccessful in quitting smoking with cessation methods approved by the Therapeutic Goods Administration and wish to use nicotine in a personal vaporiser will be required to obtain a prescription from a medical practitioner to fill at a pharmacy (either a physical community pharmacy or an Australian online pharmacy) or to legally import nicotine-containing e-cigarettes and/or liquid nicotine from overseas using the Personal Importation Scheme (Australian Government, 2020b). Nicotine-containing vaporiser products imported from overseas will be subject to Australian Border Force interrogation and those orders with-

out a valid prescription may be destroyed by the Therapeutic Goods Administration (Australian Government, 2020b). Further, the new requirements (Australian Government, 2020a) necessitate that all liquid nicotine products include child-resistant closures, and in response to concerns regarding the safety and quality of unapproved nicotine e-cigarettes and the need for prescribing guidance, additional resources and standards will be developed before the changes are implemented on 1 October 2021, including: public consultation in early 2021 on product safety and quality; provision of educational resources to support health professionals; and consumer education activities.

The United States, where e-cigarette sales are subject to very few restrictions, recently observed an exponential increase in vaping, particularly amongst youth, which was referred to as an 'epidemic' (Food & Drug Administration, 2018). Although the most recent National Youth Tobacco Survey reported a substantial decline in current e-cigarette use since 2019, 3.6 million young Americans (19.6% of high school and 4.7% of middle school students) continue to use e-cigarettes, preferring flavoured pre-filled cartridges and disposable e-cigarettes (Wang et al., 2020). In contrast, the prevalence of vaping in Australia remains relatively low, however, a significant increase in current and lifetime use has been reported (Australian Institute of Health & Welfare, 2020c). The most recent national survey estimates that 2.6% of the Australian adult population currently use e-cigarettes, up from 1.2% in 2016, with use amongst smokers (4.4% 2016, 9.6% 2019) more prevalent than non-smokers (0.6% 2016, 1.4% 2019) (Australian Institute of Health & Welfare, 2020a).

This study aimed to understand how e-cigarette users navigate Western Australia's unique regulatory environment to access vaping products and the health and safety issues they encounter. Specifically, an environment with a flourishing retail market that has not legislated total prohibition, although is relatively unaccepting of promoting e-cigarettes as a population health strategy. Understanding e-cigarette users' behaviours within this environment will provide valuable insight for decision-makers as they develop e-cigarette specific regulations.

Methods

Theoretical framework

Symbolic interactionism is situated in a constructivist epistemology and is a micro-level sociological theory providing the theoretical framework underpinning this study. Symbolic interactionism has a history of being used to investigate drug use and the creation of deviance (Becker, 1963, 1963), and provides a frame of reference to better understand how individuals interact with one another to create symbolic worlds and how these worlds shape individual behaviours (Blumer, 1969; Charon, 2001). Symbolic interaction is a framework that helps understand how society is preserved and created through repeated interactions between individuals, and in this research, facilitated consideration of vapers' realities, social network processes and interactions with others and their environment.

Sampling

Participants were purposively sampled for maximum variation in demographic characteristics (i.e. sex, age, Socio-Economic Indexes for Areas index (a ranking resulting from a value derived from income, educational attainment, employment status and skill level (Australian Bureau of Statistics, 2018)). Current and former vapers over 18 years of age were recruited between March and November 2018 from the Greater Capital City Statistical Area (GCCSA) of Perth, Western Australia. Participants were categorised as either a current vaper if at the time of data collection they vaped at least weekly, or a former vaper if they had vaped within the last 12 months but did not currently do so. There are 16 GCCSA regions within Australia, which provide a stable and consistent boundary that reflects the functional extent of each of Australia's

capital cities and includes people who regularly work, shop and socialise within the city, but live in surrounding areas (Australian Bureau of Statistics, 2012). Western Australia is Australia's largest state by total land area (Geoscience Australia, n.d) and Perth is the capital of Western Australia with very few neighbouring city centres.

Recruitment

Recruitment utilised a multipronged approach with recruitment flyers and posts placed on four online vaping forums (AussieVapers, Vaping in Australia, Vaper Café Australia and E-Cigarette Forum); seven subreddits on Reddit; and approximately 30 closed vaping groups on Facebook. The lead author created personal accounts on each of the forums and Reddit and used their personal Facebook account to access the closed Facebook groups. Facebook groups were accessed by requesting permission to enter the group as a researcher to recruit participants to the study. Vape retail stores, online and bricks and mortar, within the GOCSSA of Perth were contacted via email, social media and webpage submission forms. Snowball sampling was also utilised.

Interested individuals were invited to contact the lead author via email or telephone to express their interest in participating and receive further details about the project and what their participation would entail. Once potential participants had read the participant information statement and agreed to participate, a meeting was arranged at a convenient, safe public location (e.g. local café, university campus). The lead author, who has experience in qualitative data collection, conducted all interviews in English. Interviews lasted on average 49 min (range 25–86 min) and were audio-recorded with participant consent. Participants were provided with an AUD \$25 gift voucher at completion of the interview as an honorarium for the time they provided.

Data collection

A data collection guide (Supplementary File 1) was developed and used to capture participants' demographic and behavioural information, and observational field notes during and after the interview. Photographs were regularly taken of the vaping equipment participants had with them during the interview, and interview settings that were relevant to the study (i.e. vape store, e-liquid manufacturing laboratory).

The data collection guide included a semi-structured interview guide which focused broadly on several topic areas (i.e. devices and products used, means of accessing product, emergent subculture, regulation) guided by relevant literature and discussions with the research team. The interview guide was field tested with two people who were eligible to participate in the study which enabled the lead author to assess the flow and sequencing of questions, confirm the coverage and relevance of the content, receive feedback on the language used and questions asked, and implement changes based on participants advice (Kallio, Pietilä, Johnson, & Kangasniemi, 2016). The semi-structured approach permitted flexibility and adaptability within each interview whilst ensuring the preconceived areas of enquiry were explored (Turner, 2010). As new ideas and concepts emerged from the data these data-driven concepts were fed back into the data collection process and further guided sampling and the adaptation of the interview guide (Skeat, 2010). Sampling was terminated when thematic saturation was reached and few new data were being generated (Morse, 1995).

Analysis and interpretation

All interviews except one (file corrupt) were transcribed verbatim by an independent professional transcription service and checked for accuracy by the lead author. The detailed notes taken by the lead author of the corrupted interview were sent via email to the participant who checked the data for accuracy and validation. Transcripts and interpretations were not provided to other participants for respondent validation.

Data analysis occurred simultaneously with data collection to facilitate the assessment of existing data and the creation of strategies to collect subsequent, richer data until saturation (Corbin & Strauss, 2015). Interview transcripts were anonymised and imported into NVivo (v12). The lead author conducted all coding, this allowed for a single researcher to be immersed in both the data collection and analysis, thereby ensuring that the coding frame adequately described the intentions and content of the data (Elliott, 2018).

The analytical process followed the steps proposed by Braun and Clarke (2006) to conduct thematic analysis and drew upon the initial and axial coding process of grounded theory (Corbin & Strauss, 2015). The lead author played an active role in the analysis by searching for and identifying themes "to theorise the sociocultural contexts, and structural conditions, that enable the individual accounts that are provided" (Braun & Clarke, 2006, p. 85).

Line-by-line analysis was undertaken to look for patterns of meaning and issues of interest important to the research objective and to generate a diverse range of initial codes (Corbin & Strauss, 2015). Codes were developed based on theoretical interest and emergent concepts that arose during interaction with and interpretation of the data. Axial coding examined the initial codes at a conceptual level to combine and connect codes to form overarching 'candidate' themes and sub-themes in a meaningful way regarding the phenomenon of investigation (Corbin & Strauss, 2015) (Supplementary File 2). Revision of the candidate themes then occurred at two levels. Level one (Supplementary File 3) involved reviewing all of the data collated under each candidate theme to consider whether the data formed an intelligible pattern (Braun & Clarke, 2006). Some themes and sub-themes were refined during this process to create new themes/sub-themes and to separate and combine others (Braun & Clarke, 2006). Level two (Supplementary File 3) involved a similar process, whereby the data was reviewed and further refined. This process, however, concerned the validity of the individual themes in relation to the entire data set to ensure participants meanings and voice were accurately reflected (Braun & Clarke, 2006). A detailed analysis was then written for each theme to report the content and meaning of patterns (Braun & Clarke, 2006). Working theme titles were reviewed to ensure they accurately reflected the respective analysis and the most vivid quotes were selected which best illustrated the essence of the point being demonstrated (Braun & Clarke, 2006). A codebook was developed to provide structure and agreement about code definitions, constructs and themes (Liamputtong, 2013). Throughout the analysis, there were regular discussions amongst authors regarding the lead author's interpretations of the data and conceptual maps to improve the dependability of the findings (Given, 2008). Records of study processes, decisions, and methods were documented through meeting minutes, ethics amendments and annual reports, field notes, and personal reflections and analytic memos, contributing to a rigorous analysis process (Birks, Chapman & Francis, 2008; Liamputtong, 2013).

The study is reported following guidance from the consolidated criteria for reporting qualitative research (COREQ) checklist (Tong, Sainsbury, & Craig, 2007) (Supplementary File 4).

Demographic and behavioural data were analysed using descriptive statistics (SPSS v26).

Ethical considerations

Participants gave written consent at the time of the interview or signed and scanned a consent form via email before the interview to the lead author. One participant provided verbal consent which was audio recorded. Thirty-five face-to-face and two telephone interviews were conducted. All procedures were performed in compliance with relevant laws and institutional guidelines and the study protocol was approved by the Human Research Ethics Committee of Curtin University (HRE2017-0144). Quotes have been attributed pseudonyms to protect participants' identity.

Results

Participants

Thirty-seven interviews were conducted with current ($n = 33$, 89%) and former vapers ($n = 4$, 11%) (Table 1), with a mean of age of 32.5 ($SD=7.411$, range 20–45 years). Thirty-two participants (86.5%) were current or former cigarette smokers and five participants (13.5%) vaped despite having never been a regular smoker. Former ($n = 24$, 65%) and current ($n = 8$, 22%) smokers had been using tobacco on average for 14 years ($SD=8.268$, range 3–38 years). In comparison, participants had been vaping on average for 2.4 years ($SD=2.011$, range 1 month – 7 years).

Findings

The narrative summary describes how e-cigarette users navigate Western Australia's unique regulatory environment to access vaping products and the health and safety issues they encounter. Quotes from participants are provided in italics, followed by their pseudonym and age.

Circumventing Western Australia's regulatory framework to access e-cigarette paraphernalia

Participants provided insight into how local retailers were circumventing Western Australia's regulation which prohibits the sale of products that resemble tobacco products (i.e. e-cigarette) by selling parts (i.e. tank or mod) of 'open system' e-cigarettes that do not necessarily resemble a tobacco product when sold individually. Therefore, some local retailers had created two businesses (often side by side, or one brick and mortar and one online), enabling the whole device to be purchased through two separate transactions.

"I have moved to a different supplier now, just up the road and they have their shop set up in two different halves, just for legal reasons. There are all sorts of legal loopholes that they've got to abide by..." Kai (38)

Table 1
Summary of participant's demographic, smoking and vaping characteristics.

Characteristic	Total (n = 37)
Age (years)	
20–29	15 (40.5%)
30–39	15 (40.5%)
40–49	7 (18.9%)
Sex	
Male	26 (70.3%)
Female	11 (29.7%)
Education	
< High school certificate	6 (16.2%)
High school certificate	8 (21.6%)
Technical certificate (TAFE)	14 (37.8%)
University degree	9 (24.3%)
Employment status	
Employed	33 (89.2%)
Unemployed	2 (5.4%)
Full-time student	2 (5.4%)
Vaping status	
Current vaper	33 (89.2%)
Former vaper	4 (10.8%)
Nicotine vaping	
Yes	26 (70.3%)
No, but did initially use nicotine	4 (10.8%)
No	7 (18.9%)
Smoking status	
Current smoker	8 (21.6%)
Former smoker	24 (64.9%)
Never smoker	5 (13.5%)

Alternatively, a larger franchise was able to sell the complete device by ordering through their interstate counterpart, which was based in a state that permits the sale of the device, providing it does not contain nicotine.

If hardware was not purchased locally, or within Australia, it was imported, or purchased while overseas (e.g. Indonesia, Philippines).

"I've brought in [imported], to date, 5000 machines. ... because Australia's so desperate for it." Archie (45)

Accessing nicotine concentrate and nicotine-containing products

Importation of nicotine concentrate and nicotine-containing products

Many participants were unsure about the legality of importing, accessing and using nicotine, and the potential consequences of breaking these directives, which was conveyed by Caleb:

"Like my brother ... he couldn't believe that I had bottles of 100-milligram nicotine at home and I said, 'well, nicotine's not- it's not illegal you know?'" Caleb (34)

Twenty-five of the 26 participants who were using nicotine were illegally importing nicotine-containing e-liquid and/or nicotine concentrate from countries with more liberal e-cigarette and nicotine regulations, predominantly the United States and New Zealand. Only one participant was going through the approved Personal Importation Scheme. No one reported having their nicotine-containing order confiscated by the Australian Border Force and participants had different theories about how to successfully get nicotine through customs, which included using certain mail providers, express shipping, and only ordering small quantities.

Participants who ordered nicotine concentrate or nicotine-containing products from overseas were charged hefty shipping charges and had to wait extended periods for their order to arrive, which caused many to feel anxious if they were running low on nicotine. In an attempt to avoid running out, most participants ordered large quantities of nicotine concentrate (i.e. 1 litre) and purchased nicotine-free juice from local retailers (i.e. vape stores, newsagents, smoke shops) and home vendors which they, or someone else, spiked with nicotine.

Spiking nicotine-free e-liquid

Vapers purchased nicotine-free e-liquid locally, interstate or internationally, which was then "spiked" (Lisa, 41) with nicotine. Participants explained there are two ways to do this: they could do it themselves, which would require them to order nicotine concentrate and know how much nicotine was required for the quantity of e-liquid they were using to obtain the desired strength, or, they could seek advice and/or assistance from someone with experience (i.e. friend, retailer or home vendor).

"I know it's illegal, but there is a place around here where you can get people to [spike your e-liquid]. They try and find ways around it. It's probably still not legal, but where they'll gift you the nicotine in it, rather than making you pay for it, so, therefore, it's not a sale. There are people that will still charge you, but they just do things out of their own house. Or you can buy imported [nicotine]." Levi (29)

Felix, an owner of a small vape store explained how he was regularly approached by vapers who were buying large quantities of nicotine and did not know how to undertake the spiking process, which would leave him in a compromised position if he were to help them:

"People will bring in [to the store] bottles of nicotine and I'm like [exasperated looked]. ... because they buy like 100 mg strength. They don't know what to do with it!" Felix (45)

The interplay between Western Australian vapers' and the internet

Facilitating access to experienced global e-cigarette users to increase knowledge and ability

Participants utilised the online vaping community, which constituted an international network of vapers with varying levels of technical ability and expertise, to discuss personal experiences, acquire relevant skills, information on health and safety, the meaning of vaping specific language and jargon, and troubleshooting techniques.

"[Being involved in the online vaping community is] more so for my own personal research and helping people out if they need the help or if I need the help. It's just a very quick avenue to post something and someone can respond because there's people from Australia or the UK or America." Dylan (21)

Buying, selling and trading e-cigarette paraphernalia

Dedicated vaping groups on social media enabled the buying, selling and trading (swapping) of vaporisers, and e-liquid and accessories, with some participants conceding *"I'm not sure if that's legal though"* (Rowan, 35). Some participants were therefore particularly wary of who they sold/gifted vaporisers and nicotine-containing products to, for fear of getting into trouble with the authorities as instances of homes and businesses being raided by the authorities had permeated through the online vaping community.

"If someone messages us, 'I want to buy a mod. Do you know anyone?' if ever I encounter something like that and I wanted to buy their mods or sell the mod to them, I never invite anyone in my house. I always go to the closest petrol station, the closest food court, and things like that. In case that they're [authorities] going to raid my house ..." Rowan (35)

Being aware of and abiding by the rules of online engagement

It was generally understood by most participants who engaged in formalised vaping specific online forums and social media groups that the sale of vape equipment to minors (<18 years), and sale and exchange of nicotine were prohibited, with the rules usually presented upon entry into these online communities. Although private messages exchanged amongst vapers online could result in the sale or acquisition of nicotine-containing e-liquid. Eli described a time when he tried to sell nicotine-containing e-liquid on a Facebook vape group and was told by another member that was not allowed, and subsequently, he ceased this behaviour:

"The Facebook groups got angry with me. ... I think a lot of them say that you're not allowed to promote nicotine juice. I got in on one of those [groups] and they got really upset. ... this guy sent a message to me saying, 'You can't do this, it's illegal. I'm going to report you to the ACCC [Australian Competition and Consumer Commission]'. ... Then I said, 'I think I'm pretty sure I'm not doing anything wrong'." Eli (35)

People who broke the group's rules were commonly ostracised, and for this, some participants viewed the vape community as "self-regulating".

"You'll find that the vape industry itself actually self-regulates. What you will see in the Facebook groups is- Say we're obviously enemy vendors and I hear that you've sold vape gear to a 17-year-old, then I will feather and tar you on Facebook and people would avoid you because you've supplied something. So this is how they self-regulate. As nasty as it is, and it does get very nasty, people are self-regulating. ... If you ask for nicotine you'll get kicked from a lot of the [online] groups. If you supply nicotine, you'll definitely get kicked. ... Vendors are calling the Health Department on other vendors and there's raids happening all the time. ... That's keeping a lot of people honest as well. No one wants to supply nicotine illegally because it is illegal and there's a very heavy fine [up to AUD \$40,000], and they're scared that someone's going to do them in." Victoria (43)

Consequences of Western Australia's e-cigarette regulatory framework

Some participants remarked that Australia's current restrictions on e-cigarette use had stigmatised current vapers by making them feel like criminals, which had acted as a catalyst for some vapers to open their own business or become home vendors supplying product to "help people out".

"Not everyone follows the rules. I know I certainly don't follow all the rules, selling stuff [vape products], and I don't think I'll ever follow the rules. I'm risking it to help people out. I don't really care if I get in trouble anymore. I'd just tell the government where to stick it." Soren (33)

"I was selling out of my front room for a little while before I was working full time down here [vape retail store]. At first, I was meeting people down at 7-Eleven [convenience store] and stuff, and it ... felt like a drug deal or something you know? All I'm doing is giving this guy a tank so he can get off the cigarettes." Jasper (42)

A couple of participants had also conceded they had relapsed to cigarettes while waiting for their nicotine order to arrive. For others, the process of obtaining nicotine products or mastering the vaping process was too difficult and one of the reasons they had ceased using e-cigarettes, opting to keep smoking.

Health and safety concerns

Nicotine handling and storage

Participants purchasing nicotine concentrate were storing it at home, usually in a cool, dark place, such as the fridge/freezer or in a cupboard to prevent oxidation and to increase its lifespan. Participants frequently sought help from the internet when they were unsure of the nicotine spiking process, and many used an online nicotine mixing calculator to work out the correct strength required for their volume. Spiking e-liquid was perceived as a process which had to be learnt and required skill, appropriate equipment and protective wear.

"Initially, yeah I did [find spiking my juice with nicotine difficult] because I wasn't sure what strength I wanted and then what size- Because you have to know what size bottle you've got, whether you've got singles² or doublers,³ it is very complicated and it shouldn't be. It really shouldn't be. And I mean you need a syringe, you need a blunt needle tip, you really should be wearing gloves, you should be in a ventilated area. You know, that's avoidable, that whole process is avoidable if they were to legalise it in premix juice. ... It's very dangerous and it's really intimidating for someone who doesn't know what they're doing." Victoria (43)

Device handling and safety

Battery safety was a priority for most participants, although it was something that needed to be learnt and *"not something that is really forced down on you"* (David, 38). Participants recalled receiving little information about battery safety when purchasing batteries or devices and took it upon themselves to undertake the research due to accounts of batteries exploding in vaporisers. Understanding how to use batteries correctly (e.g. not exceeding specified amps) and the processes required to maintain them (e.g. battery case for transportation) was frequently learnt through social media (e.g. Facebook), content sharing platforms (e.g. YouTube), vape specific forums, and "experts".

"Basically you have to just know what battery to use with them [mechanical mods] and what Ohm's to run your coils at. If they're too high, it could be bad, and if they're too low, it could be bad. I talked to a bunch of experienced vapers about the battery and Ohm's laws regarding the x"

² Singles are a full bottle of e-liquid which is ready to vape and is not designed to have any nicotine added.

³ Doublers are designed to make it easier for people to add nicotine to their e-liquid. These bottles come half filled, but the flavour is double concentrated.

devices. I'm pretty confident with how mine are going ... [I found these people through] Facebook, from vape groups and stuff, and some local people that live here in Perth. There's a guy ... he's like an expert coil-maker, so I video chatted with him while I was playing around with my mods. He was basically just telling me the ins and outs and making sure that I'm running it safely." Holly (27)

One participant explained that up until recently there were no batteries specifically manufactured for vaporisers and so batteries made for other devices, such as torches, had been adopted which can be dangerous depending on how the vape is used. For example, customising the device to produce more power and bigger vape clouds. Several participants believed that batteries need to be regulated to stop the manufacturing of "knock-off" batteries, which can be extremely hazardous to users.

"That's the other thing they really need to get on top of, the batteries, they really need to regulate batteries. And it's not just Australia that does it, it's worldwide that need to regulate batteries. You got companies that are making knock-off batteries that have got stupidly high ratings on them. They're rated for four and a half thousand mAh [milliamp hours], which is not possible. Chemically, it's not possible at 40 amps or whatever, which if people believe that they'll blow their faces off." Hugo (29)

In an attempt to mitigate the risk of a device malfunction, participants explained the methods they employed. Commonly, participants purchased chargers that shut off once the battery was fully charged, never left charging batteries unattended or on charge for extended periods, purchased only regulated devices which have a safety cut-off installed, and purchased from trusted and reputable brands referred by the vaping community. Axel described the range of mods available and their respective safety mechanisms:

"You've got your regulated mods, your hybrid mods and your mechanical. I'm still sitting on regulated, simply because your regulated has got all your cut-off switches, all of your circuit breakers, everything like that, and then so that's just pretty much turn it on and you're good to go. Even if you've got hybrid that has circuit breakers in it, but you still have to follow Ohm's law which is dependant on pretty much, the output that the coil produces. Then you move to mechanical mods which are basically a battery, you basically connect the battery up and you're good to go. That's where it starts getting dangerous if you don't know what you're doing, because otherwise, you put the wrong Ohms in there, you put the wrong output batteries, you put high drain batteries in it, that's when the batteries start venting and pulling up and it's just awful, it's not good at the end of the day." Axel (20)

Product quality and control

Quality control and assurance of e-liquid were important to several participants, and the lack of regulation in Australia was a concern.

"I'd like to see some regulations. To put a house on a roof, you've got to be a carpenter. To sell tobacco products, you've got to show that you've got a license and half a brain ... Then you've got guys that are building, essentially moonshine [e-liquid] and trying to sell it. It needs to be regulated ... There's not a set of guidelines in place to go, you have to use lab quality, PG [propylene glycol], VG [vegetable glycerine]. They do whatever the frick they want! And that's scary." Hugo (29)

Commonly reported side effects of vaping including dehydration, dry mouth, nausea, dizziness, sore throat and a dry cough. Less commonly experienced side effects included a stomach ache, vomiting and loss of voice. Some participants were therefore hesitant to purchase e-liquid that was made in China or other Asian countries and preferred to purchase from the United States or New Zealand because they felt that their manufacturing standards were higher.

"I trust the US [United States] and I trust New Zealand, but ordering it anywhere else, yeah I'd be a bit sceptical." Chloe (34)

Others knew little about where their juice was produced or to what standards.

"I would have no clue [where my e-liquid comes from]. They come in like these little plastic squeeze bottles with like blue lids. [Laughs] They're quite like pretty generic. I wouldn't have any clue about quality or consistency ..." Bodhi (20)

Alternatively, participants chose to buy locally produced juice from retailers and home vendors colloquially referred to as "back yard Henders" (Victoria, 43) or "bathtub mixers" (Miles, 28). Participants who purchased from home vendors reported that the e-liquid was prepared in a "clean room" (Holly, 27) within the seller's home. Participants were generally happy with the quality of the juice and cleanliness of the at-home setup, however, some had refused to purchase from home vendors due to unsanitary conditions.

"I've been to some people's houses that want me to sell their juice. I've walked in and gone, 'No' and walked straight back out, because there's animals and there's - Whereas I've got a clean room at home that is a [with emphasis] clean room." Felix (45)

Some participants were also concerned about incorrectly labelled nicotine concentrations on e-liquid bottles.

"... some of them do say 0% nicotine on the bottles. Doesn't mean that you can believe the label that it's zero nicotine just because it's written there, doesn't mean it might not have it in there though." Seb (27)

Miles, an owner of a local vape store and e-liquid manufacturer described how he was working towards getting his laboratory certified in anticipation of e-liquid manufacturing standards being introduced in Australia. His motivation for this was the expectation that his business would be in a superior position to continue to market and sell their product compared to other retailers. Miles, along with several other participants, who were also local retailers, had regular contact with the Department of Health to ensure they were following all directives. However, they felt that even the Department of Health was unsure of the rules, which Miles described as "frustrating" because "it makes it very hard to try and conduct business, you don't really know where you stand".

"I mean regulation [of e-liquid] will be coming sooner or later, whether which way it goes [nicotine vaping legalised or not] ... getting it [laboratory] HACCP⁴ certified ... [for] when the regulations do come I'll be in a better position to hopefully meet them a lot faster than the rest of the market ... At the moment, there's no real regulation on it [e-liquid], the closest thing is just calling it a food product because it contains food ingredients but some people say that, some don't ... I mean I speak to the Health Department quite regularly, the tobacco control guy seems to still manage this and even he's not really 100% on the exact requirements ... I just figure just follow the basic food grade standards for manufacturing, the sealed packaging and all that sort of stuff, and it's all you can do it until they tell you otherwise." Miles (28)

Participants expressed similar concerns about the quality of devices being bought and sold in Australia and imported from overseas, as they did e-liquid. As a novice vaper starting, it was described as a "daunting" (Kristy, 24) experience sifting through the assortment of devices available to purchase online which fluctuated in price, technical proficiency and quality (e.g. some brands are known to leak). Quality of a device proved to be more difficult to establish as a novice vaper and in the search for a vaporiser that satisfied their budget and ability had purchased some poor quality devices and paraphernalia that had resulted in disconcerting experiences, such as melting chargers. More experienced vapers explained that they learnt over time that there are several "ma-

⁴ HACCP Australia offers its accreditation to organisations that actively apply a good safety programme or incorporate food safety principles in their design which meet the approval and standards of HACCP Australia.

for brands" (Krissy, 24) that are known to be of good quality and were "reputable" (Levi, 29). This knowledge was diffused through online vaping forums and social media groups, product reviews on retail websites and YouTube, and word of mouth. These sources of information were heavily relied upon in an attempt to steer clear of cheaply manufactured devices and to obtain the best vaping experience possible.

"Probably the only thing I'd say is just the amount of education that people have got about it [device quality] is probably the biggest issue. Because the first place people tend to go when buying things online is eBay. As soon as you buy it [mods] on eBay, you're getting clones of certain things and that's when stuff starts going very, very wrong. On most of the [Facebook] pages you're a part of, they've usually got a pinned post at the top with all like your proper vendors and everything like that, you can trust those vendors." Axel (20)

Discussion

This study aimed to gain an understanding of how e-cigarette users navigate Western Australia's regulations which 'ban' nicotine vaping and the sale of e-cigarettes to access vaping products, and the health and safety issues they encounter in an environment that is relatively unaccepting of the promotion of e-cigarette use as a population health measure. Despite Australia's nicotine restrictions, 81% ($n = 30$) of participants used nicotine or had implemented 'self-titration' methods to "wean" themselves off nicotine. Furthermore, several participants were unsure of the legality of importing, accessing and using nicotine and e-cigarettes, however, the majority continued to import high strength nicotine concentrate or nicotine-containing e-liquid from overseas, store large quantities of high concentrate liquid nicotine in their homes, and handle nicotine when spiking non-nicotine e-liquid, sometimes without appropriate protective equipment. Liquid nicotine is highly toxic, and ingestion of just 1–2 ml of nicotine within pre-mixed e-liquid can kill a child (Wylie et al., 2019). Since 2013, there has been a significant increase in the number of calls to the Australian Poisons Centres involving incidences of exposure to e-liquid (Wylie et al., 2019), and in 2018 an Australian toddler died from nicotine poisoning (The Hon Greg Hunt MP, 2020). Similarly, coinciding with the increased rates of e-cigarette use within the United States, poisoning exposure cases have increased, and there have been at least two fatalities between 2010 to 2018 (Wang, Liu, & Persoskie, 2020).

There are thousands of e-liquid flavours available for retail purchase (Hsu, Sun, & Zhu, 2018) and from home vendors (Cox et al., 2019). These products have been found to contain various excipients, flavourings, additives, potentially hazardous ingredients (Chivers, Janka, Franklin, Mullins, & Larcombe, 2019; Cox et al., 2019) and inaccurately labelled nicotine content (Buettnner-Schmidt, Miller, & Balasubramanian, 2016; Chivers et al., 2019; Goniewicz et al., 2015; NSW Government, n.d.; Trehy et al., 2011). Many of the flavouring compounds present within e-liquid have been recognised as safe for ingestion, however, none have been assessed as safe for inhalation via an e-cigarette (Commonwealth of Australia, 2020). Further, incorrect labelling and discrepancies between the labelled amount and actual nicotine content have been documented, and are misleading and may result in unintended addiction to nicotine and other adverse health effects (Buettnner-Schmidt et al., 2016; Chivers et al., 2019). Some participants in our study reported mild adverse effects after using some e-liquids, including dizziness, sore throat, dehydration, and nausea. These experiences are not uncommon and have been documented elsewhere (Chen et al., 2020; Cooper, Harrell, & Perry, 2016).

