

Curtin School of Allied Health

**Oral and written communication skills of adolescents in youth justice
with and without prenatal alcohol exposure**

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This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

April 2021

Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person, except where due acknowledgement has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human ethics

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 HRE2018-0117), the University of Western Australia Human Research Ethics Committee (approval number RA/4/1/7116), and the Western Australian Aboriginal Health Ethics Committee (approval number 582).

Research approvals

Research approvals were also obtained from the Department of Justice, Western Australia (project number 335) and the Department of Communities, Western Australia (approval number 2015/8981). Any material published or made publicly available by the author cannot be considered as either endorsed by the Departments of Justice and Communities or an expression of the policies or views of these Departments. Any errors of omission or commission are the responsibility of the researchers.

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Date: 31.03.2021

Funding sources

I received funding from the National Health and Medical Research Council (NHMRC) funded FASD Research Australia Centre of Research Excellence (#1110341) PhD Scholarship and the Australian Government Research Training Programme PhD Scholarship. The Banksia Hill Study was funded through the NHMRC (#1072072).

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Abstract

Adolescents who are involved with youth justice have been identified with compromised oral and written communication skills. Additionally, this population has a high prevalence of language disorder (LD), which often goes unidentified. Weak communication skills are problematic in youth justice given that legal proceedings as well as educational and rehabilitation programmes are language-dense and typically administered through verbal communication. Accordingly, speech-language pathology (SLP) services are argued to be critical in youth justice to improve the identification of and response to adolescents with communication difficulties. However, in youth justice in Western Australia (WA), a context in which fetal alcohol spectrum disorder (FASD) is highly prevalent and Aboriginal¹ young peoples who may be speakers of Aboriginal languages are over-represented, there is a lack of knowledge about the communication skills of adolescents. Consequently, there is little evidence to draw upon to plan and deliver appropriate SLP services in youth justice in WA. Therefore, this programme of research sought to identify and describe the communication skills of this population.

A systematic review of published literature was undertaken to understand how oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared to those with no/low-PAE (Chapter 4). As part of a multidisciplinary team assessment that involved consideration of PAE and FASD, 99 adolescents who were sentenced to detention in WA participated in an SLP assessment (Chapter 3). First, or home, languages were identified and taken into account in standardised and non-standardised language and speech assessment. Speech and voice data were analysed, which included a comparison between adolescents with and without PAE (Chapter 5). Oral language outcomes were analysed to identify the prevalence of LD, including LD associated with FASD (Chapter 6). In addition, functional text-level language skills were

¹ Aboriginal peoples is respectfully used for the Western Australian context, given all study participants identified as Aboriginal young peoples and none as Torres Strait Islander young peoples; Aboriginal and Torres Strait Islander peoples is used for the Australian context more broadly; and Indigenous peoples is used for international contexts.

examined, including comparisons between oral and written modalities, and between adolescents with and without LD (Chapter 7).

Multiple languages were spoken as first or home languages by the adolescents in youth detention in WA (Chapter 6). This finding reflects strengths of the adolescents and their families, but also highlights the potential for communication breakdowns and inequitable access to justice services given that Standard Australian English (SAE) is the dominant language in Australia. Further, both adolescents with and without PAE presented with orofacial, oromotor, speech and voice anomalies at a higher prevalence than those that occur in community samples (Chapter 5). Forty-five adolescents (45%) were identified with LD, and of these, 25 (56%) had LD associated with FASD (Chapter 6). Oral and written narrative production difficulties were widespread, and adolescents with LD demonstrated considerably greater difficulties than those without LD in both modalities (Chapter 7). Results from the systematic review were consistent with findings from the SLP assessment in that adolescents with PAE and FASD generally had weaker language skills than those with no/low-PAE (Chapter 4). However, the research base within the literature was limited; word learning, syntactical, and speech skills were not reported on, and few studies examined written language skills. This highlights important gaps in understanding about the communication profiles of adolescents with PAE.

Findings from this research demonstrate the importance of assessing both oral and written communication skills of adolescents in youth justice as well as those with PAE and FASD. The results point to important opportunities for future SLP research and practice to help address the identified high levels of communication difficulties among adolescents in WA's youth justice system. Caution is warranted in generalising the findings to other populations; however, findings are likely to be relevant to other youth justice populations given that the LD prevalence and oral narrative results from this research were consistent with those of previous studies and that FASD is also highly prevalent in youth justice populations internationally. Overall, findings from this research emphasise a critical need for SLP services in youth justice in WA. Research outcomes are anticipated to inform these services, as well as SLP services for adolescents with PAE and FASD more broadly.

Acknowledgements

I am extremely grateful to have worked as a speech-language pathologist in a justice context. However, I acknowledge that this work arose because young people as well as victims and witnesses of crime experienced circumstances that resulted in contact with justice systems. I am hopeful that this research will contribute to achieving improved health, educational, social, and justice outcomes into the future.

I acknowledge the Whadjuk Noongar peoples as the traditional custodians of the land on which this research was undertaken. I pay my respects to the dedicated Elders of the past and present as well as the younger generations who are also leading communities. I acknowledge the contributions of both Aboriginal and non-Aboriginal peoples to strive for opportunities for all children in this country in which we all live.

My most sincere thanks go to the young people at Banksia Hill Detention Centre and their families who participated in this research. I thank the Western Australian Departments of Justice and Communities for the assistance provided to help plan and conduct this research. I particularly thank the custodial and non-custodial staff at Banksia Hill Detention Centre who welcomed our research team into their workplace.

To my supervisors, Associate Professor Suze Leitão, Dr Amy Finlay-Jones, and Dr Rochelle Watkins, you have each made valuable contributions to my professional and personal development. Suze, I appreciated your professional support and mentorship throughout the initial years of the Banksia Hill Study. I have fond memories of us brainstorming, planning, and problem solving together. For being my primary PhD supervisor, I sincerely thank you for the time you dedicated and the advice you imparted to me to improve my research as well as writing and oral presentation skills. Your constant motivation helped me to keep going. Amy, I am grateful for your encouragement. I often reflect on our discussions in which you challenged and extended my thinking about this research. I appreciated your empathy and compassion in challenging times, and I thank you for fostering confidence in me when I needed it. Rochelle, I thank you for your support. Your willingness and ability to work through my many research questions was

very much appreciated. I am grateful for your regular check-ins with me and your kind words when I lacked self-assurance.

I thank the Chief Investigators of the Banksia Hill Study, Professor Carol Bower, Clinical Associate Professor Raewyn Mutch, Professor Rhonda Marriott, and, again, Dr Rochelle Watkins. Carol, I very much appreciated your leadership and steadfastness. Raewyn, I am so grateful to have worked alongside you and to have witnessed your fierce patient care. Rhonda, I am very thankful for the time you gave me and for sharing your valuable insights and knowledge. My thanks also go to the Associate Investigators and members of the Steering and Advisory Committees of the Banksia Hill Study.

I thank Glenn Pearson, Mara West, Isabelle Adams, and Sharynne Hamilton for taking the time to speak with me about, and provide feedback on this research. My thanks also go to Professor Pamela Snow and Associate Professor Mark Boyes who provided input for my research proposal. I thank Dee Lightfoot and the interpreters at Aboriginal Interpreting WA for sharing their expertise in Aboriginal languages and interpreting services in the justice system. Jenny Baker, working with you opened my eyes to the complexities of literacy and written language development. Thank you for your generosity. Mary Woodward and Sally Kedge, thank you for your encouragement and for inspiring me.

To my colleagues at Telethon Kids Institute, especially Hayley Passmore, thank you for cheering me on. Being a member of a research group and working with you all was a real privilege. To my colleagues at Curtin University, especially those in the Language and Literacy in Young People research group, thank you for your professional support and sharing your own research experiences with me.

To my parents, thank you ever so much for patiently supporting and encouraging me through many years of university studies. To my husband, Frank, thank you for your love.

Candidature Research Activity

Publications included in this thesis

1. **Kippin, N.R.**, Leitão, S., Watkins, R., & Finlay-Jones, A. (2021). Oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared to those with no/low PAE: A systematic review. *International Journal of Language and Communication Disorders*, 56, 694-718. <https://doi.org/10.1111/1460-6984.12644>
2. **Kippin, N.R.**, Leitão, S., Finlay-Jones, A., Baker, J., & Watkins, R. (2021). The oral and written narrative language skills of adolescent students in youth detention and the impact of language disorder. *Journal of Communication Disorders*, 90, 106088. <https://doi.org/10.1016/j.jcomdis.2021.106088>
3. **Kippin, N.R.**, Leitão, S., Watkins, R., Finlay-Jones, A., Condon, C., Marriott, R., Mutch, R.C., & Bower, C. (2018). Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention in Western Australia. *International Journal of Law and Psychiatry*, 61, 40-49. <https://doi.org/10.1016/j.ijlp.2018.09.004>
4. **Kippin, N.R.**, Leitão, S., Watkins, R., Mutch, R., & Finlay-Jones, A. (under review). The orofacial, oromotor, speech and voice characteristics of adolescent students in youth detention: A comparison of groups with and without prenatal alcohol exposure.

Additional publications related to this thesis and the Banksia Hill Study

1. Snow, P., Leitão, S., & **Kippin, N.** (2021). Language and literacy in the context of early life adversity. In J. S. Damico, N. Müller, & M. J. Ball (Eds.), *The handbook of language and speech disorders* (2nd ed., pp. 266-285). Wiley-Blackwell.
2. Reid, N., **Kippin, N.**, Passmore, H., & Finlay-Jones, A. (2020). Fetal alcohol spectrum disorder: The importance of assessment, diagnosis and support in the Australian justice context. *Psychiatry, Psychology and Law*, 27, 265-274. <https://doi.org/10.1080/13218719.2020.1719375>
3. **Kippin, N.**, Elliott, E., & Thorne, J. (2020). Social communication problems among children with FASD: Fact sheet for health professionals 3. https://www.fasdhub.org.au/siteassets/blocks/clinical-tip-sheets/social-communication-problems_final_6april2020.pdf
4. Hamilton, S., Reibel, T., Watkins, R., Mutch, R.C., **Kippin, N.R.**, Freeman, J., Passmore, H.M., Safe, B., O'Donnell, M., & Bower, C. (2019). 'He has problems; he is not the problem...' A qualitative study of non-custodial staff providing services for young offenders assessed for foetal alcohol spectrum disorder in an Australian youth detention centre. *Youth Justice*, 19, 137-157. <https://doi.org/10.1177/1473225419869839>
5. Bower, C., Watkins, R.E., Mutch, R.C., Marriott, R., Freeman, J., **Kippin, N.R.**, Safe, B., Pestell, C., Cheung, C.S.C., Shield, H., Tarratt, L., Springall, A., Taylor, J., Walker, N., Argiro, E., Leitão, S., Hamilton, S., Condon, C., Passmore, H.M., & Giglia, R. (2018). Fetal alcohol spectrum disorder and youth justice: A prevalence study among young people sentenced to detention in Western Australia. *BMJ Open*, 8: e019605. <http://dx.doi.org/10.1136/bmjopen-2017-019605>
6. Passmore, H.M., Giglia, R., Watkins, R.E., Mutch, R.C., Marriott, R., Pestell, C., Zubrick, S., Rainsford, C., Walker, N., Fitzpatrick, J.P., Freeman, J., **Kippin, N.**, Safe, B., & Bower, C. (2016). Study protocol for screening and diagnosis of fetal alcohol spectrum disorders (FASD) among young people sentenced to detention in Western Australia. *BMJ Open*, 6: e012184. <http://dx.doi.org/10.1136/bmjopen-2016-012184>

Submissions and reports related to this thesis and the Banksia Hill Study

1. **Kippin N**, Passmore H, Cannon L, Finlay-Jones A, Mullan N, Jones H. (2020). *Requested report: Feedback regarding the FASD in schools online learning modules*. Department of Education, Western Australia.
2. Mutch R, Passmore H, **Kippin N**, Pestell C, Mitrou, F., Mullan, N., Pedruzzi, R., & Bower C. (2020). *Submission: Council of Attorneys-General Age of Criminal Responsibility Working Group Review*. Australian Government.
3. Bower C, Mutch R, Passmore H, **Kippin N**, Hamilton S. (2020). *Requested submission: Revision of the Western Australian Supreme Court Equal Justice Bench Book*. Department of Justice, Western Australia.
4. Thompson A, O'Donnell M, **Kippin N**, & Burrow S. (2020). *Submission: A Therapeutic Approach (Pilot Court) for Protection and Care in the Children's Court of WA, Discussion paper'*. Department of Justice, Western Australia.
5. Bower C, Finlay-Jones A, Hamilton S, **Kippin N**, Mutch R. (2019). *Submission: Response to the Coroner's report on the Kimberley Youth Suicides*. Coroner's Court of Western Australia.
6. Bower C, Elliott E, and the FASD Research Australia CRE. (2019). *Submission: The Senate Community Affairs References Committee for Effective approaches to prevention, diagnosis and support for Fetal Alcohol Spectrum Disorder*. Australian Government.
7. Banksia Hill Study team. (2017). *Submission: Review of the Young Offenders Act 1994*, Department of Justice, Western Australia.
8. Banksia Hill Study team. (2017). *Submission: The Royal Commission into the Protection and Detention of Children in the Northern Territory*. Australian Government.
9. Banksia Hill Study team. (2017). *Submission: Terms of Reference for Incarceration Rates of Aboriginal and Torres Strait Islander Peoples*. Australian Government.

Conference presentations arising from this thesis and the Banksia Hill Study

1. **Kippin, N.R.**, Lightfoot, D., & Taylor, C. (2019, November). *Responding to language variation: Collaboration between certified interpreters and clinicians in the Banksia Hill Study and beyond*. Australian and New Zealand Society of Criminology (ANZSOC) Conference, Perth, Australia.
2. **Kippin, N.R.** on behalf of the Banksia Hill Study team. (2019, November). *Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention* [Poster], ANZSOC Conference, Perth, Australia.
3. **Kippin, N.R.** on behalf of the Banksia Hill Study team. (2019, May). *Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention* [Poster: 1st prize], Telethon Kids Institute, Perth, Australia.
4. **Kippin, N.R.** on behalf of the Banksia Hill Study team. (2019, April). *Translating justice research into action using the Ottawa Charter for Health Promotion: The Banksia Hill Detention Centre Study*. Public Health Association of Australia Justice Health Conference, Sydney, Australia.
5. **Kippin, N.** & Leitão, S. (2018, November). *Language and FASD: The Banksia Hill Study*. The 2nd Australasian FASD Conference, Perth, Australia.
6. Bower, C., & **Kippin, N.** (2018, November). *The Banksia Hill Study*. The 2nd Australasian FASD Conference, Perth, Australia.
7. **Kippin, N.** (2018, December). *Language, FASD and Youth Justice: The Banksia Hill Study*. ANZSOC Conference, Melbourne, Australia.
8. **Kippin N.** on behalf of the Banksia Hill Study team. (2017, May). *Language, FASD and Youth Justice*. Speech Pathology Australia National Conference. Sydney, Australia.
9. The Banksia Hill Study team. *The first Australian study to screen and diagnose Fetal Alcohol Spectrum Disorders among sentenced youth*. The 7th International Conference on Fetal Alcohol Spectrum Disorders, Vancouver, 2017.
10. Bower, C., Mutch, R., Freeman, **Kippin, N.**, Safe, B., Hamilton, S., Pestell, C., Shield, H., Jones, H., & Passmore, H.M. (2016, September). *FASD and the criminal justice system*. The Royal Australian & New Zealand College of Psychiatrists Faculty of Forensic Psychiatry Conference, Fremantle, Australia.

Additional presentations arising from this thesis and the Banksia Hill Study

1. **Kippin, N.** (2021, March). *Communication, FASD and youth justice*. Telethon Kids Institute and Curtin University. Perth, Australia.
2. Mutch, R., **Kippin, N.**, Hamilton, S., & Passmore, H. (2019, November). *Banksia Hill Research*. Youth Justice and Health Forum, Perth, Australia.
3. **Kippin, N.** Bower, C., Finlay-Jones, A., & Mutch, R. (2018, December). *Health and Justice*. Social Reinvestment Western Australia, Perth, Australia.
4. Timms, L., Leitão, S., & **Kippin, N.** (2018, November). *Accessible communication in the justice system*, Social Policy Symposium, Curtin University,
5. **Kippin, N.** (2018, September). *Communication, FASD and working with interpreters in youth justice*. WA Police Academy, Australia.
6. Gray, M., & **Kippin, N.** (2018, October). *FASD and the Banksia Hill Study*. University of Western Australia medical and biomedical students, Australia.
7. Bower, C., & **Kippin, N.R.** (2018, May). *FASD and the Banksia Hill Study*. Australian Children's Commissioners and Guardians group. The Commissioner for Children and Young People, Perth, Australia.
8. Mutch, R., & **Kippin, N.R.** (2017, October 13 & 27). *FASD and the Banksia Hill Study*. The Academy, Department of Justice, WA, Australia.
9. Mutch, R., & **Kippin, N.** (2017, September). *FASD and the Banksia Hill Study*. Graylands Mental Health Service, Perth, Australia.
10. **Kippin, N.R.**, & Leitão, S. (2017, June). *Communication, FASD, and Youth Justice*. WA Police Academy, Perth, Australia.
11. Mutch R, & **Kippin N.** (2017, May). *The Banksia Hill Study: Early findings*. Youth Justice Officer Forum, Department of Justice, WA, Australia.
12. Bower C, Mutch R, & **Kippin N.** (2017, April). *The Banksia Hill Study: Early findings*. Youth Justice Reference Group. Department of Justice, WA, Australia.
13. **Kippin, N.R.** (2017, April). *Language, FASD and Youth Justice*. Fremantle Speech Pathology Services, Fremantle, Australia.
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15. **Kippin, N.R.**, & Leitão, S. (2016, September). *Language and literacy* [workshop for education staff]. Banksia Hill Detention Centre, Perth, Australia.
16. **Kippin, N.R.** On behalf of the Banksia Hill Study team. (2015). *Fetal Alcohol Spectrum Disorder and speech pathology*. Speech Pathology Ideas Night, Curtin University, Perth.