The internet played a vital role for participants in circumventing Western Australia's restrictions and facilitated access to nicotine and vaping products. The dedicated vaping forums and social media groups that participants regularly accessed created virtual spaces to network and form trustworthy and reliable underground markets. The online environment normalised use, as those who accessed these communities

were exposed to supportive viewpoints on e-cigarettes from local vapers and those in countries with more liberalised regulations. Other studies, both Australian (Morphett, Weier, Borland, Yong, & Gartner, 2019) and international (Russell, Dickson, & McKeganey, 2018), have also discussed the significance of the online environment in e-cigarette initiation, maintenance, and knowledge sharing, with one study stating that experienced vapers involved in online fora could significantly increase smoker's awareness of the variety of vapouriser products available and increase their motivation to experiment with e-cigarettes (Russell et al., 2018). The potential for online forums, groups, and social media to raise awareness and facilitate access to e-cigarette products amongst internet users is a particularly pertinent and concerning issue in regard to minors, who can readily access this content.

Participants in this study implemented risk reduction strategies to avoid law enforcement detection via the internet (e.g. private messaging) and potential adverse health and safety consequences (e.g. purchasing from reputable brands) even though they were pursuing a behaviour that is not sanctioned by society. They also learnt that formalised vaping forums were an 'unsafe' environment to discuss nicotine acquisition, while 'direct messages' and face-to-face discussions with other vapers were 'safe' social environments to discuss such transactions. Despite participants' fear of what could happen if they were found to be procuring or selling nicotine-containing products, their experiences and those of the majority of the wider vaping community suggested their fears were rarely warranted as instances of where vapers' behaviours were formally sanctioned were rare. Subcultural community norms of online communities have been found to foster beliefs in the acceptability of these exchanges and the proliferation of nonconformity into the online milieu where traditional jurisdictional boundaries that inform policy are indistinct creates challenges for law enforcement to maintain public health and safety (Stalans & Finn, 2016).

The current regulatory framework for accessing nicotine vaping products in Australia is partially determined by the Therapeutic Goods Administration who have recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with other approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vapouriser products from a registered medical practitioner (Australian Government, 2020a). The new legislation will "align the current domestic restrictions under State and Territory law that prohibit the supply of nicotine-containing e-cigarettes in Australia without a valid medical prescription", effectively closing the loophole currently being circumvented by vapers and retailers in this study. Further, the impending legislation will clarify the restrictions on the sale, possession and use of nicotine e-cigarettes under state and territory law, and make explicit the circumstances under which the Australian Border Force may seize e-cigarettes containing nicotine that are imported into Australia (Australian Government, 2020a).

Some cigarette smoking participants in this study detailed times of relapse due to the difficulty in obtaining nicotine-containing vapouriser products, or had ceased using e-cigarettes entirely and started smoking again because the process was deemed "too difficult". The imminent prescription-only regime will position medical practitioners centrally within individuals smoking cessation endeavours, enabling them to advise on how to reduce the risks associated with liquid nicotine use, assess progress, and reduce reliance on nicotine (The Royal Australian College of General Practitioners, 2019). Recently, The Royal Australian College of General Practitioners (2019) undertook a substantial revision of their guidelines for health professionals to support smoking cessation, stating e-cigarettes may be a reasonable intervention for individuals who have been unsuccessful in achieving smoking cessation with approved pharmacotherapies, remain motivated to quit smoking, and have raised the issue with their healthcare provider. Studies have shown that smokers who discuss their quit goals and progress with a counselor have a greater likelihood of success of quitting and avoiding relapse (The Royal Australian College of General Practitioners, 2019). Efforts to curb tobacco smoking rates have stigmatised smokers, which can act as a

barrier for people to seek support and treatment (Bell, Salmon, Bowers, Bell, & McCullough, 2010). All smokers must be offered non-judgmental, evidence-based support to quit smoking and ensure that smoking cessation is fully integrated into the health system (White, McCaffrey, & Scollo, 2020).

Most Australian medical colleges and public health researchers support the federal government's precautionary approach to e-cigarette use (Australian Government Department of Health, 2020) and have recently confirmed their support for the now confirmed prescription-based model during the latest Senate Select Committee on Tobacco Harm Reduction (Commonwealth of Australia, 2020). Implementation of the new legislation will provide an opportunity for decision-makers and public health authorities to convey to the Australian population the latest national requirements for accessing nicotine-containing vapouriser products for smoking cessation. The legislation will also assist in addressing the confusion amongst some vapers, as demonstrated in this study and other Australian based research (Morphett et al., 2019), about the legality of vaping and nicotine use. However, any information will need to be clear and concise, as previous research has reported that e-cigarette health information and advice published by reputable Government organisations are more difficult to comprehend than content published by for-profit entities promoting e-cigarette use (Park, Zhu, & Conway, 2017). Given the health literacy levels of the Australian population are generally low (Australian Bureau of Statistics, 2008, 2019) and that biases in algorithms underlying online search query recommendations have been found to drive less literate users towards health-related misinformation (Susaria, 2020), these present findings have important implications. Those implications include, but are not limited to: increasing the capacity of current and potential e-cigarette users to locate, understand and use web-based information to promote and maintain health; the reinforcement of e-cigarette use; and organisations to improve the health literacy of e-cigarette information to ensure web-based resources are written at an appropriate literacy level, factually correct and regularly updated.

In addition to the prescription-based model, regulation of product quality and safety standards are required to address the health and safety concerns illuminated by the experiences of the e-cigarette users in this study. Further considerations for regulation include the setting of maximum nicotine concentrations in e-liquid, minimum standards for manufacture and safety, appropriate restrictions on advertising, prohibiting supply to minors under 18, and mandatory standards for the labelling of e-liquid (e.g. the inclusion of risk-proportionate health messages concerning toxicity and addictiveness, list of ingredients, advice to keep out of reach of children, and advice on overdose management) (Commonwealth of Australia, 2020). Currently, e-cigarette users and health professionals are being encouraged to report any suspected side effects related to e-cigarette use to a Therapeutic Goods Administration managed website for reporting generic side effects to medicines and medical devices (Australian Government, 2020b). The efficacy of this reporting system should be monitored and changes to the system be made as required. Alternatively, a specific system for the reporting of harmful effects of e-cigarette use and the recall of unsafe e-cigarette products and other related issues could be created. Several other jurisdictions including Canada, the European Union, the United Kingdom and the United States have introduced elements of the aforementioned safety measures (Commonwealth of Australia, 2020) which we could learn from in order to develop safe and appropriate regulations for Australia.

Limitations

This study was exploratory and was conducted with a purposive sample of current and former vapers in one Australian state and specifically one region of Western Australia. Therefore, these results may not be generalizable to the broader vaping community or e-cigarette users abroad due to Australia's regulatory environment, absence of mass media advertising and lack of Government endorsement as a smoking cessation

aid (National Health & Medical Research Council, 2017). However, the consistency with other research suggests these findings are not atypical. The researcher who undertook this study is a non-vaping, non-smoking female, this may have presented some challenges with participants viewing the interviewer as an 'outsider' (Dwyer & Buckle, 2009). Some participants, therefore, may have provided answers to certain questions about their behaviour which they deemed to be more socially acceptable (Lavrakas, 2008).

Conclusion

This research found some vapers were unsure about the legality of importing, accessing and using nicotine, however many continued to circumvent Western Australia's restrictions to obtain e-cigarette and liquid nicotine products through importation, local retail stores and home vendors. The Australian Therapeutic Goods Administration has recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with other approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vapouriser products from a registered medical practitioner. The results of this study suggest further consideration of regulatory measures are however required to support the different characteristics of vapers and to mitigate the health and safety concerns experienced by e-cigarette users.

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Ethical considerations

Participants gave written consent at the time of the interview or signed and scanned a consent form to the lead author via email before the interview. One participant provided verbal consent which was audio recorded. Thirty-five face-to-face and two telephone interviews were conducted. All procedures were performed in compliance with relevant laws and institutional guidelines and the study protocol was approved by the Human Research Ethics Committee of Curtin University (HRE2017-0144).

Declaration of Interest

The authors declare no conflict of interest.

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Supplementary materials

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5. Discussion

The following discussion will reflect upon the five study objectives and associated substudy (i.e. scoping review: publications 1 and 2; Twitter inquiry: Publications 3 and 4; qualitative inquiry: publications 5 and 6), and the strengths and limitations of each of the three substudy components.

5.1 Reflection on Study Objectives

5.1.1 Objective 1: Scoping review

To identify and describe the messages presented in e-cigarette related social media promotions and discussions and identify future directions for research, surveillance, and regulation.

To achieve this objective a scoping review of peer-reviewed literature was undertaken. Eligible studies were required to examine and analyse e-cigarette related social media (e.g. Twitter, Instagram) promotions and discussions within the U.S., UK, New Zealand, Canada or Australia. Evidence was synthesised to demonstrate the different social media users ('account types') posting about e-cigarettes and the 'themes' present in and 'sentiment' of e-cigarette social media posts.

Studies included in this review reported dissemination of diverse e-cigarette messaging predominantly by commercial social media accounts (Huang, Kornfield, et al., 2014; Laestadius et al., 2016), while other studies in this review reported conversations among personal accounts dominating the social media landscape (Allem, Escobedo, Chu, Soto, et al., 2017; Basch, Mongiovi, Hillyer, MacDonald, & Basch, 2016; Cole-Lewis et al., 2015; Lazard et al., 2016; Sears et al., 2017; van der Tempel et al., 2016). Personal accounts were found to be discussing, endorsing and promoting various themes, most frequently marketing (Basch et al., 2016; Cole-Lewis et al., 2015; Laestadius et al., 2016), smoking cessation (Huang, Kornfield, et al., 2014; Lazard et al., 2016; van der Tempel et al., 2016), recreation and technology (Laestadius et al., 2016; Sears et al., 2017), and first-person experience and opinion of e-cigarettes (Cole-Lewis et al., 2015; van der Tempel et al., 2016). First-person experience and opinion is a particularly important theme as individuals may be less critical of the material posted by e-cigarette users compared to retailers (Romito, Hurwich, & Eckert, 2015; Steyn, Ewing, van Heerden, Pitt, & Windisch, 2011), and may be more easily persuaded to initiate vaping by individuals they

know, given their relative closeness and potentially increased perception of source credibility (Dubois & Gaffney, 2014; Westerman, Spence, & Van Der Heide, 2014). Future research to determine the 'loudest' social media accounts, in the sense that the content is being seen and shared most frequently, and how this content is influencing other social media user's perceptions and use of e-cigarettes, is therefore warranted (Cole-Lewis et al., 2015).

Several key marketing and promotional strategies were used by commercial social media accounts. These included the use of popular hashtags which enabled marketing messages to 'piggyback' on trending topics and increase dissemination (van der Tempel et al., 2016); use of fake user accounts (i.e. hacked, bots, automated) to disseminate spam and favourable views (Huang, Kornfield, et al., 2014; van der Tempel et al., 2016); and the offer of price promotions and product giveaways (Huang, Kornfield, et al., 2014; Laestadius et al., 2016; Lazard et al., 2016). The social media networking and marketing efforts that have been undertaken by the vaping industry may have contributed to the rapid rise in popularity of e-cigarettes, the extent of which has been demonstrated by the findings of this scoping review. It has also been hypothesised by some researchers that the lack of regulatory standards on social media may be playing an ever-increasing role in the diffusion of tobacco products and pro-smoking messaging (Elkin, Thomson, & Wilson, 2010).

Of the studies that coded for government, foundation or not for profit accounts (3/25, 12%) (Burke-Garcia & Stanton, 2017; Cole-Lewis et al., 2015; van der Tempel et al., 2016), limited public health-related messaging was identified, and activity from these account types represented less than 3 percent of the social media posts investigated. These findings indicate the need for more action from the public health and government sectors to communicate the potential harms and benefits of alternate nicotine delivery products via social media to balance the information shared on these platforms.

Most tweets produced by accounts classified as fakes (i.e. hacked, bots, automated) were found to promote e-cigarettes as effective smoking cessation aids, either by emulating first-person anecdotes or linking to news articles or other online media (Cole-Lewis et al., 2015; van der Tempel et al., 2016). It was also evident that some social media accounts were potentially using computer programs to generate and post content automatically (Huang, Kornfield, et al., 2014; Kim et al., 2015). For example, Clark et al. (2016) provide evidence of the general tweet structure from an

automated 'bot' which shows tweets are published with only slight variations in some words. This type of 'spamming' suggests that there may be money to be made by steering online consumers to particular websites (Kim et al., 2015).

@USER [I, We] [tried, pursued] to [give up, quit] smoking. Discovered BRAND electronic cigarettes and quit in [#] weeks. [Marvelous, Amazing, Terrific]! URL

@USER It's now really easy to [quit, give up] smoking (cigarettes) — these BRAND electronic cigarettes are lots of [fun, pleasure]! URL

@USER electronic cigarettes can assist cigarette smokers to quit, it's well worth the cost URL

All studies that coded for health, safety and harms (16/25, 64%) reported that e-cigarettes are being referred to as 'healthier' and 'safer' than traditional tobacco products on social media (Allem, Escobedo, Chu, Soto, et al., 2017; Ayers et al., 2017; Basch et al., 2016; Burke-Garcia & Stanton, 2017; Cole-Lewis et al., 2015; Han & Kavuluru, 2016; Harris et al., 2014; Huang, Kornfield, & Emery, 2016; Huang, Kornfield, et al., 2014; Kavuluru & Sabbir, 2016; Laestadius et al., 2016; Lee et al., 2017; Merianos, Gittens, & Mahabee-Gittens, 2016; Prochaska, Pechmann, Kim, & Leonhardt, 2012; Sears et al., 2017; Unger et al., 2016). Promoting a product by claiming that it is healthier than tobacco smoking, the leading cause of preventable death may only have merit when targeting smokers who are contemplating quitting or reducing cigarette use (Schraufnagel, 2015). These reduced-risk marketing claims for e-cigarette products could contribute to confusion about their safety (Klein et al., 2016), especially among youth (Struik, Dow-Fleisner, Belliveau, Thompson, & Janke, 2020).

There is an indication that an individual's perception of a substance's potential harms and benefits and their use of the product is influenced by the information available on the health effects of that substance (Berg et al., 2015). A recent systematic review of adolescents' health perceptions of e-cigarettes in high-income countries found that adolescents, particularly e-cigarette users, have more favourable perceptions of e-cigarettes compared with cigarettes; however, these perceptions are conflicting (Sharma, McCausland, & Jancey, 2021). Further, advertising, marketing, and peer and family networks appear to influence adolescents' perceptions of e-cigarettes (Sharma et al., 2021). More research is required, particularly in Australia and New Zealand, to better understand adolescents' health perceptions of e-cigarettes and where they source information,

so misperceptions can be addressed through appropriate channels with suitable messaging.

Fourteen studies (56%) coded for e-cigarette product characteristics such as brands, flavours and nicotine content, and of these, the majority (11/14, 79%) (Ayers et al., 2017; Burke-Garcia & Stanton, 2017; Clark et al., 2016; Cole-Lewis et al., 2015; Han & Kavuluru, 2016; Harris et al., 2014; Huang et al., 2016; Jo et al., 2016; Kavuluru & Sabbir, 2016; Lee et al., 2017; Sowles et al., 2016) coded for the mention or depiction of e-liquid flavours (Ayers et al., 2017; Clark et al., 2016; Cole-Lewis et al., 2015; Han & Kavuluru, 2016; Harris et al., 2014; Huang et al., 2016; Jo et al., 2016; Kavuluru & Sabbir, 2016; Lee et al., 2017; Merianos et al., 2016; Sowles et al., 2016). Marketing social media posts and videos were most commonly found to promote an array of e-liquid flavours available (Clark et al., 2016; Han & Kavuluru, 2016; Kavuluru & Sabbir, 2016; Merianos et al., 2016; Sowles et al., 2016), a strategy historically used to entice new tobacco consumers (Physicians for a Smoke-Free Canada, 2009), especially youth (National Cancer Institute, 2008). As a result of mounting evidence that flavoured tobacco products facilitate youth smoking (Lewis & Wackowski, 2006) these products (aside from menthol) were effectively banned in 2009 (U.S. Department of Health and Human Services, 2018). Some research suggests that flavoured e-cigarettes appeal to adult smokers and may aid smoking cessation (Dawkins, Turner, Roberts, & Soar, 2013; Farsalinos et al., 2013), nevertheless, the increasing evidence demonstrating that flavours attract youth to the e-cigarette market continues to mount (Ambrose et al., 2015; Kim et al., 2016; Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015), which is cause for concern as nicotine addiction is associated with problems in adolescent brain development (Dwyer, McQuown, & Leslie, 2009). Yet, flavour profiles (e.g. tobacco and menthol) that are more appealing to some adults may have minimal appeal to young people (Farsalinos et al., 2013; Morean et al., 2018). Therefore, it has been proposed that these flavours be promoted to adults to assist tobacco substitution while restricting flavours that appeal to youth (e.g. fruits and desserts) (Pepper, Ribisl, & Brewer, 2016).

A concern of e-cigarette promotion on social media is the high level of cross-platform interaction (i.e. using apps to post content across several social media platforms) (Huang, Kornfield, et al., 2014). Given the sizeable youth presence on these platforms (Statista, 2018) cross-platform interaction provides an avenue to invite non-smokers, youth in particular, to experiment with and commence use. However, just because youth are utilising social media does not inevitably mean

they are subjected to e-cigarette marketing as they would need to 'follow' these accounts, be exposed through their social networks (i.e. followers or those they are following) or browse via direct searches (Kim et al., 2015). Recent studies have found, however, that e-cigarette users learn about vaping and devices from the internet and social media (Ayers, Ribisl, & Brownstein, 2011; Emery, Vera, Huang, & Szczypka, 2014), therefore monitoring how e-cigarettes are promoted on these platforms is a priority.

The U.S. Food and Drug Administration (FDA) has recognised the detrimental impact of e-cigarettes, ratifying a rule (8 August 2016) that extended their regulatory authority to all tobacco products, including e-cigarettes. These regulations restrict youth access by prohibiting the sale of e-cigarettes to those under 18 years, embargos the use of free samples for promotion, and states e-cigarette products must now require a health warning (U.S. Department of Health and Human Services, 2016). These restrictions highlight the need for continued research and monitoring of social media commercialisation of these products, and for this issue to be placed on public health and policy agendas.

This review found messages against government regulation of e-cigarettes were prominent and many anti-regulation posts expressed concern over the motivations of the government for wanting e-cigarettes regulated, suggesting policymakers were only concerned about the increasing prevalence of vaping because tobacco revenue would decrease if cigarette smokers switched to e-cigarettes. Further, social media discourse insinuates that some social media users believe the implementation of e-cigarette policy represents an alliance between government and industry, such that the FDA deeming rule would work only to enhance the power of the tobacco industry (Allem, Escobedo, Chu, Soto, et al., 2017; Harris et al., 2014; Lazard et al., 2016; Lazard, Wilcox, Tuttle, Glowacki, & Pikowski, 2017; van der Tempel et al., 2016). The uncertainty surrounding e-cigarette regulation expressed within the public health field did not appear to be reflected in ongoing social media dialogues (Cole-Lewis et al., 2015) and highlights the need for public health professionals to interact with the public to actively influence social media conversations and create a more balanced discussion (Lazard et al., 2016; Lazard et al., 2017).

This present review provides evidence of the existence of e-cigarette marketing on social media, including price promotions, discounts, coupons, free trials, giveaways, and competitions (Clark et al., 2016; Huang et al., 2016; Huang, Kornfield, et al., 2014; Jo et al., 2016; Kim et al., 2015; Lazard et al., 2016; Sowles et al., 2016).

These types of incentives can persuade social media users to make a purchase and support retailers to create a loyal customer base (Cheney, Gowin, & Wann, 2016), which has already been demonstrated as a viable marketing tool used by the tobacco industry (Cornelius et al., 2014; Cummings, Hyland, Lewit, & Shopland, 1997). It is well documented that smoking behaviours react to changes in cigarette prices (Chaloupka, Cummings, Morley, & Horan, 2002) and, in response, tobacco control efforts have sought to eradicate the use of these incentives (World Health Organization, 2003). Similarly, studies have reported that e-cigarette sales are very responsive to price variation, therefore implementing policy to limit price promotions, free trials and giveaways could impact use and uptake (Huang, Tauras, & Chaloupka, 2014). People who use e-cigarettes regularly cite smoking cessation as their motivation for vaping initiation. For this group of people, price promotions that enables affordability of these products longer term could be viewed as appropriate (Sowles et al., 2016), although evidence supporting the use of these devices as a smoking cessation aid is inconclusive (Hartmann-Boyce, Begh, & Aveyard, 2018).

A major drawback of cigarettes is the smoke they emit which contains chemicals detrimental to human health (Campbell, Ford, & Winstanley, 2017), providing the impetus for smoke-free policies all over the world (World Health Organization, 2018a). Studies included in this review found that e-cigarette proponents frequently highlight the smoke-free aspect of vaping, making these devices suitable for use in smoke-free areas (Ayers et al., 2017; Han & Kavuluru, 2016; Kavuluru & Sabbir, 2016; Lazard et al., 2017; Merianos et al., 2016; Sears et al., 2017). Marketing that accentuates e-cigarettes can be used 'anywhere' may undermine enforcement of smoke-free policies and tobacco control efforts (World Health Organization, 2014), and expose non-users to toxins (Grana, Benowitz, & Glantz, 2014). A survey of a representative sample of American adults (n=1449) found an increased frequency of exposure to e-cigarette advertising was associated with lower support for policies that restrict use in public places (Tan, Bigman, & Sanders-Jackson, 2015). These results suggest the need for more publicly available information regarding the chemical composition and possible health consequences of inhaling secondhand vapour (Unger et al., 2016).

E-cigarette use for recreational purposes, an important aspect of vaping, was a less prominent theme in this review discussed in only three studies (12%) (Laestadius et al., 2016; Lee et al., 2017; Sears et al., 2017). These studies commonly reported depictions of customisation and modification of e-cigarette devices for both functional and aesthetic purposes, vapers exhaling large plumes of vapour (known

as cloud chasing), and performing vape tricks. Depiction of these vaping practices could contribute to the normalisation of vaping as images and videos represent these acts as recreation, and more commonplace and socially accepted than is in reality (Chu et al., 2016; Lerman, Yan, & Wu, 2016). It may, therefore, be valuable for future research to investigate the degree to which the e-cigarette industry is targeting non-smoking youth who may have an interest in vaping for enjoyment or as a hobby rather than a smoking cessation tool (Measham, O'Brien, & Turnbull, 2016; Sowles et al., 2016).

Studies that coded for sentiment and did not specifically state they were coding for message attitude most frequently reported that their sample was positively skewed towards e-cigarettes, their users and anti-regulation (Allem, Escobedo, Chu, Soto, et al., 2017; Cole-Lewis et al., 2015; Harris et al., 2014; Kavuluru & Sabbir, 2016; Lazard et al., 2017; Merianos et al., 2016; Sears et al., 2017; van der Tempel et al., 2016). On the other hand, studies that coded for message attitude reported predominantly neutral attitude (Dai & Hao, 2016; Unger et al., 2016; van der Tempel et al., 2016). Social media posts from accounts with vested interests (e.g. commercial, automated) and everyday people were found to present positive messages related to e-cigarettes (Clark et al., 2016; Cole-Lewis et al., 2015; Kavuluru & Sabbir, 2016; Merianos et al., 2016; van der Tempel et al., 2016), whereas news and health-related accounts provided messages that were least positive or neutral (Cole-Lewis et al., 2015; Merianos et al., 2016; van der Tempel et al., 2016).

5.1.2 Objective 2: Twitter study A

To investigate how e-cigarettes are portrayed and promoted on Twitter, and how this portrayal and promotion has emerged and trended over time within an Australian context.

To achieve this objective, tweets posted or retweeted by Australian Twitter users mentioning at least one of the 15 identified e-cigarette related terms were captured via TrISMA (Tracking Infrastructure for Social Media Analysis) and analysed by qualitative content analysis. Only tweets which contained an image were eligible for analysis in this study.

The use of several promotional practices and strategies were documented in this study, namely the promotion of positive perceptions of e-cigarette use, implicit and explicit marketing of e-cigarette products and businesses, and the use of promotional offers (monetary and non-monetary). These findings are consistent with

those reported in substudy 1 (scoping review: publication 2) and are known and effective strategies utilised by the tobacco industry for decades (Paek, Reid, Jeong, Choi, & Krugman, 2012). These promotional practices coupled with the ease with which consumers can purchase products online through the click of a link has supported the exponential growth of online e-cigarette sales worldwide (Mordor Intelligence, 2020). Investigations into youth online purchasing have confirmed the ease in which young people can purchase e-cigarette products due to the lack of appropriate age detection processes (Gurram, Thomson, Wilson, & Hoek, 2019; Knopf, 2018; Mackey, Miner, & Cuomo, 2015). Processes for appropriate age detection should be developed and trialled, and supported by policies to enforce these procedures in the online environment.

The promotion of e-liquid flavours through images, detailed flavour descriptions and appealing product packaging were common and are supported by other social media-based investigations (Allem, Majmundar, Dharmapuri, Cruz, & Unger, 2019; Soule et al., 2019). E-cigarette users commonly report the importance of flavoured e-cigarette products in facilitating smoking abstinence and enhancement of their vaping experience (Farsalinos et al., 2013). Subsequently, e-cigarette manufacturers and retailers have adopted the promotion of flavoured e-cigarette products as a major marketing strategy (Chu, Unger, Cruz, & Soto, 2015). However, evidence indicates the promotion of flavoured e-liquid may be particularly attractive to young people (Hoffman, Salgado, Dresler, Faller, & Bartlett, 2016) and serve as one of the main reasons for e-cigarette initiation (Tsai et al., 2018). Furthermore, youth have been found to perceive fruit-flavoured e-liquids to be less harmful than tobacco-flavoured products (Pepper et al., 2016) and have been linked to greater perceived enjoyment (Soule, Rosas, & Nasim, 2016).

It is not uncommon to find posts on Twitter claiming e-cigarettes are safer than cigarettes and can be used as a cessation tool, with limited or no validation (Cole-Lewis et al., 2015). Only a very small proportion of posts in this present investigation of Twitter were accompanied by or depicted a health warning or age restriction, and an increasing proportion of posts were found to be promoting the positive health effects of vaping. Furthermore, a substantial proportion of posts promoted e-cigarettes as a replacement or alternative to cigarettes, like that found by Laestadius et al. (2016). Risk perception plays an important role in product use decision making, and a commonly cited reason for e-cigarette uptake among adults and young people is the belief that they are less harmful than cigarettes (Czoli, Fong, Mays, & Hammond, 2017; Farsalinos et al., 2014; Tomashefski, 2016). Youth who

perceive e-cigarettes as harmless or less harmful than cigarettes are more susceptible to uptake compared to those youth with more negative views towards vaping (Gorukanti, Delucchi, Ling, Fisher-Travis, & Halpern-Felsher, 2017; Strong et al., 2019).

A common post found in this study was 'hand check/product check'. Such posts are significant because they reflect the variety and wide range of vaporiser and e-liquid products and accessories that exist. As vaporisers continue to evolve and allow users to customise and create unique devices, users are increasingly turning to Twitter to share the products they are using and creating. Similarly, Chu et al. (2016) found a large proportion of product-based images posted to the social media platform Instagram, exhibiting the hashtag #handcheck. The authors expressed concern regarding this increasing trend as these images act as unpaid marketing of e-cigarette products and viewers may interpret these devices to be commonplace and socially acceptable.

The inclusion of hashtags such as #vapecommunity, #vapelife, #vapenation, and #cloudchaser demonstrate the existence of a vaping identity and community on Twitter, which was also found in prior vaping-related social media investigations (Allem, Ferrara, et al., 2017; Laestadius et al., 2016). The inclusion of such hashtags may also function to create an internalisation of social bonding and a vape related identity (Allem, Ferrara, et al., 2017). This internalisation may help one to define who they are and create their own identity and values within a society that has normalised values and practices. This has led to the formation of unique online and face-to-face 'vaper' communities and identities (Farrimond, 2017; McCausland, Jancey, et al., 2020), which some people are now adopting and associating with rather than the identity of being a 'cigarette smoker' or 'ex-smoker'. The application of hashtags to social media posts is a form of folksonomy and it has therefore been suggested by some that these vaping-related discussions may be occurring within some networks as an 'echo chamber', whereby the ideas and beliefs of those within the network are strengthened, resulting in the normalisation of vaping within these communities (Allem, Ferrara, et al., 2017). Research examining Australian Twitter users using network analysis methods could provide an Australian perspective on this hypothesis.

This study found the proportion of posts specifically promoting e-cigarette products for purchase decreased in 2018 (Table 12), although this correlates with a relative decline in Twitter use by Australians in comparison to other larger and growing

platforms. Due to the increased popularity of Instagram over recent years, and more recently TikTok, it would be valuable to investigate e-cigarette related promotional content posted to these platforms. Instagram and TikTok are primarily photo and video-sharing social networking services, therefore, these platforms may be more desirable and highly accessed than Twitter for sharing this type of content.

A product for therapeutic use, such as smoking cessation or alleviation of nicotine withdrawal, must be registered by the Therapeutic Goods Administration to be sold lawfully in Australia (Therapeutic Goods Administration, 2019). At present no heated tobacco or nicotine vaporiser has been approved by the Therapeutic Goods Administration and therefore should not be promoted as a smoking cessation product. Continued monitoring of Australian e-cigarette retailers to ensure misleading health and smoking cessation claims are not being made is therefore important so as not to contribute further to the confusion regarding e-cigarette safety and efficacy.

5.1.3 Objective 3: Twitter study B

To identify key conversation trends and patterns over time, and discern the core voices, message frames and sentiment surrounding e-cigarette discussions on Twitter within an Australian context.

To achieve this objective, tweets posted or retweeted by Australian Twitter users mentioning at least one of the 15 identified e-cigarette related terms were captured via TrISMA and analysed by qualitative content analysis. This study specifically investigated who was posting e-cigarette related tweets, and what the sentiment and message of their posts were. All tweets, whether they included an image or not were eligible for analysis in this study.

Analysis of the 4432 tweets indicates that positive sentiment continues to dominate the e-cigarette discourse on Twitter, and the ongoing polarised debate among the public health community is not reflected. Largely, a one-sided perspective is being presented by vape retailers and manufacturers, e-cigarette advocates, the general public and select public health professionals, researchers and academics.

Twitter users with vested interests in e-cigarettes (i.e. retailers and manufacturers), e-cigarette advocates and the general public were found to tweet a very high proportion of positive tweets (>70%). News and health-related accounts provided messages that were the least positive and/or neutral, however, these tweets comprised a small proportion of the total sample. These findings concur with a

recent study (Ayers et al., 2018) and the findings of substudy 1 (scoping review: publication 2). However, it was also found that some vocal pro-vaping public health professionals, researchers, and academics are skewing the conversation of this group of users, which is not the view of the wider Australian and international public health communities (Greenhalgh & Scollo, 2019a).

E-cigarette advocates, along with a small number of vocal public health professionals, researchers and academics were predominantly positive in their discussions and were found to challenge other Twitter users who expressed anti-vaping views or were deemed to be 'misrepresenting the facts' concerning e-cigarettes. Some Australian public health academics, who do not support the use of e-cigarettes until they are proven to be a safe and efficacious smoking cessation aid, have documented their relentless struggles with pro-vaping advocates on Twitter (Chapman, 2018; Daube, 2015), with one stating that the collective abuse received from other interest groups, such as smokers' rights advocates, anti-vaccinationists and climate change denialists, pales into insignificance compared with the volume of abuse received from vaping advocates. Several tactics were used by e-cigarette advocates to communicate their beliefs, including attempts to frame e-cigarettes as safer than traditional cigarettes, imply that federal government agencies lack sufficient competence or evidence for the policies they endorse about vaping, and denounce as propaganda 'gateway' claims of youth progressing from e-cigarettes to tobacco cigarettes. Australian e-cigarette advocates were also found to use a range of tropes to justify their support for vaping which have been identified in international research (Martinez, 2018), including encouraging an 'us versus them' mentality, attacking those opposed to e-cigarettes, relying on personal anecdotal evidence, minimalising side effects, normalising use, and emphasising the benefits of e-cigarettes. These tactics may impact the proportion of the public health community and other Twitter users who are willing to express contradictory views (Fairchild et al., 2019), thereby distorting the commentary and possibly shaping the views and risk perceptions of vulnerable populations such as young people (Martinez, Tsou, & Spitzberg, 2019). This notion is supported by the present findings, with only 7.9% (352/4432) of tweets categorised as negative and 7.4% (326/4432) as neutral.

Groups who are usually viewed as health experts or opinion leaders, such as medical doctors and nurses, reputable scientific organisations, and government organisations and politicians, collectively posted only 2.3% (100/4432) of tweets analysed in this study. A great deal of health information is now distributed and

sourced online, which has resulted in less of a reliance upon these traditional knowledge brokers in offline settings (Eysenbach, 2008). In the online environment, “the multiplicity of sources involved in information dissemination, their possible anonymity, the absence of standards for information quality, the ease in manipulating and altering content, the lack of clarity of the context, and the presence of many potential targets of credibility evaluation (i.e. the content, the source, and the medium)” (Eysenbach, 2008, p. 19) make the assessment of information an often-complex task. As a result, individuals are now burdened with the responsibility of information evaluation that was once the responsibility of professional gatekeepers (Flanagin & Metzger, 2008). The health literacy levels of the Australian population are generally low (Australian Bureau of Statistics, 2008, 2019a) and investigating methods to assist internet users in assessing the credibility of online information is therefore particularly important, as well as the dissemination of evidence-based information by respected experts and opinion leaders.

There are known and trusted strategies for addressing misinformation⁸ and disinformation⁹ in the field of health communication, but more research is needed to fully understand how well these translate into a social media context, how this information spreads online, and how to develop data-driven solutions to this growing threat (Chou, Oh, & Klein, 2018; Jamison, Broniatowski, & Quinn, 2019; Wang, McKee, Torbica, & Stuckler, 2019). It is important to assess the extent of misinformation and disinformation related to vaping, considering its potential to generate negative public health consequences. Deployment of innovative methods on a broader scale is needed, including natural language processing, assisted data mining, social network analysis, and online experimentation to track the spread of this content (Jamison et al., 2019). Surveillance endeavours must be agile and adaptable and require both researchers and practitioners to establish relationships with computer science professionals to stay abreast of the rapidly changing technology.

These results support previous vaping-related Twitter investigations that report the Twitter landscape is dominated by tweets from industry and commercial users championing e-cigarettes as a healthier tobacco alternative and as a successful cessation aid (Huang, Kornfield, et al., 2014; Kim et al., 2015; van der Tempel et al., 2016). These views are contrary to Australia’s regulatory approach to e-cigarettes

⁸ Misinformation is “false information that is spread, regardless of intent to mislead” (Dictionary.com, 2020).

⁹ Disinformation is “deliberately misleading or biased information; manipulated narrative or facts; propaganda” (Dictionary.com, 2020).

which aims to safeguard public health and control the drivers of negative e-cigarettes use (i.e. use among youth and non-smokers, and unfettered marketing) (Australian Government Department of Health, 2019). Australia is a signatory to the World Health Organization Framework Convention on Tobacco Control which is designed to protect public health policies from commercial and other vested interests (World Health Organization, 2003). Until there is adequate evidence that e-cigarettes are a safe and efficacious smoking cessation product they should not be promoted as such.

A substantial proportion of tweets used sales techniques such as price promotions which have historically been successfully employed by the tobacco industry to greatly influence cigarette uptake and consumption (Cummings et al., 1997). These findings have implications for the marketing of e-cigarettes on other social media platforms, Instagram in particular, owing to cross-platform interaction which is worth further examination because of the levels of interaction found in this investigation. Given the substantial youth presence on social media, the marketing of e-cigarettes on these platforms may entice non-smokers and youth, in particular, to experiment with, and initiate vaping (Amin, Dunn, & Laranjo, 2020b). Data from the most recent Australian National Drug Strategy Household Survey (NDSHS) (Australian Institute of Health and Welfare, 2020c) reports 11.3% of Australians aged over 14 years have ever used, and 2.5% currently use e-cigarettes, with increases of 2.5% and 1.3%, respectively, since 2016. These increases occurred in both smokers and non-smokers and contrast with Australian tobacco smoking rates which have continued to decline over the last 30 years. The most frequent reason for using e-cigarettes reported by people over 14 years was 'out of curiosity' (54.2%). Others (22.8%) cited using e-cigarettes because they perceived them to be 'less harmful' than tobacco cigarettes (19.2% in 2016) and 10.1% believed vaping to be 'more socially acceptable' than tobacco smoking (6.0% in 2016). Further, 26.9% of respondents reported they obtained their e-cigarette products online (Australian retailer 12.5%, overseas retailer 11.1%, unknown origin 3.3%), a trend that should be closely monitored (Amin et al., 2020a).

5.1.4 Objective 4: Qualitative study A

To examine adult e-cigarette users who reside within the Greater Capital City Statistical Area of Perth, their motivations for e-cigarette use, reinforcing influences, and association with the vaper subculture.

To achieve this objective current or former e-cigarette users over 18 years were recruited to participate in an in-depth interview.

Of the 37 people interviewed in this study, 32 were committed smokers for several years and five were dual users of tobacco and e-cigarettes. The primary reason for initiating vaping was to quit smoking, citing less than optimal successes with other government-approved smoking cessation aids, which has also been described by a sample of American vapers (Simmons et al., 2016). Vaping was considered more satisfying and therefore more supportive of successfully quitting smoking compared to other methods due to its similarity with cigarette smoking, namely the inhale and exhale of vapour, nicotine hit, and the hand-to-mouth action, as also documented in other international research (Barbeau, Burda, & Siegel, 2013; Hoek, Thrul, & Ling, 2017; Rooke, Cunningham-Burley, & Amos, 2016). Furthermore, vaping does not expect the vaper to relinquish the rituals and habits connected to smoking (Weier, 2018). The conclusions surrounding the effectiveness of e-cigarettes as a smoking cessation aid and their harm reduction potential, however, are varied and depend on several factors, such as whether the smoker switches completely to e-cigarettes, becomes a dual user with cigarettes, and whether the user becomes a sustained and persistent vaper (National Academies of Sciences Engineering and Medicine, 2018).

Most vapers in this sample were former smokers, however, several respondents had taken up the practice despite having never smoked. Understanding how vapers 'make sense' of their health practices (Radley, 1994) is necessary to understand the processes by which vapers make health behaviour choices, such as choosing to vape, so that appropriate tailored communication on the risks and benefits of e-cigarette use can be developed (Joffe, 2002). Limiting vaping uptake by non-smokers is essential and the supportive role Australia's strict regulation plays in limiting this uptake and exposure to marketing is discernibly apparent when compared with vaping prevalence within countries with more liberal regulation (i.e. U.S. (Cullen et al., 2019; Truth Initiative, 2019) and the UK (Action on Smoking and Health, 2019; Office for National Statistics, 2019)).

Participants within this study generally exhibited limited knowledge of the potential health effects of e-cigarettes. However, as reported by vapers abroad (Coleman et al., 2016; Wadsworth, Neale, McNeill, & Hitchman, 2016), they expressed many positive attitudes towards e-cigarettes, held very strong opinions that vaping offered them an alternative means to consume nicotine, and based their decision to use e-

cigarettes on perceived harm reduction compared to cigarettes. For them, the individual health benefits experienced, and the tangible sense of satisfaction since ceasing smoking outweighed the potential health risks of maintaining vaping. Furthermore, continued nicotine addiction was largely perceived as unproblematic so long as it helped maintain a cigarette-free lifestyle, also documented by others (Langley, Bell-Williams, Pattinson, Britton, & Bains, 2019; Rooke et al., 2016). This concept has been studied by Oakes, Chapman, Borland, Balmford, and Trotter (2004) who explored the rationalisations smokers use to explain their justification of continued smoking and suggest a series of self-exempting beliefs may provide smokers with a false sense of security and ultimately block them from exploring the importance of quitting. Given the complexity of nicotine and addiction, and the assortment of information presented on e-cigarettes, it is not unexpected that users in this study and overseas (Johnson, Coleman, Tessman, & Dickinson, 2017) rely on their own experiences, and that of others, to inform their behaviour and decision-making processes (Hoek et al., 2017). This highlights the need for accessible, clear, and impartial information about e-cigarette use which communicates the benefits, risks and current uncertainties to health professionals and the public about e-cigarettes (Rooke et al., 2016) and continued support for nicotine cessation through approved cessation methods.

Participants mostly described positive reactions from friends and family to their e-cigarette use, particularly when their goal was to abstain from smoking. In this sample of vapers, few had close friends who vaped and therefore sought camaraderie through online forums and vape retail stores. As found in other qualitative inquiries (Barbeau et al., 2013), the notion of a vaping community was recurrent. However, participating in a community that accepts the practice may make it difficult for individuals to quit and therefore contribute to sustained use (Marron, 2017). These findings suggest that social norms surrounding e-cigarette use have a potentially powerful influence on initiation and maintenance and that understanding social networks is integral to prevention efforts.

Although tobacco smoking among people over 18 years is legal in Australia, the decline in prevalence combined with the denormalisation of smoking and societal aversion has fated the behaviour to be predominantly relocated to the fringes of society and viewed as a deviant and marginalised behaviour (Chapman & Freeman, 2008). For some smokers in this study, feeling stigmatised for being a tobacco smoker was the catalyst for them to redefine themselves as 'vapers', as supported by findings from Barbeau et al. (2013), making the language used (i.e. not referring

to vaporisers as e-cigarettes) incredibly important in an attempt to escape the stigma attached to cigarette smoking (Simmons et al., 2016). This redefinition and transition from smoker to non-smoker has been argued to play a key role in supporting successful smoking cessation (Vangeli & West, 2012). However, through the quest to obtain the socially desirable non-smoker status, smokers have adopted another behaviour that maintains addiction and deviates from current societal norms, an unapproved and unconventional means to quit smoking.

Two approaches to vaping emerged from the data, that of the 'cloud chaser' and the 'substitute'. Vapers within this sample displayed similar subcultural elements and practices to those reported in the international literature examining the motivations of e-cigarette users, identity formation and involvement in the vaping subculture (Farrimond, 2017; Tøkle & Pedersen, 2019) which could be diffused via global structures such as social media. However, some subcultural elements are localised to Australian vapers due to the unique social conditions under which the behaviour has evolved. For example, the vaping subculture which has emerged in the U.S. is more encompassing than in Australia, which may be attributed to differences in the country's regulatory contexts (Klein, Chaiton, Kundu, & Schwartz, 2020), access to nicotine products, and exposure to mass marketing (Huang et al., 2019) and subcultural practices (e.g. vaping conventions (Ziyad & Kalan, 2018) and abundant vape stores (Lee & Kim, 2015)).

Supported by Farrimond (2017) and McQueen, Tower, and Sumner (2011), 'cloud chasers' perceived their affiliation and connection with the vape community in the online and offline milieu as a positive source of support and reinforcement. Moreover, vaping was regarded as an integral part of their social identity, influencing how they behaved and the social and political activities they engaged in. Given the loss of identity and social engagement reported by individuals who quit smoking, the social opportunities and group and community experience of vaping may be a particularly appealing aspect of the endeavour (Barbeau et al., 2013; Pokhrel, Herzog, Muranaka, & Fagan, 2015; Wadsworth et al., 2016). Furthermore, vaping was explicitly differentiated from cigarette smoking and referred to by many 'cloud chasers' as a hobby. Several dimensions of 'pleasure' were identified, including the sensory experience (i.e. flavours) and electronic and technological aspects of vaping (McDonald & Ling, 2015; Pokhrel, Herzog, Muranaka, & Fagan, 2015). Such descriptions of enjoyment are not usual in the substance-use discourse (Duff, 2008) due to the dominance of the 'pathology paradigm' which marginalises the idea of pleasure concerning drug use (Moore, 2008).

The assessment that e-cigarettes are a tool to manage nicotine addiction among 'substitute' vapers may explain why these users did not strongly identify with, or actively rejected connection with the social identity of vaping, and enjoyment did not play a substantive role in their use and maintenance (Farrimond, 2017). Research suggests that cessation goal-oriented vapers may be less likely to become persistent e-cigarette users compared with vapers who do not stipulate future intentions to quit (Pepper & Brewer, 2014; Pokhrel, Herzog, Muranaka, Regmi, & Fagan, 2015). The nuanced differences in experiences of 'cloud chasers' and 'substitute' vapers may, therefore, contribute important insights for health communication. Australia has implemented a suite of effective strategies (Australian Council on Smoking and Health, 2020a) to combat tobacco smoking that could be applied to e-cigarettes, such as supplementing health communications with legislation (e.g. health warnings, plain packaging, smoke-free laws that include e-cigarette use), until there is scientific evidence regarding their safety and efficacy as a tobacco cessation therapy (Cancer Council Australia, n.d.).

E-cigarettes are both technically complex devices, which novice users may find difficult to spontaneously start, and a non-medical consumer product, which has resulted in the need for many aspiring users to look to other vapers as their experts, building a vast and international social network of shared knowledge and identity (Farrimond, 2017). A common experience among this cohort of vapers was their use of e-cigarette forums and social media groups to discuss personal experiences, exchange information, and obtain new knowledge, similarly reported by vapers in New Zealand (Hoek et al., 2017). Seasoned vapers and newcomers disclosed periods of both active and passive engagement (also known as 'lurking' (Tagarelli, 2017)). Lurking allowed newcomers to observe the community and its rules (Malinen, 2015) and provided more established vapers with the opportunity to monitor changes in the industry and the development of new products. Conversely, active contribution to these forums provided opportunities for learning among 'newbies' and mentorship for more experienced vapers. Some research suggests that joining and actively participating in e-cigarette related social media communities (Dai & Hao, 2016; Luo, Zheng, Zeng, & Leischow, 2014; Pepper et al., 2017) may play an important role in the development of a person's vaping identity (Farrimond, 2017; Hoek et al., 2017) and can exert a significant influence on attitudes and behavioural intentions toward e-cigarettes (Phua, 2019). The investigation of dedicated vaping forums, therefore, may be valuable to study interactions among

users and how these interactions shape e-cigarette knowledge, attitudes, and behaviours.

5.1.5 Objective 5: Qualitative study B

To examine how adult e-cigarette users residing within the Greater Capital City Statistical Area of Perth, navigate Western Australia's restrictions (i.e. 'ban' on nicotine vaping and the sale of e-cigarettes devices) to access vaping products and the health and safety issues they encounter.

To achieve this objective current or former e-cigarette users over 18 years were recruited to participate in an in-depth interview.

Despite Australia's nicotine restrictions, 30 of the 37 participants used nicotine or had implemented 'self-titration' methods to "wean" themselves off nicotine. Furthermore, several participants were unsure of the legality of importing, accessing and using nicotine and e-cigarettes, however, the majority continued to import high strength nicotine concentrate or nicotine-containing e-liquid from overseas, store large quantities of high concentrate liquid nicotine in their homes, and handle nicotine when spiking non-nicotine e-liquid, sometimes without appropriate protective equipment. Liquid nicotine is highly toxic, and ingestion of just 1–2 ml of nicotine within pre-mixed e-liquid can kill a child (Wylie et al., 2019). Since 2013, there has been a significant increase in the number of calls to the Australian Poisons Centres involving incidences of exposure to e-liquid (Wylie et al., 2019), and in 2018 an Australian toddler died from nicotine poisoning (The Hon Greg Hunt MP, 2020). Similarly, coinciding with the increased rates of e-cigarette use within the U.S., poisoning exposure cases have increased, and there have been at least two fatalities between 2010 and 2018 (Wang, Liu, & Persoskie, 2020).

Thousands of e-liquid flavours are available for retail purchase (Hsu, Sun, & Zhu, 2018) and from home vendors (Cox et al., 2019). These products have been found to contain various excipients, flavourings, additives, potentially hazardous ingredients (Chivers, Janka, Franklin, Mullins, & Larcombe, 2019; Cox et al., 2019) and inaccurately labelled nicotine content (Buettner-Schmidt, Miller, & Balasubramanian, 2016; Chivers et al., 2019; Goniewicz et al., 2015; Health, n.d.; Trehy et al., 2011). Many of the flavouring compounds present within e-liquid have been recognised as safe for ingestion, however, none have been assessed as safe for inhalation via an e-cigarette (Commonwealth of Australia, 2020). Further, incorrect labelling and discrepancies between the labelled amount and actual nicotine content have been documented, and are misleading and may result in

unintended addiction to nicotine and have other adverse health effects (Buettner-Schmidt et al., 2016; Chivers et al., 2019). Some participants in this present study reported mild adverse effects after using some e-liquids, including dizziness, sore throat, dehydration, and nausea. These experiences are not uncommon, and have been documented elsewhere (Chen et al., 2020; Cooper, Harrell, & Perry, 2016).

The internet played a vital role for participants in circumventing Western Australia's restrictions and facilitated access to nicotine and vaping products. The dedicated vaping forums and social media groups that participants regularly accessed created virtual spaces to network and to form trustworthy and reliable underground markets. The online environment normalised use, as those who accessed these communities were exposed to supportive viewpoints on e-cigarettes from local vapers and those in countries with more liberalised regulations. Other studies, both Australian (Morphett, Weier, Borland, Yong, & Gartner, 2019) and international (Russell, Dickson, & McKeganey, 2018), have also discussed the significance of the online environment in e-cigarette initiation, maintenance, and knowledge sharing, with one study stating that experienced vapers involved in online forums could significantly increase smokers' awareness of the variety of vaporiser products available and increase their motivation to experiment with e-cigarettes (Russell et al., 2018). The potential for online forums, groups, and social media to raise awareness and facilitate access to e-cigarette products among internet users is a particularly pertinent and concerning issue with regard to minors, who can readily access this content.

Participants in this study implemented risk reduction strategies to avoid law enforcement detection via the internet (e.g. private messaging) and potential adverse health and safety consequences (e.g. purchasing from reputable brands) even though they were pursuing a behaviour not sanctioned by society. They also learned that formalised vaping forums were an 'unsafe' environment to discuss nicotine acquisition, while 'direct messages' and face-to-face discussions with other vapers were 'safe' social environments to discuss such transactions. Despite participants' fear of what could happen if they were found to be procuring or selling nicotine-containing products, their experiences and those of the majority of the wider vaping community suggested their fears were rarely warranted as instances of where vapers' behaviours were formally sanctioned were rare. Subcultural community norms of online communities have been found to foster beliefs in the acceptability of these exchanges and the proliferation of nonconformity into the online milieu where traditional jurisdictional boundaries that inform policy are

indistinct creates challenges for law enforcement to maintain public health and safety (Stalans & Finn, 2016).

The current regulatory framework for accessing nicotine vaping products in Australia is partially determined by the Therapeutic Goods Administration who have recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vaporiser products from a registered medical practitioner (Australian Government, 2020b). The new legislation will “align the current domestic restrictions under State and Territory law that prohibit the supply of nicotine-containing e-cigarettes in Australia without a valid medical prescription”, effectively closing the loophole currently being circumvented by vapers and retailers in this study. Further, the impending legislation will clarify the restrictions on the sale, possession and use of nicotine e-cigarettes under state and territory law, and make explicit the circumstances under which the Australian Border Force may seize e-cigarettes containing nicotine that are imported into Australia (Australian Government, 2020b).

Some cigarette smoking participants in this study detailed times of relapse due to the difficulty in obtaining nicotine-containing vaporiser products, or had ceased using e-cigarettes entirely and started smoking again because the process was deemed “*too difficult*”. The imminent prescription-only regime will position medical practitioners centrally within individuals smoking cessation endeavours, enabling them to advise on how to reduce the risks associated with liquid nicotine use, assess progress, and reduce reliance on nicotine (The Royal Australian College of General Practitioners, 2019). Recently, The Royal Australian College of General Practitioners (2019) undertook a substantial revision of their guidelines for health professionals to support smoking cessation, stating e-cigarettes may be a reasonable intervention for individuals who have been unsuccessful in achieving smoking cessation with approved pharmacotherapies, remain motivated to quit smoking, and have raised the issue with their healthcare provider. Studies have shown that smokers who discuss their quit goals and progress with a counsellor have a greater likelihood of success of quitting and avoiding relapse (The Royal Australian College of General Practitioners, 2019). Efforts to curb tobacco smoking rates have stigmatised smokers, which can act as a barrier for people to seek support and treatment (Bell, Salmon, Bowers, Bell, & McCullough, 2010). All smokers must be offered non-judgmental, evidence-based support to quit smoking

and ensure that smoking cessation is fully integrated into the health system (White, McCaffrey, & Scollo, 2020).

5.2 Research Strengths

5.2.1 Scoping review

The development and publication of a protocol (publication 1) contributed to research rigour by providing a plan for the implementation of the study, limited the occurrence of reporting bias and provided an opportunity to document any deviations from the proposed plan in the publication of the results (publication 2), increasing the transparency of the process (Peters et al., 2017).

The review adhered to the methodologically rigorous methods manual developed by the Joanna Briggs Institute (Peters et al., 2015) which further enhanced the earlier work of Arksey and O'Malley (2005) and Levac et al. (2010). It was not until 2018 that the Preferred Reporting Items for Systematic Reviews (PRISMA) Statement was extended to Scoping Reviews – the PRISMA-ScR (Tricco et al., 2018). The PRISMA-ScR was developed by several experts in scoping reviews and evidence synthesis, including members of the Joanna Briggs, to be consistent with the Joanna Briggs Institute's scoping review methodology (Peters et al., 2017).

5.2.2 Twitter inquiry

The scoping review identified no Australian studies examining e-cigarette related social media discourse. The subsequent social media inquiries were the first studies to contribute insights to fill this gap in the literature.

The TrISMA infrastructure provides access to Australian-specific and historical Twitter data which most other social media platforms do not, enabling the investigation of Australian-specific data over time.

5.2.3 Qualitative inquiry

The COnsolidated criteria for REporting Qualitative research (COREQ) (Tong et al., 2007) (appendix T) was developed to promote explicit and comprehensive reporting of interviews and focus groups and was used to guide the reporting of the qualitative inquiry (publications 5 and 6).

The limited literature investigating e-cigarette use in Australia suggests e-cigarette use is most prevalent among males, people aged between 13–39 years, and current and former smokers (Australian Institute of Health and Welfare, 2020c; Jongenelis et al., 2019), which is reflective of the composition of individuals interviewed.

5.3 Research Limitations

5.3.1 Scoping review

The review did not assess the quality of the evidence presented in each study, but rather provided an overview regardless of quality as per the methodology outlined in the Manual for Scoping Reviews developed by the Joanna Briggs Institute (Peters et al., 2015).

The search strategy included several popular terms used to describe e-cigarettes; however, keywords including emerging and variations of slang terms may have been overlooked and therefore, resulted in an incomplete retrieval of identified research.

Additional studies relevant to the research question may have been identified if alternative databases were searched.

The reviewed studies reflect a general bias toward certain social media platforms such as Twitter as its data are mostly public and easily accessible to researchers, whereas Facebook and other platforms are not (Weller, Bruns, Burgess, Mahrt, & Puschmann, 2014). This is not an indication that Facebook and other platforms are not spaces where e-cigarettes are discussed, but only that these activities are not accessible to researchers.

5.3.2 Twitter inquiry

The Twitter inquiry (publications 3 and 4) examined data from one social media platform, Twitter, as its data are mostly public and easily accessible to researchers, whereas some other social media platforms are not as readily accessible.

The data were limited to tweets posted and retweeted by Australian users. Therefore, the findings may not be reflective of other social media platforms or people in different countries.

Due to the way that the Australian Twitter Collection gathers tweets from identified Australian accounts, data from non-Australian Twitter users may have been included in the analysis.

The search strategy included several popular terms used to describe e-cigarettes and vaping practices, however, emerging and variations of slang terms may have been overlooked.

The coding process relied on the PhD Scholar's subjective assessment, however, this was mitigated by a particularly thorough investigation of each tweet and user profile, and included the examination of associated commentary to help determine the context of the tweet, and examination of the user's profile page including profile photo, bio, and recent activity.

TriSMA's programmed bot filtering processes were relied upon to remove data posted by questionable accounts. However, through the manual investigation, some Twitter users were signposted as 'suspected bot' accounts. Bot accounts have become more sophisticated over time, better aligning with human activity on Twitter (Tucker, 2019), and as such it was particularly difficult in some instances to ascertain whether some accounts were genuine users or not. Future studies examining Twitter data are encouraged to apply denoising techniques after data collection (Allem & Ferrara, 2016).

5.3.3 Qualitative inquiry

This data was gathered from a small purposive sample within a specific geographical context and time, and therefore may not be generalisable to the broader vaping community or e-cigarette users abroad due to Australia's regulatory environment, absence of mass media advertising and lack of Government endorsement as a smoking cessation aid (National Health and Medical Research Council, 2017). However, the consistency with other research suggests these findings are not atypical.

All participants were adults; therefore, these results may not be generalisable to younger vapers.

As the PhD Scholar was a non-vaping, non-smoking female, this may have presented some challenges for participants who may have viewed the Scholar as an 'outsider' (Dwyer & Buckle, 2009). As a result, some individuals may have provided answers to certain questions about their behaviour that they deemed to be more acceptable (Lavrakas, 2008).

Recruitment relied on voluntary participation, mostly through social media and online forums, which may have attracted a particular type of participant (e.g. enthusiastic vaper, social media user), although this was not evident in the demographics, which reflected a relatively diverse sample. Further, some participants were active in advocacy activities to legalise nicotine vaping which may have reflected their interest in participating in this study.

6. Implications and Recommendations for Public Health Research, Policy, and Practice

The findings highlight a number of areas for consideration. Recommendations for public health research, policy and practice are discussed here.

Continued efforts are required to combat disinformation and misinformation

The practice of public health relies on evidence and clear communication between practitioners and the communities they serve (Jamison et al., 2019), and in the absence of balanced evidence-based dialogue, personal opinion and marketing of e-cigarettes dominate the Twitter landscape. The scientific community is generally still highly regarded as a trustworthy source of information (Chou et al., 2018). However, if disinformation and misinformation continue to be disseminated online this could pose a legitimate threat to public health, as evidenced by the propaganda circulated during the 2014 Ebola outbreak (Oyeyemi, Gabarron, & Wynn, 2014) and the 2020 Coronavirus pandemic (Kouzy et al., 2020). These realities require action, with a combination of regulatory intervention and health groups contributing to peer-reviewed evidence and working with social media platforms to recognise and abate health information and disinformation. Offline, medical and public health practitioners and researchers can work to dispel misinformation and disinformation directly through their built and trusted relationships and networks (Chou et al., 2018).

Broadening and enforcing social media policies to restrict the promotion of e-cigarettes

The Twitter inquiry (publications 3 and 4) demonstrate that some Australian Twitter users are purposefully (with commercial intent) and also inadvertently (through posts by vapers) promoting the use of e-cigarettes. Twitter has a 'paid' advertising policy prohibiting the promotion of tobacco products, accessories, and branding (including e-cigarettes) (Twitter, 2019). The policy, however, does not relate to individual account holders' content, fan pages or groups. The boundaries between owned, paid, earned and shared content has become increasingly blurred (Macnamara, Lwin, Adi, & Zerfass, 2016), with evidence now suggesting 'influencers' are being used to circumvent social media policies (Kirkham, 2019; Vassey, Metayer, Kennedy, & Whitehead, 2020). In the absence of regulations controlling online promotions and formal gateways restricting access to content, posts on social media platforms, such as Twitter, can reach and potentially influence both e-cigarette users and non-users alike (Allem, Majmundar, et al., 2019). Exploring opportunities to

further restrict the commercial promotion of these devices (i.e. unpaid promotion from commercial accounts) on Twitter and other social media platforms is required and one possible solution is to work with social media platforms to voluntarily employ these restrictions (Freeman, 2012). Further, the field of online e-cigarette promotion can learn much from, and contribute to the knowledge of the promotion of other unhealthy commodities (e.g. alcohol, ultra-processed food and beverage, gambling and pharmaceuticals) in the online environment.