Podcast episodes arising from this thesis and the Banksia Hill Study

1. Kilpatrick, T., & **Kippin, N.** (Hosts). (to be released). Discourse and text-level language in adolescence: Relevance to mental health and youth justice [Audio podcast episode]. In *Language and literacy in young people (LaLYP)*. Curtin University.
2. Woodward, M. (Host). (2020, August). Communication in WA youth justice (Season 2, episode 29) [Audio podcast episode]. In *Speak Up: A Speech Pathology Australia podcast*. Speech Pathology Australia.
<https://podcasts.apple.com/us/podcast/communication-in-wa-youth-justice-s02-e29/id1472296991?i=1000487873229>
3. Cumming, C. (Host). (2020, March). FASD (Episode 8) [Audio podcast episode]. In *The Meaning of Health*. The University of Western Australia.
<https://soundcloud.com/meaningofhealth/episode-8-fasd>

Details of publication	Kippin, N.R., Leitão, S., Watkins, R., Mutch, R., Finlay-Jones, A. (under re-review). The orofacial, oromotor, speech and voice characteristics of adolescent students in youth detention: A comparison of groups with and without prenatal alcohol exposure.
Thesis chapter	5
Student contribution	95%; NRK was the lead speech-language pathologist and responsible for conceptualisation and design, methodology, data collection, curation, analysis, and interpretation, writing (original draft), writing (review and editing), final approval and submission. SL, RW, and AF-J provided PhD supervision and assisted with data analysis, data interpretation and writing (review and editing). RM assisted with data collection, data analysis, data interpretation and writing (review and editing).
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Details of publication	Kippin, N.R., Leitão, S., Watkins, R., Finlay-Jones, A., Condon, C., Marriott, R., Mutch, R.C., Bower, C. (2018). Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention in Western Australia. <i>International Journal of Law and Psychiatry</i> , 61, 40-49.
Thesis chapter	6
Student contribution	90%; NRK was the lead speech-language pathologist and responsible for conceptualisation and design, methodology, data collection, analysis and interpretation, writing (original draft), writing (review and editing), final approval and submission. SL, RW and AF-J provided PhD supervision and assisted with data analysis, data interpretation and writing (review and editing). CC provided data management and assisted with data analysis and writing (review and editing). RM assisted with writing (review and editing). RCM assisted with data interpretation and writing (review and editing). CB assisted with conceptualisation and writing (review and editing).
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Professor Rhonda Marriott	23/02/2021
Clinical Associate Professor Raewyn Mutch	22/02/2021
Professor Carol Bower	19/02/2021

Details of publication	Kippin, N.R., Leitão, S., Finlay-Jones, A., Baker, J., Watkins, R. (2021). The oral and written narrative language skills of adolescent students in youth detention and the impact of language disorder. <i>Journal of Communication Disorders, 90</i> , 106088.
Thesis chapter	7
Student contribution	95%; NRK was the lead speech-language pathologist and responsible for conceptualisation and design, methodology, data collection and curation, formal analysis and interpretation, writing (original draft), writing (review and editing), final approval and submission. SL, AF-J and RW provided PhD supervision and assisted with conceptualisation, methodology, data analysis, data interpretation, and writing (review and editing). JB provided mentorship and assisted with data interpretation and writing (review and editing).
Co-authors	Signature of agreement and date
Associate Professor Suze Leitão	05/03/2021
Dr Amy Finlay-Jones	19/02/2021
Jennifer Baker	22/02/2021
Dr Rochelle Watkins	18/02/2021

Glossary of Abbreviations

AA	Absolute alcohol
ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AE	Aboriginal English
ACARA	Australian Curriculum Assessment and Reporting Authority
CELF-4	Clinical Evaluation of Language Fundamentals – Fourth edition
DDK	Diadochokinetic
EAL	English as an additional language
FASD	Fetal alcohol spectrum disorder
FAS	Fetal alcohol syndrome
LD	Language disorder
MRR	Mean repetition rate
NHMRC	National Health and Medical Research Council of Australia
NSW	New South Wales
NWR	Non-word repetition
OZ	Ounce
PAE	Prenatal alcohol exposure
SAE	Standard Australian English
SLP	Speech-language pathology
WA	Western Australia

CHAPTER 1:

Thesis overview

Background

The overarching objective of this programme of research was to investigate the oral and written communication skills of adolescents in youth detention in Western Australia (WA). Legal proceedings as well as rehabilitation and educational programmes are typically administered through complex oral and written language (Lieser et al., 2019; Snow & Bryan, 2018). Therefore, an adolescent requires proficient communication skills, at word-, sentence-, and text-levels to participate in and receive benefit from youth justice services. However, language disorder (LD) is highly prevalent, but under-diagnosed, among adolescents in youth justice (Anderson et al., 2016), and some research shows that speech disorders also occur (Gregory & Bryan, 2011; Zinkus & Gottlieb, 1983). In addition, written language (literacy) problems are widespread (Rogers-Adkinson et al., 2008). A growing body of research also shows that fetal alcohol spectrum disorder (FASD) is highly prevalent, but under-diagnosed in this population (Hughes et al., 2016), and impaired oral and written language as well as speech difficulties can occur among individuals with FASD (Popova et al., 2016). Both weak communication skills and FASD are associated with poor social, emotional, and educational outcomes (Durkin et al., 2017; Streissguth et al., 2004), as well as offending behaviours (Brownlie et al., 2004; Flannigan et al., 2018; Katsiyannis et al., 2008). However, little is known about the overlap of communication difficulties with prenatal alcohol exposure (PAE) and FASD in adolescent populations, including in youth justice (Doyle et al., 2018). This has implications for accurate identification of and response to an individual's communication needs. In youth justice settings, failure to identify and respond to these needs may undermine the administration of legal proceedings and services designed to rehabilitate adolescents and address criminogenic risk (Reid et al., 2020; Snow, 2019).

A further factor related to communication that may compromise the justice process is a mismatch in languages used by service providers and adolescents. In Australia, Aboriginal and Torres Strait Islander young peoples, who may use first or

'home' languages in addition to the dominant language of Standard Australian English (SAE), are over-represented in youth justice (Australian Institute of Health and Welfare [AIHW], 2020). A mismatch in languages used highlights a risk for communication breakdowns to occur, which can undermine the administration of justice services (Eades, 2008, 2013). However, little is known about the language repertoires of adolescents in youth justice in Australia. This knowledge is vital for the planning and provision of responsive and equitable youth justice services.

The research included in this thesis addresses the knowledge gaps related to the overlap of language and speech difficulties with PAE and FASD as well as the language repertoires of adolescents in youth justice. This research has a specific focus on sentenced adolescents at WA's Banksia Hill Detention Centre, a context in which Aboriginal young peoples are over-represented and Australia's first prevalence study of FASD in a criminal justice population, called the Banksia Hill Study, was undertaken (Bower et al., 2018). The current programme of research was derived from the Banksia Hill Study, in which I was involved as part of a clinical assessment team. Stakeholders of the Banksia Hill Study and the current research included Aboriginal and non-Aboriginal peoples, families who have children with FASD, government and non-government representatives, including frontline workers, as well as researchers and clinicians who work in the fields of FASD and youth justice. Consultation and feedback with these stakeholders informed several aspects of this programme of research, including research designs, interpretation of findings, as well as the limitations and recommendations.

Research Aims

The over-arching objective of this programme of research was to identify and describe the communication skills of adolescents in youth detention in WA. The following specific questions guided this programme of research:

1. How do the oral and written communication skills of adolescents compare between those with and without prenatal alcohol exposure (PAE)?
2. What languages are spoken by adolescents in youth detention in WA?

3. What are the speech skills of adolescents in youth detention in WA, and how do they compare between those with and without PAE?
4. What is the prevalence of LD among adolescents in youth detention in WA, and what is the overlap of LD with FASD?
5. How do the text-level language production skills of adolescents in youth detention in WA compare by modality (oral and written), and by LD?

Overview of thesis chapters

This thesis comprises a series of chapters that address each of the research questions. Chapter 2 explores what is known about adolescent language and speech skills in the contexts of both youth justice and FASD and PAE. This broad overview provides a background for the programme of research.

Chapter 3 contains methodology and background information about the Banksia Hill Study, providing context and the setting for this programme of research.

Chapter 4 is presented as a submitted manuscript (accepted) to the *International Journal of Language and Communication Disorders*; it addresses research question one and provides a systematic review of published literature in regard to the oral and written communication skills of adolescents with PAE compared to those with no/low PAE.

Chapter 5 is presented as a submitted manuscript (under re-review) to a journal; it addresses research question three, and details the methods and results of non-standardised examinations of orofacial, oromotor, speech and voice characteristics of adolescents in youth detention in WA. This study includes a comparison of adolescents with and without PAE.

Chapter 6 is presented as the final, peer reviewed and published manuscript (open access), in the *International Journal of Psychiatry and Law*; it addresses research questions two and four and details the methods and results of the language assessment undertaken as part of the Banksia Hill Study. This study includes findings of language diversity as well as prevalence estimates of LD and LD associated with FASD among adolescents in youth detention in WA.

Chapter 7 is presented as the final, peer reviewed and published manuscript (open access), in the *Journal of Communication Disorders*; it addresses research question five and details the oral and written narrative language skills of adolescents in youth detention in WA and the impact of LD on the provision of narrative macrostructure and microstructure elements. This study involved only participants who were speakers of SAE, who were a subgroup from the larger participant study sample.

Chapter 8 presents a general discussion, including a summary of the main findings of the above studies and the strengths and limitations of this programme of research. Implications these findings have for future research and practice as well as research translation to date are also discussed.

CHAPTER 2:

Literature review

Chapter overview

Language and speech are key to communication. An understanding of their development as well as disorders of language and speech in adolescence is important as background for considering the communication skills of adolescents in youth justice. Therefore, this chapter commences with an introduction to speech and language skills and disorders, as well as associated functional impacts, with particular emphasis on the period of adolescence. Following this, the chapter includes a summary of what is currently known about the language and speech skills of adolescents in youth justice and among those with PAE and FASD.

Adolescence and communication skills

Adolescence

Adolescence involves rapid growth and neurocognitive development, supporting more advanced learning and socialisation, and in turn, the transition to greater independence (Arain et al., 2013; Dahl et al., 2018). With greater independence, the contexts in which communication occurs extends beyond the family and primary school settings and into more demanding social, secondary school, and occupational settings (Spencer, 2018). The adolescent years begin when biological changes associated with puberty occur; however, the end point of adolescence varies across countries and communities, and may be based on educational attainment or social and financial independence rather than on a biological event (Blakemore, 2018). The World Health Organisation defines adolescence as 10 to 19 years of age while health researchers consider both the adolescent (10 to 19 years) and youth (15 to 24 years) age groups as being within the scope of adolescent health (Patton et al., 2016; Viner et al., 2012). Just as development in childhood lays the foundations from which adolescence emerges, development within adolescence underlies and modifies longer-term health and wellbeing (Dahl et al., 2018). Therefore, it is argued that investment in adolescent health can yield

triple dividends whereby gains are realised in the short term - during adolescence, into the longer-term - in adulthood, as well as into the much longer term – in other words, into the lives of children of the next generation (Patton et al., 2016).

Language and speech skills

Communication is a complex process and draws on both language and speech. Language skills encompass semantics (meaning) and syntax (grammar, morphology), and are necessary for the effective exchange of information (McLeod & McCormack, 2015). Language in the oral modality is shared through speech, which comprises phonetics (speech sounds), phonology (linguistic rules that govern speech sound use) and oromotor processing (motor functions that plan and produce speech sounds) (McLeod & McCormack, 2015). Language in the written modality is shared through print, requiring skills in spelling, writing, and reading (decoding and comprehension) (Leitão, 2015; Nation, 2019). Oral and written communication are also associated with other skills, including attention, memory, and executive functioning (Rosselli et al., 2014). Competence with word- and sentence-levels of communication, in both oral and written modalities, is foundational to the development and use of discourse- and text-levels of communication (Ferguson & Spencer, 2015; Hall-Mills & Apel, 2015; Spencer & Petersen, 2018). Hence, language and speech skills are integral to successful participation in social and academic contexts (Feeney et al., 2017; Ferguson & Spencer, 2015), supporting functional independence in adolescence (Conti-Ramsden & Durkin, 2008) and work potential (Cronin et al., 2020; Dubois et al., 2020). The functional impacts of language and speech skills point to the importance of considering these in adolescent communication and provide motivation for examining them in adolescents within this programme of research.

As a primary neurodevelopmental process, oral language development occurs with exposure to words and concepts, resulting in the mapping of phonological, semantic, and syntactical representations (Brackenbury & Pye, 2005; Clark, 1995; Conti-Ramsden et al., 2015; Geary, 2008; Romeo et al., 2018). Across adolescence, this process continues, with increases in both vocabulary (words: receptive and expressive) and semantic knowledge (conceptual organisation of the lexicon) (Chami et al., 2018; Rice & Hoffman,

2015; Rosselli et al., 2014). Older research has identified that from the age of 10 years, adolescents encounter approximately 10,000 new vocabulary items in school texts per year (Feifel & Lorge, 1950; Werner & Kaplan, 1950), and more recent research shows that by 15 years, they can understand approximately 30,000 words (Nippold, 2016). From 10 years of age, adolescents also make the transition from having a mostly concrete understanding of word meanings to being able to apply more abstract thought and reasoning (Nagy & Herman, 1987). Growth in vocabulary and semantic knowledge enables adolescents to comprehend and produce more creative and detailed oral and written texts, and supports the interpretation and use of figurative language (Spencer, 2018; Spencer & Petersen, 2018). Competence in semantic skills is critical for accessing educational resources, and in turn, promotes further development of vocabulary and semantic knowledge (Nagy & Townend, 2012; Steele & Mills, 2011). Semantic skills also support participation in social contexts, in which the ability to converse about a range of topics and infer meaning, underpins effective two-way communication (Ferguson & Spencer, 2015; Spencer et al., 2010).

Syntax also becomes more advanced in adolescence, with basic sentence structures being manipulated and combined to create more complex utterances (Nippold, 2016; Rosselli et al., 2014). For example, the mean length of utterance in expository text-level language has been found to increase from 10 words at 11-years of age through to 12 and 14 words at 17- and 25-years, respectively (Nippold et al., 2007). Clausal density also increases with age, for example, changing from 1.5 clauses per utterance in an expository text of an 11-year-old to 1.8 and 2 clauses per utterance for those aged 17 and 25 years (Nippold et al., 2007). Age-related increases are not observed in all language tasks (Nippold et al., 2005); however, an increasing ability to adapt syntactical complexity according to different task, social, and pragmatic demands is characteristic of adolescent language (Ferguson & Spencer, 2015). Adolescents demonstrate more complex syntax in expository language compared to conversational language (Nippold et al., 2008; Nippold et al., 2015), and in narrative language compared to language used to respond to critical thinking questions (Nippold et al., 2014; Nippold et al., 2017). The variation in syntactical complexity across adolescence as well as within and across genres highlights the

importance of syntactical skills for meeting language demands of different contexts in which adolescents participate.

Development of written language skills, including spelling, writing, and reading, is also important in adolescence. This occurs through both explicit teaching and implicit learning, drawing on underlying language and cognitive skills (Mackenzie & Scull, 2015; McDonagh, 2015). Accordingly, development of written language skills is considered a secondary process (Geary, 2008; Snow, 2020). As discussed in Chapter 7, written language is typically more literate in style, with greater complexity and structure than oral language (DeVito, 1967; Haslett, 1983; Loban, 1976; Spencer & Petersen, 2018). It also requires punctuation to mark sentence boundaries, as well as accurate spelling to clarify meaning and promote fluent reading by an audience. Written language skills are important to becoming literate and are essential to achieving educational requirements of the school curriculum (Snow, 2016). Spelling, writing, and reading skills also support daily activities in the home and at work, for example, filling in forms, managing finances and reading workplace procedures. Given the importance of written language to both communication and participation in everyday contexts, these skills are important to consider when examining adolescent language skills.