Enhanced reporting and surveillance of e-cigarette use to extend public health efforts

The proliferation of social media platforms and Big Data¹⁰ analytics provides the opportunity to explore and monitor people's perceptions of e-cigarettes in near real-time, and what fuels opinion over time (Cole-Lewis et al., 2015; Dai & Hao, 2016). The studies included in the scoping review (publication 2) could be used to establish a sentiment baseline for public health professionals to develop campaigns and interventions (Cole-Lewis et al., 2015), and act as supplementary data to traditional surveys (Dai & Hao, 2016).

The process of undertaking research and publishing results in academic journals can be lengthy. An alarming and frequently quoted statement about the lapse between research and practice is that it takes 17 years to turn 14% of original research into population benefit (Green, Ottoson, García, & Hiatt, 2009). With the e-cigarette industry changing so rapidly, near real-time monitoring and surveillance of how these devices are discussed, promoted, and used on social media should be explored and supplemented with evidence published in academic journals. The need for near real-time monitoring and surveillance also highlights the need to close the chasm between research and practice (Green, 2014). Some government agencies have recognised and are attempting to bridge this gap by introducing research translation initiatives, annual conferences, education programs, and more varied communications (National Health and Medical Research Council, 2000; Public Health England, 2015) as they attempt to move evidence through the publication pipeline faster and more efficiently. However, government departments of health may well have to start considering an investment in near real-time monitoring and surveillance to actively influence social media conversations and create a more balanced discussion concerning e-cigarettes.

The Australian National Drug Strategy Household Survey (NDSHS) has been regularly conducted since 1985, and first provided limited data about e-cigarette use

¹⁰ Big data is a term that applies to the growing availability of large datasets in information technology.

in 2013. Data from the most recent NDSHS (Australian Institute of Health and Welfare, 2020c) reports the most prevalent e-cigarette users are male current and former smokers, which is reflective of the participants interviewed. NDSHS data do not distinguish whether e-cigarette users use nicotine in their vaporisers, nor what type of device they use. Enhanced surveillance and reporting of e-cigarette use within Australia would contribute to a deeper understanding of the population using e-cigarettes, the reasons for using e-cigarettes, and the types of devices used among this cohort, and would assist policymakers to determine where public health efforts should be focused.

The majority of participants interviewed in substudy 3 (qualitative inquiry: publications 5 and 6) who had never smoked cigarettes preferred nicotine-containing products compared to non-nicotine equivalents, of which similar results have been found in an online survey of Australian vapers (Jongenelis et al., 2018). The use of nicotine-containing products has been documented to increase one's risk of nicotine addiction (Cobb, Hendricks, & Eissenberg, 2015) and act as a 'gateway' to tobacco product use (Chapman, Bareham, & Maziak, 2019). Further research to examine the motivations of never-smokers to use nicotine-containing vapouriser products would, therefore, be useful.

The need to implement comprehensive national e-cigarette regulations

Although an investigation by Scott (2019) found some Perth (Western Australia) based e-cigarette retailers display minimum age entry requirements and/or minimum age restrictions to purchase signage in their retail stores, and some participants in substudy 3 (qualitative inquiry: publication 6), some of whom were local retailers, described the industry as "*self-regulating*", concerns have been raised about underage vaping in Australia (Fitzsimmons, 2020; Guerin & White, 2018). In an effort to dissuade youth vaping with or without nicotine, minimum age requirements for purchasing e-cigarette products should be established and consistent regulation of the promotion of these products across Western Australia's brick and mortar retail environments be implemented, as evidence from Scott (2019) indicates e-cigarette products, displays and promotions vary and are exhibited in diverse outlets (i.e. news agencies, supermarkets, petrol stations) accessed by youth.

Most Australian medical colleges and public health researchers support the federal government's precautionary approach to e-cigarette use (Australian Government Department of Health, 2020) and have recently confirmed their support for the now confirmed prescription-based model during the latest Senate Select Committee on

Tobacco Harm Reduction (Commonwealth of Australia, 2020). Implementation of the new legislation will provide an opportunity for decision-makers and public health authorities to convey to the Australian population the latest national requirements for accessing nicotine-containing vaporiser products for smoking cessation. The legislation will also assist in addressing the confusion among some vapers, as demonstrated by substudy 3 (qualitative inquiry: publications 5 and 6) and other Australian based research (Morphett et al., 2019) about the legality of vaping and nicotine use. However, any information will need to be clear and concise, as previous research has reported that e-cigarette health information and advice published by reputable Government organisations are more difficult to comprehend than content published by for-profit entities promoting e-cigarette use (Park, Zhu, & Conway, 2017). Given the health literacy levels of the Australian population are generally low (Australian Bureau of Statistics, 2008, 2019a) and that biases in algorithms underlying online search query recommendations have been found to drive less literate users towards health-related misinformation (Susaria, 2020), these present findings have important implications. Those implications include, but are not limited to:

- increasing the capacity of current and potential e-cigarette users to locate, understand and use web-based information to promote and maintain health;
- the reinforcement of e-cigarette use; and
- organisations to improve the health literacy of e-cigarette information to ensure web-based resources are written at an appropriate literacy level, factually correct and regularly updated.

In addition to the prescription-based model, regulation of product quality and safety standards are required to address the health and safety concerns illuminated by the experiences of the e-cigarette users in substudy 3 (qualitative inquiry: publications 5 and 6). Further considerations for regulation include the setting of maximum nicotine concentrations in e-liquid, minimum standards for manufacture and safety, appropriate restrictions on advertising, prohibiting supply to minors under 18, and mandatory standards for the labelling of e-liquid (e.g. the inclusion of risk-proportionate health messages concerning toxicity and addictiveness, list of ingredients, advice to keep out of reach of children, and advice on overdose management) (Commonwealth of Australia, 2020). Currently, e-cigarette users and health professionals are being encouraged to report any suspected side effects related to e-cigarette use to a Therapeutic Goods Administration managed website

for reporting generic side effects to medicines and medical devices (Australian Government, 2020c). The efficacy of this reporting system should be monitored and changes to the system should be made as required. Alternatively, a specific system for the reporting of harmful effects of e-cigarette use and the recall of unsafe e-cigarette products and other related issues could be created. Several other jurisdictions including Canada, the European Union, the UK and the U.S. have introduced elements of the aforementioned safety measures (Commonwealth of Australia, 2020) which Australia could learn from.

Some public health academics and professionals contend that countries adopting a precautionary approach to e-cigarettes penalise tobacco smokers seeking an alternative smoking cessation product (Gartner, 2018; Levy et al., 2017; Mendelsohn, Hall, & Borland, 2020). However, Australia's precautionary approach aims to safeguard public health and restrict youth and non-smokers from taking up the practice in large numbers (Australian Government Department of Health, 2019), which has been documented in other countries that have liberalised nicotine vaping (e.g. U.S., Canada and New Zealand (Cullen et al., 2018; Hammond et al., 2019; Walker et al., 2020)). The continued application of the precautionary principle to e-cigarette use in Australia (Jancey et al., 2018) may prevent future adverse tobacco-related public health consequences (Bush, Holsinger, & Prybil, 2016).

7. Conclusion

This research comprised three components: a) scoping review, b) Twitter inquiry and c) qualitative inquiry, providing data on the current literature, e-cigarette related discourse on Twitter and perspectives of e-cigarette users.

The Twitter landscape is dominated by pro-vaping messages disseminated by the vaping industry and e-cigarette proponents, with limited discourse stemming from the public health sector. This limited discourse by public health may reflect the sector's cautious approach due to the inconclusive health evidence and conflicting opinions on e-cigarettes role and safety, or perhaps the agitating nature of the pro-vaper discourse.

Latest generation e-cigarettes are resembling less and less their first-generation *cig-a-like* counterparts and are being promoted not only as a smoking cessation device and safer alternative to smoking but also as a recreational activity whereby you can create your own unique vaping experience with the use of flavours, device modification, and vape tricks.

Despite Australia's cautious approach to e-cigarettes and the limited evidence supporting e-cigarettes as an efficacious smoking cessation aid, it is evident that there is a concerted effort by some Twitter users to promote these devices as a harmless, health conducive, smoking cessation product. Further, Twitter is being used in an attempt to circumvent Australian regulation and advocate for a liberal approach to personal vaporisers. The borderless nature of social media presents a clear challenge for enforcing Article 13 of the World Health Organization Framework Convention on Tobacco Control (WHO FCTC).

As 'digital media' consumption has increased, content that was previously inaccessible due to conventional advertising regulations, such as tobacco advertising, is now visible, and traditional tobacco control regulations are no longer adequate. The internet is the perfect platform to promote e-cigarettes, even in a highly regulated country such as Australia. Countering the advertising and promotion of these products is a public health challenge that will require cross-border co-operation with other WHO FCTC parties.

Few studies have explored vapers' motivations for use, reinforcing influences, and association with the vaper subculture, especially within the unique regulatory context of Australia. Vapers largely started vaping to quit smoking and underwent common experiences during their initiation phase. Subsequently, vapers tended to adopt one

of two vaper identities, that of the 'cloud chaser' or the 'substitute', which some users moved between during different stages of their vaping 'career'. The social and symbolic meaning of e-cigarettes and vaping were diverse. 'Cloud chasers' connected with the vaper subculture in varying degrees and involved concepts of pleasure, community and performance. However, the aesthetic and performance part of the subculture, in particular, had little appeal to 'substitute' vapers who largely viewed their use of e-cigarettes as a means to quit smoking, and enjoyment did not play a substantive role in their use. Understanding the complexities of vaping, and the nuanced differences of 'cloud chasers' and 'substitute' vapers may have important implications for health communication, research and policy. These findings add to the understanding of the varying motives for e-cigarette use and provide new insights into the socialisation process and subsequent identity adoption of Western Australian vapers.

This research found some vapers were unsure about the legality of importing, accessing and using nicotine, however many continued to circumvent Western Australia's restrictions to obtain e-cigarette and liquid nicotine products through importation, local retail stores and home vendors. The Australian Therapeutic Goods Administration has recently (21 December 2020) confirmed that from 1 October 2021 smokers who have tried quitting with other approved cessation pharmacotherapies will be required to obtain a prescription for nicotine-containing vaporiser products from a registered medical practitioner if they want to use them. The results of this study suggest further consideration of regulatory measures are however required to support the different characteristics of vapers and to mitigate the health and safety concerns experienced by e-cigarette users.

Appendices

Appendix A: Copyright permissions

McCausland, K., Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633>

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McCausland, K., Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/>

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McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. JMIR Public Health and Surveillance, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/>

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McCausland, K., Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. BMC Public Health, 20:1552. <https://doi.org/10.1186/s12889-020-09651-z>

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McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94:103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

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Jancey, J., Maycock, B., McCausland, K., Howat, P. (2018). E-cigarettes: Implications for health promotion in the Asian Pacific Region. *Asia Pacific Journal of Public Health*, 30(4):321–327. <https://journals.sagepub.com/doi/10.1177/1010539518762855>

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Sharma, A., McCausland, K., Jancey, J. (2021). Adolescent's health perceptions of e-cigarettes: A systematic review. American Journal of Preventive Medicine, 60(5):P716-725. <https://doi.org/10.1016/j.amepre.2020.12.013>

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Appendix B: Co-author contributions

The International Committee of Medical Journal Editors (2020) recommends that authorship be based on the following four criteria:

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; and
2. Drafting the work or revising it critically for important intellectual content; and
3. Final approval of the version to be published; and
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Based on the above, those contributors who meet all four criteria for authorship have been provided co-authorship and those who do not have been acknowledged in the respective publication.

The following works included the following authorship contribution and acknowledgement statements:

McCausland, K., Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633>

KM, JJ, and BM conceptualised the research. KM drafted the protocol. JJ and BM aided in developing the research question and study methods and contributed meaningfully to editing and approved the final manuscript.

McCausland, K., Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/>

KM, JJ, and BM conceptualised the research. KM drafted the manuscript, and JJ and BM aided in developing the research question and study methods. All authors contributed meaningfully to editing and approved the final manuscript.

McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Thomson, K., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. JMIR Public Health and Surveillance, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/>

JJ, BM, TL, KW, and KM acquired the funding. KM, JJ, BM, TL, and KW conceptualised the study and methodology. KM performed project administration, curated the data, and wrote the original draft of the manuscript. JJ, BM, and TL supervised the study. KM and KT performed the formal analysis. Review and editing of the manuscript were performed by BF, JJ, BM, KW, and TL.

We would like to acknowledge Dr Kevin Chai, Dr Alkim Ozaygen, and Dr Yun Zhao from Curtin University for their assistance with data collection and statistical analyses. We would also like to thank the Cancer Council Western Australia, Australian Council on Smoking and Health, Public Health Advocacy Institute of Western Australia, and Royal Australian College of General Practitioners Western Australia for being members of the study's advisory committee; they provided advice to the research team to help guide the implementation of the project, use of generated data, and dissemination of the research findings.

McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. JMIR Public Health and Surveillance, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/>

Funding acquisition: JJ, BM, TL, KW, and KM; conceptualisation: KM, JJ, BM, TL, and KW; project administration: KM; supervision: JJ, BM, and TL; data curation: KM; formal analysis: KM; methodology: KM, JJ, BM, TL, and KW; writing—original draft: KM; writing—review and editing: BF, JJ, BM, KW, and TL.

We would like to acknowledge Dr Kevin Chai, Dr Alkim Ozaygen, and Dr Yun Zhao from Curtin University, for their assistance with data collection and statistical analysis. We would also like to thank the Cancer Council Western Australia, Australian Council on Smoking and Health, Public Health Advocacy Institute of Western Australia, and the Royal Australian College of General Practitioners Western Australia for their contributions as members of the study's advisory committee. They provided advice to the research team to help guide the implementation of the project, use of generated data, and dissemination of the research findings.

McCausland, K., Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. BMC Public Health, 20:1552. <https://doi.org/10.1186/s12889-020-09651-z>

Conception and design of the work: JJ, BM, KM, TL, KW; Data acquisition and analysis: KM; Data interpretation: KM, BM; Writing – original draft: KM; Writing - review and editing: JJ, BM, BF, KW, TL. All authors read and approved the final manuscript.

McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). “Is it banned? Is it illegal?”: Navigating Western Australia’s regulatory environment for e-cigarettes. International Journal of Drug Policy, 94:103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

Kahlia McCausland: Conceptualisation; Methodology; Investigation; Data curation; Formal analysis; Writing - original draft; Project administration. Jonine Jancey: Conceptualisation; Methodology; Writing - review and editing; Funding acquisition; Supervision. Bruce Maycock: Conceptualisation; Methodology; Writing - review and editing; Funding acquisition; Supervision. Tama Leaver: Conceptualisation; Writing - review and editing; Funding acquisition; Supervision. Katharina Wolf: Conceptualisation; Writing - review and editing; Funding acquisition; Supervision. Becky Freeman: Writing - review and editing.

Appendix C: Co-author contribution statements



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I, Associate Professor Jonine Jancey, contributed as the Primary Supervisor of the PhD. I had an ongoing, close relationship with the research, including conceptualisation of the study design and analysis, discussing the structure of publications, reading draft manuscripts and making suggestions for improvements for all publications:

1. McCausland, K., Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633>
2. McCausland, K., Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/>
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4. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. *JMIR Public Health and Surveillance*, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/>
5. McCausland, K., Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. *BMC Public Health*, 20, 1552. <https://doi.org/10.1186/s12889-020-09851-z>
6. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94, 103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

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20 December 2020

I, Professor Bruce Maycock contributed as a Co-Supervisor of the PhD in my previous appointment as Professor of Public Health, Curtin University. I had an ongoing, close relationship with the research, including conceptualisation of the study design and analysis, discussing the structure of publications, reading draft manuscripts and making suggestions for improvements for all publications:

1. McCausland, K., Maycock, B., Jancey, J. (2017). The messages presented in online electronic cigarette promotions and discussions: A scoping review protocol. *BMJ Open*, 7:e018633. <https://bmjopen.bmj.com/content/7/11/e018633>
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6. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94, 103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

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I, Professor Tama Leaver, contributed as an Associate Supervisor of the PhD. I contributed to the conceptualisation of the study design and analysis for publications 2 and 3, and contributed to discussions concerning the structure of publications, read draft manuscripts and made suggestions for improvements for the following publications:

1. McCausland, K., Maycock, B., Leaver, T., Jancey, J. (2019). The messages presented in electronic cigarette-related social media promotions and discussion: Scoping review. *Journal of Medical Internet Research*, 21(2):e11953. <https://www.jmir.org/2019/2/e11953/>
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5. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94, 103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

Professor Tama Leaver (Associate Supervisor, co-author)

Kahlia McCausland (Candidate)



20 December 2020

Dr Katharina Wolf
Associate Professor
School of Marketing

I, Associate Professor Katharina Wolf, contributed as a collaborator and Associate Supervisor of the PhD, and contributed to the study design, read draft manuscripts and suggested improvements.

I contributed as a collaborator to the following publications:

1. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Thomson, K., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. *JMIR Public Health and Surveillance*, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/>
2. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. *JMIR Public Health and Surveillance*, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/>

I contributed as an Associate Supervisor of the PhD for the following publications:

3. McCausland, K., Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. *BMC Public Health*, 20, 1552. <https://doi.org/10.1186/s12889-020-09651-z>
4. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021). "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94, 103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

Associate Professor Katharina Wolf (Associate Supervisor, co-author)

Kahlia McCausland (Candidate)



Dr Becky Freeman
Senior Lecturer
Prevention Research Collaboration

20 December 2020

I, Dr Becky Freeman, contributed as a collaborator and contributed to the study design, read draft manuscripts, and suggested improvements for the following publications:

1. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Thomson, K., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. *JMIR Public Health and Surveillance*, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/>
2. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2020). E-cigarette advocates on Twitter: Content analysis of vaping-related tweets. *JMIR Public Health and Surveillance*, 6(4):e17543. <https://publichealth.jmir.org/2020/4/e17543/>
3. McCausland, K., Jancey, J., Leaver, T., Wolf, K., Freeman, B., Maycock, B. (2020). Motivations for use, identity and the vaper subculture: A qualitative study of the experiences of Western Australian vapers. *BMC Public Health*, 20, 1552. <https://doi.org/10.1186/s12889-020-09651-z>
4. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Jancey, J. (2021) "Is it banned? Is it illegal?": Navigating Western Australia's regulatory environment for e-cigarettes. *International Journal of Drug Policy*, 94, 103177. <https://doi.org/10.1016/j.drugpo.2021.103177>

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Katie Thomson
8 February 2021

I, Katie Thomson contributed as a Research Assistant to the PhD for 8 weeks. During this time, I worked closely with the PhD Scholar to co-create the coding framework developed for the following publication and apply the coding framework to the data. I was provided with an opportunity to read the draft manuscript and suggest changes.

1. McCausland, K., Maycock, B., Leaver, T., Wolf, K., Freeman, B., Thomson, K., Jancey, J. (2020). E-cigarette promotion on Twitter in Australia: Content analysis of tweets. *JMIR Public Health and Surveillance*, 6(4):e15577. <http://publichealth.jmir.org/2020/4/e15577/>

The PhD Scholar tried several times to establish contact with Katie, however, contact could not be made.

I hereby assert the above statement to be a true reflection of events.

Kahlia McCausland (Candidate)

Appendix D: Related works – E-cigarettes: Implications for health promotion in the Asia Pacific Region

Citation: Jancey, J., Maycock, B., **McCausland, K.**, Howat, P. (2018). E-cigarettes: Implications for health promotion in the Asian Pacific Region. *Asia Pacific Journal of Public Health*, 30(4):321–327. <https://doi.org/10.1177/1010539518762855>
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E-Cigarettes: Implications for Health Promotion in the Asian Pacific Region

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Kahlia McCausland, BSc¹, and Peter Howat, PhD¹

Abstract

Since their introduction to the United States in 2007, electronic cigarettes (e-cigarettes) use has grown exponentially. This rapid growth in e-cigarette use has been heralded by some as a potential important public health measure that could ultimately replace tobacco cigarettes, while others recommend a cautionary approach until there is clear evidence they will not become “new tobacco” bringing a possible myriad of other problems. E-cigarettes may have real benefits, however they do expose users and those nearby to organic compounds, solvents and particulate matter, with there being limited data relating to their health impact. It is unclear as to whether this relatively new device has the potential to exacerbate nicotine addictions, or play a part in reducing harm and smoking cessation. The fundamental requirement of public health practice is to do no harm and from the inconclusive evidence we have to date on e-cigarettes, it appears a cautious approach is warranted. This commentary reviews evidence that supports a cautious approach to e-cigarette availability in Australia and the Asian Pacific region.

Keywords

public health, global health, population health, smoking/tobacco/drug abuse

Introduction

The rapid growth of electronic cigarette (e-cigarette; vaping) use globally is heralded by some, including the United Kingdom’s (UK) Royal College of Physicians as well as multinational tobacco companies (“Big Tobacco”), as a potentially important public health measure that could ultimately replace tobacco cigarettes.^{1–3} However, other authoritative groups, including the Office of the Surgeon General of the United States (US), the World Health Organization, and most Australian medical and public health organizations recommend a cautionary approach until there is clear evidence that they will not become the “new tobacco” bringing with it a possible myriad of other problems.^{4–6} This reticence is understandable considering negative perceptions that are associated with Big Tobacco being a major manufacturer and promoter of the product.⁷

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In mid-2015 we concluded, "From the limited evidence available to date on ECs [e-cigarettes], it is apparent that a cautious approach is warranted with a case that supports strict regulation until rigorous research is conducted."⁸ Despite extensive new international publications over the past 30 months, our conclusions and recommendations remain largely unchanged for Australia, which has a very low smoking rate (12% of adults; and only 2% of 12-17 year olds).⁹ For countries with a high smoking rate, for example, several countries of the Asian Pacific region with smoking rates by male adults well in excess of 40%, and Indonesia at 76%,¹⁰ a similar cautious approach is justified.

This commentary reviews evidence that supports a cautious approach to e-cigarette availability in Australia and the Asian Pacific region.

Support and Concerns for E-Cigarettes

The international debate continues in the public media and scientific literature as to whether e-cigarettes should be readily available to the general public. For example, the recent Royal College of Physicians report *Nicotine without Smoke*¹ created substantial conversation among the scientific community and was quickly picked up and cited by the e-cigarette and vaping industry. There were numerous critical reviews of the report and of particular note was the concern relating to the claim of e-cigarettes being 95% less harmful than regular cigarettes, even though there is no scientific data to support this position. Eminent toxicologist Robert Combes and colleague explained that this finding was simply based on a multi-criteria decision analysis study, whereby a group of so-called experts considered the harm of a wide range of tobacco products.¹¹ The products were ranked on a scale where cigarette smoking was ranked at 100% and e-cigarettes at 4%.^{11,12} This ranking was then uncritically cited by Public Health England (a UK executive agency sponsored by the Department of Health)¹³ even though these data were not evidence based. Combes and Balls¹¹ go on to state, "If e-cigarettes are really 'safer,' then their use should be recommended, but only after an intelligent analysis of their risk to human health, based on integrated *in silico*, *in vitro*, and clinical studies for both scientific and logistical reasons." Unfortunately, this figure of 95% has been restated and used to support arguments in favor of e-cigarettes.

Potential E-Cigarette Benefits

However, it must also be acknowledged that e-cigarettes may have real benefits. For example, Levy et al¹⁴ conducted a hypothetical modelling study in the US, where replacing cigarette use with e-cigarettes in their most pessimistic scenario yielded 1.6 million fewer premature deaths and 20.8 million fewer years of life lost over a 10-year period. However, their scenario also acknowledged that it may eventuate that e-cigarettes are actually more harmful than current evidence suggests; there is potential for an increase in initiation into regular e-cigarette use by people including youth who would not otherwise use a nicotine delivery product, resulting in unacceptably high levels of e-cigarette use through normalization of vaping.¹⁴ This assertion by Levy et al,¹⁴ which was made in a US context, is contested by Bauld et al,¹⁵ who presented UK youth (11-16 year olds) data indicating that regular smoking was 1% to 4%, regular e-cigarette use was 1% to 3%, and ever use 7% to 18%. Their contention was that while prevalence of ever use of e-cigarettes rose from 7% in 2016 to 11% in 2017, the prevalence of regular use did not change.

Do No Harm

Fundamental to public health practice is the requirement to do no harm. In their book *Law and the Technologies of the Twenty-First Century*, the authors explore the legal frameworks and

principles through which risk from new technologies can be mitigated.¹⁶ The use of e-cigarettes or vaping is an example of new technology with an impact on health. Central to the risk-mitigation process is the precautionary principle, which is a principle of decision making that requires decision makers in cases where there are threats of environmental or health harm not to use “lack of full scientific certainty” as a reason for not taking measures to prevent such harm.¹⁷

The trigger to invoke a precautionary principle is based on the desire to protect a population from a level of risk, and the acknowledgement that there may be a gap in the evaluation of the level of risk due to insufficient data. This insufficiency may include absence of cause and effect relationship (which for smoking took a long time to demonstrate), quantifiable dose-response relationship, and evidence of the emergence of adverse effects following exposure. Further, in the case of substances that are a priori hazardous or which are potentially hazardous to a certain level of absorption (such as nicotine and vegetable glycerin that are both present in some e-cigarettes), there should be a reversed burden of proof by requiring that the substances be deemed hazardous until ultimately proven otherwise. Until this is done the legislator is not legally entitled to authorize use of the substance unless exceptionally for test purposes. The decision to act is a political decision with decision makers having to determine the level of risk that is acceptable to the society on which the risk will be imposed. In the case of e-cigarettes there is continuing emerging evidence indicating potential harms,^{18,20} and as such the precautionary principle should be followed.

Some reputable public health advocates and medical organizations have been criticized because they support a very cautious approach to the use of e-cigarettes rather than the more liberal approach.^{1,21,22} The Royal College of Physicians¹ review purports that e-cigarettes are used almost exclusively as safer alternatives to cigarette smoking. However, other international authorities are concerned about the potential for their unrestricted use to *renormalize* smoking and to act as a *gateway* to smoking by youth.^{4,5,21,23} There is also concern that the *harm reduction/harm minimization* arguments of the e-cigarette proponents are severely flawed and inappropriately applied.^{3,6,24}

E-Cigarettes and Cigarette Consumption

Barrington-Trimis et al²⁵ identified 3 studies where there were associations between e-cigarette use and subsequent cigarette smoking by adolescents. In one study, they found that adolescents who used e-cigarettes had more than 6 times the odds of initiating cigarette smoking compared with non-e-cigarette users. These findings suggest that e-cigarette use may increase the risk of smoking during the transition to adulthood. A systematic review and meta-analysis of 9 longitudinal studies of over 17 000 young people found that e-cigarette users had at least a 3-fold risk of becoming cigarette smokers after adjustments were made to factors that predict cigarette smoking.²³ The authors concluded that “Strong e-cigarette regulation could potentially curb use among youth and possibly limit the future population-level burden of cigarette smoking.”²³ A Canadian study that tracked teenagers over 12 months found that users of e-cigarettes were almost twice as likely to become regular cigarette smokers, with a study by Chatterjee et al²⁶ making a similar conclusion in their review of longitudinal studies. This adds weight to the concern that vaping is a gateway to smoking by “renormalizing” it.²⁷

A recent Italian national study indicated that smokers who used e-cigarettes as an aid to quit smoking had similar abstinence rates (8%) as those using no aid (9%), compared with significantly higher abstinence by those using official quitting methods (15%). Use of e-cigarettes may have been a key motivator for a number of the 8% to quit;²⁸ however, this cannot be proven from such a cross-sectional study alone. This concurs with other recent reviews that concluded that the evidence to date in support of the effectiveness of e-cigarettes in helping smokers quit was inconclusive.^{4,5}

Chemical Composition

Studies indicate that e-cigarette vapor is not as harmless as often claimed, though less harmful than tobacco smoke.^{4,6,8,29} Chemicals and toxins emitted by e-cigarettes have potential to cause adverse health effects. As well as formaldehyde, other carcinogenic compounds can be formed when solvents such as propylene glycol, glycerol, and ethylene glycerol are vaporized.^{4,30} Combes and Balls¹¹ highlight that 9 chemicals found in e-cigarette fluid as listed by the Environmental Protection Authority of the US State of California are of concern in regard to human safety. These include acetaldehyde, cadmium, isoprene, lead, nickel, nicotine, N-nitrosornicotine, and toluene. There is also potential for the heating element and associated components (eg, adhesives and solders) to shed particles on heating. This all requires investigation. However, Combes and Balls¹¹ emphasize that the way that e-cigarettes are used makes risk assessment of chemical exposure more challenging because of the way the delivery device is used, how often it is used, the differences in e-cigarette design, and the composition of the e-juice (mixture used in vapor devices).

Availability and Promotion

Evidence from the UK and Germany concludes that the ready availability of e-cigarettes in community outlets accompanied by promotions makes these products attractive to children.³¹ Most European Union member states have advertising bans on e-cigarettes but promotion of the product still occurs there and in many other countries.^{3,6} A total of 40% of respondents aged ≥ 15 years in 28 European Union member states reported having been exposed to e-cigarette advertising or promotion in the previous 12 months.³¹ In the US, marketing of e-cigarettes is carried out by using techniques similar to those used for tobacco cigarettes, with high levels of exposure to youth and young adults.⁶

Tobacco companies are increasing their advocacy for e-cigarettes as they claim they plan to eventually replace their tobacco products with the much safer e-cigarette alternative.^{2,3} Tobacco control experts, however, are concerned about the dubious tactics of the tobacco industry. They claim that promotional activities to date lure nonsmokers, especially young people to the new product, rather than just encouraging current smokers to switch to e-cigarettes as a quit aid.⁶ Daube et al⁷ are very clear that Phillip Morris and associated global tobacco companies cannot be trusted as they continue to pour millions of dollars into undermining the global "tobacco control" movement. It is very unlikely they are serious about a "tobacco-free world." Evidence from leaked documents offers no indication that the tobacco industry has become less cynical and dishonest over time. Their hypocrisy is epitomized in Phillip Morris's youth-oriented marketing of their "Be Marlboro" cigarette campaign targeting low- and middle-income countries.⁷

A critical question is posed for the future. *If the target of e-cigarette sales is current tobacco smokers, who will be the target once the numbers of smokers continues to fall to very low levels?* Can we trust that the e-cigarette manufacturers will not make their main target young people as the tobacco industry did so successfully over many decades? Now that Big Tobacco is a major player, such a scenario is very likely considering their unethical marketing record. Indeed, there is evidence this is already happening worldwide.^{6,7}

What Is the Sensible Way Forward for Australia and the Asian Pacific Region?

Despite considerable progress in research on e-cigarettes with many studies funded by eminent funding bodies like the Australian National Health and Medical Research Council and the US National Institutes of Health, it is likely that we are still at least a couple of years away from reasonably

conclusive findings. Limitations of research to date and conflicting and inconclusive results support continuation of a relatively cautious approach to policy regulating e-cigarette use globally.

In light of the growing incidence of lung cancer in low- and middle-income countries, a *Lancet* Editorial also supports this stance by concluding, "The fact remains that most lung cancers are highly preventable, and could almost all be avoided through tobacco control."³² The editorial acknowledges that appropriate policies in relation to the escalating use of e-cigarettes must be a key element in global tobacco control. They call for regulation of e-cigarettes that will protect youth and other vulnerable people from the potential gateway effect on smoking and minimize potential renormalization of smoking. On the other hand, they concede that e-cigarettes should be accessible to addicted smokers as part of a quit strategy.³²

Proponents in Australia also argue that it would be desirable if there was better availability of e-cigarettes than currently is the case for addicted smokers trying to quit.³³ This appears a challenge, as it seems that only a small proportion of e-cigarette users currently obtain their supplies via medical prescription from a pharmacy, the only legal avenue in Australia. Evidence at the recent Australian Parliamentary Inquiry suggests that there is a thriving "black market" of e-cigarette products including liquid nicotine that are readily available.³ A range of retail stores and markets as well as online sources sell the products with a concomitant range of health and safety standards. Hence, to better control the "illegal" trade in e-cigarettes consideration *may* be given to extending availability to other special outlets besides pharmacists such as selected outlets that sell cigarettes, but still under medical prescription. Such a regulated scheme where the Therapeutic Goods Administration approves licensing of their sales may ensure better health and safety quality control over the products. It is assumed that similar restricted availability of e-cigarettes would be possible in other countries of the Asian Pacific region but considering the unique circumstances of each country.⁵

Surveys indicate that a majority of people support significant restrictions on e-cigarette use. An Australian Institute of Health and Welfare⁹ report indicates strong public support in Australia for restrictions on the use of e-cigarettes in public places (66%) and on advertising of them, plus a ban on their sales to under 18 year olds (75%). Similarly, an European Union-wide survey on the use of e-cigarettes in public places found that 79% of never smokers, 63% of former smokers, and 46% of current smokers supported a ban.³⁴ A systematic review found that there was no clear evidence that restrictions on e-cigarette use in public places would deter smokers switching to e-cigarettes for harm reduction purposes.³⁵

Conclusions

From the inconclusive evidence we have to date on e-cigarettes, it is apparent that a cautious approach is warranted with a case that supports strict regulation until rigorous research results are published. More randomized controlled trials are needed to compare e-cigarettes with other nicotine-replacement therapies, and research studies should be designed to assess long-term health outcomes of e-cigarette use. The same rigor that is applied to new therapeutic products should be applied to e-cigarettes.⁸ Above all we must support the precautionary principle, which is a principle of decision making that requires decision makers in cases where there are threats of environmental or health harm not to use "lack of full scientific certainty" as a reason for not taking measures to prevent such harm.¹⁷ The trigger to invoke a precautionary principle is based on the desire to protect a population from a level of risk, and the acknowledgement that there may be a gap in the evaluation of the level of risk due to insufficient data on the health impact of e-cigarettes.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix E: Related works – Adolescent’s health perceptions of e-cigarettes: A systematic review

Sharma, A., **McCausland, K.**, Jancey, J. (2021). Adolescent’s health perceptions of e-cigarettes: A systematic review. *American Journal of Preventive Medicine*, 60(5):P716-725. <https://doi.org/10.1016/j.amepre.2020.12.013> [Impact Factor 4.420]

Adolescent's Health Perceptions of E-Cigarettes:
A Systematic Review



Anupriya Sharma, MPH,¹ Kahlia McCausland, BSc,² Jonine Jancey, PhD²

Context: E-cigarette use is increasing among adolescents, particularly in high-income countries. This review examines the health perceptions of E-cigarettes among adolescents (aged 12–17 years) residing in the U.S., United Kingdom, Canada, Australia, and New Zealand and their sources of E-cigarette information.

Evidence acquisition: Peer-reviewed literature published in January 2009–April 2019 in MEDLINE, Embase, and ProQuest were systematically reviewed using identified keywords. The search identified 654 references. Studies ($n=99$) that met the inclusion criteria were subjected to full-text screening. A total of 27 articles were subjected to quality appraisal using the Joanna Briggs Institute's critical appraisal checklists.

Evidence synthesis: A total of 7 qualitative and 18 quantitative studies were included in the review, and the study characteristics, results, and limitations were extracted. A total of 4 main themes emerged from the study findings: (1) perceived relative harm of E-cigarettes versus that of cigarettes, (2) perceived health effects of E-cigarettes, (3) perceived benefits and safety of E-cigarettes, and (4) sources of E-cigarette information and exposure. Most adolescents perceived E-cigarettes to be less harmful than cigarettes; however, often, their health perceptions of E-cigarettes were conflicting. Sources of exposure to E-cigarette information included friends, family, retail point of sale, TV and online advertising, national agencies, healthcare providers, and from direct experience.

Conclusions: Findings indicate that adolescents, particularly E-cigarette users, have more favorable perceptions of E-cigarettes than of cigarettes; however, these perceptions are conflicting. Advertising, marketing, and peer and family networks appear to influence adolescents' perceptions. More research is required, particularly in Australia and New Zealand, to better understand adolescents' health perceptions of E-cigarettes and where they source information from so that misperceptions can be addressed through appropriate channels with suitable messaging.

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CONTEXT

E-cigarettes are battery-operated devices containing a liquid (electronic liquid [e-liquid]) usually comprising an amalgamation of nicotine, flavored compounds, propylene glycol, and glycerine, which once heated forms an aerosol that users inhale. After being introduced to the American market in the middle 2000s,¹ they were primarily manufactured and marketed globally by independent E-cigarette companies. However, E-cigarettes have since undergone rapid diversification and investment from the tobacco

industry,² and there are now 3 broad classifications of E-cigarettes—disposables (the device is discarded after e-liquid is exhausted), closed reusable systems (user purchases prefilled e-liquid cartridges), and open reusable

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systems (the device contains a tank reservoir that users refill with e-liquids of their choice).³ Many of the disposable and early edition pen-style systems were designed to mimic the design of cigarettes. Recently, the tobacco company Altria acquired the E-cigarette brand JUUL,⁴ transforming the E-cigarette marketplace by developing a Universal Serial Bus (USB)-shaped device that uses novel chemistry (nicotine salts), enabling higher nicotine concentrations in a limited aerosol plume.⁵

The increased uptake of E-cigarettes⁶ among American adolescents has been hailed as an epidemic by the U.S. Surgeon General, public health leaders, and the former U.S. Food and Drug Administration Commissioner.^{7,8} In 2020, a total of 3.6 million American adolescents, including 19.6% of high school students and 4.7% of middle school students, used E-cigarettes (≥ 1 day in the past 30 days).⁹ Increased rates of vaping among adolescents in Canada,¹⁰ New Zealand (NZ),¹¹ the United Kingdom (UK),¹² and Australia¹³ have also been documented, although not to the same extent as in the U.S. The differences in adolescent uptake among these countries could be attributed to the diverse regulatory frameworks the countries have implemented.¹⁴

The popularity and variety of available flavored E-cigarettes¹⁵ are a primary concern regarding the public health implications of these products. Numerous studies have demonstrated that candy-, fruit-, and menthol-flavored E-cigarettes are appealing to adolescents,^{16–19} and widespread and unregulated availability of E-cigarettes may facilitate youth nicotine addiction, replicate smoking behaviors, and result in the use of conventional tobacco products.^{20,21}

Adolescents may initiate E-cigarette use because they perceive them to be less harmful or less addictive than cigarettes,^{22,23} especially in the context of attractive and seemingly harmless flavors.²⁴ A recent systematic review found an increase in E-cigarette marketing expenditure and online engagement through social media and concluded that exposure to E-cigarette marketing may be associated with lower harm perceptions of E-cigarettes and adolescent's intention to use and try E-cigarettes.²⁵

The National Academies of Sciences, Engineering, and Medicine report that E-cigarettes contain fewer and lower levels of toxicants than cigarettes and pose less risk to individuals because they do not contain tobacco and no combustion is involved. Furthermore, E-cigarettes may potentially reduce harm among current smokers if they completely transition to E-cigarettes and abstain from cigarettes.²⁶ However, evidence also indicates that these products are not entirely harmless.²⁷ This is particularly pertinent to adolescents, with the U.S. Surgeon General declaring E-cigarette use as “unsafe, even if they do not progress to future cigarette

smoking.”²⁸ Nicotine exposure during adolescence can have detrimental effects on the developing brain, affecting learning, memory, and attention capabilities. In addition, E-cigarette use can expose both users and bystanders to aerosols containing harmful substances, including heavy metals, volatile organic compounds, and ultrafine particles.¹

Given the conflicting discourse surrounding E-cigarettes^{28,29} in the media, academia, and political arena, it is critical to understand adolescents' health perceptions of E-cigarettes and the sources they use to obtain E-cigarette information. To the best of the authors' knowledge, this is the first study to systematically review literature examining the health perceptions of E-cigarettes among adolescents aged 12–17 years living in the U.S., UK, Canada, Australia, and NZ.

Electronic vaporizers are referred to by a multitude of names³⁰ by retailers and consumers (e.g., mod, vape, electronic hookah) and in the academic literature (e.g., electronic nicotine delivery device and nicotine vaping products). This paper uses the term E-cigarette to include the various electronic vaporizers that are available.

EVIDENCE ACQUISITION

This systematic review (without meta-analysis) was prospectively registered with International Prospective Register of Systematic Reviews³¹ (registration number CRD42019131253) on April 18, 2019, and it adhered to the PRISMA checklist.³²

Search Strategy Development

The search was guided by the sample, phenomenon of interest, design, evaluation, and research type framework.³³ The sample (target group) included adolescents aged 12–17 years living in the U.S., UK, Canada, Australia, or NZ. The phenomenon of interest (behaviors, experiences, and interventions) was the health perception of E-cigarette use. Design (study designs) included all study designs. The evaluation (outcome measures) was health perceptions (attitudes, beliefs, and knowledge). Research type (of research studies) included peer-reviewed qualitative and quantitative studies.

Perception is defined as a belief or opinion often held by people on the basis of how things seem,³⁴ is closely related to attitudes,³⁵ and is influenced by previous knowledge.³⁶ Therefore, to ensure that relevant data were collected on perceptions, the terms *knowledge*, *attitude*, and *belief* were included in the search strategy.

Eligibility Criteria

Eligible articles were peer-reviewed primary research studies (quantitative or qualitative) published in English

between January 2009 and June 2019. Articles characterized as literature reviews, systematic reviews, meta-analyses, gray literature, editorials, and thesis publications were excluded. There are various definitions of youth and adolescence, with the terms used interchangeably. The WHO defines *young people* (a term combining adolescents and youth) as those aged 10–24 years and *adolescents* as those aged 10–19 years,³⁷ and the National Strategy for Young Australians defines *young people* as those aged 12–24 years.³⁸ In addition, the medical subject heading *adolescent* is defined as a person aged 13–18 years.³⁹ Because individuals aged 18 years in Australia,⁴⁰ Canada,⁴¹ and the UK⁴² are legally adults, the authors defined this study's age range as 12–17 years. The review only included studies of adolescents aged 12–17 years from the U.S., UK, Canada, Australia, and NZ. These are high-income countries as defined by the World Bank,⁴³ their predominant language is English,⁴⁴ and they have relatively similar health profiles.⁴⁵ Studies reporting the inclusion of participants both within and outside the age criteria were included if the results were reported separately for adolescents aged 12–17 years. Articles reporting adolescents' perceptions of E-cigarettes before the application of an intervention were also included.

Information Sources and Search Strategy

The Curtin University Faculty Librarian guided the identification of appropriate scholarly databases (i.e., MEDLINE, ProQuest, and Embase). An initial search of the keywords *e-cigarette* and *knowledge* was conducted in MEDLINE, followed by an analysis of the keywords used in the titles of retrieved studies and the associated indexed terms and medical subject headings that assisted in developing the search strategy.

The final search strategy was *electronic cigarette* OR e-cigarette* OR electr* nicotine delivery system* OR personal vapo? ri? er* OR electr* nicotine delivery device* OR vape pen OR e-hookah OR JUUL OR vap** AND (*adolescent* OR youth* OR teen* OR middle school* OR high school* OR juvenile**) AND (*health knowledge OR health literacy OR health knowledge, attitudes, and practice OR perception* OR health risk perception* OR knowledge OR belief* OR harm perception* OR perceived harm* OR attitude**).

Selection Process

The search strategy results are presented in a PRISMA flow diagram (Figure 1). The search strategy was entered into each database on May 1, 2019, and all retrieved citations (N=654) were imported into EndNote, version X8. Duplicate citations were removed (n=249). The remaining 405 citations were imported into Covidence, an

online screening tool that guides reviewers through the key stages of the systematic review process.⁴⁶ A total of 2 reviewers (AS and KM) independently screened all titles and abstracts for eligibility, resulting in 309 excluded studies. Reviewer JJ resolved any uncertainties. A total of 99 full texts were assessed for eligibility. A total of 72 studies were excluded owing to the country not meeting the inclusion criteria, did not examine research outcomes, adults being included only, and results for participants aged 12–17 years were not reported separately from those outside the review's age range. A total of 27 studies were quality appraised.

Quality Assessment and Data Extraction

The Joanna Briggs Institute critical appraisal checklists were used to assess the quality of studies (reliability, validity, trustworthiness, and credibility) because they were specific to the various study designs (qualitative research, analytical cross-sectional, cohort, and RCT [Appendix 1, available online]) in this review.^{47,48} The Joanna Briggs Institute checklists have been approved by the Joanna Briggs Institute Scientific Committee after an extensive peer review. AS and JJ assessed the quality of the studies. Reviewer KM resolved conflicts or uncertainties. A total of 2 studies did not meet the quality requirements and were excluded. Risk of bias was not assessed given the differing methodologies (qualitative and quantitative) of identified studies.

Data from the 25 articles were extracted, guided by a data extraction pro forma (Appendix Table 1, available online). Information on the authors, year of study, study design, participants (age, sex, ethnicity, and E-cigarette user status), country of study, sample pool and size, sampling method, response rate, results, and limitations were extracted.

Data Analysis and Synthesis

The primary reviewer (AS) utilized thematic analysis to aggregate the data (qualitative and quantitative results) into broad themes. These themes were presented to 2 reviewers (JJ and KM) to further refine and ensure validity and credibility.⁴⁹ Particular descriptive quotes from qualitative studies were chosen for their ability to support the presented findings.

EVIDENCE SYNTHESIS

Characteristics of Included Studies

Included studies were conducted in the U.S. (n=19),^{16,50–67} UK (n=5),^{68–72} and Canada (n=1).⁷³ No studies were identified as originating from Australia or NZ. Of the 25 included studies, 13 were cross-sectional,^{16,51–53,59–61, 63,65–67,69,72} 7 were qualitative (grounded theory or

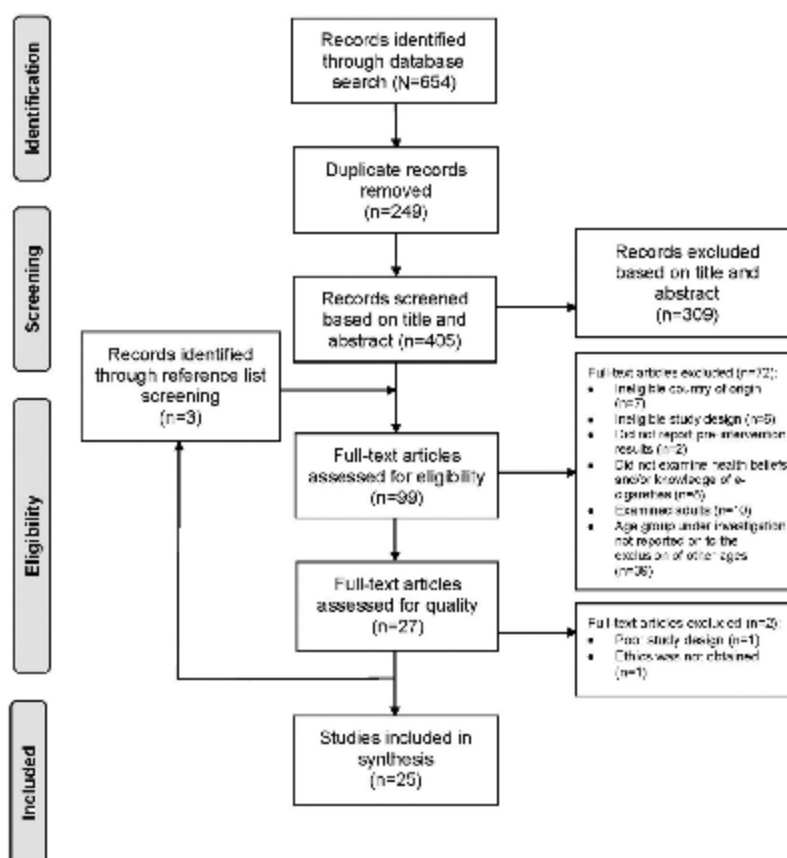


Figure 1. PRISMA flow diagram.

phenomenological),^{50,56,62,68,70,71,73} 3 were cohort,^{54,58,64} and 2 were RCTs.^{55,57} Studies were published between 2013 and 2019, with data collected between 2012 and 2016. Sample size ranged from 25 to 24,658. The study characteristics and results are presented in Appendix Table 2 (available online).

A total of 11 studies used the same data sets,^{51,52,54, 58–61,63,66,70,71} A total of 5 studies were published using the U.S. Population Assessment of Tobacco and Health data from 2013 to 2015.^{54,58,61,63,66} A total of 2 studies used data from the 2012 U.S. National Youth Tobacco Survey,^{51,52} and 2 UK studies used data from the same focus groups.^{70,71} Furthermore, 2 studies analyzed the same online survey data collected in 2016.^{59,60}

The quantitative studies sampling methods included convenience sampling,^{55,57,59,60,64} stratified cluster sampling,^{51,52,65} cluster probability sampling,^{53,67} random location quota sampling,⁷² probability sampling,¹⁶ and stratified sampling.^{54,58,61,63,66,69} Quantitative data were collected using surveys (paper,^{51–53,64,65,72} online,^{55,57,59,60,67,69} and phone¹⁶) and interviews (in person⁷² and audio computer assisted^{54,58,61,63,66}). The qualitative studies sampling methods included convenience sampling,^{50,62,75} stratified quota sampling with snowball sampling techniques,⁷³ and purposive sampling.^{56,70,71} Qualitative data were collected through focus groups^{50,62,68,70,71,73} and telephone interviews.⁵⁶ The response rate of 11 studies (10 quantitative^{16,51–54,}

^{63–67} and 1 qualitative⁶⁸) ranged from 37% to 99%; in 14 studies (8 quantitative^{55,57–61,69,72} and 6 qualitative^{50,56,62,70,71,73}), response rates were either not reported or not applicable. Study limitations included self-reported data,^{51,52,54,56,58,64–66} small sample size,^{50,56,62,70,73} low response rate,^{16,60} non-generalizable data,^{50,51,55,56,60,62,65,67,69–71,73} and inability to show causality.^{52,63,66,69,72}

All studies included male and female participants in almost equal proportions, except for 1 study that only included male young Americans who identified as E-cigarette users.⁶² A total of 9 studies recruited participants from schools.^{51–53,62,64,65,67,68,73} Other approaches included online recruitment (including social media),^{59,60} household recruitment,⁷² and recruitment from a primary health setting⁵⁶ and community groups.^{70,71} A total of 4 studies included only E-cigarette users,^{50,59,60,62} 2 studies included those who had never used E-cigarettes,^{55,56} and 2 studies excluded cigarette users.^{53,66} Most studies ($n=16$) did not sample by smoking or E-cigarette use but included a breakdown of results by smoking or E-cigarette use.^{16,51,52,54,58,61,63–65,67–73}

All studies explored participants' perceptions of the harm or health effects of E-cigarettes,^{16,50–73} with 16 studies exploring perceptions relative to cigarettes.^{51–53,55,56,58,61–64,66–70,73} A total of 12 studies examined perceived benefits and appeal of E-cigarettes (e.g., flavors, social benefits, and stress relieving),^{16,50,53,55,56,60,63,66–70} 7 assessed the knowledge of E-cigarettes (e.g., authors use words including knowledge, know, knew),^{50,56,59,60,68,70,73} 3 examined attitudes (e.g., how adolescents feel [e.g., good, bad, pleasant, annoying] toward E-cigarettes),^{16,57,73} and 4 explored the beliefs about E-cigarettes (e.g., adolescents thinking that E-cigarettes are cool, healthy, harmful).^{57,60–62}

Aggregated Results

A total of 4 key themes emerged from the study findings: (1) perceived relative harm of E-cigarettes versus that of cigarettes, (2) perceived health effects and safety of E-cigarettes, (3) perceived benefits of E-cigarettes, and (4) sources of E-cigarette information and exposure.

Perceived relative harm of E-cigarettes versus that of cigarettes. In 16 studies (64%; 11 quantitative^{51–53,58,61,63,64,66,69} and 5 qualitative^{56,62,68,70,73}), adolescents' perception of the harm from E-cigarettes compared with that from cigarettes was reported. Similarly, across all studies reporting proportions, at least one third reported E-cigarettes as being less harmful than cigarettes,^{51–53,55,56,58,61,62,66,69} and specifically in national surveys conducted in the U.S.^{51,52,58,61,66} and UK,⁶⁹ this

proportion ranged from 34% to 67%. One qualitative study⁶⁸ in the UK reported that E-cigarettes were less harmful than cigarettes owing to the vapor being evaporated water or flavored smoke, and containing fewer toxins, such as tar. However, in 4 quantitative studies in the U.S., between 19% and 44% of adolescents reported E-cigarettes to be as harmful as cigarettes,^{53,58,61,66} and fewer (3%–5%) reported E-cigarettes to be more harmful than cigarettes.^{52,53,58,66}

Of the 8 studies (7 quantitative^{51–53,55,61,63,69} and 1 qualitative⁶⁶) that measured adolescents not knowing or being unsure whether E-cigarettes were more or less harmful than cigarettes, 2 quantitative studies (25%)^{52,53} reporting findings that disaggregated the adolescents' age reported that between 33% and 45% of adolescents did not know how harmful E-cigarettes were compared with cigarettes. Furthermore, the proportion of adolescents (U.S.) who had heard about E-cigarettes but did not know how harmful they were compared with cigarettes decreased as age increased (45% at age 13 years and 42% at age 16 years).⁵²

Dual users (using both cigarettes and E-cigarettes), cigarette-only smokers, and E-cigarette users were more likely to consider E-cigarettes to be less harmful than cigarettes than adolescents who did not smoke cigarettes or use E-cigarettes.^{51–53,62,64,69}

Perceived health effects and safety of E-cigarettes. A total of 18 studies (72%)^{50,52,53,55,56,58–60,62,63,65–68,70–73} reported adolescents' perceptions of the health impact of E-cigarettes. Adolescents believed that E-cigarettes either were likely to harm health,^{50,53,58–60,62,73} did not harm health,^{50,53,58–60,62,73} (most likely to be E-cigarette users in 6 studies^{50,53,59,60,62,73}), or were unsure if there were any risks to health.^{50,52,68,73}

Adolescents in 10 studies (40%; 5 quantitative^{53,55,63,67,72} and 5 qualitative^{56,68,70,71,73}) reported that E-cigarettes could have adverse health impacts. Large surveys of U.S. adolescents revealed that perceived health harm from using E-cigarettes was lower among E-cigarette users and cigarette users than among non-users.^{55,63} Adolescents in the U.S. also reported that E-cigarettes had fewer short-term and long-term health risks than other tobacco products. Nominated short-term health risks from E-cigarette use included lower sports performance (54%), trouble catching one's breath (52%), bad cough (47%), and mouth sores (42%). Long-term health risks from E-cigarette use were tobacco-related disease (68%), lung cancer (61%), wrinkles (61%), oral cancer (57%), heart attack (57%), and tobacco-related death (56%).⁵⁷

A total of 10 studies (40%; 5 quantitative^{53,59,60,63,65} and 5 qualitative^{50,58,62,71,73}) reported no perceived

adverse health impacts from E-cigarettes. A respondent in a qualitative study performed in the UK cited that the National Health Service had verified 1 particular type of E-cigarette as being safe to use⁷¹ because they perceived Medicines and Health Care Products Regulatory Agency regulations as an official statement that medicinal E-cigarettes were safe. Parker et al.⁵⁸ (quantitative study) noted that youth who reported E-cigarettes as posing little or no harm were more than twice as likely to try them than youth who reported the products to pose a lot of harm. Furthermore, Pepper and colleagues⁵⁹ (quantitative study) found that adolescents who use E-cigarettes reported that they were less likely to develop health problems in adulthood than cigarette smokers. E-cigarette users in a qualitative study⁵⁰ said that they used E-cigarettes because they are perfectly safe but would stop using them if they found out that they were harmful to their health.

A total of 3 qualitative studies (12%) reported that adolescents recognized a lack of evidence regarding the safety of E-cigarettes, which is why they reported that E-cigarettes were unsafe/harmful or were unsure about their health impact.^{74,71,73} For example, a male aged 16 years (current smoker and current vaper) said, “We need to find out a bit more about, like, the chemicals that are in it too, like, know whether you’d want to be around vapors.”⁷⁰

Bernat et al. (quantitative study) found that 36% of adolescents were unsure about the health impact of E-cigarettes.⁵³ Similarly, 4 qualitative studies (16%; UK, U.S., and Canada^{50,56,64,73}) reported that adolescents were unsure about the health impact of E-cigarettes. Adolescents (aged 13–16 years) stated, “I feel like they’re going to find some study on them [E-cigarettes] that’s going to find them unhealthy and like cigarettes...”⁵⁰ (14–15-year-old) and “Nobody knows what’s in them” and that “[it] hasn’t been tested what’s inside them [E-cigarettes]...”⁶⁸

A total of 3 studies (12%; 2 quantitative^{53,67} and 1 qualitative⁷⁰) reported that adolescents considered secondhand vapor from E-cigarettes to be unsafe for those exposed, although E-cigarette users had lower odds of reporting that E-cigarette vapor was harmful than never users.⁵³ Conversely, another quantitative study (U.S.) reported that approximately 31% of adolescents said that E-cigarette vapor was not harmful to bystanders.⁵⁵ One Canadian quantitative study reported that adolescents were unsure about the safety of E-cigarette vapor.⁷³

A total of 6 studies (24%; 3 quantitative^{53,63,66} and 3 qualitative^{56,68,73}) identified that adolescents reported E-cigarettes to be addictive. The majority (61%) of U.S. high school students surveyed in 1 quantitative study also reported that people can become addicted to E-cigarettes.⁵³

Perceived benefits of E-cigarettes. A total of 14 studies (56%; 8 quantitative^{16,53–55,57,64,66,72} and 6 qualitative^{50,56,62,68,70,73}) reported adolescents’ perceptions of the benefits of E-cigarettes. The main perceived benefits of E-cigarettes were that they are healthy/healthier than cigarettes,^{56,57,62,64,68} E-cigarette vapor is safe for bystanders,^{55,62,68,70} users have lower perceived susceptibility to nicotine addiction,^{53,56,66,70} and E-cigarettes are used as a smoking-cessation tool.⁷⁰

Bernat and colleagues⁵³ reported that the proportion of adolescents who believed that E-cigarettes would be easy to quit if they chose to ranged from 16% among non-E-cigarette users to 55% among E-cigarette users. A qualitative study on E-cigarette users also reported that they could easily quit if they decided to and if they did not think that they would become addicted to E-cigarettes.⁵⁰ Similarly, in the U.S. Population Assessment of Tobacco and Health study, 4% of adolescents who never smoked and had seen or heard of E-cigarettes but never used them perceived E-cigarettes as being very unlikely to be addictive.⁶⁶ Another qualitative study (U.S.) on mostly nonsmokers reported that E-cigarettes were less addictive than cigarettes because of the small amount of nicotine in them.⁵⁶ For example, a female aged 17 years stated, “I’m thinking that they probably don’t have as much nicotine or whatever is in cigarettes that make[s] them so addictive.”⁵⁶

A total of 1 quantitative study⁵³ found that almost one third (31%) of adolescents reported that using E-cigarettes helped to relieve stress and that E-cigarette users (ever user, past 30-day user, lifetime user) reported this more than adolescents who never used E-cigarettes.