Speech skills underlie the perception, encoding and production of speech sounds (McLeod & McCormack, 2015). A speaker of English will typically have acquired accurate speech sound production by approximately 7 to 8 years of age (Paul & Norbury, 2012). Proficient perception of speech sounds helps to build robust phonological and semantic representations of words (Brackenbury & Pye, 2005; Levelt, 1995). In oral language, this supports intelligibility and discrimination between words while in written language, this supports spelling and reading (decoding), whereby phonemes are mapped to and from graphemes (Leitão & Fletcher, 2004; Wagner & Torgesen, 1987). Speech skills are important contributors to confidence and psychosocial wellbeing as well as written language competence and educational outcomes (Feeney et al., 2017; McAllister et al., 2013; Wren et al., 2021). Thus, in the examination of adolescent language skills, it is also important to consider speech skills.

Language and speech disorders

The development of communication is the result of complex interactions between biological and psychosocial factors. Biological and psychosocial adversities can result in atypical development, including of communication skills (Snow, 2020). When problems with communication skills are enduring and result in significant functional impacts, such as on social interaction and educational attainment, diagnoses of language and speech disorders may be considered (Bishop et al., 2017; Washington, 2007). Language disorder is a significant, persistent, and quantifiable problem with either or both the comprehension of language (receptive language) and spoken expression (expressive language) (American Psychiatric Association, 2013). Speech disorders encompass phonological problems that result in sound distortions and mispronunciations as well as motor-based articulation problems (Bishop et al., 2017).

A range of terms have been used to refer to LD, including specific language impairment (SLI); however, in recent years, an international expert consortium reviewed existing terms, and reached consensus on terminology to be used for LD (Bishop et al., 2017). The consortium agreed that, ‘Developmental LD’ (DLD) would be used for LD of no known associated biomedical condition, and ‘LD associated with ‘X’ would be used for LD associated with a known biomedical condition, for example, LD associated with FASD, as is discussed in Chapter 6 of this thesis. Given that much of this research relates to adolescents in youth justice, and that neuro-disability is highly prevalent, however often unidentified, in this population (Hughes et al., 2012), it is likely that LD will commonly occur with other biomedical conditions. For this reason, LD and LD associated with ‘X’ will be used in this thesis.

Language disorder is one of the most highly prevalent neurodevelopmental disorders (Bishop, 2010). Research with younger children reports DLD prevalence at 7.6% and LD associated with intellectual disability and other conditions at 2.3% (Norbury et al., 2016). These figures indicate that every school classroom is likely to have students with significant communication difficulties (Norbury et al., 2016). The persistent nature of LD means that either or both language comprehension and expression difficulties continue from childhood into adolescence and beyond (Clegg et al., 2005; Durkin et al.,

2017; Law et al., 2009). Among adolescents, aged 10 to 18 years, the prevalence of language and speech difficulties, combined into a single category of communication disorders, is estimated to be 10% (McLeod & McKinnon, 2007).

There are important implications of language and speech disorders in adolescence. Language disorder is associated with less confidence, lower participation levels in social and educational activities and less independence (Conti-Ramsden & Durkin, 2008; Dubois et al., 2020; Durkin et al., 2017). In school, adolescents with LD require additional help from teachers and parents, for example, to follow the school timetable, understand classroom expectations, comprehend lesson content, as well as organise and complete their work (Conti-Ramsden & Durkin, 2008; Palikara et al., 2009). Adolescents with speech disorders have weaker skills in phonological awareness, reading, and spelling compared to those without speech disorders (Leitão & Fletcher, 2004), and are less likely to meet secondary curriculum expectations when compared to students with typical speech skills (Wren et al., 2021). Co-occurrence of speech disorders with LD further increases the risk of poor oral and written language outcomes (B. A. Lewis et al., 2015). The age at which adolescents with LD cease formal schooling is younger compared to those who do not have LD (Conti-Ramsden et al., 2018). For adolescents with LD who go on to participate in vocational and work-based training programmes, improvement in self-esteem, in domains including scholastic competence and physical appearance, have been reported; however, self-esteem in domains related to social acceptance and close friendships remains vulnerable (Lindsay et al., 2010). Adolescents with LD are at increased risk of mental ill-health following bullying victimisation compared to those without LD (Kilpatrick et al., 2019), and are more likely to have anxiety and social phobia (Voci et al., 2006; Wadman et al., 2011). Participating in job interviews, both in-person and via the telephone is difficult for individuals with LD, and fewer full-time and professional work roles are held by those with language and speech problems (Conti-Ramsden et al., 2018). An Australian study into the indirect costs of communication needs revealed that oral and written language difficulties negatively impact workforce participation through reduced educational achievement, resulting in a yearly loss of income of \$133 to \$451 per person (Cronin et al., 2020). Individuals with LD are also more likely to require support from others to manage financial tasks, such as paying bills

(Winstanley, Durkin, et al., 2018). Such results demonstrate the pervasive and functional implications of language and speech disorders on social, educational, and occupational success, outcomes of which are likely to be relevant to the rehabilitation of adolescents in youth justice. This provides the rationale for the examination of adolescents' language and speech skills as part of this research.

Despite the significant implications, disorders of language and speech skills can be overlooked as factors which underlie social and academic failure as well as behaviour problems (Clegg et al., 2009; Law & Stringer, 2014; Snow et al., 2012). For example, among 50 adolescent students who were excluded from, or diverted out of, mainstream schools and into flexible learning programmes, 14% reported a previously diagnosed communication disorder; however, upon direct language assessment, 52% of the 50 students were found to have oral language problems (Snow, Graham, et al., 2020). For some adolescents, weak literacy skills and academic failure can increase criminogenic risk (Barton & Hobson, 2017; Christle et al., 2010; O'Brien, 2019; Wald & Losen, 2003). Among 238 adolescents, weaker oral language and reading skills were identified among those who had been in trouble at school or with police services, compared to those who had not been in trouble (Conti-Ramsden & Durkin, 2008). An earlier study revealed a direct effect of LD on criminal behaviour, arrests, and convictions in adolescence (Brownlie et al., 2004). However, in youth justice, communication skills are typically presumed to be adequate and are not routinely assessed (Winstanley et al., 2020). This highlights that the communication skills of adolescents in youth justice is an important area of need that requires further attention.

Youth justice

In this section, I describe what is known about adolescents in youth justice contexts, and then provide a brief overview of language and speech difficulties in this population as background for the studies I report on in Chapters 5, 6 and 7 of this thesis.

Adolescents in youth justice

In community and custodial youth justice contexts, there is variation in the terminology used within research to refer to adolescents who have participated, or allegedly participated, in criminal behaviour. Some examples of terms include youth

offenders, delinquents, incarcerated youths, and adolescents in detention (Borschmann et al., 2020; Sanger et al., 2001; Snow, 2019; Strnadová et al., 2017). The minimum age of criminal responsibility is recommended by the United Nations (2019) to be 14 years; however, this varies across countries. For example, the minimum age is 7 years in Grenada (*Criminal Code 1987*) and 16 years in Timor-Leste (*Decree Law No. 19/2009*). In all Australian states and territories, the minimum age of criminal responsibility is being reviewed (Attorney-General's Department, 2019). However, it is currently 10 years of age, and adolescents up to 17 years who are charged with a criminal offence are managed by respective state government youth justice agencies (AIHW, 2021). Individuals who are charged with a criminal offence from the age of 18 years in Australia are managed by adult corrective services.

Australia-wide, between 2018 and 2019, there were, on average, 5,694 Australian adolescents under youth justice supervision per day, 956 of whom were on custodial orders (AIHW, 2020). Aboriginal and Torres Strait Islander young peoples are over-represented in the Australian youth justice system. While making up just 6% of the country's total youth population, aged 10 to 17 years, Aboriginal and Torres Strait Islander young peoples make up 58% of those on custodial orders and 48% of those on community-based orders (AIHW, 2020). In WA, between 2019 and 2020, a daily average of 1,412 adolescents were under youth justice supervision, 107 of whom were on custodial orders (72% Aboriginal young peoples, 90% male) (Department of Justice, 2020). The rate of return to sentenced detention within two years of release was 53% (Department of Justice, 2017, 2020). The five most committed principal offences by adolescents in WA are theft, acts intended to cause injury, unlawful entry with intent, illicit drug offences, and property damage/environmental pollution (Australian Bureau of Statistics [ABS], 2020).

Aboriginal and Torres Strait Islander young peoples

Contributory factors for the over-representation of Aboriginal and Torres Strait Islander young peoples in youth justice need to be acknowledged. The colonisation of Australia, which began in 1788, resulted in the land on which Australia's Aboriginal and Torres Strait Islander peoples lived and thrived being occupied by European settlers

(Broome, 2010). Disputes over land and liberty escalated into massacres of many Aboriginal and Torres Strait Islander communities (Broome, 2010). The introduction of foreign foods, alcohol as well as viruses also increased vulnerability to sickness, mental ill-health, and premature death (Dudgeon et al., 2014; Parker & Milroy, 2014). Oppressive legislation promoted systemic and institutional racism. For example, Aboriginal and Torres Strait Islander peoples were forbidden from entering specified areas, participating in cultural practices as well as speaking home languages, and unjust imprisonment occurred (Australian Human Rights Commission, 1997; Dudgeon et al., 2014). The Western Australian *Aborigines Act 1905* enabled forcible removal of Aboriginal and Torres Strait Islander children from their families (Australian Human Rights Commission, 1997). It was not until 1962 that Aboriginal and Torres Strait Islander peoples were given voting rights as Commonwealth Electors (*Commonwealth Electoral Act 1962*), and in 1967, were acknowledged as Australian citizens within the Constitution (Parliament of Australia, 2007).

Today, Aboriginal and Torres Strait Islander peoples continue to challenge and overcome longstanding social norms that have impeded equitable access to opportunities and services including education and employment. However, colonisation and racism still occur, for example, through education, health, and justice services, which are steeped in both European values and the English language (Freeman & Staley, 2017; Locke, 2018; Shepherd & Phillips, 2016; Sherwood, 2013). International research has identified that racial discrimination exposure for Indigenous young peoples has strong longitudinal associations with poor physical and mental health outcomes, as well as with risk-taking and offending behaviours (Cave et al., 2020). In addition, involvement with the criminal justice system compounds inequities in education and employment for Indigenous adolescents, further compromising adolescent development and a successful transition into adulthood (Sittner & Estes, 2020).

Health needs in youth justice

Internationally, adolescents in youth justice are increasingly recognised as requiring comprehensive supports and services to address a range of health, psychosocial and educational needs (Borschmann et al., 2020; Lim et al., 2018). In Australia, 58% of

adolescents in youth detention in New South Wales (NSW) had a substance-related disorder, 25% had an anxiety disorder, and 73% had disengaged from education services (Justice Health and Forensic Mental Health Network, 2017). In Victoria, 22% of adolescents in youth detention were dependent on heroin, 37% were first expelled from school by 14-years of age, and 54% had family members who had also been incarcerated (Kinner et al., 2014). Attempted suicide, abuse, and sexual and reproductive health concerns are also reported among adolescents in youth justice (Justice Health and Forensic Mental Health Network, 2017; Kenny et al., 2008; Meurk et al., 2019). High prevalence of neuro-disabilities, including intellectual disability, attention deficit hyperactivity disorder (ADHD), autism, traumatic brain injury and epilepsy has also been identified (Cheely et al., 2012; Hughes et al., 2012; Kenny et al., 2008; Rava et al., 2017). Two neurodevelopmental disorders, LD and FASD, are also common, yet under-diagnosed among adolescents in youth justice, and improved practices to better identify and respond to adolescents with these disorders are recommended (Passmore et al., 2018; Snow, 2019). Language and speech skills as well as PAE and FASD will now be explored in more detail.

Language and speech skills of adolescents in youth justice

Language and speech disorders

Language disorder is highly prevalent among adolescents in youth justice. As discussed in more detail in Chapters 6 and 7, internationally, adolescents in youth justice score lower on oral language measures compared to those who have not participated, or allegedly participated, in criminal behaviour, and LD prevalence ranges between 19% and 90%, depending on criteria used (Anderson et al., 2016). Research also shows that LD is associated with more violent offending behaviours (Mouridsen & Hauschild, 2009; Snow & Powell, 2011). In Australia, a small body of work undertaken in Victoria and NSW youth justice contexts indicated LD prevalence to be between 37% and 52% (Justice Health and Forensic Mental Health Network, 2017; Snow & Powell, 2004, 2008, 2011; Snow et al., 2016). Subgroup analyses limited to Aboriginal and Torres Strait Islander young peoples indicated LD prevalence, or severe language difficulties, to be between 44% and 57% (Justice Health and Forensic Mental Health Network, 2017; Snow et al.,

2016). As expanded on in Chapter 7, narrative language skills in the oral modality are also weak among adolescents in youth justice in Australia, both among those with and without LD (Humber & Snow, 2001; Snow & Powell, 2005, 2008). These results highlight that many adolescents in youth justice are likely to lack the language skills required to effectively participate in evidentiary contexts as well as rehabilitation and educational programs, all of which are language dense (Lieser et al., 2019; Snow & Bryan, 2018).

The high prevalence of LD identified in these studies and recognition of their functional impacts were key drivers for the implementation of SLP interventions in youth detention centres in Victoria and NSW. Preliminary evaluations of the effects of the interventions revealed promising results, with improved language, social communication, and speech skills, as well as self-confidence among the small groups of participating adolescents (Snow et al., 2017; Snow & Woodward, 2016; Swain et al., 2020). Such results support the argument that SLP services are important and beneficial in youth justice settings (Snow, 2019). However, there is currently a lack of research related to the oral communication skills of adolescents in youth justice in the remaining Australian states and territories. Consequently, there is little evidence to draw upon to plan SLP services and inform existing programs and interventions. Further, in comparison to research on LD, there has been little research on the prevalence and profiles of speech skills and disorders among adolescents in youth justice contexts internationally. This highlights a gap in current understanding of the supports and interventions that may be required. This provided strong motivation for investigating the speech skills in this population as described in Chapter 5.

Adolescents in youth justice also experience difficulties with written language skills (Rogers-Adkinson et al., 2008). As discussed in more detail in Chapter 7, a small body of research shows that adolescents in youth detention lack adequate written expression skills at the text-level of language to meet expectations of the school curriculum (Green et al., 2018). Reading difficulties are also common in adolescents in youth justice (Grigorenko et al., 2015), and are associated with both vocabulary and phonological deficits (Snowling et al., 2000). In youth detention centres in NSW and South Australia, approximately 50% of adolescents were found to struggle reading at the single-word level and more than 70% had difficulties comprehending what they were

reading (Justice Health and Forensic Mental Health Network, 2017; Putnins, 1999). Weak academic skills were previously identified to predict criminal behaviour (Maguin & Loeber, 1996), and more recent research shows they are strongly associated with recidivism (Katsiyannis et al., 2008). Adolescents in youth justice have reported that they desire improved literacy skills and that literacy skills are important for comprehending legal documentation (Hopkins et al., 2016). A recent small-scale intervention study in youth detention in Victoria showed that SLP intervention was efficacious in improving adolescents' reading and spelling skills (Swain et al., 2020). Given written language skills of adolescents in youth justice are vulnerable but responsive to targeted intervention, further investigation of these skills among a larger sample is warranted to help identify specific areas of need and inform SLP services into the future.

Languages spoken in youth justice

When evaluating the communication skills of adolescents in youth justice, it is also important to consider the languages used, given the over-representation of Indigenous young peoples. In Australia, the language of the majority population is SAE; however, among Aboriginal and Torres Strait Islander peoples, SAE may be spoken as an additional language to a first, or 'home' language (ABS, 2017; Cox & Palethorpe, 2010). Aboriginal English is spoken by most Aboriginal and Torres Strait Islander peoples (Butcher, 2008); it is a language that developed among Aboriginal and Torres Strait Islander peoples following colonisation to support communication with European settlers (Simpson & Wigglesworth, 2008; Malcolm, 2013). While Aboriginal English incorporates linguistic properties of both traditional Aboriginal and Torres Strait Islander languages and SAE, it varies to SAE in phonology, semantics, syntax, and pragmatics (Department of Education, 2012; Webb & Williams, 2020). Another 123 Aboriginal and Torres Strait Islander languages are spoken to varying extents (Office for the Arts, 2020). Such language diversity highlights that consideration of the language repertoires of adolescents in youth justice is important.