A total of 6 studies (24%; 2 quantitative^{16,72} and 4 qualitative^{50,68,70,73}) reported that adolescents considered the flavors and vapor to be appealing. One quantitative study reported that cherry and candy flavors were perceived as less harmful than tobacco-flavored E-cigarettes.⁷² Experimentation with and the use of E-cigarettes were considered a fun social activity with friends where flavors and smoke tricks could be trialed and discussed.^{53,68,70,73}

Sources of E-cigarette information and exposure. A total of 7 studies discussed the sources of E-cigarette information and exposure (1 quantitative⁷² and 6 qualitative^{50,56,68,70,71,73}). Of these studies, 3 qualitative studies (43%) reported that adolescents were exposed to E-cigarettes by peers, friends, and family.^{50,56,70} Authors also reported exposure to E-cigarette marketing and promotion through posters, billboards, TV, print, radio, retail point of sale,^{56,68,72,73} and online advertising.^{56,70} Other sources of E-cigarette information and exposure included Facebook, Twitter, YouTube, the Internet,^{70,72}

national agencies and healthcare providers,^{56,71} and adolescents' direct experience with E-cigarettes.^{68,71}

DISCUSSION

This is the first systematic review that the authors are aware of to examine the health perceptions of E-cigarettes among adolescents aged 12–17 years living in the U.S., UK, Canada, Australia, and NZ. It is evident from the reviewed studies that there is a mixture of perceptions held by this population about E-cigarettes. In general, regardless of cigarette or E-cigarette user status, adolescents regarded E-cigarettes to be a healthier alternative to cigarettes owing to the perception that nicotine in E-cigarettes is less addictive,^{50,56} that there are minimal chemicals in E-cigarettes,⁶⁸ and that secondhand vapor is safer for bystanders.^{55,62,68,70} Adolescents in 10 studies also perceived no adverse health impacts from using E-cigarettes.^{50,53,58–60,62,63,65,71,73} However, 10 studies also reported that adolescents believed that there were adverse health impacts and were cautious about E-cigarettes on the basis of the lack of evidence regarding their safety, secondhand vapor, and addiction potential.^{53,55,56,63,67,68,70–73}

This mixed perception of harm from E-cigarettes may stem from the lack of clear evidence surrounding their health impacts and lack of consensus within public health, along with misinformation surrounding E-cigarette safety and E-cigarette advertising. For example, E-cigarettes are often promoted as a benign, efficacious smoking-cessation product,^{74,75} a position dramatically contrasting that of the U.S. Office of the Surgeon General, who has stated that any E-cigarette use among young people is unsafe.⁸

Dual users of cigarettes and E-cigarettes, cigarette-only users, and users of E-cigarettes only, were more likely to consider E-cigarettes less harmful than cigarettes.^{51–53,62,64} This decreased harm perception increases the likelihood of E-cigarettes being perceived as attractive and reconciles any cognitive dissonance regarding their use.⁷⁶ E-cigarettes were also perceived to be a stress-reducing agent,⁵³ and the array of flavors were reported to make the product appealing and appear less harmful and more fun,^{50,68,70,72,73} perhaps providing a rationale for adolescents to initiate vaping. Further insights are required for public health to respond and counter these perceptions.

Only 1 qualitative study explicitly discussed why adolescents perceived E-cigarettes as less harmful than cigarettes (e.g., E-cigarette vapor is evaporated water or a flavored smoke and contains fewer toxins such as tar).⁶⁸ Adolescents who perceived this decreased relative harm of E-cigarettes may have been influenced by E-cigarette

marketing and promotion (point of sale, TV, radio, and online), lack of regulation and health warning labels on packaging, and social networks.^{56,62,69–72} Previous research supports this notion, stating that adolescents perceive E-cigarettes to be less harmful than cigarettes because of marketing and lack of regulation.⁷⁷ Other sources of information and exposure, which may influence adolescents' perception of E-cigarettes, varied and included experiences of/with peers, friends, family,^{50,56,62,69,70} direct experience with the product,⁶⁸ and the online environment.^{52,56,70,72} Youth (70%) spend a large proportion of their day on the Internet and social media,^{78,79} an environment where E-cigarette marketing and interactions have been increasing, particularly in the U.S.,²⁵ as multinational tobacco companies investment increases.² In addition, adolescents' decreasing harm perception may be further reinforced by seemingly harmless electronic-juice flavors (e.g., candy and fruit).¹⁶ Beyond this, the potential influence of various country's regulatory environments on adolescents' perceptions of E-cigarettes should also be acknowledged because research suggests that the regulatory framework (less versus more restrictive) adopted by countries can affect the perception of harm.⁸⁰

This systematic review provides evidence that adolescents perceive E-cigarettes to be healthier than cigarettes,^{56,62,64,68} particularly among those who are current E-cigarette or cigarette users. This perception exists despite inconclusive evidence on the health impact of E-cigarettes.^{81,82} In addition, the potential for E-cigarettes to renormalize smoking and act as a gateway for youth smoking cannot be ignored⁸³ because there is evidence that it can lead to the uptake of cigarettes.⁸⁴ This is concerning because the exponential growth in E-cigarette use may undermine the progress made in tobacco control over the last 50 years.

Limitations

All the identified studies were conducted in the U.S., UK, and Canada, with no Australian or NZ studies identified, limiting the understanding of adolescents' health perceptions of E-cigarettes across all investigated countries. Further research, particularly in Australia and NZ, is required to understand adolescents' health perceptions of E-cigarettes. In addition, only 7 studies^{50,56,68–72} provided information on sources of E-cigarette information and exposure. Future studies should incorporate questions about sources of information. Furthermore, several studies used the same data sets,^{51,52,54,58–61,63,70,71} limiting the understanding of adolescents' perspectives. However, this is a new and emerging health area, and therefore, research is limited. A strength of this review is that it incorporated findings from both quantitative and qualitative studies.

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Appendix F: Related works – Submissions to the Select Committee on Tobacco Harm Reduction



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Select Committee on Tobacco Harm Reduction
Committee Secretariat
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600

05/11/2020

Dear Members,

Re: Select Committee on Tobacco Harm Reduction

The Australian Health Promotion Association (AHPA) is the only professional association in Australia specifically for people interested or involved in the practice, policy, research and study of health promotion. The AHPA vision is for a healthy, equitable Australia through leadership, advocacy and workforce development for health promotion practice, research, evaluation and policy. AHPA advocates for the development of healthy living, working and recreational environments for all people. It also supports the participation of communities and groups in decisions that affect their health. The Association supports more than 1000 members, supporters and subscribers, from government agencies, universities, non-government organisations, community-based organisations and groups, private companies and industries, and students. The Association contributes to public health evidence through workforce capacity building and the management of the Health Promotion Journal of Australia as well as the development of position statements and policies on issues of health promotion concern, particularly those which relate to ethics, evidence, equity and the determinants of health.

The Association would like to make some broad comments on the areas covered by the terms of reference. We would also refer you to the work of public health colleagues including work by Professors Mike Daube, Melanie Wakefield and Simon Chapman, Dr Becky Freeman, Cancer Council Australia, Maurice Swanson and the Australian Council on Smoking and Health, the Public Health Association of Australia and colleagues at the Collaboration for Evidence, Research and Impact in Public Health, Associate Professor Jonine Jancey and Kahliia McCausland (KM has led the development of this submission).

Tobacco use is the leading cause of preventable cancer and cardiovascular death and disease in Australia. The history of tobacco control is littered with examples of purported 'reduced harm' products. Where risks and harms for new tobacco products need to be considered as well as potential benefits, adherence to the evidence is critical. Current public health [evidence](#) does not support electronic cigarette (e-cigarette) use. The Commonwealth Department of Health suggests insufficient evidence of the safety of e-cigarettes or their use as an aid for tobacco use cessation. The Australian Chief Medical Officer and State and Territory Chief Health Officers have reiterated that evidence is unclear regarding the short and long term harm of e-cigarettes, highlighting an emerging [link between their use and lung disease](#). Australian governments take a precautionary approach to e-cigarettes. This approach is outlined in the [Principles that underpin the current policy and regulatory approach to \(e-cigarettes\) across Australia](#) and is strongly supported by leading national and international health and medical organisations.

Of particular concern, use is growing at significant rates, particularly among young people. The Cancer Council and National Heart Foundation [Position Statement on Electronic Cigarettes](#) recommend the following measures to protect young people from potential harms of e-cigarette use:

1. Ban the retail sale of non-nicotine e-cigarettes (unless the product has been approved by the TGA).
2. Ensure smoke-free laws in each state and territory cover e-cigarette use.
3. Prohibit advertising and promotion of e-cigarettes, consistent with tobacco advertising prohibitions.

We note that the committee will inquire into tobacco reduction strategies, with particular reference to the following.

- a. the treatment of nicotine vaping products (electronic cigarettes and smokeless tobacco) in developed countries similar to Australia (such as the United Kingdom, New Zealand, the European Union and United States), including but not limited to legislative and regulatory frameworks

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At present, 70 countries have enacted e-cigarette specific policy, with other countries applying a range of product classifications to suit existing policies, including 'tobacco products' (57 countries), 'medicinal products' (24 countries), 'consumer products' (18 countries), and 'nicotine as poisons' (4 countries) (Institute for Global Tobacco Control, 2020). Australia is not the only country to effectively ban the sale of nicotine-containing e-cigarettes, with Jamaica, Japan, and Switzerland also enacting similar approaches (Institute for Global Tobacco Control, n.d).

**Quoted from paper currently under review (McCausland et al., 2020b).*

b. the established evidence on the effectiveness of e-cigarettes as a smoking cessation treatment

We would refer to the National Academies of Sciences Engineering and Medicine (2018) report which states:

- Conclusion 17-1. Overall, there is *limited evidence* that e-cigarettes may be effective aids to promote smoking cessation.
- Conclusion 17-2. There is *moderate evidence* from randomized controlled trials that e-cigarettes with nicotine are more effective than e-cigarettes without nicotine for smoking cessation.
- Conclusion 17-3. There is *insufficient evidence* from randomized controlled trials about the effectiveness of e-cigarettes as cessation aids compared with no treatment or to Food and Drug Administration–approved smoking cessation treatments.
- Conclusion 17-4. While the overall evidence from observational trials is mixed, there is *moderate evidence* from observational studies that more frequent use of e-cigarettes is associated with an increased likelihood of cessation.

c. the established evidence on the uptake of e-cigarettes amongst non-smokers and the potential gateway effect onto traditional tobacco products

We would refer to the National Academies of Sciences Engineering and Medicine (2018) report which states:

- Conclusion 16-1. There is *substantial evidence* that e-cigarette use increases risk of ever using combustible tobacco cigarettes among youth and young adults.
- Conclusion 16-2. Among youth and young adult e-cigarette users who ever use combustible tobacco cigarettes, there is *moderate evidence* that e-cigarette use increases the frequency and intensity of subsequent combustible tobacco cigarette smoking.
- Conclusion 16-3. Among youth and young adult e-cigarette users who ever use combustible tobacco cigarettes, there is *limited evidence* that e-cigarette use increases, in the near term, the duration of subsequent combustible tobacco cigarette smoking.

See also - Guerin and White (2018) (Youth use)

d. evidence of the impact of legalising nicotine vaping products on youth smoking and vaping rates and measures that Australia could adopt to minimise youth smoking and vaping

The United States, where e-cigarette sales are subject to very few restrictions, has observed an exponential increase in vaping, particularly among youth, now being referred to as an 'epidemic' (Food and Drug Administration, 2018). In 2017, e-cigarettes were the most commonly used tobacco product among American high school (11.7%; 1.73 million) and middle school (3.3%; 0.39 million) students (Wang et al., 2018). In contrast, the prevalence of vaping in Australia remains relatively low, however, a significant increase in current and lifetime use has been reported (Australian Institute of Health and Welfare, 2020). The most recent national survey estimates that 2.6% of the Australian adult population currently use e-cigarettes, up from 1.2% in 2016, with use among smokers (4.4% 2016, 9.6% 2019) more prevalent than non-smokers (0.6% 2016, 1.4% 2019) (Australian Institute of Health and Welfare, 2020).

**Quoted from paper currently under review (McCausland et al., 2020b).*

e. access to e-cigarette products under Australia's current regulatory frameworks

Australian's have access to nicotine-containing e-cigarette products via the internet and those who choose to import nicotine-containing products are not currently actively prosecuted. Approximately 70% of Australian e-cigarette purchases are made online (Australian Institute of Health and Welfare, 2020; Euromonitor International, 2018), of which more than 40% of vapers use nicotine-containing products (Yong et al., 2015).

McCausland and colleagues (2020b) conducted a study which aimed to understand how e-cigarette users navigate restrictions to access vaping products and the health and safety issues they encounter in an environment that is relatively unaccepting of the promotion of e-cigarette use as a population health measure. Thirty-seven interviews were conducted with current (n=33, 89%) and former vapers (n=4, 11%). Thirty-two participants (86.5%) were current

or former cigarette smokers and five participants (13.5%) vaped despite having never been a regular smoker. The authors found local vape retailers were circumventing Western Australia's e-cigarette restrictions by selling the components of 'open system' devices that do not necessarily resemble a tobacco product when sold individually. Several participants were unsure of the legality of importing, accessing and using nicotine and e-cigarettes, however, the majority continued to use nicotine-containing vapourisers and implemented strategies in an attempt to avoid detection and safeguard their health. The internet, in particular, was used in a variety of ways to facilitate their access to the required products, exchange information, and obtain new knowledge.

Despite Australia's nicotine restrictions, 81% (n=30) of participants in this study currently used nicotine. Of concern is that the majority of participants who had never smoked preferred these products compared to non-nicotine equivalents, of which similar results have been found in an online survey of Australian vapers (Jongenelis et al., 2018). The use of nicotine-containing products has been documented to increase one's risk of nicotine addiction (Cobb, Hendricks, & Eissenberg, 2015) and act as a 'gateway' to combustible tobacco product use (Chapman, Bareham, & Maziak, 2019).

Although an investigation by Scott (2019) found some Perth based retailers display minimum age entry requirements and/or restrictions to purchase signage, and some participants in the study by McCausland and colleagues (ref – under review study), some of whom were local retailers, described the local e-cigarette industry as "self-regulating", concerns have been raised about underage vaping in Australia (Fitzsimmons, 2020; Guerin & White, 2018). In an effort to dissuade youth vaping with or without nicotine, we concur with Scott (2019) that minimum age requirements for purchasing should be established and consistent regulation of the promotion of these products across Western Australia's brick and mortar retail environments be implemented, as evidence indicates e-cigarette products, displays and promotions vary and are exhibited in diverse outlets (i.e. newsagencies, supermarkets, petrol stations) accessed by youth. It seems reasonable to suggest these findings should be applied consistently across Australia.

An unintended outcome of Australia's framework, however, has been the development and rapid expansion of a local independent industry who are exploiting loopholes to sell e-cigarette devices (Scott, 2019). Australia's current regulatory framework does function to mostly control the drivers of negative use (i.e. uptake among youth and non-smokers) through limiting nicotine availability, obstructing tobacco industry produced nicotine-containing e-cigarette and heated tobacco products (Tobacco Tactics, 2020) from entering Australian retail stores, and unfettered marketing (Rahman, Hann, Wilson, & Worrall-Carter, 2014) while fostering a local vaping community of predominantly former smokers (Australian Institute of Health and Welfare, 2020) who can meet most of their needs, although through a convoluted process, and without engaging in the criminal system.

**Quoted from paper which is currently under review (McCausland et al., 2020b).*

See also - Liber (2020) AND Waa, Maddox, and Nez Henderson (2020) (Indigenous research)

f. tobacco industry involvement in the selling and marketing of e-cigarettes

The Association supports the current evidence and position of leading health and medical bodies with respect to industry involvement in e-cigarette sales and marketing. For example in their [position statement on e-cigarettes](#), the Cancer Council Australia and National Heart Foundation Australia cite a range of evidence which suggests that "Significantly, electronic cigarette brands, including those owned by tobacco companies, are increasingly becoming involved in sophisticated promotional arrangements reminiscent of strategies previously used to glamorise tobacco". They note that that "Young people are likely to be susceptible to the advertising techniques and new technology associated with electronic cigarettes. Given that electronic cigarettes resemble tobacco cigarettes and allow users to simulate the physical behaviour of smoking tobacco cigarettes, images of smoking behaviour in electronic cigarette advertisements could re-normalise smoking behaviour among young Australians and encourage children to use tobacco cigarettes."

See also -

- *Freeman, Hefler, and Hunt (2019)*
- *Watts and Freeman (2019)*
- *Watts, Hefler, and Freeman (2019)*
- *van der Eijk, Bero, and Malone (2019)*

g. any other related matter.

Health and safety: There are thousands of e-liquid flavours available for retail purchase (Hsu, Sun, & Zhu, 2018) and from home vendors (Cox et al., 2019). These products have been found to contain various excipients, flavourings, additives, potentially hazardous ingredients (Chivers, Janka, Franklin, Mullins, & Larcombe, 2019; Cox et al., 2019) and inaccurately labelled nicotine content (Buettner-Schmidt, Miller, & Balasubramanian, 2016; Chivers et al., 2019; Goniewicz et al., 2015; NSW Government, n.d; Trehy et al., 2011). Some participants reported in the study by McCausland and colleagues* mild adverse effects after using some e-liquids, including dizziness, sore throat, dehydration and nausea. These experiences are not uncommon and have been documented elsewhere (Chen et al., 2020; Cooper, Harrell, & Perry, 2016). Incorrect labelling and discrepancies between the labelled amount and actual nicotine content are misleading and may result in unintended addiction to nicotine and other adverse health effects (Buettner-Schmidt et al., 2016; Chivers et al., 2019).

**Quoted from paper currently under review (McCausland et al., 2020b).*

See also - Wylie et al. (2019)

Australian studies – social media promotion: *See - McCausland et al. (2020a); AND Amin, Dunn, and Laranjo (2020)*

The application of the precautionary approach to e-cigarettes: Although some contend that countries adopting a precautionary approach to e-cigarettes penalise tobacco smokers seeking an alternative smoking cessation product (Gartner, 2018; Levy et al., 2017; Mendelsohn, Hall, & Borland, 2020), those who are motivated, as demonstrated by the vapers in the study by McCausland and colleagues,* manage to navigate the restrictions to obtain the required products through importation and purchasing at local retail stores. Australia's precautionary approach aims to safeguard public health and restrict youth and non-smokers taking up the practice in large numbers (Australian Government Department of Health, 2019), which has been documented in other countries who have liberalised nicotine vaping (e.g. United States, Canada and New Zealand (Cullen et al., 2018; Hammond et al., 2019; Walker et al., 2020)). The continued application of the precautionary principle to e-cigarette use in Australia (Jancey, Maycock, McCausland, & Howat, 2018) may prevent future adverse public health consequences (Bush, Holsinger, & Prybil, 2016), as we have seen occur with the tobacco epidemic (World Health Organization, 2020). Efforts to curb tobacco smoking rates have stigmatised smokers, which can act as a barrier for people to seek support and treatment (Bell, Salmon, Bowers, Bell, & McCullough, 2010). All smokers must be offered non-judgmental, evidence-based support to quit smoking and that smoking cessation is fully integrated into the health system (White, McCaffrey, & Scollo, 2020).

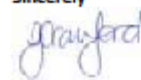
Bowing to pressure to weaken Australia's tobacco control laws to make an exemption for nicotine vaping could also permit the sale of tobacco industry produced heated tobacco and vapour products. Australia is a signatory to the World Health Organization Framework Convention on Tobacco Control which is designed to protect public health policies from commercial and other vested interests and applies to the tobacco industry irrespective of the type of products they are selling. Until there is adequate evidence that e-cigarettes are safe and an efficacious smoking cessation product they should not be promoted as such. This lack of evidence and the power and influence of the tobacco industry justify the application of the precautionary principle and stress the need to future-proof tobacco control legislation against current and future novel tobacco and vapour products.

**Quoted from paper currently under review (McCausland et al., 2020b).*

See also - Jancey et al (2015) (General commentary)

Thank you for the opportunity to raise these important issues with you. If you have any queries or comments, or if you would like to discuss this further, please feel free to email us via: national@healthpromotion.org.au.

Sincerely



Dr Gemma Crawford
National President | Australian Health Promotion Association

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5 November 2020

Re: Protecting the health of adolescents from nicotine vaping products (e-cigarettes, smokeless tobacco)

I write on behalf of the Australian Association for Adolescent Health Ltd, the national organisation that brings young people and professionals together to promote the health and wellbeing of adolescents and young adults throughout Australia.

AAAH expresses deep concern about increasing e-cigarette use among adolescents and the growing evidence of the harm caused by e-cigarette use.

We respond to selected terms of reference of the Select Committee as follows:

The treatment of nicotine vaping products (electronic cigarettes and smokeless tobacco) in developed countries similar to Australia (such as the United Kingdom, New Zealand, the European Union and United States), including but not limited to legislative and regulatory frameworks

At present, 70 countries have enacted e-cigarette specific policy. Australia, as well as other countries, has effectively banned the sale of nicotine-containing e-cigarettes, with Jamaica, Japan, and Switzerland also enacting similar approaches (McCausland et al., 2020).

The impact nicotine vaping products have had on smoking rates in these countries, and the aggregate population health impacts of these changes in nicotine consumption.

The National Drug Strategy Household Survey 2019 reported continued decline in cigarette smoking among Australians aged 14 and older (from 24% in 1991 to 11.0% in 2019). This trend has been countered by steady increases in e-cigarette use since 2016 among both smokers and non-smokers. (Australia Institute of Health and Welfare, 2020)

The established evidence on the effectiveness of e-cigarettes as a smoking cessation treatment

The National Academies of Sciences (Engineering and Medicine) consensus study report on public health consequences of e-cigarettes (Stratton et al., 2018) states that there is *limited evidence* that e-cigarettes may be effective aids to promote smoking cessation and *moderate evidence* from randomized controlled trials that e-cigarettes with nicotine are more effective than e-cigarettes without nicotine for smoking cessation. There is *insufficient evidence* from randomized controlled trials about the effectiveness of e-cigarettes as cessation aids compared with no treatment or to Food and Drug Administration–approved smoking cessation treatments. While the overall evidence from observational trials is mixed, there is *moderate evidence* from observational studies that more frequent use of e-cigarettes is associated with

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an increased likelihood of cessation. However, AAAH cautions against extrapolating findings from any such experimental studies to an adolescent population.

The established evidence on the uptake of e-cigarettes amongst non-smokers and the potential gateway effect onto traditional tobacco products

There is growing evidence that the relationship between cigarette smoking and e-cigarette use among adolescents is different compared to established cigarette smokers. E-cigarette use can lead to the uptake of cigarette smoking in young people and dual use of cigarettes and e-cigarettes. (Public Health Association of Australia, 2018)

There is *substantial evidence* that e-cigarette use increases risk of ever using combustible tobacco cigarettes among youth and young adults (Stalton, 2018; Seneff et al., 2017). Among youth and young adult e-cigarette users who ever use combustible tobacco cigarettes, there is *moderate evidence* that e-cigarette use increases the frequency and intensity of subsequent combustible tobacco cigarette smoking. Among youth and young adult e-cigarette users who ever use combustible tobacco cigarettes, there is *limited evidence* that e-cigarette use increases, in the near term, the duration of subsequent combustible tobacco cigarette smoking.

Evidence of the impact of legalising nicotine vaping products on youth smoking and vaping rates and measures that Australia could adopt to minimise youth smoking and vaping

The United States, where e-cigarettes sales are subject to very low restrictions, has observed an exponential increase in vaping, particularly among youth, now being referred to as an 'epidemic'. (Food and Drug Administration, 2018) In 2017, e-cigarettes were the most commonly used tobacco product among American high school (11.7%; 1.73 million) and middle school (3.3%; 0.39 million) students. (Wang et al., 2018) In contrast, the prevalence of vaping in Australia remains relatively low, however, a significant increase in current and lifetime use has been reported. (Australian Institute of Health and Welfare, 2020)

E-cigarettes are particularly dangerous when used by children and adolescents, due to the highly addictive potential of nicotine and its impact on brain development. There is evidence that in some settings adolescents who have never smoked cigarettes but use e-cigarettes at least double their chance of starting to smoke cigarettes later in life. (St Clair, 2020)

Access to e-cigarette products under Australia's current regulatory frameworks

Australians have access to nicotine-containing e-cigarette products via the internet and those who choose to import nicotine-containing products are not currently actively prosecuted. Approximately 70% of Australian e-cigarette purchases are made online. (Australian Institute of Health and Welfare, 2020; EuroMonitor International, 2018)

Tobacco industry involvement in the selling and marketing of e-cigarettes

Attempts have been made to lobby AAAH by Philip Morris Limited since August 2020. AAAH has not engaged in their requests for support.

The tobacco industry has a long track record of targeting vulnerable populations such as adolescents and young people, and those in low and middle income countries.

Giving to pressure to weaken Australia's tobacco control laws to make an exemption for nicotine vaping could also permit the sale of tobacco industry produced heated tobacco and vapour products. Australia is a signatory to the World Health Organization Framework Convention on Tobacco Control

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which is designed to protect public health policies from commercial and other vested interests and applies to the tobacco industry irrespective of the type of products they are selling. Until there is adequate evidence that e-cigarettes are safe and an efficacious smoking cessation product they should not be promoted as such. This lack of evidence and the power and influence of the tobacco industry justify the application of the precautionary principle and stress the need to bring proof tobacco control legislation against current and future novel tobacco and vapour products. (McCausland, 2020)

Any other related matter

Additional health and safety concerns

There are thousands of e-Liquid flavours available for retail purchase (Hsu et al., 2018) and from home vendors. (Cox et al., 2019) These products have been found to contain various excipients, flavourings, additives, potentially hazardous ingredients (Chivers et al., 2019; Cox et al., 2019) and inaccurately labelled nicotine content. (Buetner-Schmidt et al., 2016; Chivers et al., 2019; Goniiewicz et al., 2015; NSW Government, n.c.; Trehy et al., 2011) Some participants reported mild adverse effects after using some e-liquids, including dizziness, sore throat, dehydration and nausea. These experiences are not uncommon and have been documented elsewhere. (Chen et al., 2020; Cooper et al., 2016) Incorrect labelling and discrepancies between the labelled amount and actual nicotine content are misleading and may result in unintended addiction to nicotine and other adverse health effects (Buetner-Schmidt et al., 2016; Chivers et al., 2019).

Very recent research in the USA has found that COVID-19 infection was associated with the use of e-cigarettes only and dual use of e-cigarettes and cigarettes (Gulha et al., 2020) and that e-cigarettes use is significantly associated with asthma and had an additive effect beyond smoking cigarettes. (Wills et al., 2020)

In summary, this is a time of unprecedented low rates of smoking in Australia, the only age group reporting an increase in smoking rates over the past three years is Australian adolescent males aged 14 to 17. Adolescent males aged 14 to 17 also reported a 26% increase in e-cigarette use over the same period.

We urge the committee to put the health of Australian adolescents and young adults at the forefront of its considerations. We recommend a tightening of controls on e-cigarette access to protect our youth from further increases in e-cigarette use and prevent the epidemic and associated harms reported in countries such as the United States.

Thank you for your time and consideration of our submission.



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- manipulate children and young people and hook a new generation of users. *Journal of Adolescent Health*, 67, 334–337.
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Appendix G: Related works – A briefing note to the Honourable Roger Cook MLA



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19 December 2019

The Honourable Roger Cook MLA
Deputy Premier; Minister for Health; Mental Health
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Dear Deputy Premier,

Further to your conversation with Professor Bruce Maycock at the Bob Elphick Award breakfast, this briefing note highlights research the Collaboration for Evidence, Research and Impact in Public Health (CERIPH) based at Curtin University is undertaking into e-cigarettes in the online, and bricks and mortar environment. Below is a summary of this research.

Online e-cigarette environment

Our research into e-cigarettes indicates that positive sentiment continues to dominate the discourse surrounding e-cigarettes on Twitter; and vape retailers and manufacturers, the general public and vape proponents are the most prominent posters of e-cigarette content. Despite Australia's cautious approach to e-cigarettes and the limited evidence supporting them as an efficacious smoking cessation aid, it is clear that these dominant groups are promoting e-cigarettes as a health conducive, smoking cessation product, and using Twitter to circumvent Australian regulations while advocating for a more liberal approach to personal vaporisers. Vape proponents imply that Federal Government agencies lack sufficient competence and the evidence for the policies they endorse around vaping. The borderless nature of social media presents a new and growing challenge for public health to counter inaccurate and unfounded claims about products such as e-cigarettes. We aim to address this in our future research.

In addition, our research into Philip Morris International's (PMI) corporate communications has found they are openly challenging Australia's existing e-cigarette regulations and garnering public support for broader access to nicotine containing e-cigarette products. PMI argue that their e-cigarette and heat not burn products are safer options, reducing the presence of harmful chemicals inhaled by smokers. PMI is positioning itself as a 'Good Corporate Citizen', working to better the health of current smokers, while equally positioning Government and health authorities as failing to collaborate with the tobacco industry to 'solve' the ongoing issue of smoking, while ignoring consumer demand for 'safer' alternatives. According to PMI's communication materials, Australian consumers' rights are being infringed, leaving them condemned to smoking harmful combustible cigarettes. Being aware of how transnational tobacco corporations use communication platforms to influence opinion and e-cigarette legislation, emphasises the need for vigilance and strong evidence-based counter arguments.

Bricks and mortar e-cigarette environment

Our recent audit of vape stores in Perth identified 98 retailers selling e-cigarette products, comprising vape shops, tobacconists, smoke shops, service stations and supermarkets. Most reported selling 'non-nicotine' e-liquid, and parts of e-cigarette devices and accessories. Several loopholes are being taken advantage of by most e-cigarette retailers to allow customers to buy the whole e-cigarette device. These include having two separate stores adjacent to each other, one store selling the mod (main part of the device that contains the battery) and the other, the tank (part of the device that holds the e-liquid); two business names with the second store fully online, or selling the device through two unrelated stores located adjacent to each other (e.g. tobacconist and newsagency). Sales promotion techniques being used include point-of-sale displays, free samples, and monetary discounts. The current legislation is not deterring stores from promoting and selling e-cigarette products and these stores are proliferating. The first Perth vape shop opened just two years before this study, an expanding industry.

Our adherence to the precautionary approach has left us in a far better position than other countries, and we support the Government's current stance on e-cigarettes. However, the online environment presents many challenges for public health. We aim to contribute to solutions via research grants we are currently developing, which will employ innovative computational science techniques to determine how to more efficiently and effectively harness digital technology for public health issues. We expect this research will guide public health advocates in responding to health issues in real-time on social media by countering misinformation and inappropriate practices.

We would welcome the opportunity to discuss our research with you or your team. If you would like further information or a meeting, then please contact me at any time. We look forward to your response.

Yours faithfully,

Dr Jonine Jancey
Associate Professor, School of Public Health

On behalf of the research team, Prof Bruce Maycock, A/Prof Tama Leaver, Dr Katharina Wolf, Dr Becky Freeman, Ms Kahli McCausland.

Appendix H: Related works – Submission to the Select Committee on Personal Choice and Community Safety



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5 October 2018

Hon Aaron Stonehouse MLC
Chairperson
Select Committee on Personal Choice and Community Safety
Parliament House, 4 Harvest Terrace
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Dear Mr Stonehouse,

Thank you for the opportunity to make a submission to the *Select Committee on Personal Choice and Community Safety*.

The rapid growth of electronic nicotine delivery devices (ENDS) or more commonly known as electronic cigarettes or e-cigarettes has been heralded by some, including multi-national tobacco companies ('Big Tobacco'), as a potentially important public health measure that could ultimately replace tobacco cigarettes.¹⁻³ However, other authoritative groups, including the Office of the Surgeon General of the United States of America (USA), The World Health Organization, and most Australian medical and public health organisations recommend a cautious approach until there is clear evidence that they will not become the 'new tobacco' bringing with it a possible myriad of other problems.⁴⁻⁶

In mid-2015 in our commentary published in the *Australian Health Promotion Journal of Australia*,⁷ we concluded, "From the limited evidence available to date on ECs [e-cigarettes], it is apparent that a cautious approach is warranted with a case that supports strict regulation until rigorous research is conducted." Despite new international publications over the last three years, the conclusions and recommendations documented in our most recent publication⁸ in 2018 on e-cigarettes remain largely unchanged for Australia, as Australia is a unique environment due to its very low smoking rate (12% of adults; and only 2% of 12-17 year olds).⁹

The international debate continues in the public media and scientific literature as to whether ENDS should be readily available to the general public. For example the recent Royal College of Physicians report *Nicotine without Smoke*¹ created substantial conversation amongst the scientific community and was quickly picked up and cited by Big Tobacco, and the vaping industry and community. There were numerous critical reviews of the report and of particular note was the concern relating to the claim of ENDS being 95% less harmful than regular cigarettes. Eminent toxicologist Robert Combes and colleague explained that this finding was simply based on a multi-criteria decision analysis (MCDA) study, whereby a group of "so called" experts considered the harm of a wide range of tobacco products.¹⁰ The products were ranked on a scale where cigarette smoking was ranked at 100% and ENDS at 4%.^{10, 11} This ranking was then uncritically cited by Public Health England (a UK executive agency sponsored by the Department of Health)¹². Combes and Balls¹⁰ stated "If e-cigarettes are really 'safer', then their use should be recommended, but only after an intelligent analysis of their risk to human health, based on integrated in silico, in vitro and clinical studies for both scientific and logistical reasons". Unfortunately, this figure of 95% has been restated and used to support arguments in favour of ENDS.

Fundamental to public health practice is the requirement to do no harm. In their book *Law and the Technologies of the Twenty-First Century*, the authors explored the legal frameworks and principles through which risk from new technologies can be mitigated.¹³ The use of ENDS or vaping is an example of new technology with an impact upon health. Central to the risk mitigation process is the precautionary principle, which is a principle of decision making that requires decision makers in cases where there are threats of

environmental or health harm not to use "lack of full scientific certainty" as a reason for not taking measures to prevent such harm.¹⁴ The trigger to invoke a precautionary principle is based upon the desire to protect a population from a level of risk, and the acknowledgement that there may be a gap in the evaluation of the level of risk due to insufficient data. This insufficiency may include; absence of cause and effect relationship (which for smoking took a long time to demonstrate); quantifiable dose-response relationship; and quantitative evaluation of probability of the emergence of adverse effects following exposure. There should be a reversed burden of proof by requiring that the substances be deemed hazardous until proven otherwise. Until this is done the legislator is not legally entitled to authorise use of the substance unless exceptionally for test purposes. The decision to act is a political decision with decision makers having to determine the level of risk that is acceptable to the society on which the risk will be imposed.

Evidence from the European Union concludes that the ready availability of ENDS in community outlets accompanied along with promotions makes these products attractive to children.¹⁵ Dr Scott Gottlieb, US Food and Drug Administration (FDA) Commissioner, recently singled out vaping giant [JUUL Labs](#) (who now dominates almost 73% of the US vaping market) for what he calls an "epidemic of high school students using e-cigarettes." In response to the increase in youth vaping in the US, the FDA is investigating JUUL Labs marketing practices, and very recently seized thousands of pages of documents in a surprise inspection.¹⁶ The inspection comes weeks after the FDA announced a crackdown that requires ENDS manufacturers, including JUUL, to submit plans to address youth use of their products within 60 days.¹⁷ The agency has also threatened to ban some flavoured nicotine liquids,¹⁸ which have been found to attract children.^{19, 20}

Tobacco companies are ramping up their advocacy for ENDS as they claim they plan to eventually replace their tobacco products with the much safer ENDS alternative.^{2, 3} Tobacco control experts however are concerned about the dubious tactics of the tobacco industry. They claim that promotional activities to date smack of luring non-smokers especially young people to the new product, rather than just encouraging current smokers to switch to ENDS as a quit aid.⁶ Daube and Moodie²¹ are very clear that Phillip Morris and associated global tobacco companies cannot be trusted as they continue to pour millions of dollars into undermining the global 'tobacco control' movement. It is very unlikely they are serious about designing a 'Smoke-Free Future'. Evidence from leaked documents offers no indication that the tobacco industry has become less cynical and dishonest over time. Their hypocrisy is epitomised in Phillip Morris's youth oriented marketing of their '[Be Marlboro](#)' cigarette campaign targeting low and middle income countries.²¹

A critical question is posed for the future. *If the target of ENDS sales is current tobacco smokers, who will be the target once the numbers of smokers continues to fall to very low levels?* Can we trust that the ENDS manufacturers will not make their main target young people as the tobacco industry did so successfully over many decades? Now that Big Tobacco is a major player, such a scenario is very likely considering their atrocious and unethical marketing record. Indeed, there is evidence this is already happening worldwide.^{6, 21}

From the inconclusive evidence we have to date on ENDS, it is apparent that a cautious approach is warranted with a case that supports strict regulation until rigorous research results are published. More randomised controlled trials are needed to compare ENDS to other nicotine replacement therapies and research studies should be designed to assess long-term health outcomes of ENDS use. The same rigor that is applied to new therapeutic products should be applied to ENDS.⁷ We should remember that nicotine replacement and cessation programs played only a minor role in the decline in regular smoking prevalence in Australia, as the main influences were due to a comprehensive health promotion approach that restricted access and opportunities to smoke. However, above all we must support the precautionary principle, which is a principle of decision making that requires decision makers in cases where there are threats of environmental or health harm not to use "lack of full scientific certainty" as a reason for not taking measures to prevent such harm.¹⁴ The trigger to invoke a precautionary principle is based upon the desire to protect a population from a level of risk, and the acknowledgement that there may be a gap in the evaluation of the level of risk due to insufficient data on the health impact of ENDS.

On behalf of all authors, thank you for your time and the opportunity to make this brief submission.

Yours sincerely,



Ms Kahlia McCausland, BSc Hlth Prom

Professor Bruce Maycock, PhD
Emeritus Professor Peter Howat, PhD
Associate Professor Jonine Jancey, PhD

School of Public Health, Faculty of Health Science, Curtin University
GPO Box U1987, Western Australia 6845, Australia

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Appendix I: Related works – Media

26/11/2020

Vaping: the new WA subculture - People News | Particle

Particle

TOPICS ▾ EXPLORE ▾



People



Image | Getty Images

WHY DO WEST AUSSIES VAPE?

The popularity of vaping is on the rise, but one of its main appeals may come as a surprise.



DR KATE RAYNES-GOLDIE

AWARD-WINNING DESIGNER & KEYNOTE SPEAKER

PEOPLE | 20 November 2020



Long gone are the days of hazy bars and smoking sections on airplanes. And while [cigarette use in Australia has been in steady decline since 1994](#), the popularity of vaping is exploding, especially among young people.

Conventional cigarettes create smoke by burning tobacco. E-cigarettes create a vapour from nicotine-containing liquid, which is then inhaled.

A [survey conducted in 2019](#) for the Australian Institute of Health and Welfare found that the use of e-cigarettes and

WE'VE GOT CHEMISTRY. WANT SOMETHING PHYSICAL? ×

What are you searching for? ×

<https://particle.scitech.org.au/people/why-do-west-aussies-vape/>

1/6

A WAY TO QUIT, OR A WAY TO START?

In America, the Food and Drug Administration (FDA) took vaping company Juul to task for making [unauthorised claims](#) that vaping is safer than smoking or even a way to quit.



IMAGE | PHOTO BY [CDC](#) ON [UNSPASH](#)

The Centers for Disease Control and Prevention (CDC) has researched the health effects of e-cigarettes

[VIEW LARGER](#)

Perhaps unsurprisingly, evidence suggests that vaping and the marketing around it is having the opposite effect.

"Disturbingly, of the students who use e-cigarettes, [48% report that they had not smoked a tobacco cigarette before their first e-cigarette](#)," says Kahlia.

"AND 25% OF STUDENTS WHO VAPE BEFORE SMOKING REPORT LATER TRYING TOBACCO CIGARETTES."

Kahlia and her team also found that people trying to give up smoking were switching to vaping because "they believed vaping was significantly less detrimental to their health than tobacco smoking".

CLOUD CHASERS

But what may be surprising is that one of main appeals of vaping may actually be the subculture around it.

WE'VE GOT CHEMISTRY. WANT SOMETHING PHYSICAL?

×

What are you searching for?

×



IMAGE | GETTY IMAGES

VIEW LARGER

[Looking specifically at Western Australia](#), Kahlia and her team calls these vapers "cloud chasers".

"Cloud chasers connected with aspects of the vaper subculture. This included engaging in hobbyist activities like collecting mods and flavoured e-liquids, making their own e-liquids and accessories such as coils," says Kahlia.

They also connect with other vapers through mediums like social media and local vape stores.

"A smaller number of cloud chasers were heavily invested in the vape trick culture, expressing interest in participating in local vape competitions and posting content on their social media pages."

IS IT SAFER?

So is vaping actually safer than smoking tobacco as vaping companies have claimed?

"There is evidence that suggests e-cigarettes are less harmful than combustible tobacco cigarettes. However, there is also evidence that e-cigarettes are not harmless and may deliver ultrafine particles into the lungs of users," says Kahlia.

"Studies have found short-term acute health consequences associated with e-cigarette use such as nausea, vomiting, mouth and airway irritation, chest pain and palpitations."

But the real challenge is time, she says. "As seen with tobacco, it took decades to determine the link between smoking and lung cancer."

WE'VE GOT CHEMISTRY. WANT SOMETHING PHYSICAL?



What are you searching for?





IMAGE | GIPHY
If Betty Draper taught us anything ...

Just because it hasn't been scientifically proven to be harmful is not the same thing as something being safe.



REPUBLISH



DR KATE RAYNES-GOLDIE

AWARD-WINNING DESIGNER & KEYNOTE SPEAKER

In an age when disruption is the new normal, curiosity is the becomes the key 21st century skill. This is why Dr. Kate is an advocate for curiosity, through her work as a designer, speaker, writer and researcher. She's written for variety of publications in Canada and Australia and is an innovation columnist for the Business News. She's also a Certified Facilitator of LEGO® Serious Play®. As a globally recognised thought leader on innovation, Kate has been the recipient of numerous international awards and has spoken at conferences around the globe, including SXSW (Austin), NXNE (Toronto), REMIX Academy, Pecha Kucha, PAX AUS and TEDxPerth.

WE'VE GOT CHEMISTRY. WANT SOMETHING PHYSICAL?



What are you searching for?



Appendix J: Project advisory group terms of reference

15 August 2018

HEALTHWAY PROJECT: Vaping: the appeal of e-cigarettes and their online promotion

ADVISORY GROUP TERMS OF REFERENCE

Project overview

This research project aims to conduct a mixed-methods investigation of the Australian online e-cigarette discourse, and perspectives of e-cigarette users residing within the Greater Capital City Statistical Area of Perth, Western Australia to determine opportunities for health promotion intervention.

Advisory group role, function and membership

The Advisory Group is a key component of this project and is a representative, consultative body comprising relevant representative/s from non-government organisations and educational institutions. The Advisory Group will:

- Provide advice to the Research Team to help guide the implementation of the project.
- Provide advice on the use of generated data and assist with the dissemination of findings.
- Promote the project in the community.

Organisation	Members
Curtin University (Research Team)	A/Prof Jonine Jancey Prof Bruce Maycock A/Prof Tama Leaver A/Prof Katharina Wolf Ms Kahlia McCausland (Project Coordinator)
Australian Council on Smoking and Health	Mr Maurice Swanson Ms Noni Walker
Cancer Council WA	Ms Kelly Kennington
The Royal Australian College of General Practitioners (WA Branch)	Mr Hamish Milne
Public Health Advocacy Institute of WA	Ms Melinda Edmund
The University of Sydney	Dr Becky Freeman

Advisory Group members may invite additional parties to a meeting however please first notify the Project Coordinator.

Chairperson

The Advisory Group will be chaired by a member of the Research Team from Curtin University.

The role of the chairperson is:

- To guide the meeting according to the agenda and time available.
- To review and approve the draft minutes before distribution.

Minute taking

The minute taker for the Advisory Group is the Project Coordinator. The role of the minute taker is to:

- Establish meeting times.

15 August 2018

- Prepare agendas and issue notices for meetings, and ensure all necessary documents requiring discussion or comment are attached to the agenda.
- Distribute the agenda prior to the meeting.
- Take notes of proceedings and prepare the minutes of the meeting.
- Distribute the minutes to all members one week after each meeting.
- Follow up on action points.

The minutes shall be checked by the relevant Chairperson and accepted by at least one other group member as a true and accurate record.

Meetings

- The Advisory Group will meet twice a year (or more often if required). As of 2019 meetings will be held in April and October.
- Meetings will be at a mutually agreed upon time (via Doodle Poll) at Curtin University.
- The Advisory Group will receive electronic briefings (dependent on whether there is data to report) from the Research Team.
- Advisory Group members may be asked to comment via email on documents as required.

Tenure

To assist with continuity, tenure will be for the length of the project (currently 2 years).

Conflict of interest

Members must identify any possible conflict of interest.

Appendix K: Ethics approval



Office of Research and Development

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

22-Mar-2017

Name: Jonine Jancey
Department/School: Health Promotion
Email: J.Jancey@curtin.edu.au

Dear Jonine Jancey

RE: Ethics approval
Approval number: HRE2017-0144

Thank you for submitting your application to the Human Research Ethics Office for the project **Youth Vaping: The appeal and online promotion of electronic cigarettes**.

Your application was reviewed by the Curtin University Human Research Ethics Committee at their meeting on **07-Mar-2017**.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **22-Mar-2017** to **21-Mar-2018**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Jancey, Jonine	Supervisor
Maycock, Bruce	Supervisor
Leaver, Tama	Supervisor
Benn, Anna	Co-Inv
McCausland, Kahliia	Student

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:

- proposed changes to the approved proposal or conduct of the study
 - unanticipated problems that might affect continued ethical acceptability of the project
 - major deviations from the approved proposal and/or regulatory guidelines
 - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
 4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
 5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
 6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
 7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
 8. Data and primary materials must be retained and stored in accordance with the [Western Australian University Sector Disposal Authority \(WAUSDA\)](#) and the [Curtin University Research Data and Primary Materials policy](#)
 9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
 10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
 11. Ethics approval is dependent upon ongoing compliance of the research with the [Australian Code for the Responsible Conduct of Research](#), the [National Statement on Ethical Conduct in Human Research](#), applicable legal requirements, and with Curtin University policies, procedures and governance requirements
 12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Special Conditions of Approval

This letter constitutes ethical approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.


Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely



Professor Peter O'Leary
Chair, Human Research Ethics Committee

Appendix L: Recruitment flyers

 Curtin University

DO YOU USE, OR HAVE YOU USED ELECTRONIC CIGARETTES? WE WANT TO SPEAK TO YOU!

TO PARTICIPATE CONTACT

Kahlia McCausland
School of Public Health, Curtin University
p: 08 9266 7382
m: 0481 900 756
e: kahlia.mccausland@curtin.edu.au

PROJECT INFORMATION

Researchers from Curtin University would like to better understand why people start, continue and cease electronic cigarette use, and how they are promoted and discussed online and on social media.

If you are interested in participating in an interview or would like more information please use the contact details above. Participants will be reimbursed for their time.

To be able to participate you must:

- Currently use electronic cigarettes, or have used them in the last 12 months;
- Be aged 18 years or older; and
- Live in the Perth Metropolitan or Peel region.

Curtin Universities Human Research Ethics Committee (HREC) has approved this study (HRE2017-0144).

DO YOU USE, OR HAVE YOU USED ELECTRONIC CIGARETTES? WE WANT TO SPEAK TO YOU!



TO PARTICIPATE CONTACT

Kahlia McCausland
School of Public Health, Curtin University
p: 08 9266 7382
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- Currently use electronic cigarettes, or have used them in the last 12 months;
- Be aged 18 years or older; and
- Live in the Perth Metropolitan or Peel region.

Curtin Universities Human Research Ethics Committee (HREC) has approved this study (HRE2017-0144).
Image: Unplash @itaykabalo

Appendix M: Participant information statement



Vaping: Electronic cigarette use and their online promotion

PARTICIPANT INFORMATION STATEMENT

HREC Project Number:	HRE2017-0144
Project Title:	<i>Vaping: Electronic cigarette use and their online promotion</i>
Chief Investigator:	<i>Associate Professor Jonine Jancey School of Public Health, Curtin University</i>
Student researcher:	<i>Ms Kahlia McCausland</i>
Version Number:	V4
Version Date:	<i>04 September 2018</i>

What is the project about?

This research aims to better understand the reasons why people initiate, continue and cease electronic cigarette use, and how they are promoted and discussed online and on social media.

Who is doing the research?

This project is being conducted by Associate Professor Jonine Jancey and Ms Kahlia McCausland from the School of Public Health at Curtin University. The results of this research project will be used by Ms Kahlia McCausland to obtain a Doctor of Philosophy at Curtin University and is funded by the University, and supported by an Australian Government Research Training Program Scholarship.

Why am I being asked to take part and what will I have to do?

We are seeking current and past (within the last 12 months) electronic cigarette users who are 18 years or older, and reside within the Perth Metropolitan or Peel Region of Western Australia. Participation in this study will involve an informal conversation with Kahlia who will ask you some questions about how and why you started using electronic cigarettes, and where you see them promoted online. The study will take place at a mutually convenient location and take approximately 45-60 minutes. With your permission the conversation will be audio recorded so I can concentrate on what you have to say and not distract myself with taking notes. At the end of the conversation you will be asked to pass on my contact details to any friends who also use (current or past) electronic cigarettes to see if they would like to participate in the study. There will be no cost to you for taking part in this research.

Are there any benefits' to being in the research project?

There may be no direct benefit to you from participating in this research. You will be reimbursed with a \$25 gift voucher as an honorarium for the time you have taken to participate.

Are there any risks, side-effects, discomforts or inconveniences from being in the research project?

Apart from giving up your time, we do not expect that there will be any risks or inconveniences associated with taking part in this study. During the conversation if there is a question you don't want to answer you don't have to.

Vaping: Electronic cigarette use and their online promotion

Who will have access to my information?

I will ask for your name, email address or phone number to allow me to contact you if I need to clarify anything after our conversation, and to follow up with you to see if you have any other potential study participants. This means the data I collect will be identifiable, however, after follow up I will remove all identifying information from the data. That means the data we analyse and the data we store will be non-identifiable (anonymous). No one, not even the research team will be able to identify your information. The following people will have access to the information we collect in this research: the research team and, in the event of an audit or investigation, staff from the Curtin University Office of Research and Development. Electronic data will be password-protected and hard copy data will be in locked storage. The information we collect in this study will be kept under secure conditions at Curtin University for 7 years after the research is published and then it will be destroyed. The results of this research may be presented at conferences or published in professional journals. You will not be identified in any results that are published or presented.

Will you tell me the results of the research?

The results of this research will not be available until approximately 2019, if you are interested in obtaining a summary of the results please contact me at kahlia.mccausland@curtin.edu.au.

Do I have to take part in the research project?

Taking part in the research project is voluntary. It is your choice to take part or not. You do not have to agree if you do not want to. If you decide to take part and then change your mind, that is okay, you can withdraw from the project. If you choose not to take part, or start and then stop the study, it will not affect your relationship with the University, staff or colleagues. With your permission, if you chose to leave the study we will use any information collected unless you tell us not to (only applicable before data is de-identified).

What happens next and who can I contact about the research?

If you decide to take part in this research I will ask you to sign a consent form. By signing it you are telling us that you understand what you have read and what has been discussed. Signing the consent indicates that you agree to be in the research project and use the data collected as described. Please take your time and ask any questions you have before you decide what to do. You will be given a copy of this information and the consent form to keep.

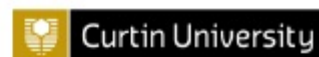
For more information or if you have any questions please contact either:

Chief Investigator	Project Coordinator
Associate Professor Jonine Jancey	Ms Kahlia McCausland
j.jancey@curtin.edu.au	kahlia.mccausland@curtin.edu.au
08 9266 3807	08 9266 7382

Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

Curtin University Human Research Ethics Committee (HREC) has approved this study (HRE2017-0144).

Appendix N: Participant consent form



Vaping: Electronic cigarette use and their online promotion

CONSENT FORM

HREC Project Number:	HRE2017-0144
Project Title:	<i>Vaping: Electronic cigarette use and their online promotion</i>
Chief Investigator:	<i>Associate Professor Jonine Jancey School of Public Health, Curtin University</i>
Student researcher:	<i>Ms Kahlia McCausland</i>
Version Number:	V3
Version Date:	23 February 2018

- I have read the information statement version listed above and I understand its contents.
- I believe I understand the purpose, extent and possible risks of my involvement in this project.
- I voluntarily consent to take part in this research project.
- I have had an opportunity to ask questions and I am satisfied with the answers I have received.
- I understand that this project has been approved by Curtin University Human Research Ethics Committee and will be carried out in line with the National Statement on Ethical Conduct in Human Research (2007).
- I understand I will receive a copy of this Information Statement and Consent Form.

Please tick one of the following boxes:

<input type="checkbox"/> I do	<input type="checkbox"/> I do not	consent to being audio-recorded
-------------------------------	-----------------------------------	---------------------------------

Participant signature	
Date	

Declaration by researcher: I have supplied an Information Statement and Consent Form to the participant who has signed above, and believe that they understand the purpose, extent and possible risks of their involvement in this project.

Researcher name	
Researcher signature	
Date	
ID number	

Appendix O: Interview guide

Reasons for use

- Can you please explain why you started using e-cigarettes?
- Do you currently smoke tobacco as well as using e-cigarettes or have you ever used both at the same time?
- Do you still get cravings for cigarettes?
- Have you had any positive effects since using e-cigarettes? (health, physical, psychological, social)
 - Have these experiences contributed to your continued use of e-cigarettes?
- Have you had any negative effects when using e-cigarettes? (health, physical, psychological, social)
 - Have these experiences contributed to your continued use of e-cigarettes?
- Have you thought about stopping e-cigarette use? Or why did you stop using e-cigarettes?
 - Is there anything that would potentially make you stop using e-cigarettes?
- Do you use e-cigarettes in front of people who don't smoke traditional cigarettes or e-cigarettes? Why, why not?

Pathway to e-cigarette use

- How long ago did you first start using?
- How did you start using e-cigarettes?
- Can you explain the scenario for me the first time you used an e-cigarette?
- What made you want to try an e-cigarette?
- How did you learn to use e-cigarettes?
 - *If someone taught them*
 - Did you approach this person to teach you, did someone else ask on your behalf or did someone approach you?
 - *If they chose someone*
 - Why did you choose this person to teach you?
 - *If someone asked on their behalf*
 - Who was the person that asked on your behalf?
 - Why did the person who asked on your behalf ask this certain person to teach you?
 - *If someone approached them*
 - In what setting did this occur?
 - Did you feel pressured to say yes?
- What relationship did you have with the person who taught you? E.g. best friend, sibling
- Did you look up to the person who taught you?
- What were the techniques of use that you were taught?
 - *Through observation*
 - Who were the people you observed?
 - What were the techniques of use that you observed?
 - *Self-taught*
 - Can you explain the process you used to teach yourself?

- Any online tutorials used?
- Have you ever taught someone else to use an e-cigarette?
- Can you explain the process you used to teach someone else? Any online tutorials used?
- Do you tend to use e-cigarettes when you are alone, or is it more of a social activity with others?
- Are there times when you are more inclined to use an e-cigarette? E.g. when you are stressed?
- Does using an e-cigarette help you when you feel like this?
- When you use e-cigarettes how do you feel? E.g. mood, physical effects
- How often do you spend time with people who use e-cigarettes? E.g. times per week/month
- Who are the people that you spend time with that use e-cigarettes? E.g. parents, brothers or sisters, friends, sports teammates
- How would you describe your relationship with these people? E.g. friendly, fleeting, permanent, competitive

Products used

- What type of e-cigarette did you first start using?
- What type of e-cigarette do you use now?
- How did you learn to use this type of e-cigarette?
- Have you tried different flavoured e-liquids?
 - What flavour is your favourite?
- Have you ever made your own flavour?
- Have you ever had an adverse reaction to a certain e-liquid or flavour? E.g. Throat irritation or nausea?

Accessibility

- Do you tend to purchase your e-cigarettes and e-liquid online or at a brick and mortar shop?
- Are you able to tell me some of the websites you use or shops you attend?
- How did you first come across this site/shop?
- Do specials and e-cigarette promotions encourage you to buy more?
- How do you find out about other sites/shops to browse?
- Do you use e-liquid that contains nicotine?
- From your experience how easy or difficult has it been to purchase e-cigarettes and e-liquid online/from a shop?

Knowledge, attitudes and beliefs

- Can you tell me how you first became aware of e-cigarettes?
- Do you believe that e-cigarettes are better for your health than traditional cigarettes?
- Do you think the vapour from e-cigarettes can be classified as second-hand smoke?
- What are your thoughts on using e-cigarettes to quit smoking?
- Do you think e-cigarettes should be registered as a quit smoking aid?
- What do you think about people using e-cigarettes if they have never smoked traditional cigarettes before?

- Do you think e-cigarettes have the potential to renormalise tobacco smoking?
- Thoughts on gateway theory? (Young people who start vaping moving to tobacco)
- Do you think there is the same sort of stigma attached to e-cigarettes as there is to traditional cigarettes?

Cost

- *[If a past/current smoker]* Has the increase in the price of traditional cigarettes influenced your decision to use e-cigarettes?
- If the price of e-cigarettes were to increase would this influence your decision to continue using e-cigarettes?

Familial and peer attitudes

- Do your parents and/or friends know that you use e-cigarettes?
 - If no, have you deliberately kept it from them?
 - If yes, how do they feel about your use?
- Do you think your parent and/or friends attitudes or opinions towards smoking tobacco/using e-cigarettes have influenced your decision to use e-cigarettes?

Regulation and policies

- Have you ever used an e-cigarette in a public place?
- Have you ever been asked to stop vaping in a public place?
 - How did this make you feel? Why did you feel that way?
- Do you think people have the right to ask you to stop using e-cigarettes in public places?
- How do you feel about having to vape in “smoker’s areas”? Especially for those trying to quit, and for having to inhale second-hand smoke.
- Do you think e-cigarettes and e-liquid should be regulated like cigarettes and alcohol, and be subject to quality assurance (e.g. list of ingredients)?
- What would be the regulation model you would like to see Western Australian Government implement?
 - Sale to minors
 - Advertising
 - Prescription
 - Childproof packaging
 - Licensing scheme
- Thoughts on tobacco industry involvement?
 - Would you purchase from them?

Advertising and promotion

- Have you seen any ads promoting or discouraging e-cigarettes pop up on your social media platforms?
- Can you describe any of the adverts/promotion you have seen on social media? Prompt: brand of e-cigarette
 - What was the main message you took away from the ad/promotion?
 - How frequently do these ads appear on your social media?

- Does seeing e-cigarettes promoted and advertised on social media reinforce your decision to continue using e-cigarettes?
- Have you ever seen e-cigarette advertising/promotion that made you want to smoke/vape again or try for the first time a traditional cigarette?
- Do you follow any e-cigarette companies, promoters or retail outlets on any social media platforms?
- Do you share or tag your friends in or do your friends tag you in posts posted by e-cigarette accounts?
- Have you ever entered any e-cigarette promotional competitions online or on social media? If yes, can you tell me about them?

Emergent subculture

- Are you currently, or have you ever been a part of any e-cigarette groups or communities? This can include online groups
- How did you initially get involved in this group?
- What does it mean to be a part of this group?
- Do you know of any vaping or e-cigarette gatherings or events in Australia?
 - Have you ever attended one of these events in Australia? What about overseas?
 - How did you find out about these events?
- I have heard that some people customise their e-cigarettes. Do you like to customise your e-cigarettes? Can you tell me more about your process of customisation?
 - Why do you customise your e-cigarettes?
 - How did you learn to customise your e-cigarettes?
- I have seen online videos of people who call themselves vape cloud and trick artists.
 - Do you watch videos online or on social media?
- In addition to these vape cloud and trick artists, I have become aware of vape cloud and trick championships. Have you ever heard of these events being held in Australia before?
 - Have you ever attended one of these events in Australia? What about overseas?
 - How did you find out about these events?
 - Do you watch these events online or on social media?
 - Can you show me any sites or social media accounts you follow?
- Are these people giving vaping a bad name or tarnishing the industry?