As discussed in Chapter 6, there is limited literature related to the languages spoken by adolescents in the Australian youth justice contexts. This is problematic given that legislation mandates that information be provided to adolescents in a language that

they can understand (*Young Offenders Act 1994*). While interpreter and translation services exist to help facilitate communication, these services are not always available to adolescents or used by service providers (Commonwealth of Australia, 2017; Eades, 2008). Therefore, adolescents who may be proficient in languages other than SAE can experience inequitable access to legal, rehabilitation and educational services (Commonwealth of Australia, 2017; Office for the Arts, 2020). Due to the dearth of information related to the languages used among adolescents in youth justice in WA, little is known about the implications for those who are speakers of SAE as an additional language. This emphasises the importance of understanding the language repertoires of this population to help promote more equitable services.

Accounting for home languages in the assessment of language and speech skills is important. As expanded on in Chapters 5 and 6, most assessments used to determine an individual's language and speech abilities are typically normed using samples of a population who speak the majority language (Farrugia-Bernard, 2018). Accordingly, there are concerns related to the use of standardised assessment tools with Aboriginal and Torres Strait Islander peoples (Armstrong et al., 2019; Gould, 2008; Laffey et al., 2014). Language and speech skills may be inadequately assessed, which can increase risk of under- or over-diagnosis of neurodevelopmental disorders (Norbury & Sparks, 2013; Webb & Williams, 2018). As a result, intervention services may be provided when they are not required, or not provided when they are required. These reasons provide rationale for identifying the languages used by adolescents in youth justice and accounting for first or home languages in the assessment of communication skills.

Prenatal alcohol exposure and fetal alcohol spectrum disorder

As expanded on in Chapters 4, 5 and 6 of this thesis, difficulties with language and speech skills occur in individuals with PAE and FASD, and are important to consider in FASD diagnostic decisions. However, little is known about the overlap of language and speech disorders with PAE and FASD in both the general adolescent and youth justice populations. In this section, a summary of what is meant by PAE and FASD is provided, followed by an introduction to language and speech disorders associated with PAE and FASD as well as the relevance of FASD to the criminal justice system.

PAE and FASD

Alcohol is a teratogen and in-utero exposure can have devastating consequences for neurocognitive functioning and physical development, potentially resulting in neurodevelopmental impairment including FASD (Burd et al., 2003; Lemoine et al., 2003; Streissguth et al., 1985). In 1987, PAE was recognised as the leading known cause of intellectual disability (Abel & Sokol, 1987). While intellectual disability does not occur in all individuals who have PAE, a spectrum of atypical neurodevelopmental and behavioural problems are associated with PAE, both with and without a diagnosis of FASD (Amos-Kroohs et al., 2016; Jirikowic et al., 2016; Kerns et al., 1997; Mattson et al., 2019; McDougall et al., 2020; McLachlan, Flannigan, et al., 2020; Safe et al., 2018). Growth deficits and sentinel facial features (short palpebral fissures, smooth philtrum and thin upper lip compared to the lower lip) may also be present in some individuals who have PAE (Hoyme et al., 2016). Thus, decisions related to a FASD diagnosis involve consideration of: growth and structural characteristics; neurocognitive domains, which include brain size/neurology, executive functioning, memory, attention, language, cognition, and motor skills; and functional domains, which include academic achievement, adaptive functioning, and mental health (Bower & Elliott, 2016; Bower et al., 2017; Cook et al., 2016; Hoyme et al., 2016; Scottish Intercollegiate Guidelines Network, 2019). As expanded on in Chapter 5, FASD diagnostic categories and criteria vary across countries. In Australia, diagnostic categories include FASD with or without three sentinel facial features, and diagnosis requires evidence of PAE and that an individual meets criterion for impairment, defined as a score of at least two standard deviations below the population mean, in at least three of the above-mentioned 10 domains (Bower et al., 2017). This emphasises the severity of the disorder. The annual economic burden of FASD, based on studies in New Zealand, Canada, the US, and Sweden, is \$22,810 per child and \$24,308 per adult through costs associated with, for example, morbidity, special education, criminal justice system involvement and premature mortality (Greenmyer et al., 2018). Research into the lifetime cost of FASD in Australia is currently underway (Finlay-Jones, 2021).

Internationally, approximately 7.7 per 1000 children and adolescents are estimated to have FASD; however, prevalence estimates vary across and within countries due to

different study methodologies, diagnostic criteria and populations included in study samples (Lange et al., 2017; Roozen et al., 2016). In Australia, prevalence of FASD with three sentinel facial features was identified to be 0.06 per 1000 live births through a national prospective surveillance study (Elliott et al., 2008). In WA, a prevalence of FASD, also with three sentinel facial features, was identified to be between 0.18 to 0.26 per 1000 live births through data linkage studies (Bower et al., 2000; Mutch et al., 2015). However, a prevalence of FASD, both with and without three sentinel facial features, was identified as 19% among 7- to 9-year-old children in remote WA communities through active case ascertainment (Fitzpatrick et al., 2017). As highlighted in Chapters 4 and 5 of this thesis, specific sub-populations, which include Indigenous peoples, children in care, individuals in special education and psychiatric services as well as individuals in justice settings, have increased prevalence of FASD (Popova et al., 2019). However, given the risks of PAE are inconsistently understood by health professionals and few FASD diagnostic services are available, FASD is considered to be under-diagnosed in the general community (Payne et al., 2014; Reid et al., 2019).

The under-identification of FASD and limited specialist services can restrict timely provision of required support and intervention services (Petrenko et al., 2014). As a result, the needs of an individual with PAE may be inadequately identified and addressed, increasing risk for problems with schooling, employment, and substance use (McLachlan, Flannigan, et al., 2020; Streissguth et al., 2004). Accordingly, it may not be until adolescence and adulthood, when behavioural, learning, and social problems become more apparent, that concerns about FASD are raised and assessment and supports are provided (McLachlan, Flannigan, et al., 2020). Further, diagnoses other than FASD, but which may co-occur with FASD, may be assigned given that the clinical presentation of FASD is complex (Flannigan, Gill, et al., 2019). For example, an overlap of FASD with ADHD (84%), intellectual disability (23%) and autism (13%) was identified from retrospective chart reviews of 31 children diagnosed with FASD at a specialist clinic in Australia (Reid et al., 2017).

Communication difficulties, including language and speech disorders, also occur as part of FASD, and speech-language pathologists have a key role in identification of, and intervention related to, FASD given that speech-language pathologists are likely to

be one of the initial health care providers accessed by families who have concerns about their child's development (Popova et al., 2014). Increased diagnostic and therapeutic capacity in health services is required for individuals with PAE and FASD (Reid 2017). Accordingly, greater understanding of the impact of PAE and FASD on communication skills is important to help inform speech-language pathologists' and other specialists' clinical practices.

Language and speech skills of individuals with PAE and FASD

As expanded on in Chapter 4, PAE and FASD are associated with deficits in several domains of language, including phonology, semantics, and syntax, as well as written language skills. Difficulties at the text-level of language are also reported, highlighting the impact of word- and sentence- level language difficulties on functional communication skills (Ganthous et al., 2017). In Australia, a national prospective surveillance study on FASD prevalence (mentioned above) showed that speech/language disorder, reported as a combined category, was the most commonly reported disorder among children with FASD (60%) (Elliott et al., 2008). However, very few individuals had received SLP intervention, and just 34% had received remedial education services (Elliott et al., 2008). A further Australian study reporting on neurocognitive profiles of individuals with FASD, aged 2- to 31-years, reported that 71% of 178 individuals also had LD (Connor et al., 2020). In WA, where FASD and alcohol use were identified as being high in remote communities, 43% of children aged 7 to 9 years diagnosed with FASD also had LD compared to 18% of those without FASD (Fitzpatrick et al., 2017). Further, 62% of the children with FASD had under-achieved at school compared to 28% of those without FASD (Fitzpatrick et al., 2017). In Canada, the world's first known follow-up study examining manifestations of FASD in adolescence and adulthood revealed average spelling and reading abilities were equivalent to the levels expected of grade three and four students (Streissguth et al., 1991).

Despite oral and written communication skills being commonly compromised in FASD and the functional implications for social, educational, and occupational outcomes, little research has been undertaken to examine communication profiles of adolescents who have PAE and FASD (Doyle et al., 2018). Further, in Canada, individualised SLP

intervention for adolescents with FASD was estimated to cost between CAD\$21 million and CAD\$43 million depending on the severity of impairment and length of intervention period; however, these estimates are limited due to poor understanding of what constitutes the most effective SLP intervention approaches for adolescents with FASD (Popova et al., 2014). The gap in what is known about oral and written communication skills of adolescents who have PAE and FASD has implications for both accurate diagnosis and best practice for intervention provision during this critical developmental period. This underpins the rationale for exploring the oral and written communication skills of adolescents with PAE and FASD in both youth justice and general adolescent populations.

FASD in youth justice

Neurodevelopmental and functional impairments associated with PAE and FASD are pertinent considerations in forensic contexts (Flannigan, Pei, et al., 2019; Jonsson et al., 2018). Problems with decision-making, social skills, and moral maturity can result in individuals with FASD becoming both victims and perpetrators of criminal behaviour (Brownell et al., 2019; Fraser, 2008; Pei et al., 2016; Schonfeld et al., 2005). A seminal study that examined adverse life outcomes of 415 individuals with FASD revealed that 67% had experienced physical, sexual, or domestic abuse, and among the adolescent group specifically ($n = 163$; 12 to 21-years of age), 67% had been arrested and charged with criminal behaviour (Streissguth et al., 2004). A more recent study identified that 47% of 92 adolescents with PAE and FASD had been involved with the criminal justice system (Popova et al., 2021). There is increasing recognition of reduced culpability given the severity of neurodevelopmental impairments associated with PAE and FASD (Brookbanks, 2020; Freckelton, 2016a; Greenspan & Woods, 2018). In Australia, implications of FASD for both sentencing and the provision of services to deter recidivism are beginning to be understood (Freckelton, 2016b). However, greater understanding of FASD and its associated impairments is required to help plan and provide appropriate youth justice services (Reid et al., 2020).

In youth justice, FASD prevalence has been previously examined and consistently found to be high (Hughes et al., 2016; Popova et al., 2011). Researchers using active case ascertainment identified FASD in 23% of Canadian adolescents remanded at a forensic

psychiatric facility (Fast et al., 1999) and 86% of adolescents serving an adjudicated probation order and who were referred for assessment (Conry & Lane, 2009). Other methods, including file reviews and self-report methods to estimate FASD prevalence in justice populations resulted in 16% of Israeli adolescents in a correctional facility being identified with suspected FASD (E. Fisher et al., 2019), and 11% of Canadian adolescents completing a sexual offence treatment programme being identified with suspected or diagnosed FASD (Rojas & Gretton, 2007). A survey of adolescents in custody in Canada, undertaken in 2005 and again in 2013, identified that 12% and 21% of adolescents (respectively) had been told that they had FASD (Murphy & Chittenden, 2005; Smith et al., 2013). These studies included between 47 and 72% Indigenous young peoples, and a higher prevalence of FASD was found among Indigenous young peoples (Murphy & Chittenden, 2005; Rojas & Gretton, 2007; Smith et al., 2013).

In Australia, children exposed to maternal alcohol use disorders are at increased odds of justice system involvement (Hafekost et al., 2017). However, the prevalence of FASD within a justice population was not known until recently when Bower et al. (2018) undertook a FASD prevalence study among adolescents sentenced to youth detention in WA, detailed in Chapter 3. No other known studies report on FASD prevalence in Australian custodial or community-based youth justice contexts. Accordingly, current knowledge about FASD, including LD associated with FASD, within Australian youth justice contexts is limited.

Language and speech disorders, FASD and youth justice

As expanded on in Chapters 4, 5 and 6 of this thesis, there is a small body of literature related to the co-occurrence of language and speech disorders with PAE and FASD in youth justice populations. For example, among a small group of adolescents with FASD in youth justice in Canada, 43% had severe receptive language difficulties, 80% had moderate to severe difficulties with verbal reasoning, and 21% had articulation difficulties (Conry & Lane, 2009). Individuals with FASD have demonstrated weak oral narrative production skills, omitting key events and using poor coherence throughout a story (Ganthous et al., 2017). In evidentiary contexts, this is concerning given narrative language skills underpin the provision of a detailed testimony (Snow et al., 2012). Further,

compromised language and cognitive skills associated with FASD can increase the risk for suggestibility and confabulation, which has implications for police interviews and cross-examinations (Brown et al., 2011; Brown et al., 2020; Freckelton, 2016c). Young people with LD, both with and without FASD, have been identified with weak skills in the comprehension, explanation, and application of their legal rights that are related to avoiding self-incrimination and having legal representation to help ensure procedural fairness (Lieser et al., 2019; McLachlan et al., 2014; Rost & McGregor, 2012). In one of these studies, intelligence and reading comprehension, which include measures of language and verbal skills, were predictive of comprehension, explanation, and application of such rights rather than a FASD diagnosis (McLachlan et al., 2014). Such findings highlight that the communication skills of both adolescents with and without FASD are particularly important to consider in forensic contexts.

Communication difficulties among adolescents in youth justice are also likely to have implications for rehabilitation and educational programmes designed to address criminogenic risk. Adolescents with unidentified LD were 2.5 times more likely to reoffend within 12 months of a court order than those without LD, irrespective of other known risk factors (Winstanley et al., 2020). In contrast, PAE was found as having no effect on the frequency or variety of offending behaviours compared to life stress, drug use and reduced parental supervision among 250 adolescents with and without PAE (Lynch et al., 2003). Previous studies with youth justice workforces highlighted that staff underestimated the level of communication needs of the adolescents they work with, and that working with speech-language pathologists improved the ways in which staff communicated with and delivered services to adolescents (Bryan & Gregory, 2013; Games et al., 2012; Snow et al., 2017). Hence, examination of the communication skills of adolescents in youth justice is particularly important to help inform interventions and build workforce capacity in youth justice.

In summary, little is known about the overlap of language and speech disorders with PAE and FASD among adolescents in youth justice. There is also a lack of knowledge about the communication skills of adolescents in youth justice in WA. This highlights the risk that adolescents' communication needs are likely to go unmet in youth justice. If specific needs are not understood, then services provided by youth justice

services are likely to be undermined. This lack of knowledge underpinned this programme of research, which is nested within the Banksia Hill Study described in Chapter 3.

CHAPTER 3:

The Banksia Hill Study

Chapter overview

This chapter provides background information to the Banksia Hill Study, providing context and the setting for the current programme of research. A protocol for the Banksia Hill Study was published; however, the paper was written outside of the period in which the current programme of research was undertaken, and my contribution was limited to the methods section. Further, a FASD prevalence paper for the Banksia Hill Study was also published; however, my contribution was limited to the SLP assessment findings. Hence, this chapter provides a summary of both the methods detailed in the published protocol and the main findings from the published prevalence study. The term ‘young people’ was used in these published studies to refer to adolescents in WA’s youth detention centre, and is the term preferred by Department of Justice; therefore, ‘young people’ is used in this chapter.

The citation for the protocol paper, of which I am a co-author is:

Passmore, H. M., Giglia, R., Watkins, R. E., Mutch, R. C., Marriott, R., Pestell, C., Zubrick, S.R., Rainsford, C., Walker, N., Fitzpatrick, J.P., Freeman, J., **Kippin, N.**, Safe, B., & Bower, C. (2016). Study protocol for screening and diagnosis of fetal alcohol spectrum disorders (FASD) among young people sentenced to detention in Western Australia. *British Medical Journal Open*, 6, e012184 <http://dx.doi.org/10.1136/bmjopen-2016-012184>

The citation for the prevalence paper, of which I am a co-author is:

Bower, C., Watkins, R. E., Mutch, R. C., Marriott, R., Freeman, J., **Kippin, N. R.**, Safe, B., Pestell, C., Cheung, C.S.C., Shield, H., Tarratt, L., Springall, A., Taylor, J., Walker, N., Argiro, E., Leitão, S., Hamilton, S., Condon, C., Passmore, H.M., & Giglia, R. (2018). Fetal alcohol spectrum disorder and youth justice: A prevalence study among young people sentenced to detention in Western Australia. *BMJ Open*, 8, e019605. <http://dx.doi.org/10.1136/bmjopen-2017-019605>

Introduction

In Australia, there is increasing recognition of FASD and its implications for young people and forensic, health and educational service providers. As discussed by Passmore et al. (2016), both government and non-government agencies have highlighted a need to better identify and support young people in youth justice who have FASD. The Australian justice workforce have also identified that they required knowledge related to FASD to assist them in their work (Mutch et al., 2016). However, the prevalence of FASD in any justice-related population group in Australia was previously unknown. Given the identified high prevalence of FASD in international justice contexts (Hughes et al., 2016) as well as among Aboriginal children in WA (Fitzpatrick et al., 2017), it was anticipated that young people with FASD would be over-represented in youth justice in WA.

With support from key government and non-government agencies, the Banksia Hill Study was planned and undertaken. The aims of this National Health and Medical Research Council (NHMRC) funded research study were to determine the prevalence of FASD among young people in youth detention in WA and to help guide the identification of and response to those who have FASD. To determine the prevalence of FASD, four clinicians (paediatrician, speech-language pathologist, occupational therapist, provisional neuropsychologist) administered a range of assessments with young people in youth detention. The programme of research reported in this thesis draws upon the SLP assessment protocol. Chapters 5, 6, and 7 of this thesis provide detailed information specific to the SLP assessment. A summary of the over-arching Banksia Hill Study methods is provided here.

Materials and Methods

Ethics approval

Ethics approval for the Banksia Hill Study, inclusive of this research, was provided by the Western Australian Aboriginal Health Ethics Committee (approval number 582) and the University of WA Human Research Ethics Committee (approval number RA/4/1/7116). Research approvals were also provided by the WA Department of Justice (project ID 335) and the WA Department for Child Protection and Family Support (approval number 2015/8981). Additional ethics approval for the current programme of

research was obtained from the Curtin University Human Research Ethics Committee (approval number HRE2018-0117).

Setting

Banksia Hill Detention Centre is located in Perth, WA, and holds male and female young people, aged 10- to 18-years, who are on remand or a custodial sentence due to involvement, or alleged involvement, in criminal behaviours. It is the only youth detention centre in WA. At the time of the Banksia Hill Study, which was undertaken during 2015 to 2016, there was an average of 133 young people in youth detention each day, 73% of whom were Aboriginal young peoples and 94% were male (Department of Corrective Services, 2016).

Consultation

Prior to research funding being sought and secured for the Banksia Hill Study, extensive consultation was undertaken with several stakeholder groups to establish the feasibility and appropriateness of a FASD prevalence study in a youth justice setting. This included consultations with the Department of Justice as well as Aboriginal and non-Aboriginal community groups that were involved with work related to both youth justice and FASD. With stakeholder support, a research funding application was submitted for the NHMRC targeted research grant for fetal alcohol spectrum disorders in Indigenous populations (#634341), which was successful. Consultations were recommenced and were ongoing throughout the multi-year Banksia Hill Study. Three formal consultation groups were formed, which included a Consumer and Community Reference Group, a Steering Group as well as a Department of Justice and Department for Child Protection and Family Support Reference Group. These groups helped to facilitate both formal and informal discussions with other community members and organisations. Study team members who were based within Banksia Hill Detention Centre during the course of the study maintained close working relationships with detention centre staff to ensure the operational procedures of the research project were acceptable and safe for both young people and staff.

Participants

All sentenced young people at Banksia Hill Detention Centre who had at least two weeks remaining of their sentence were eligible to participate. Young people were recruited by a research officer using a face-to-face approach. This involved simple explanations and pictorial information sheets to help explain the study to potential participants. For the young people who assented to the Study, their caregivers were contacted and asked if they would provide written consent for the young person's participation. As reported by Bower et al. (2018), of the 166 young people who were approached by the research officer, 154 (93%) provided written assent, and of these, written caregiver consent was provided for 113 (73%). In total, 108 young people participated in assessment with at least one clinician, and 99 participated in assessment with all four clinicians. Most of the 99 participants were male (93%), aged 16 years and over (57%), and Aboriginal young peoples (74%).

Assessment

Direct assessment was undertaken with young people in an allocated area of the detention centre. Assessment and consideration of FASD diagnoses was guided by the Australian Guide to the diagnosis of FASD (Bower & Elliott, 2016). Nine domains were assessed as part of the diagnostic process: brain structure/neurology, attention, executive functioning, memory, language, cognition, motor skills, academic achievement, and adaptive functioning. Assessment time with each clinician ranged from one to two hours; however, assessments were carried out over multiple days. Details of the assessments are reported in the protocol paper (Passmore et al., 2016) and in Chapters 5, 6, and 7 of this thesis. Following assessment of every participant, the clinicians held team meetings to discuss and finalise results. A results and recommendations report was created for every participant and provided to them, their families, and with consent, to relevant Department of Justice staff.

Main findings

The main findings of the overarching Banksia Hill Study were that 89% of 99 young people assessed were identified as meeting criteria for severe impairment (≥ 2 SD below the mean) in at least one of the nine domains assessed, and 36% of 99 young people assessed were identified with FASD (Bower et al., 2018). FASD was identified in 47% of

Aboriginal young peoples compared to 8% of non-Aboriginal young people. Among young people with FASD, 69% ($n = 25$) were identified with LD associated with FASD. Findings related to language skills and FASD are expanded on in Chapter 6. The high prevalence of both FASD and severe impairment among young people in youth detention in WA highlight the importance of comprehensive multidisciplinary team assessment to identify young peoples' health and neurocognitive needs and inform required supports and services.

CHAPTER 4:

Oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared to those with no/low PAE: A systematic review

Chapter Overview

To consider communication profiles associated with PAE and FASD in the context of youth justice, it is also important to understand them in the context of adolescents generally. Therefore, the next chapter addresses research question 1 by detailing a synthesis of the evidence regarding oral and written communication skills of adolescents with PAE compared to those with no/low PAE through a systematic review.

This chapter is presented as a final peer-reviewed and published manuscript (Appendix 1). There is a small amount of reformatting to adhere to the format of the broader thesis. Repetition has been minimised where possible, although there may be some key literature that has been reported in previous chapters.

The citation for this publication is:

Kippin, N.R., Leitão, S., Watkins, R., & Finlay-Jones, A. (2021). Oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared to those with no/low PAE: A systematic review. *International Journal of Language and Communication Disorders*, 56, 694-718. <https://doi.org/10.1111/1460-6984.12644>

Abstract

Background: Prenatal alcohol exposure (PAE) is associated with growth deficits and neurodevelopmental impairment including fetal alcohol spectrum disorder (FASD). Difficulties with oral and written communication skills are common among children with PAE; however, less is known about how communication skills of adolescents who have PAE compare to those who do not. Adolescence is a critical time for development, supporting the transition into adulthood however it is considered a high-risk period for those with FASD.

Aims: We conducted a systematic review to synthesize evidence regarding oral and written communication skills of adolescents with PAE or FASD and how they compare to those with no PAE.

Methods: A comprehensive search strategy used seven databases: Cochrane Library, Cinahl, Embase, Medline, PsycInfo, Eric, and Web of Science. Included studies reported on at least one outcome related to oral and written communication for a PAE (or FASD) group as well as a no/low-PAE group, both with age ranges of 10- to 24-years. Quality assessment was undertaken.

Results: Communication skills most often assessed in the seven studies included in this review were semantic knowledge, semantic processing, and verbal learning and memory. These communication skills, in addition to reading and spelling, were commonly weaker among adolescents with PAE compared to those with no/low-PAE. However, the findings were inconsistent across studies, and studies differed in their methodologies.

Conclusions: Our results emphasise that for adolescents with PAE, communication skills in both oral and written modalities should be comprehensively understood in assessment and when planning interventions. A key limitation of the existing literature is that comparison groups often include some participants with a low level of PAE, and that PAE definitions used to allocate participants to groups differ across studies.

What this paper adds

What is already known on this subject? PAE and FASD are associated with deficits in oral and written communication skills. Studies to date have mostly focused on children with a FASD diagnosis as well as combined groups of children and adolescents with FASD or PAE. There is a gap in what is known about oral and written communication skills of adolescents, specifically, who have PAE or FASD, which has implications for the provision of assessment and supports during a period of increased social and academic demands.

What this study adds: This review provides systematic identification, assessment, and synthesis of the current literature related to oral and written communication skills of adolescents with PAE compared to those with no/low-PAE. The review revealed a small knowledge base with inconsistent methodologies and findings across studies. However, the findings overall highlight that adolescents with PAE have weaker skills in oral and written language than those with no/low-PAE. Results are discussed in relation to education, social and emotional wellbeing, and forensic contexts.

Clinical implications of this study: Findings emphasise that for adolescents with PAE, comprehensive assessment of both oral and written communication skills, through both standardised and functional tasks, should be undertaken. Speech-language pathologists have a key role in assessment with individuals who have PAE.

Introduction

Prenatal alcohol exposure and fetal alcohol spectrum disorder

Prenatal alcohol exposure (PAE) is a global public health concern. Alcohol can affect fetal development, potentially resulting in a range of neurodevelopmental impairments, including fetal alcohol spectrum disorder (FASD) (McCormack et al., 2017). Globally, the prevalence of alcohol use in pregnancy is 10% however variation is considerable within and across countries (Popova et al., 2017). In Australia, for example, one study, in which children were randomly selected from a government database and their parents were interviewed face-to-face, reported that 30% of pregnancies involved PAE (Hutchinson et al., 2013). In another Australian study, in which women were from a prospective pregnancy cohort study and interviewed via telephone, PAE was identified in 61% of pregnancies (McCormack et al., 2017). Following pregnancy recognition, just over one in four pregnancies in Australia continue to involve PAE (Muggli et al., 2016). Globally, approximately 8% of children with PAE receive a diagnosis of FASD (Lange et al., 2017). Pooled prevalence estimates of FASD among children and youth in the general community range from < 1 to 2% (Lange et al., 2017). However, the prevalence is much higher among specific sub-populations, such as in special education (3 to 8%) and child welfare populations (5 to 31%) (Popova et al., 2019).

Duration and dose of PAE are associated with risk of psychosocial and behaviour problems which extend into early adulthood (Day et al., 2013), and PAE of ≥ 1 ounce (oz.) of absolute alcohol (AA) per week² is associated with structural changes and reduced volume of the brain (Chen et al., 2012). Individuals with a FASD diagnosis demonstrate severe impairments across a wide range of neurocognitive domains, including attention, memory, language, executive function, cognition, motor skills, and affect regulation (Mattson et al., 2019). These impairments confer additional vulnerability for the acquisition and use of adaptive functioning and academic skills (Lynch et al., 2017; McLachlan, Flannigan, et al., 2020). Neurodevelopmental impairment associated with PAE can also be compounded by exposure to childhood trauma and other adversities

² In the United States, 1 standard alcoholic drink = 0.6 fl oz or 14 grams of AA (National Institute on Alcohol Abuse and Alcoholism, n.d).

(Hyter, 2007; Kambeitz et al., 2019). While neurodevelopmental impairment can occur among children with trauma alone, it is more common among those with both trauma and FASD (Henry et al., 2007).

PAE and skills related to oral and written communication

Communication skills are a key consideration in FASD diagnostic assessments, and in the provision of services to support functioning (Bower & Elliott, 2016; Scottish Intercollegiate Guidelines Network, 2019). Speech-sound, word- and sentence-level language difficulties were first observed among children and adolescents of parents with alcohol use problems in France in the late 1960s (Lemoine et al., 2003). In the 1970s, standardised assessment of the communication skills of 45 young children with a diagnosis of fetal alcohol syndrome (FAS: a diagnosis subsumed under the diagnosis of FASD) in the United States (US), revealed that 80% demonstrated speech, language, or voice deficits (Iosub et al., 1981). In Australia, parent-reported language delay at two years of age was not associated with PAE at low levels (≤ 20 grams of AA per occasion, less than weekly³) however was more common among those with higher levels of PAE in trimesters two and three of pregnancy (O'Leary et al., 2009). More recently, in Canada, among children of high-risk drinkers, a 50% increased risk of parent-reported communication delay in early childhood was identified (Netelenbos et al., 2020).

Several studies show that individuals with FASD or PAE (without a diagnosis of FASD) demonstrate impairments across multiple verbal skills. In general, the research focuses on children with a FASD diagnosis, combined groups of children and adolescents with FASD or PAE, and adolescents with PAE that was assessed for part of the pregnancy, rather than for all three trimesters in pregnancy. Weak verbal memory skills are seen in children with FASD and adolescents with PAE (Becker et al., 1990; Olson et al., 1998; Willford et al., 2004). Hearing loss is also common among children with FASD (McLaughlin et al.). Such deficits affect the encoding and consolidation of speech and language, and in turn, compromise learning within oral language domains of phonology, semantics, and syntax (grammar). Individuals with FASD have been found to lack adequate semantic knowledge, including receptive and expressive vocabulary (Wyper &

³ In Australia, 1 standard alcoholic drink = 10 grams of AA (Department of Health, n.d.).

Rasmussen, 2011), and those with PAE are slower to access and retrieve vocabulary items based on semantic and phonemic constraints (Mattson and Riley, 1999). Using semantic knowledge for language-related problem-solving tasks is also difficult for individuals with FASD (Rasmussen & Bisanz, 2009; Wyper & Rasmussen, 2011). Grammatical skills can also be compromised, impeding both comprehension and formulation of language at sentence- and text-levels (Kodituwakku et al., 2006; Wyper & Rasmussen, 2011).

Oral language skills are foundational to learning how to read, spell and write (Nation, 2019; Wagner & Torgesen, 1987). Both oral and written language skills are critical for academic and occupational success, therefore it is important to consider both these modalities. Studies with children who have FASD, either separate to or in a combined group with adolescents, have found compromised reading and spelling abilities (Adnams et al., 2007; Glass et al., 2015). These studies have also shown that underlying these difficulties are weaknesses in phonological awareness, phoneme manipulation, decoding (mapping graphemes to phonemes) and encoding (mapping phonemes to graphemes) (Adnams et al., 2007; Glass et al., 2015). According to the Simple View of Reading, skills in both decoding and semantic knowledge are required for reading comprehension (Nation, 2019), and weak reading comprehension skills have also been found among individuals with PAE, with and without FASD (Mattson et al., 1998; Vaurio et al., 2011). Further, rapid naming skills, which are strongly associated with reading fluency (Norton & Wolf, 2012), were also found to be weak (Glass et al., 2015).

PAE, communication skills and adolescence

Some studies have reported that deficits with communication skills among individuals with FASD or PAE become more severe with increasing age. Increasing deficits in overall receptive and expressive language ability have been identified (de Beer et al., 2010; Proven et al., 2014) as well as in specific skills, such as grammar (Wyper & Rasmussen, 2011) and verbal fluency (Rasmussen & Bisanz, 2009). It is not surprising that deficits in communication skills become more severe with age given the increasing social and academic demands as well as fewer parent and teacher supports. Individuals with FASD struggle with the complex language and cognitive skills required to navigate learning and social situations (Duquette et al., 2006; Skorka et al., 2020). Consequently,

the transition from primary to high school as well as from adolescence into young adulthood is particularly problematic (Lynch et al., 2017; Skorka et al., 2020).

Adolescence begins at the commencement of puberty (a biological event); however, the end of adolescence differs according to country and community, and can align with social and cultural achievements, such as educational attainment, social competence, and financial independence (Blakemore, 2018). Adolescence is a critical time for the development of neurocognitive skills which support the establishment of greater independence as well as influence social, educational, health and economic trajectories (Dahl et al., 2018). Thus, adolescent health has emerged as an internationally recognised priority area concerned with health and wellbeing, encompassing both the adolescent (10 to 19) and youth (15 to 24) age ranges (Patton et al., 2016; Viner et al., 2012).

The development of communication skills is particularly important during adolescence, with growth in skills related to semantic knowledge, morphology, and syntax as well as metacognitive verbs, figurative and pragmatic language (Nippold, 2016; Spencer, 2018). Adolescents become increasingly capable of producing and comprehending more complex oral and written language. This in turn contributes to successful participation in social, academic, and occupational contexts. However, during adolescence, the development of communication skills can be often overlooked, and communicative competence assumed, given that development of communication skills is less visible compared to early childhood years (Spencer, 2018). Given the significance of oral and written communication skill development within adolescence and beyond, specific attention to the communication skills of adolescents with PAE is warranted.

Previous systematic reviews

Four systematic reviews report communication outcomes as part of their investigation of individuals with FASD or PAE. A systematic review and meta-analysis, by Popova et al. (2016), of the comorbid conditions among children, adolescents, and adults with a diagnosis of FAS established receptive (82%) and expressive language disorder (76%) as two of the most common comorbid conditions. Articulation, motor-speech, and voice problems were also commonly noted; however, detailed communication profiles were not reported given that the focus of the review related to a

wide range of comorbidities (Popova et al., 2016). Price et al. (2017) systematically reviewed research related to the impact of both PAE and trauma on development; they identified that, for 0- to 16-year-olds, exposure to both trauma and PAE can have a compounding effect, resulting in a higher risk of communication problems, including with phonological awareness, speech, vocabulary, grammar, as well as verbal memory, compared with exposure to one of these factors alone. Flak et al. (2014) systematically reviewed and meta-analysed research related to the association between PAE and child neurodevelopment; they failed to find an association between mild, moderate and binge levels of PAE and expressive vocabulary, verbal intelligence, semantic verbal fluency and reading for 0- to 14-year-olds. Due to the complex and dynamic nature of neurodevelopment, Flak et al. (2014) raised a concern about analysing results from studies with a wide age range of participants. Irner et al. (2014) undertook a systematic review on the association between PAE and other substance exposures in-utero and developmental outcomes in adolescence. They included studies with and without comparisons between PAE and no/low-PAE groups, as well as studies with participant groups with children, adolescents, and adults. They concluded that PAE, especially at high levels (≥ 5 alcoholic drinks per occasion), is associated with developmental deficits, including in verbal skills and academic achievement, and highlighted the impact on development that social adversity and other drug exposures may also have.