If the participant is involved in the retail business

- How and why did you get into this business? How long in operation?
- What are you allowed to sell and what are your thoughts on the current regulatory framework?
- Juice – local or imported from elsewhere?
- Ratio of male vs women clientele?
- Have you had any visits from the Health Department and/or other law enforcement officials?
- How do you advertise the business?

Appendix Q: Coding framework

Qualitative study A

Theme	Codes	Sub-codes	Sub-codes
Reason started vaping	Cigarette stigma		
	Work regulations		
	Piqued interest		
	Abstain from cigarettes		
	Looked cool		
	Pacify food craving		
	Peer influence		
	Abstain from substance use		
	Fun		
	Health		
	Family and/or partner influence		
	Cost of tobacco		
	Quit smoking		
	Tobacco use		
Age of initiation			
Trying tobacco again after e-cigarette use			
History of tobacco use			
E-cigarette use	Connection with other vapers		
	Did not quit using e-cigarettes		
	Social capital		
	Physiological effects of using e-cigarettes		
	Dual-use		
	Without nicotine		
	Never smokers		
	Interaction with other vapers		
	Vaping duration		
	Ceasing e-cigarettes		
	Places and times of use		
Learning how to use e-cigarettes	Device instructions		
	Trial and error		
	Vape store or manufacturer		
	Other vapers		
	First-time use		

Theme	Codes	Sub-codes	Sub-codes
	Converting others to vapes		
	Giving others advice		
	Introduction to e-cigarettes		
	Internet and social media		
	Progression through devices		
Opinions of others	Stigma	Preferred classification of e-cigarettes	
		From smokers	
		E-cigarettes associated with cigarettes	
		General	
	Friends and family		
	Society		
Types of e-cigarettes users	Opinionated		
	Whinging		
	The DIY vapers		
	Small business supporter		
	The flavourist		
	The middle ground		
	Pretentious		
	The activist		
	The veteran		
	The noob		
	The causal vaper		
	Private		
	The quitter		
	The cloud chaser		
	The hobbyist		
Vaping groups and social media	Creating an online presence	Vape related tags	
		Mentor role	
		Admin role	
		YouTube reviewer	
		Sponsorship and product reviewing	
		Number of online groups involved in	
	Function of groups	Connection	
		Provision of information	
		Buy, sell, trade	
		Source of knowledge, influence, and support	
	Quitting vaping		
	Hand check		
	Online behaviour and environment		

Theme	Codes	Sub-codes	Sub-codes	
Hardware and juice	Cloud chasing and trick videos			
	DIY	Mixing flavours		
		Rebuildable		
		Business		
		Building coils		
		Making juice		
	Juice	Throat hit		
		Nicotine concentration		
		Flavours		
		Methods of obtaining juice		
Hardware	Methods of acquiring hardware	People's homes		
		Social media		
		Brick and mortar stores		
		Online stores		
General purchasing				
Nicotine	Methods of acquiring nicotine concentrate			
Vape business and retail	Importation			
	Retail experience			
	Connectedness			
	Home vendors			
	Starting business			
Personal experiences	Advocacy activities			
	The symbolic and social meaning of vaping vs smoking			
Positive and negative experiences	Positives		Reduced time used for smoke breaks	
			Substance abuse abstinence	
			Freedom or ease of use	
		No or pleasant smell		
		Quit smoking	Journey to quitting	
			Methods tried to quit	
		Renewed senses (i.e. smell, taste)		
		Increase in social capital		
		Decreased nicotine or amount smoked		
		Enjoyment and/or hobby		
	Reduced financial burden			
	Health			
	Beating addiction	Craving for cigarettes		
	Negatives	Weight gain		

Theme	Codes	Sub-codes	Sub-codes
		Youth interest	
		Dry hit or spit back	
		Confusion about how much to vape	
		Mouth and oesophagus	
		Dehydration	
		Constant or over-use	
		Restricted access to product	
		Throat hit and cravings	
		Headspin or feeling ill	
		Financial burden	
		Transfer of dependency	
		Relapsing to or occasional use of cigarettes	
		Logistics	
Vape community	Interaction with local vape stores		
	Male-dominated industry		
	Socialising with other vapes		
	Cloud chasing and tricks	Cloud and trick competitions	Interest in these events
	Vape meets and events		Impact on the vape industry

Qualitative study B

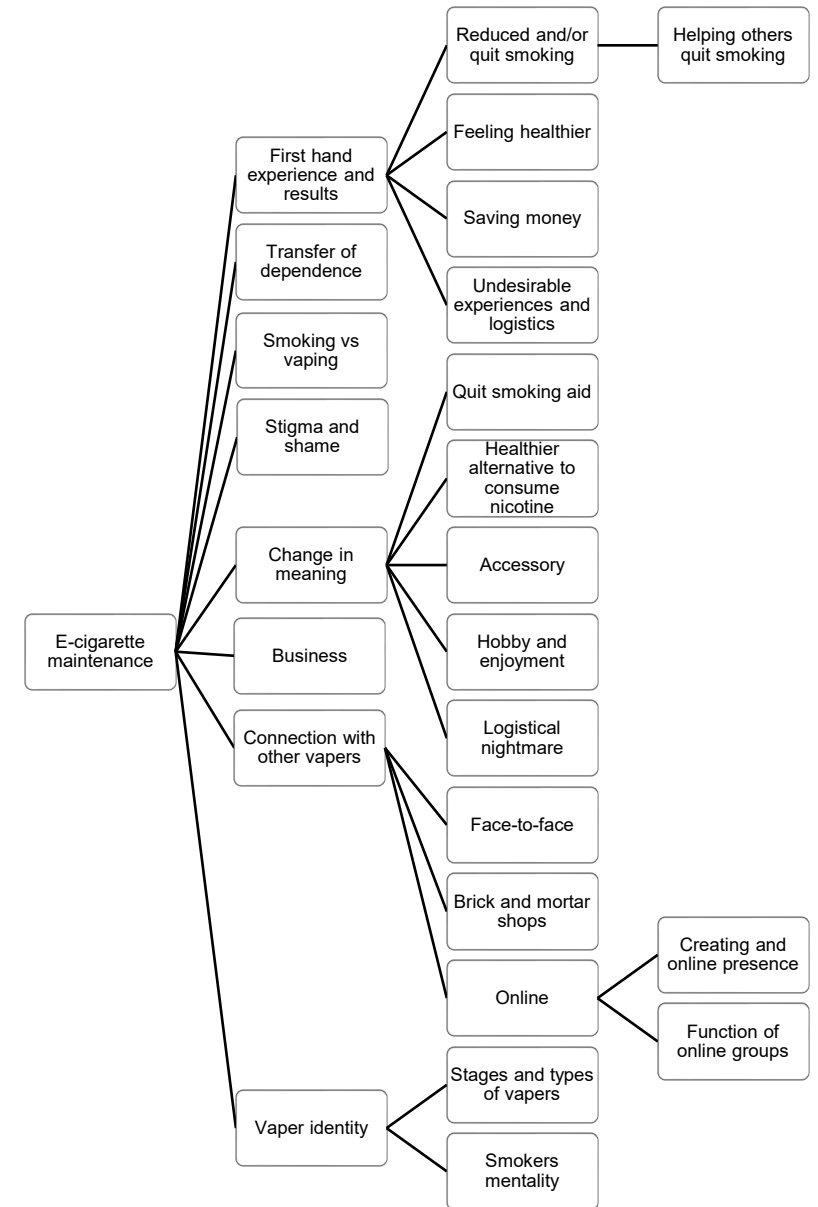
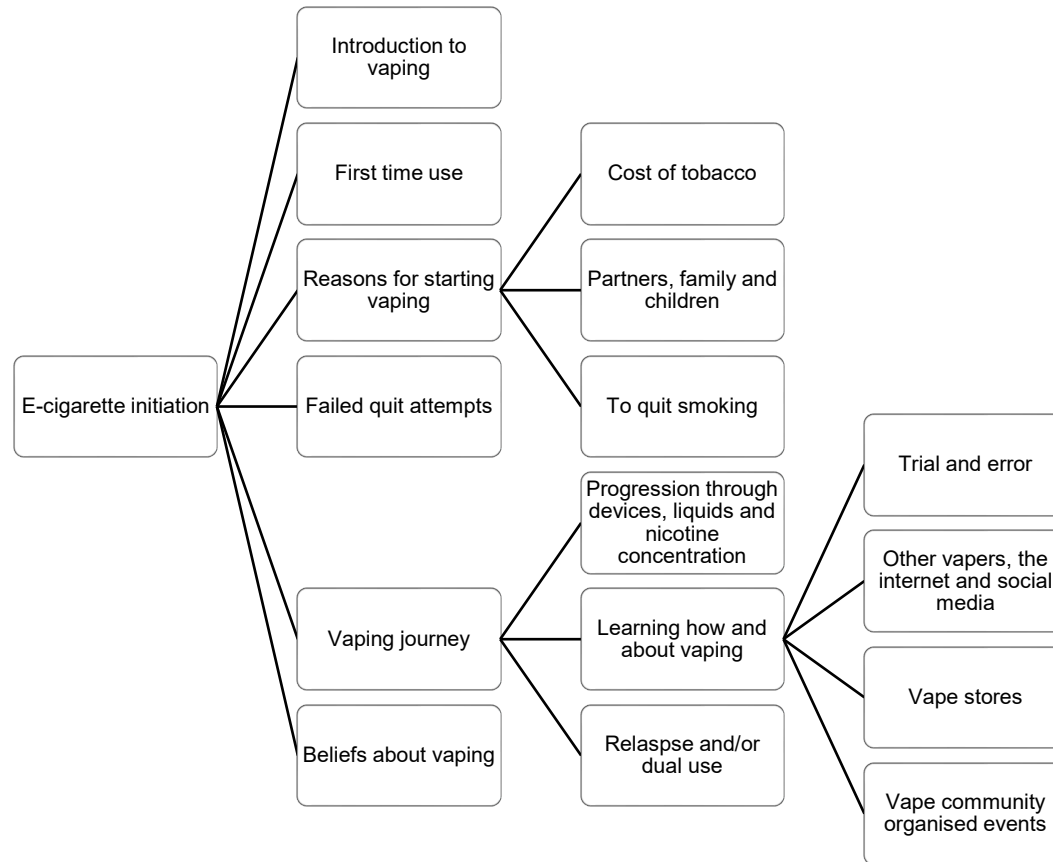
Theme	Codes	Sub-codes	Sub-codes		
E-cigarette use	Physiological effects				
	Without nicotine				
	Never smoker experience				
	Ceasing use				
Regulation and policy	Batteries				
	Importation				
	Current regulation			Restricted access to products	Relapse or occasional tobacco use
	Unsure of legal status			Logistics	
	Nicotine			Confiscation	
	Law enforcement				
Health and safety	Building coils				
	Ohms law and wattage				
	Device malfunction				
	Nicotine				
	Battery safety				
	Research				
	Product quality				
	Health conducive				
Vaping groups and social media	The function of groups	Connection			
		Provision of information			
		Buy, sell, trade			
		Source of knowledge, influence, and support			
	Self-regulation				
	Online behaviour and environment				
Hardware and juice	DIY	Rebuildable			
		Business			
		Building coils			
		Making juice			
	Juice	No-nicotine			
		Acquisition			
	Hardware	Acquisition	Home vendor		
			Social media		
			Brick and mortar retail		
			Online retail		
	Nicotine	Acquisition			
		Nicotine concentration			
Vape business and retail	Importation				

Theme	Codes	Sub-codes	Sub-codes
	Effects of the current regulation		
	Retail experience		
	Connectedness		
	Advertisement		
	Self-regulation		
	Home vendors		
	Raids law enforcement		
	Starting a business		
	Restricted access to products		
Advertising and promotion	Online	Promotion by retailers (interviewees)	
		Exposure to advertising and promotion	
	Mainstream media		
	Enticing youth and non-smokers		

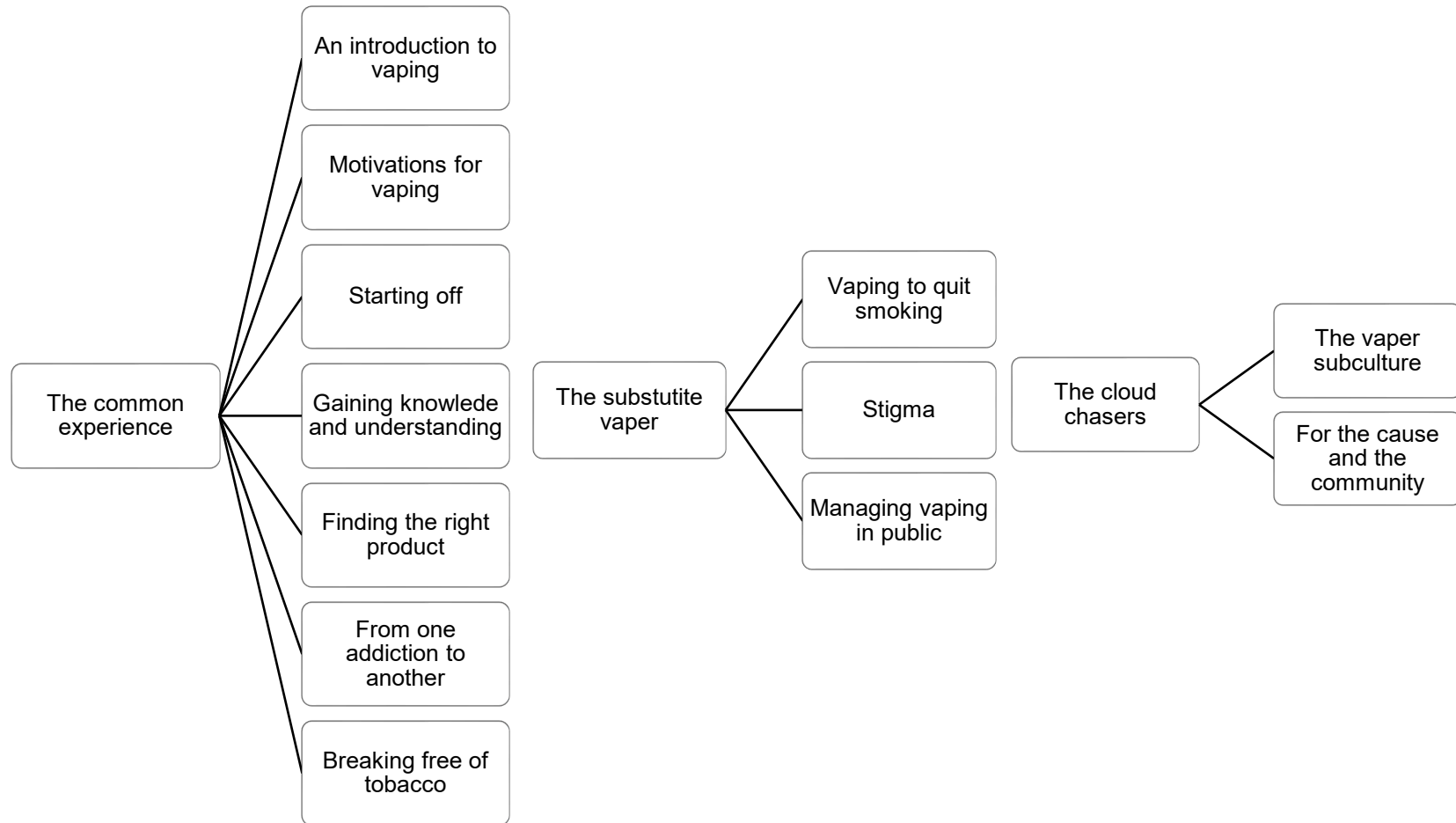
Appendix R: Level one and two theme refinement

Qualitative study A

Level 1

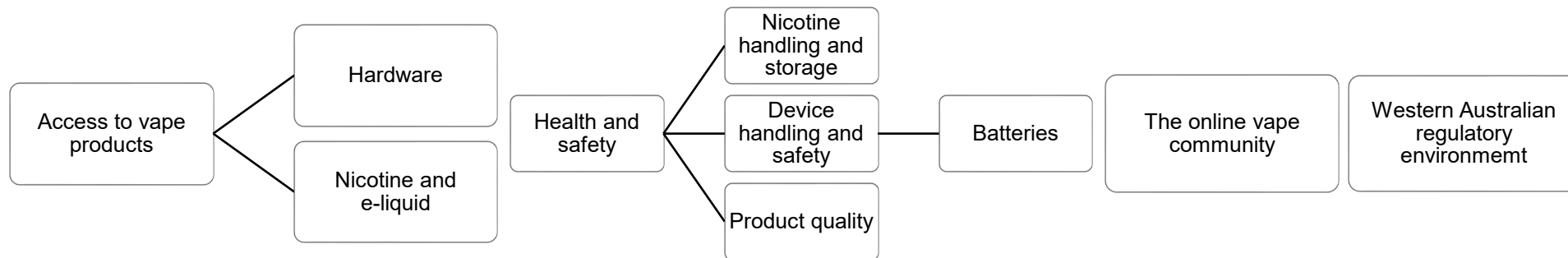


Level 2

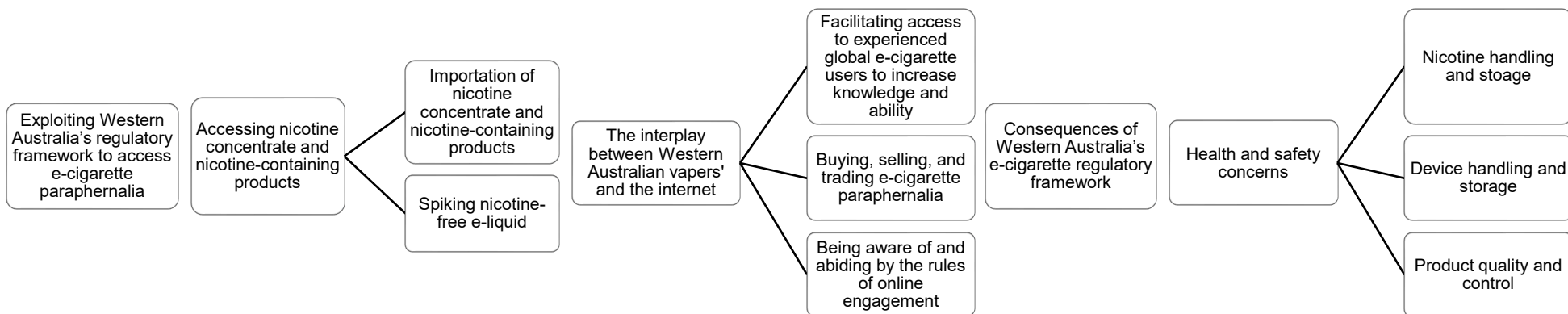


Qualitative study B

Level 1



Level 2



Appendix S: Participant demographic and behavioural data

ID	Gender	Age	Continent of birth	Education	Employment - Industry	IRSAD
1	M	38	Australia & Oceania	Vocational training or equivalent	Construction	2 - Disadvantaged
2	M	34	Australia & Oceania	High School or equivalent	Construction	3 - Neutral
3	M	32	Australia & Oceania	Vocational training or equivalent	Other services	1 - Most Disadvantaged
4	M	29	Australia & Oceania	Vocational training or equivalent	Other services	1 - Most Disadvantaged
5	M	27	Australia & Oceania	High School or equivalent	Retail Trade	2 - Disadvantaged
6	M	35	Asia	University Degree	Transport, Postal and Warehousing	2 - Disadvantaged
7	M	21	Australia & Oceania	Less than High School or equivalent	Retail Trade	2 - Disadvantaged
8	M	23	Australia & Oceania	Vocational training or equivalent	Retail Trade	3 - Neutral
9	M	29	Australia & Oceania	Vocational training or equivalent	Mining	1 - Most Disadvantaged
10	F	26	Australia & Oceania	University Degree	Professional, Scientific and Technical Services	5 - Most Advantaged
11	F	24	Australia & Oceania	University Degree	Full-time Student	4 - Advantaged
12	F	24	Australia & Oceania	University Degree	Education and Training	5 - Most Advantaged
13	M	36	Australia & Oceania	Vocational training or equivalent	Construction	4 - Advantaged
14	M	33	Europe	Less than High School or equivalent	Construction	5 - Most Advantaged
15	M	35	Africa	University Degree	Transport, Postal and Warehousing	5 - Most Advantaged
16	M	39	Australia & Oceania	Less than High School or equivalent	Construction	3 - Neutral
17	M	24	Asia	Vocational training or equivalent	Arts and Recreation Services	4 - Advantaged
18	M	45	South Africa	High School or equivalent	Retail Trade	3 - Neutral
19	M	45	Europe	Less than High School or equivalent	Retail Trade	2 - Disadvantaged
20	M	20	Australia & Oceania	Vocational training or equivalent	Administrative and Support Services	4 - Advantaged
21	F	43	Australia & Oceania	Vocational training or equivalent	Retail Trade	4 - Advantaged
22	M	35	Asia	University Degree	Professional, Scientific and Technical Services	5 - Most Advantaged
23	M	28	Australia & Oceania	University Degree	Retail Trade	3 - Neutral
24	F	34	Australia & Oceania	Vocational training or equivalent	Construction	3 - Neutral
25	F	27	Australia & Oceania	Less than High School or equivalent	Full-time Student	5 - Most Advantaged
26	M	42	Australia & Oceania	High School or equivalent	Retail Trade	2 - Disadvantaged
27	M	34	Australia & Oceania	High School or equivalent	Construction	3 - Neutral
28	F	33	Australia & Oceania	Less than High School or equivalent	Rental, Hiring and Real Estate Services	1 - Most Disadvantaged
29	M	38	Australia & Oceania	Vocational training or equivalent	Other services	2 - Disadvantaged
30	F	41	Australia & Oceania	University Degree	Accommodation and Food Service	1 - Most Disadvantaged
31	F	43	Australia & Oceania	Vocational training or equivalent	Unemployed	1 - Most Disadvantaged
32	F	45	Europe	Less than High School or equivalent	Unemployed	2 - Disadvantaged
33	M	36	Australia & Oceania	Vocational training or equivalent	Construction	1 - Most Disadvantaged
34	M	26	Australia & Oceania	University Degree	Retail Trade	2 - Disadvantaged
35	M	27	Europe	Vocational training or equivalent	Construction	4 - Advantaged
36	F	33	Australia & Oceania	High School or equivalent	Professional, Scientific and Technical Services	4 - Advantaged
37	M	20	Australia & Oceania	High School or equivalent	Accommodation and Food Service	3 - Neutral

ID	Gender	Age	Smoking status	Time tobacco use	Vaping status	Time vaping	Nicotine use	Primary reason started vaping
1	M	38	Ex-smoker	21-25 years	Current vaper	1-5 years	Yes	Quit smoking
2	M	34	Ex-smoker	11-15 years	Current vaper	1-5 years	Yes	Quit smoking
3	M	32	Ex-smoker	11-15 years	Current vaper	6-10 years	Yes	Quit smoking
4	M	29	Ex-smoker	6-10 years	Current vaper	1-5 years	Yes	Quit smoking
5	M	27	Ex-smoker	1-5 years	Current vaper	1-5 years	No	Quit smoking
6	M	35	Ex-smoker	16-20 years	Current vaper	<1 year	Yes	Quit smoking
7	M	21	Occasional smoker	6-10 years	Current vaper	1-5 years	Yes	Quit smoking
8	M	23	Occasional smoker	1-5 years	Current vaper	1-5 years	No	Social vaping
9	M	29	Ex-smoker	11-15 years	Ex-vaper	1-5 years	No	Quit smoking
10	F	26	Occasional smoker	1-5 years	Current vaper	<1 year	Yes	Quit smoking
11	F	24	Ex-smoker	6-10 years	Current vaper	<1 year	Yes	Quit smoking
12	F	24	Never smoker	N/A	Current vaper	<1 year	Yes	Social vaping
13	M	36	Ex-smoker	16-20 years	Ex-vaper	1-5 years	Yes (was not vaping)	Cost of cigarettes
14	M	33	Ex-smoker	16-20 years	Current vaper	1-5 years	No (weaned off)	Quit smoking
15	M	35	Occasional smoker	11-15 years	Current vaper	<1 year	Yes	Cost of cigarettes
16	M	39	Ex-smoker	16-20 years	Current vaper	6-10 years	Yes	Smoking prohibited at work
17	M	24	Ex-smoker	6-10 years	Current vaper	<1 year	Yes	Health
18	M	45	Ex-smoker	16-20 years	Current vaper	1-5 years	Yes	Quit smoking
19	M	45	Ex-smoker	21-25 years	Current vaper	1-5 years	No (weaned off)	Health
20	M	20	Ex-smoker	1-5 years	Current vaper	<1 year	Yes	Cost of cigarettes
21	F	43	Ex-smoker	21-25 years	Current vaper	1-5 years	Yes	Quit smoking
22	M	35	Current smoker	16-20 years	Ex-vaper	1-5 years	Yes	Health
23	M	28	Ex-smoker	1-5 years	Current vaper	1-5 years	No (weaned off, do	Quit smoking
24	F	34	Ex-smoker	11-15 years	Current vaper	1-5 years	Yes	Quit smoking
25	F	27	Ex-smoker	11-15 years	Current vaper	1-5 years	Yes	Recreation
26	M	42	Ex-smoker	16-20 years	Current vaper	6-10 years	Yes	Recreation
27	M	34	Never smoker	N/A	Current vaper	<1 year	Yes	Reduce alcohol consumption
28	F	33	Never smoker	N/A	Current vaper	1-5 years	No	Recreation
29	M	38	Ex-smoker	6-10 years	Current vaper	1-5 years	Yes	Cost of cigarettes
30	F	41	Ex-smoker	6-10 years	Current vaper	1-5 years	Yes (alternating bet	Cost of cigarettes
31	F	43	Ex-smoker	36-40 years	Current vaper	1-5 years	No	Prevent relapse
32	F	45	Ex-smoker	31-35 years	Current vaper	1-5 years	No (weaned off)	Cost of cigarettes
33	M	36	Occasional smoker	16-20 years	Current vaper	1-5 years	No	Recreation
34	M	26	Never smoker	N/A	Occasional vaper	1-5 years	No	Recreation
35	M	27	Current smoker	6-10 years	Ex-vaper	<1 year	Yes	Social vaping
36	F	33	Never smoker	N/A	Current vaper	1-5 years	Yes	To enjoy sweet foods after wei
37	M	20	Current smoker	1-5 years	Occasional vaper	<1 year	Yes	Cost of cigarettes

ID	Gender	Age	Social med	Trick videos	Vape comp	Convert othe	Give advice	Build coils	Hobby	Business	Vape in pub	Reviewer
1	M	38	Yes	No	No	-	-	No	No	No	Yes	No
2	M	34	Yes	No	No	Yes	Yes	Yes	Started as -	No	No	No
3	M	32	Yes	No	No	No	Yes	Yes	No	No	Yes	No
4	M	29	Yes	Yes	No	No	No	No	No	No	Yes	No
5	M	27	Yes	Yes	Yes - partici	Yes	Yes	Yes	Yes	Yes	Yes	No
6	M	35	Yes	-	-	Yes	Yes	Yes	Yes	No - would	-	Yes
7	M	21	Yes	No	No - would	Yes - not pus	Yes	No - but plan	Yes	No	Yes	No
8	M	23	Yes - but fe	No	No	Yes	Yes	No	No	No	Yes	No
9	M	29	Yes	No	No	Yes	Yes	Yes	Yes	No - did thi	Yes	No
10	F	26	No	No	No	-	-	No	No	No	Yes	No
11	F	24	No	No	No - would	-	Yes - but sugg	No	No	No	Yes - but try	No
12	F	24	No	Friends have	No	No	Yes - just the	No	No	No	No	No
13	M	36	No	No	No	Yes	Yes	No	No	No	Yes	No
14	M	33	Yes	Yes	-	Yes	Yes	No	Yes	Yes	Yes	No
15	M	35	Yes	No	No	Yes - not pus	Yes - mainly r	No	Yes	No	Yes	No
16	M	39	Yes	Yes	-	Yes	Yes	Yes	-	No	Yes	No
17	M	24	Yes	-	-	Yes	Yes	-	Yes	No	-	No
18	M	45	Yes	-	-	Yes	Yes	-	-	Yes	-	-
19	M	45	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
20	M	20	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	No
21	F	43	Yes	No	-	Yes	Yes	No	No	No	No	No
22	M	35	Yes	-	-	Yes	-	To start with	To start wit	Yes	Yes	-
23	M	28	Yes	No	No	Yes	Yes	Yes	Yes	Yes	-	-
24	F	34	Yes	No	No	-	Yes	No - did give	Sort of - ha	No	Yes	No
25	F	27	Yes	Yes	Yes	Yes	Yes	-	Yes	No	Yes	Yes
26	M	42	Yes	No	No	Yes	Yes	No - did at tl	Yes	Yes	Yes	No
27	M	34	Yes	Yes but get k	-	Yes	Yes	No	Started as -	No	Yes	No
28	F	33	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes - was ap
29	M	38	Yes	No	No	-	-	-	No	No	Yes	No
30	F	41	Yes	No	No	Yes - not pus	Yes	No	No	No	Yes - respec	No
31	F	43	Yes	No	No	Yes - not pus	Yes	No	No	No	Yes - but try	No
32	F	45	Yes	No	No	Yes - not pus	Yes	No	No	No	Yes	No
33	M	36	Yes	No	No	-	-	Yes	Yes	No	-	No
34	M	26	Yes	Yes	-	No	-	Yes	Yes	No	No	No
35	M	27	No	Yes - someti	-	Yes	Yes	No	Yes	No	Yes	No
36	F	33	Yes	No - partner	Yes	Yes	No	No	No	No	Yes	No
37	M	20	No	Yes	Yes	-	-	No	No	No	No	No

Appendix T: COREQ checklist

COREQ (Consolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

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