A further two systematic reviews specifically focused on PAE and communication skills among infants and young children, but are equivocal in their findings as to whether PAE, at varying levels, is associated with weaker communication outcomes (Hendricks et al., 2019; O'Keeffe et al., 2014). The current review aimed to address a gap in previous reviews; namely the need to synthesise nuanced data on communication profiles of adolescents to provide a comprehensive understanding of how both PAE and FASD affect oral and written communication outcomes during this developmental period.

Current study

Our objective was to systematically review and synthesise literature to identify the communication profiles of adolescents (10 to 24 years) with PAE, and to examine how they compare to those with no/low-PAE. Detailed insights into the specific

communication profiles of adolescents with PAE can help to drive assessment, support and therapeutic approaches that are developmentally and neurocognitively appropriate for this age group.

Materials and methods

We conducted and report this systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). Our protocol was registered with PROSPERO (ID: CRD42019077187).

Eligibility criteria

This review included only English-language, peer-reviewed and published studies which had both a PAE (or FASD) group and a no/low-PAE group. For inclusion in this review, PAE needed to have been assessed for each group. In this review, we used the age range consistent with that used in adolescent health (Patton et al., 2016; Viner et al., 2012); all participants in both the PAE and no/low-PAE groups needed to be aged 10- to 24-years. Studies in which the age range of participants fell outside of this age criterion were excluded, unless data were provided specifically for those in the required age range. We contacted the authors if a study did not specify the age range of the participants. Studies were eligible if they included data (mean/SD) from standardised or non-standardised assessments for at least one outcome related to oral or written communication skills.

Search strategy and information sources

Our search strategy included terms for (i) adolescents (ii) PAE and FASD (iii) control groups, and (iv) outcomes related to oral and written communication skills examined when a diagnosis of FASD is being considered, for example, speech, language, verbal memory, verbal fluency, and literacy (Bower & Elliott, 2016; Scottish Intercollegiate Guidelines Network, 2019). An example of our search strategy is provided (Appendix 2). We did not include individual subtest outcomes related to mathematics, social communication or social problem solving. While composite verbal IQ and verbal comprehension scores include data related to these skills, they also include data related to vocabulary, similarities, and general knowledge, and are considered to reflect overall verbal ability (Wechsler, 1991). Therefore, we have included the verbal IQ and verbal

comprehension composite scores. Further, we did not include verbal tasks which require switching and are considered measures of inhibition, for example, the switching subtest scores for verbal fluency and rapid naming.

The databases searched were Cochrane Library, Cinahl, Embase, Medline, PsycInfo, Eric, and Web of Science. We used MeSH headings as well as title and abstract truncation relevant to each electronic database, and our search strategy was reviewed by an experienced university librarian. The search included studies published from 1967 onwards and was conducted in March 2019. Before our final reporting, we conducted the search again for studies published during 2019 and up to 6 July 2020.

Study selection

The search results were exported to Endnote (X8.2) and uploaded to Covidence, a web-based software programme for systematic reviews (Veritas Health Innovation, n.d.). Following the removal of duplicates, the first author and a second (SL/RW/AFJ) independently screened 100% of titles and abstracts. The same method was carried out for full-text screening of 100% of the remaining results. We resolved disagreements by team discussion.

Quality assessment

The first author and a second (RW/AFJ) independently assessed the methodological quality of the included studies using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (Kmet et al., 2004). Studies were assessed for their design, participant recruitment, assessment, and outcomes as well as reporting of results and confounders. Items can be scored 0 = no, 1 = partial, 2 = yes, or N/A if not applicable. Items 5 to 7 can be excluded for observational studies however we included item 6 as it relates to blinding of investigators which is an important item to consider in quality assessment (National Health and Medical Research Council, 1999). Raw scores were converted to percentages and used to categorise study quality as strong (> 80%), good (70 to 80%), adequate (50 to 69%), or limited (< 50%) (Lee et al., 2008) (Table 1). Disagreements were resolved by team discussion.

Data extraction

The first author extracted data related to study characteristics from the included studies, using a template that we developed based on guidelines from the National Health and Medical Research Council (1999). The extracted data was related to study design and participant characteristics (Table 1), as well as the definitions used for PAE and the methods used to guide FASD diagnostic decisions (Table 2). We extracted outcomes of interest (i.e., mean/SD) and the respective assessments administered (Table 3). All extracted data were crosschecked by a second author (SL/AFJ/RW). We classified outcomes according to oral language domains, verbal processing skills that underlie communication skills, and written language skills. Two speech-language pathologists (NK and SL) reviewed each administered assessment task and classified outcomes accordingly. Discrepancies were resolved through team discussion.

Statistical analysis

Pooled samples *t*-tests in SPSS were undertaken to examine between group differences when studies reported group comparisons with more than two groups, and when post-hoc tests were reported without *p* values. Where effect sizes were not reported for between-group comparisons, we calculated these with Cohen's *d*, and for one study with unequal group sizes (C. E. Lewis et al., 2015), with Hedge's *g* (*d/g*: small = 0.2, medium = 0.5, large = 0.8) (Cohen, 1988).

Results

Study selection

As shown in Figure 1, the initial search yielded 4,264 records following the removal of 2,577 duplicates. Title and abstract screening resulted in 165 records being retained for full-text screening from which 158 records were excluded. We achieved inter-rater agreement of 98% at the title and abstract screening stage and 95% at the full text screening stage. Team discussion resulted in 100% consensus at each stage. Reasons for full-text exclusion included incorrect participant population ($n = 130$), comparator group ($n = 5$), outcomes ($n = 21$), and language ($n = 2$). The remaining seven search results were consistent with the inclusion criteria and were included in this review. No further studies were identified as meeting the inclusion criteria when the search was re-run in July 2020.

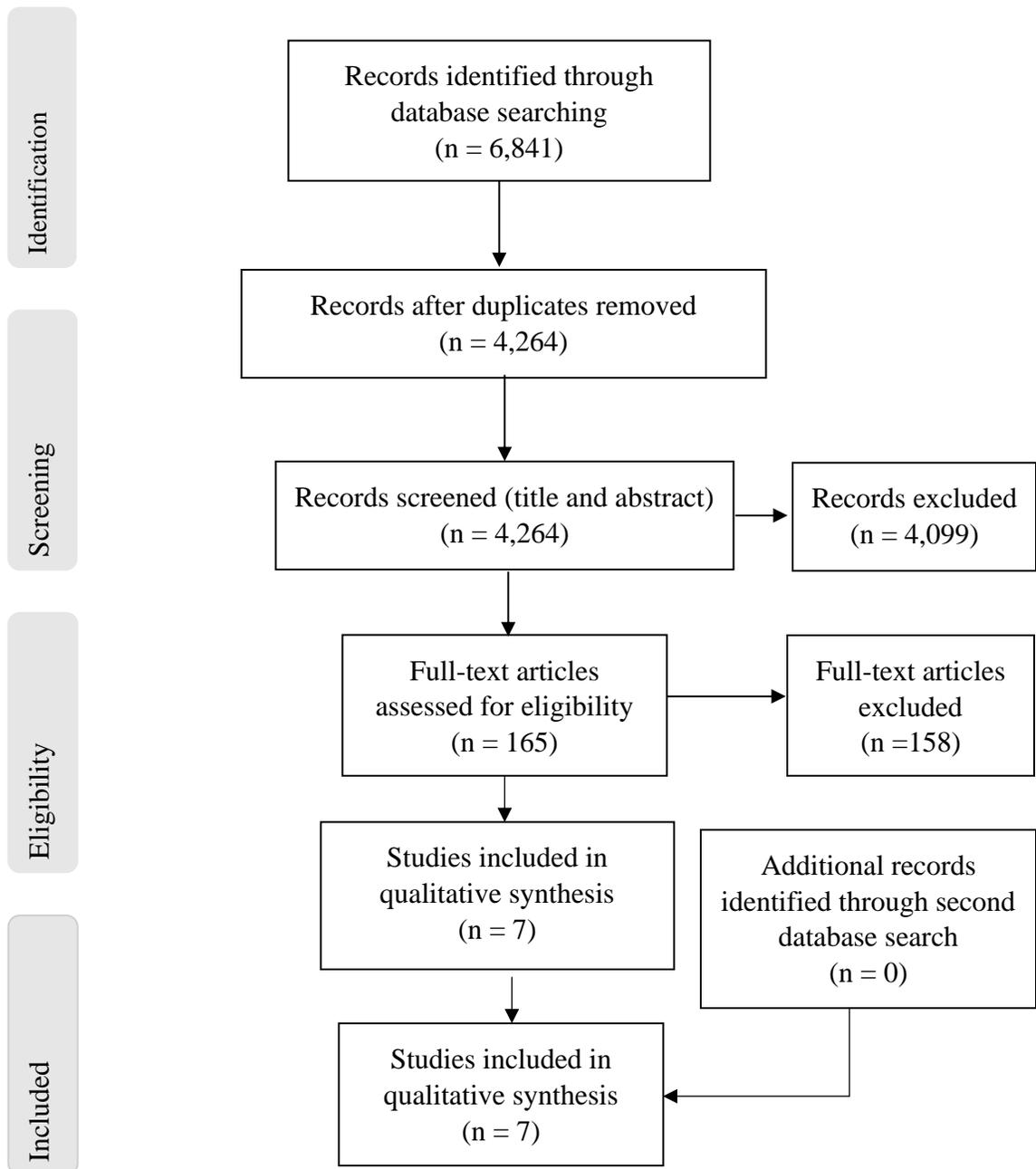


Figure 1. PRISMA Flow Diagram showing the process and selection of included studies (Moher et al., 2009).

Study and participant characteristics

Study and participant characteristics of five of the seven included studies are reported in Table 1. Three of the seven studies contained unique participant groups from Brazil, Canada, and the US (Furtado & de Sa Roriz, 2016; C. E. Lewis et al., 2015; McLachlan et al., 2014), and are reported in Table 1. Two of the seven studies, also from the US, reported data for the same participants, but on different outcomes and ages (Coles et al., 2010; Howell et al., 2006). We report the study and participant characteristics for the study with the largest sample (Howell et al., 2006) in Table 1 while study and participant characteristics for the other study are provided in Appendix 3. The remaining two of seven studies are from the Collaborative Initiative on Fetal Alcohol Spectrum Disorders (CIFASD) research group, also in the US, who reported data for the same participants, but on different outcomes (Doyle et al., 2018; Panczakiewicz et al., 2016). We include the study and participant characteristics for the study that reported data for one combined PAE and one no/low-PAE group (Doyle et al., 2018) in Table 1. Study and participant characteristics for the remaining study, with PAE subgroups according to gender, are provided in Appendix 3.

All included studies were observational, and all but one, were cohort in design. There was a total of 388 adolescents in the PAE groups, and 542 in the no/low-PAE groups (Table 1). One study reported on participants who were involved with the criminal justice system (McLachlan et al., 2014) while the remaining reported on participants recruited in clinic (Furtado & de Sa Roriz, 2016; Howell et al., 2006; C. E. Lewis et al., 2015) or community and clinic (Doyle et al., 2018) settings. Where data is provided, the PAE and no/low-PAE groups included a similar percentage of female and male participants. The participant groups reported by Howell et al. (2006) and C. E. Lewis et al. (2015) included all or mostly African American participants while Doyle et al. (2018) included mostly white participants. Data for ethnicity and race were not provided in the remaining two studies. The languages of the participant groups were not reported in any study. However, Furtado and de Sa Roriz (2016) administered tests normed with Brazilian children, and studies from the CIFASD research group excluded participants if English was not their primary language, or if they had been adopted from abroad after five years of age or within two years of assessment.

Table 1. Included study and participant characteristics of five of the eight included studies.

Author & Country	Design	Groups	n	Age		Male (%)	Ethnicity/Race (%)	Social strata	QA (%)
				Range	Mean				
Furtado & de Sa Roriz (2016), Brazil	Cohort	PAE	28	11 - 13	11.9 (0.4)	43	-	Low ⁴	71
		No/low-PAE	28		12.0 (0.3)	50	-	Low	Good
Lewis et al. (2015), US ¹	Cohort	PAE+Heavy	19	13 - 16	14.4 (0.6)	43	African American: 100	Medium ⁵	83
		PAE+Moderate	21				African American: 100		Strong
		No/low-PAE	251				African American: 100		
McLachlan et al. (2014), Canada	Case-control	PAE (FASD)	50	12 - 23	17.6 (1.8)	80	-	-	79
		No/low-PAE	50	12 - 23	17.5 (1.3)	82	-	-	Good
Howell et al. (2006), US ²	Cohort	PAE+Dysmorphic	46	13 - 17	15.1 (1.1)	48	African American: 98	Low ⁶	75
		PAE-Dysmorphic	82		14.9 (0.8)	39	African American: 96	Low	Good
		No/low PAE	53		14.9 (0.8)	44	African American: 96	Low	
Doyle et al. (2018), US ³	Cohort	PAE	142	10 - 16	12.9 (2.1)	52	White: 59; Hispanic: 20	Medium ⁷	71
		No/low-PAE	160		13.5 (2.1)	51	White: 61; Hispanic: 24	Medium	Good

Note: ¹ Detroit participants only; ² The same participants, but different outcomes and ages, are reported by Coles et al. (2010) (see Appendix 3); ³ The same participants, but different outcomes, are reported by Panczakiewicz et al. (2016) (see Appendix 3); ⁴ Based on parent education; ⁵ Based on Hollingshead Four Factor Index of Socioeconomic Status (individual group data not provided); ⁶ Based on geographic location; ⁷ Based on parent education and SES data provided by Panczakiewicz et al. (2016); QA = quality assessment score.

Studies that reported sociodemographic data for both the PAE and no/low-PAE groups showed that participants were classified as being of low and medium sociodemographic strata (Table 1). There were no between-group differences for the reported variables, with the exception of Furtado and de Sa Roriz (2016) whose groups differed on maternal religion only. Only one study (Howell et al., 2006) reported whether the participants lived with their biological families (PAE+dysmorphic: $n = 76\%$; PAE-dysmorphic: $n = 78\%$; no/low-PAE: $n = 93\%$).

Intelligence scores (full-scale IQ or general conceptual ability) for both the PAE and no/low-PAE groups were reported for all of the included studies except one (C. E. Lewis et al., 2015) in which a score for all participants combined was reported. The IQ scores of the PAE and no/low-PAE groups in one study (Furtado & de Sa Roriz, 2016) were not different. However, the IQ scores of the PAE groups in two studies (Doyle et al., 2018; McLachlan et al., 2014) were lower than those of the no/low-PAE groups. Further, IQ scores of the PAE+dysmorphic group in another study (Howell et al., 2006) were lower than those of both the PAE-dysmorphic and no/low-PAE groups. Doyle et al. (2018), who did not adjust for intelligence, cited (Dennis et al., 2009) who argues against adjusting for IQ in studies related to populations with neurodevelopmental disorders. For the studies that have controlled for IQ and other variables, details are reported within the results on communication outcomes below.

PAE definitions & FASD determination

Definitions of PAE and no/low-PAE groups differed between studies, and are based on scores from measures used to assess alcohol dependence or thresholds for daily/weekly alcohol use (Table 2). For those studies that used daily/weekly thresholds, the thresholds were reported by number of alcoholic drinks or amount of AA. In the US, where the studies that used thresholds took place, one standard drink is equal to 0.6 oz of AA (National Institute on Alcohol Abuse and Alcoholism, n.d). Based on this definition, PAE thresholds ranged from ≥ 2 standard drinks per week to ≥ 13 standard drinks per week during pregnancy for the PAE groups. For the no/low-PAE groups, threshold ranged from alcohol abstinence to < 1 standard drink per day during pregnancy. The one study with a

FASD group, rather than a PAE group (McLachlan et al., 2014), used a published FASD diagnostic guideline (Chudley et al., 2005).

Quality assessment

Quality assessment outcomes of the included studies ranged from good to strong (Table 1). Areas of weakness included inadequate description of the study question or objective, limited provision of participant characteristics, lack of investigator blinding, and possible measurement errors when assessing PAE (Sayal, 2007) (Appendix 4).

Table 2. Definitions of PAE by group for the included studies.

Study	Group definitions of PAE	
	PAE	No/low-PAE
Furtado & de Sa Roriz, 2016	Any positive answer to alcohol consumption questions; score ≥ 1 on an assessment of high-risk drinking (T-ACE); alcohol abuse/dependence	Alcohol abstinence in pregnancy; score of 0 on T-ACE assessment; no alcohol diagnosis
Lewis et al., 2015 ¹	Heavy: ≥ 1.0 oz AA per day during pregnancy Moderate: 0.5 - 0.99 oz AA per day during pregnancy	< 0.5 oz AA per day during pregnancy
McLachlan et al., 2014	Participant has a FASD diagnosis	No known, documented, or suspected PAE
Howell et al., 2006 ²	≥ 2 drinks per week during pregnancy	No PAE
Doyle et al., 2018 ³	> 4 drinks per occasion or > 13 drinks per week on average during pregnancy; Alcohol abuse/dependence; PAE suspected AND criteria met for FAS	≤ 1 drink per week on average and never > 2 drinks per occasion during pregnancy ⁴

Note: AA: absolute alcohol. 0.6 fluid ounces (fl oz) of AA = 1 standard drink in the US (National Institute on Alcohol Abuse and Alcoholism, n.d.); FAS: fetal alcohol syndrome (diagnosis subsumed under FASD); ¹ Detroit sample only; ² The same participants, but different outcomes and age, are reported by Coles et al. (2010); ³ The same participants, but different outcomes, are reported by Panczakiewicz et al. (2016); ⁴ Definition used by Panczakiewicz et al., 2016: < 1 drink per week on average and never > 2 drinks per occasion during pregnancy.

Communication outcomes

Across studies, data were reported for multiple tasks related to oral language skills, verbal processing skills that underlie and support communication skills, and written language skills (Table 3). Oral communication outcomes predominantly drew on semantic knowledge and organisation, with no reported measures of speech or syntactic skills in any study.

Oral language

Semantic knowledge and organisation. Four studies reported on five different tasks related to semantic knowledge and organisation. (McLachlan et al., 2014) compared outcomes among adolescents with FASD to those with no/low-PAE, while three studies examined outcomes among those with PAE and no/low-PAE. Howell et al. (2006) reported on subgroups within the PAE group (+/-dysmorphic) and Panczakiewicz et al. (2016) reported on male and female subgroups within both the PAE and no/low-PAE groups.

In the comparison of adolescents with FASD to those with no/low-PAE, McLachlan et al. (2014) reported between-group differences for all six measures (vocabulary, sentence recognition, and paraphrasing with and without Canadian supplementary versions). In comparisons of adolescents with PAE versus no/low-PAE, results were mixed. Furtado and de Sa Roriz (2016) found no differences between groups for vocabulary, general knowledge, or similarities. Howell et al. (2006), who conducted post-hoc between group analyses found a difference between the PAE+dysmorphic subgroup and the no/low-PAE group for vocabulary, but not for similarities. However, in our analysis using pooled samples *t*-tests, we identified a difference between these two groups for both vocabulary and similarities. Panczakiewicz et al. (2016) identified a difference on word definitions and similarities between the PAE and no/low-PAE groups.

McLachlan et al. (2014) identified that IQ was predictive of all six outcomes (vocabulary, sentence recognition, and paraphrasing with and without Canadian supplementary versions), and after controlling for IQ, that reading was also associated with the six outcomes. However, when controlling for both IQ and reading, group membership was not predictive of any of the six outcomes. Panczakiewicz et al. (2016)

identified that among their participants, age did not interact with any of their outcomes for semantics. Overall, within the language domain of semantics, measures of word definitions were the most administered tasks. Group differences on these were common, with those in the PAE groups demonstrating weaker skills than those in the no/low-PAE groups in most studies.

Verbal processing skills

Verbal intelligence. Two studies reported on communication-related skills as measured by verbal IQ and verbal comprehension, comparing outcomes of adolescents with PAE and no/low-PAE. Furtado and de Sa Roriz (2016), who excluded participants with an IQ < 70 or a language disorder, reported no group differences for verbal IQ, and both groups scored in the average range. Howell et al. (2006) included participants with intellectual and language disorders; they identified differences for both verbal IQ and verbal comprehension between the PAE+dysmorphic subgroup and the no/low-PAE group, and both PAE subgroups and the no/low-PAE group scored below the average range on the measures.

Phonological and semantic processing skills. Three studies reported on two different tasks related to access and retrieval of lexical items. All three compared outcomes of adolescents with PAE and no/low-PAE. Doyle et al. (2018) and Panczakiewicz et al. (2016) reported on the same participants. Furtado and de Sa Roriz (2016) identified a difference for semantic verbal fluency, but not for phonemic verbal fluency. Doyle et al. (2018) and Panczakiewicz et al. (2016) identified group differences for two word generation measures (semantic only, and semantic and initial letter combined) and a speeded naming measure. Panczakiewicz et al. (2016) found that age did not interact with the outcome for word generation.

Verbal working memory. Two studies reported on a digit span task. Howell et al. (2006) included subgroups within the PAE group (+/-dysmorphic). Both Howell et al. (2006) and Furtado and de Sa Roriz (2016) found no between group differences for digit span (total: forwards and backwards).

Verbal learning and memory. Four studies administered 3 different tasks related to verbal learning and memory. All four compared outcomes of adolescents with PAE and

no/low-PAE. Panczakiewicz et al. (2016) reported data for different subgroups in both the PAE and no/low-PAE groups (male and female), and Coles et al. (2010) and Lewis et al. (2015) reported data for subgroups within the PAE group (+/-dysmorphic, and heavy and moderate). For verbal processing skills that underlie and support communication skills, semantic processing as well as verbal learning and memory were the most commonly reported measures. Group differences were identified for these measures across most studies, with the PAE groups demonstrating weaker skills than the no/low-PAE groups.

Panczakiewicz et al. (2016) identified differences between the PAE and no/low-PAE groups for a word-level memory measure (memory for names) and a text-level memory measure (narrative memory). For outcomes related to word-list learning, Furtado and de Sa Roriz (2016) found no differences between groups for any of the measures. In contrast, Coles et al. (2010) identified group differences between both PAE subgroups (+/-dysmorphic) and the no/low-PAE group for four of six measures (total recall, trial 8, long term storage, consistent long-term retrieval), and between the PAE+dysmorphic subgroup and the no/low-PAE group for the remaining two of six measures (learning slope and delayed recall). Lewis et al. (2015), who included heavy and moderate PAE subgroups, and whose no/low-PAE group had the highest threshold for no/low-PAE, identified differences between the PAE+heavy subgroup and the no/low-PAE group for three of five measures (short delay recall, long delay recall and recognition discrimination).

Panczakiewicz et al. (2016) identified that age did not interact with memory outcomes. When controlling for IQ, Coles et al. (2010) found that the results changed for total recall only, and only between the PAE-dysmorphic subgroup and the no/low-PAE group. Coles et al. (2010) also examined forgetting across groups by analysing delayed recall in the context of total recall, long term storage, and consistent long-term retrieval. There was no difference between groups for forgetting. When Lewis et al. (2015) controlled for socioeconomic status, maternal vocabulary, and maternal smoking in pregnancy, differences between the groups remained. Lewis et al. (2015) also identified that outcomes were not related to prenatal exposure to marijuana or cocaine.

Written language skills

Reading. Two studies reported on reading using three different measures. McLachlan et al. (2014) compared outcomes among adolescents with FASD and no/low-PAE while Howell et al. (2006) compared outcomes between PAE subgroups (+/-dysmorphic) and a no/low-PAE group. McLachlan et al. (2014) identified differences between the FASD and no/low-PAE groups for their reading measure (combined score for identification of letters, word reading, and sentence-level reading comprehension). Howell et al. (2006) also identified a difference for one reading measure (combined score for receptive vocabulary and text-level reading) between the PAE+dysmorphic subgroup and the no/low-PAE group, but not for another reading measure (nonword and word-reading).

Spelling. Just one study reported on spelling. Howell et al. (2006), who included two PAE subgroups (+/-dysmorphic), did not identify a difference between groups in their post-hoc tests. However, in our analysis, we identified a difference between the PAE+dysmorphic subgroup and the no/low-PAE group for single-word spelling.

Table 3: Assessments and outcomes reported in the included studies.

Study	Assessment and Subtest	Outcomes
Oral language		
<u>Semantic knowledge and organisation</u>		
<i>Word definitions: Spoken definitions of vocabulary items</i>		
Furtado et al., 2016	WISC-III:Language ¹	PAE (mean=10.8, SD=3.3), no/low-PAE (mean=10.3, SD=2.1), $p=0.48$, $d=0.2$
McLachlan et al., 2014	CMR:Vocabulary	FASD (mean=5.7, SD=3.2) < no/low-PAE (mean=8.2, SD=2.4), $p<0.01$, $d=0.9$
	CMR:Vocabulary ²	FASD(mean=11.3, SD=4.4) < no/low-PAE(mean=14.8, SD=4.0), $p<0.01$, $d=0.9$
Howell et al., 2006	WISC-III:Vocabulary	PAE+dysmorphic(mean=4.1, SD=2.4) < no/low-PAE(mean=5.8, SD=2.4), $p<0.01$, $d=0.7$ PAE–dysmorphic(mean=5.4, SD=3.3), no/low-PAE, $p=0.34$, $d=0.2$
Panczakiewicz et al., 2016	DAS-II:Word definitions	Female: PAE(mean=44.2, SD=11.2) < no/low-PAE(mean=51.9, SD=9.2), $p<0.01$, $d=0.8$ Male: PAE(mean=48.3, SD=8.0) < no/low-PAE(mean=56.1, SD=9.8), $p<0.01$, $d=0.9$
<i>General knowledge: Spoken responses to general knowledge questions, such as ‘how many days are there in a week?’</i>		
Furtado et al., 2016	WISC-III:Knowledge ¹	PAE(mean=8.1, SD=3.0), no/low-PAE(mean=8.1, SD=3.3), $p=0.97$, $d<0.1$
<i>Similarities: Spoken explanations supported by reasoning, e.g., ‘In what way are milk and water alike?’</i>		
Furtado et al., 2016	WISC-III:Similarities	PAE(mean=10.8, SD=3.9), no/low-PAE(mean=10.4, SD=3.4), $p=0.68$, $d=0.1$
Howell et al., 2006	WISC-III:Similarities	PAE+dysmorphic(mean=6.0, SD=3.3) < no/low-PAE(mean=7.3, SD=2.6), $p=0.03$, $d=0.4$ PAE–dysmorphic(mean=7.4, SD=3.4), no/low-PAE, $p=0.86$, $d<0.1$
Panczakiewicz et al., 2016	DAS-II:Verbal Similarities	Female: PAE(mean=41.1, SD=10.0) < no/low-PAE(mean=49.0, SD=8.3), $p<0.01$, $d=0.9$ Male: PAE(mean=46.2, SD=8.1) < no/low-PAE(mean=51.1, SD=9.8), $p<0.01$, $d=0.5$

Sentence recognition: Recognition of semantically identical sentences related to interrogation warnings

McLachlan et al., 2014	CMR: Sentence recognition	FASD(mean=9.3, SD=3.2) < no/low-PAE(mean=10.6, SD=1.2), $p<0.01$, $d=0.9$
	CMR: Sentence recognition ²	FASD(mean=14.3, SD=2.3) < no/low-PAE(mean=15.7, SD=1.7), $p<0.01$, $d=0.9$

Paraphrasing: Spoken paraphrasing of sentences related to interrogation warnings

McLachlan et al., 2014	CMR: Paraphrasing	FASD(mean=4.9, SD=2.0) < no/low-PAE(mean=6.3, SD=1.9), $p<0.01$, $d=0.7$
	CMR: Paraphrasing ²	FASD(mean=7.0, SD=2.7) < no/low-PAE(mean=9.2, SD=2.4), $p<0.01$, $d=0.9$

Verbal processing skills

Verbal intelligence

Verbal IQ and VCI. The combined scores of verbal subtests³

Furtado et al. 2016	WISC-III: Verbal IQ	PAE(mean=95.8, SD=15.6), no/low-PAE(mean=98.2, SD=16.6), $p=0.59$, $d=0.2$
Howell et al. 2006	WISC-III: Verbal IQ	PAE+dysmorphic(mean=72.4, SD=14.2) < no/low-PAE(mean=80.3, SD=10.9), $p<0.01$, $d=0.6$
		PAE-dysmorphic(mean=80.5, SD=15.9), no/low-PAE, $p=0.93$, $d<0.1$
	WISC-III: VCI	PAE+dysmorphic(mean=73.4, SD=14.5) < no/low-PAE(mean=81.1, SD=10.8), $p<0.01$, $d=0.6$
		PAE-dysmorphic(mean=81.0, SD=16.1), no/low-PAE, $p=0.99$, $d<0.1$

Phonological and semantic processing: Access to and retrieval of lexical items

Verbal fluency: Spoken production of vocabulary items that meet semantic/phonemic as well as time constraints

Furtado et al., 2016	Verbal fluency:F-A-S ⁴	PAE(mean=17.5, SD=6.0), no/low-PAE(mean=18.0, SD=7.2), $p=0.79$, $d<0.1$
	Verbal fluency:animals ⁴	PAE(mean=13.6, SD=3.6) < no/low-PAE(mean=15.8, SD=4.4), $p=0.05$, $d=0.5$
Doyle et al. 2018	NEPSY-II: Word generation (semantic & initial)	PAE(mean=7.3, SD=3.0) < no/low-PAE(8.3, SD=3.0), $p<0.01$, $d=0.3$

Panczakiewicz et al., 2016	NEPSY-II:Word generation (semantic)	Female: PAE(mean=10.5, SD=4.1) < no/low-PAE(mean=12.4, SD=3.2), <i>p</i><0.01, <i>d</i>=0.5 Male: PAE(mean=9.9, SD=3.6) < no/low-PAE(mean=11.9, SD=3.5), <i>p</i><0.01, <i>d</i>=0.7
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Rapid naming: Rapid spoken naming of printed letters and numbers

Doyle et al., 2018	NEPSY-II:Speeded naming (letters & numbers)	PAE(mean=8.2, SD=2.8) < no/low-PAE(mean=9.0, SD=2.4), <i>p</i><0.01, <i>d</i>=0.3
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Verbal working memory

Digit span (total): Spoken recall of a sequence of orally presented digits, forwards and backwards

Furtado et al., 2016	WISC-III:Digit span (total)	PAE(mean=9.3, SD=3.2), no/low-PAE(mean=8.7, SD=2.3), <i>p</i> =0.41, <i>d</i> =0.2
Howell et al., 2006	WISC-III:Digit span (total)	PAE+dysmorphic(mean=7.8, SD=3.2), no/low-PAE(mean=8.0, SD=3.1), <i>p</i> =0.85, <i>d</i> <0.1 PAE-dysmorphic(mean=8.0, SD=2.8), no/low-PAE, <i>p</i> =0.91, <i>d</i> <0.1

Verbal learning and memory

Memory for names: Listening to and spoken recall of names associated with pictures of faces

Panczakiewicz et al., 2016	NEPSY-II:Memory for names delayed	Female: PAE(mean=7.6, SD=3.8) < no/low-PAE(mean=9.8, SD=3.1), <i>p</i><0.01, <i>d</i>=0.6 Male: PAE(mean=7.3, SD=3.8) < no/low-PAE(mean=10.0, SD=2.7), <i>p</i><0.01, <i>d</i>=0.8
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Narrative memory: Listening to and immediate recall of a verbally provided story (text-level of language)

Panczakiewicz et al., 2016	NEPSY-II:Narrative memory immediate recall	Female: PAE(mean=8.1, SD=3.2) < no/low-PAE(mean=10.3, SD=3.2), <i>p</i><0.01, <i>d</i>=0.7 Male: PAE(mean=8.7, SD=3.2) < low/no-PAE(mean=10.9, SD=3.4), <i>p</i><0.01, <i>d</i>=0.7
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Word list learning and recall: Listening to and spoken recall of a series of words within different time intervals

Furtado et al., 2016	RAVLT:Immediate recall	PAE(mean=7.1, SD=1.5), no/low-PAE(mean=6.7, SD=1.9), <i>p</i> =0.39, <i>d</i> =0.2
	RAVLT:Total recall	PAE(mean=57.8, SD=4.7), no/low-PAE(mean=55.9, SD=6.7), <i>p</i> =0.21, <i>d</i> =0.3

	RAVLT:Recall 30 minute	PAE(mean=13.5, SD=1.6), no/low-PAE(mean=13.1, SD=1.8), $p=0.38$, $d=0.2$
	RAVLT:Recognition	PAE(mean=14.9, SD=0.4), no/low-PAE(mean=14.5, SD=1.0), $p=0.09$, $d=0.5$
	RAVLT:Proactive interference	PAE(mean=1.1, SD=0.4), no/low-PAE(mean=1.2, SD=1.0), $p=0.46$, $d=0.2$
	RAVLT:Retroactive interference	PAE(mean=0.69, SD=0.49), no/low-PAE(mean=0.72, SD=0.06), $p=0.75$, $d<0.1$
Coles et al., 2010 ⁴	VSRT:Learning slope	PAE+dysmorphic(mean=0.27, SD=0.14) < no/low-PAE(mean=0.36, SD=0.13), $p<0.01$, $d=0.7$ PAE-dysmorphic(mean=0.32, SD=0.14), no/low-PAE, $p=0.13$, $d=0.3$
	VSRT:Total recall	PAE+dysmorphic(mean=7.1, SD=2.1) < no/low-PAE(mean=8.5, SD=1.4), $p<0.01$, $d=0.8$ PAE-dysmorphic(mean=7.8, SD=1.7) < no/low-PAE, $p<0.01$, $d=0.5$
	VSRT:8 th trial	PAE+dysmorphic(mean=8.4, SD=2.5) < no/low-PAE(mean=10.3, SD=1.8), $p<0.01$, $d=0.9$ PAE-dysmorphic(mean=9.3, SD=2.1) < no/low-PAE, $p<0.01$, $d=0.5$
	VSRT:Long-term storage	PAE+dysmorphic(mean=8.3, SD=3.3) < no/low-PAE(mean=10.5, SD=2.0), $p<0.01$, $d=0.8$ PAE-dysmorphic(mean=9.6, SD=2.7) < no/low-PAE, $p=0.04$, $d=0.4$
	VSRT:Consistent long-term retrieval	PAE+dysmorphic(mean=5.8, SD=3.4) < no/low-PAE(mean=8.6, SD=2.9), $p<0.01$, $d=0.9$ PAE-dysmorphic(mean=7.1, SD=3.0) < no/low-PAE, $p<0.01$, $d=0.5$
	VSRT:Delayed recall 30 minutes	PAE+dysmorphic(mean=6.3, SD=3.0) < no/low-PAE(mean=8.5, SD=2.6), $p<0.01$, $d=0.8$ PAE-dysmorphic(mean=7.6, SD=2.8), no/low-PAE, $p=0.08$, $d=0.3$

Lewis et al., 2015	CVLT-C:Immediate	PAE+heavy(mean=6.8, SD=1.8), no/low-PAE(mean=7.1, SD=1.7), $p=0.46$, $g=0.2$ PAE+moderate(mean=6.6, SD=1.9), no/low-PAE, $p=0.20$, $g=0.3$
	CVLT-C:Total learning	PAE+heavy(mean=46.8, SD=7.3), no/low-PAE(mean=50.4, SD=8.1), $p=0.06$, $g=0.4$ PAE+moderate(mean=49.4, SD=8.9), no/low-PAE $p=0.59$, $g=0.1$
	CVLT-C:Short delay recall	PAE+heavy(mean=9.0, SD=1.9) < no/low-PAE(mean=10.5, SD=2.3), $p<0.01$, $g=0.7$ PAE+moderate(mean=10.3, SD=2.3), no/low-PAE, $p=0.70$, $g=0.1$
	CVLT-C:Long delay recall	PAE+Heavy(mean=9.4, SD=1.8) < no/low-PAE(mean=10.9, SD=2.1), $p<0.01$, $g=0.7$ PAE+moderate(mean=10.7, SD=2.1), no/low-PAE, $p=0.68$, $g=0.1$
	CVLT-C:Recognition discrimination	PAE+heavy(mean=93.4, SD=5.7) < no/low-PAE(mean=96.4, SD=4.1), $p=0.04^5$, $g=0.7$ PAE+moderate(mean=94.6, SD=6.0), no/low-PAE, $p=0.18^6$, $g=0.4$

Written language

Reading

Letter identification, word reading, and sentence-level reading comprehension (WRAT-4); non-word and word reading (WIAT-I); receptive vocabulary and text-level reading (ITBS)

McLachlan et al., 2014	WRAT-4:Reading	FASD(mean=5.2, SD=2.2) < no/low-PAE(mean=7.8, SD=3.0), $p<0.01$, $d=1.0$
Howell et al., 2006	WIAT-I:Basic reading	PAE+dysmorphic(mean=78.2, SD=14.5), no/low-PAE(mean=82.9, SD=13.7), $p=0.10$, $d=0.3$ PAE-dysmorphic(mean=82.5, SD=15.8), no/low-PAE, $p=0.90$, $d<0.1$
	ITBS:Reading	PAE+dysmorphic(mean=18.2, SD=17.1) < no/low-PAE(mean=30.5, SD=24.0), $p<0.01$, $d=0.6$ PAE-dysmorphic(mean=32.8, SD=25.2), no/low-PAE, $p=0.59$, $d=0.1$

Spelling

Spelling of single words

Howell et al., 2006 WIAT-I:Spelling PAE+dysmorphic(mean=78.5, SD=15.6) < no/low-PAE(mean=85.0, SD=15.3), ***p=0.04, d=0.4***
PAE-dysmorphic(mean=83.4, SD=16.3), no/low-PAE, *p=0.55, d=0.1*

Note: WISC-III=Wechsler Intelligence Scale for Children-Third Edition (scaled/standard scores) (Wechsler, 1991); CMR=Grisso's Comprehension of Miranda Rights (score range: 0-12 (vocabulary, recognition) 0-8 (paraphrasing)) (Grisso, 1998); DAS-II=Differential Ability Scales-Second Edition (T-scores) (Elliott, 2007); DKEFS=Delis-Kaplan Executive Function System (scaled scores) (Delis et al., 2001); NEPSY-II=Developmental Neuropsychological Assessment-Second Edition (scaled scores) (Korkman et al., 2007); RAVLT=Rey Auditory Verbal Learning Test (Brazilian standardisation) (Diniz et al., 2000); VSRT=Verbal Selective Reminding Test (learning slope/number of words) (Buschke & Fuld, 1974); CVLT-C=California Verbal Learning Test, Children's version (number of words/percentages) (Delis et al., 1994); WRAT-4=Wide Range Achievement Test, Fourth edition (combined scaled score) (Wilkinson & Robertson, 2006); WIAT-I=Wechsler Individual Achievement Test, First edition (standard scores) (Wechsler, 1992); ITBS=Iowa Test of Basic Skills (percentiles) (Hoover et al., 1996); ¹Equivalent to Vocabulary and Information subtests; ²Canadian supplementary; ³Verbal IQ subtests=Information, Similarities, Arithmetic, Vocabulary, Comprehension and Digit span, and Verbal Comprehension Index subtests=Information, Similarities, Vocabulary & Comprehension; ⁴Brazilian standardisation; ⁵Authors reported *p=0.004*; ⁶Authors reported *p=0.06* however in our analysis we accounted for Hartley's test for equal variance, *p=0.008*; Cohen's *d* and Hedge's *g* effect sizes: small=0.2, medium=0.5, large=0.8.

Discussion

We synthesized the published, peer-reviewed literature on oral and written communication skills of adolescents who have PAE compared to those with no/low-PAE. Studies included in this review demonstrated that participants with PAE generally had weaker skills in vocabulary and semantic knowledge, semantic processing, verbal learning, and memory, as well as reading and spelling compared to those with no/low-PAE. However, these findings were inconsistent across studies and measures. For the domain of oral language, two studies found between-group differences on all measures of semantic knowledge and organisation, while one found no difference on any task, and another found differences on all tasks but only for the comparison between adolescents with PAE plus dysmorphic features and those with no/low PAE. For verbal processing skills, one study found differences on semantic verbal fluency but not phonemic verbal fluency, verbal IQ, working memory or verbal learning and memory. Another study found differences on verbal IQ, for just adolescents with PAE plus dysmorphic features compared to those with no/low PAE, but not for working memory. Two studies found differences on both tasks administered (semantic verbal fluency and rapid naming, and semantic verbal fluency and learning and memory, respectively). Another study identified differences on all six subtests of a verbal learning and memory task; however, on two of these subtests, between group differences were not observed for the comparison involving the PAE group who did not have dysmorphic features. A further study identified differences for three out of five subtests of a verbal learning and memory task, but only for comparisons involving adolescents with heavy levels of PAE and those with no/low PAE. For written language skills, one study found between group differences for reading, while the other only reported differences for spelling and one of two reading tasks, but only for comparisons involving adolescents with PAE plus dysmorphic features. Studies were rated as having either good or strong quality.

In line with the findings of previous systematic reviews, methodological differences for the included studies potentially contributed to mixed findings. Together, with the small number of studies identified and included, this limits our capacity to draw robust conclusions from the extant literature. We identified inconsistency in the definitions used to allocate participants to groups based on PAE levels. No safe level of PAE has been

identified, methods used to assess PAE vary, and the effect of alcohol on the fetus can be influenced by other exposures, timing, and dose of PAE, as well as individual differences in alcohol metabolism (Popova et al., 2017). Misclassification of participants is likely to have also occurred within the included studies due to caregiver-fears of stigmatisation as well as memory and recall bias (Sayal, 2007). Furthermore, assessment and diagnostic guidelines for FASD differ internationally. Accordingly, it is possible that the definitions used to allocate research participants to PAE groups will continue to lack consistency. To determine the source of variation in communication profiles of those with and without PAE, it will be important that there is consistency in the ways in which PAE is assessed and defined in future research.

Previous systematic reviews related to individuals with FASD or PAE and which reported communication outcomes emphasise a need to consider additional confounding factors. While SES was considered in most studies in this review, most reported on adolescents from medium and low socioeconomic strata, highlighting a dearth of knowledge related to higher SES groups. Given that PAE is also associated with educational attainment and economic advantage (Hutchinson et al., 2013; McCormack et al., 2017; Muggli et al., 2016), research with groups from medium to high SES will contribute to a better understanding of the effects of PAE on communication skills. This review revealed that little is known about the communication skills of adolescents with PAE in relation to caregiving and trauma backgrounds. We further identified that most studies lacked data related to the languages spoken of the participants. The languages used, as well as the culture and caregiving environment of a child heavily influences language skill development (Norbury & Sparks, 2013). Therefore, it is important that future research considers and accounts for these variables.

We identified that participants were assessed predominantly using tasks that draw on semantic knowledge and organisation. Vocabulary knowledge is enriched within the lexicon, and the breadth, depth and organisation of semantic knowledge promotes the ability to efficiently appreciate and convey meaning (Levelt, 1995). Semantic knowledge is fundamental to educational and occupational success (Lowe et al., 2018). In this review, we found that expressive vocabulary skills were generally weaker among adolescents with PAE compared to those with no/low-PAE. Receptive vocabulary skills are also important

when examining semantic skills, but data for receptive vocabulary were not reported in any of the included studies.

Semantic knowledge and organisation were also assessed on other measures such as similarities, sentence recognition, paraphrasing, semantic processing, and reading comprehension. Across most studies, adolescents with PAE performed more poorly than those with no/low-PAE. This may reflect the influence of their weaker expressive vocabulary knowledge on more complex word- and sentence-level language-based tasks and highlights the importance of examining vocabulary and semantic skills comprehensively.

Word learning involves the encoding and mapping of phonological (sound-based) and semantic representations of words (Brackenbury & Pye, 2005). Phonological representations are encoded using phonological memory skills (Gathercole, 2006), and semantic representations, which are thought to develop through syntactic, semantic, pragmatic, and social-cognitive cues, map onto their respective phonological representations (Brackenbury & Pye, 2005; Stackhouse & Wells, 1997). A robust measure of phonological memory skills is nonword repetition (Gathercole, 2006), however none of the included studies reported nonword repetition data. Individual subtest data for digit span forwards, also a measure of phonological memory (Rasmussen, 2005), was also not reported. Research with 9-year-old children with PAE and no/low-PAE has shown that the patterns of neural activation involved in phonological memory differ, indicating atypical phonological skills among those with PAE (Diwadkar et al., 2013). Further, the transition from visual to verbal memory strategies, which draws on phonological memory skills, occurs in late childhood and early adolescence among children with FASD, which is much later than for children without FASD (Rasmussen & Bisanz, 2009). The lack of evidence about phonological memory skills identified in this review makes it difficult to draw conclusions about if, and how, phonological memory skills of adolescents with PAE compare to those with no/low-PAE, and how they relate to word learning and semantic knowledge.

In the studies included in this review, participants were also assessed on verbal working-memory and verbal learning and memory measures. While we identified no

between-group differences in verbal working memory, there was an identified trend for verbal learning and memory skills to decrease according to the presence of dysmorphology (Coles et al., 2010) and the level of PAE (Lewis et al., 2015). Age-related specialisation of neural systems that underlies memory skills occurs across childhood and adolescence (Bathelt et al., 2017). However, PAE is associated with smaller brain volumes and atypical brain structures, including those important for memory (Chen et al., 2012; Willoughby et al., 2008), therefore, a growth deficit related to PAE might contribute to atypical neural development and weaker verbal learning and memory skills among adolescents with PAE.

Using different methods, Lewis et al. (2015) and Coles et al. (2010), whose studies differed on sample size, participant age, assessment task, and PAE definitions, examined the deficits underlying weaker learning and memory performance among their PAE groups. Coles et al. (2010) suggested that memory difficulties among their participants with PAE are linked to encoding problems rather than a tendency to forget learned information. Lewis et al. (2015) suggested that memory difficulties among their participants with PAE are linked to problems with retention as well as inefficient strategies to access and retrieve words. Further, as discussed by Lewis et al. (2015) and Furtado and de Sa Roriz (2016), a semantic clustering strategy, which can support memory and recall is used less frequently and effectively by individuals who have PAE, and the findings for verbal fluency show that semantic information is accessed and retrieved less efficiently by adolescents with PAE. A specific deficit in semantic skills was posited by Furtado and de Sa Roriz (2016) as being a key consequence of PAE, given that semantic verbal fluency was the only verbal measure in their study in which group differences were identified, and that children who have FASD have abnormal neural activation of a language processing area in the temporal lobe (Sowell et al., 2007). Access to and retrieval of words is complex, and thought to be supported by the robustness of stored phonological and semantic representations as well as the ability to use retrieval cues (Brackenbury and Pye, 2005, Levelt, 1995). While limited, our findings indicate that in assessment of memory and learning skills with adolescents with PAE, it is important to consider both lexical storage and retrieval strategies.

Few studies in this review examined reading and spelling skills. However, those that did indicated that adolescents with PAE perform more poorly. As reading requires skills in both the decoding of graphemes, as well as in receptive language, weaknesses in one or both can compromise reading ability (Nation, 2019). Howell et al. (2006) identified that the receptive vocabulary and text-level reading comprehension score was lower among adolescents with PAE. As these participants' scores for nonword and word reading were similar for both groups, albeit below the expected level for their age, it is likely that receptive language skills, rather than decoding skills, underlie the between-group difference for the reading scores. This is supported by our findings in the domain of semantic knowledge. In addition, Doyle et al. (2018) showed that adolescents with PAE have weaker rapid naming skills, which has implications for decoding, word recognition, and reading fluency (Norton and Wolf, 2012). As a result, both reading and spelling skills can be compromised. Our findings highlight that for adolescents with PAE, assessment should consider phonological processing, decoding and receptive language skills, and the impact these have on literacy skill development.

Several studies included in this review reported on communication measures that draw on grammar comprehension and expression. For example, tasks involving sentence- and text-levels of language require grammatical skills, in addition to semantic and memory skills, to support language processing (Levelt, 1995). However, none of the studies used measures of grammar, nor reported directly on grammatical skills. Therefore, it is unclear how the grammatical skills of adolescents who have PAE compare to those with no/low-PAE, and what implications there are for their communication ability.

Implications for clinical practice and research

Our findings are important to functioning and wellbeing in adolescence and have implications for clinicians working across a variety of settings. For example, in a school setting, students who lack competence in oral and written communication skills are likely to have problems with the comprehension and production of both oral and written texts (Lowe et al., 2018; Nippold et al., 2009). As a result, a student may have difficulty extending and demonstrating their knowledge, and in turn, meeting the requirements of the school curriculum. A pilot SLP intervention study with 9-year-old students with

FASD revealed that gains in language and literacy skills can be made (Adnams et al., 2007), suggesting an important role for speech-language pathologists within schools to deliver services to improve language and literacy outcomes of students with PAE and FASD. However, there is a dearth of research investigating language and literacy interventions for adolescent students who have PAE. Given our findings that adolescents with PAE have difficulties with both oral and written communication skills, and that completing school is important to adolescent students who have FASD (Duquette et al., 2006), future research investigating the effectiveness of language and literacy interventions is required to inform clinical practice.

Our findings are also relevant to social and emotional wellbeing. Language skills are critical to supporting the recognition and labelling of emotions (Griffiths et al., 2020). Among children and adolescents with FASD, strengths in emotion recognition support adaptive functioning in the classroom (Crawford et al., 2020), and expressive vocabulary skills are associated with social perspective-taking (Stevens et al., 2015). Given that social and emotional wellbeing are areas of identified difficulty for children and adolescents who have PAE (Coggins et al., 2007; Kjellmer & Olswang, 2013; Schonfeld et al., 2005), it is imperative that assessment and service provision with them includes consideration of communication skills.

Weak communication skills also have implications for forensic contexts, compromising psycholegal abilities and, potentially, success in rehabilitation and educational programmes (McLachlan et al., 2014; Rost & McGregor, 2012). Adolescents and adults who have either or both FASD and language deficits are over-represented, yet often under-identified, in justice settings (Kippin et al., 2018; McLachlan et al., 2019). Therefore, it is critical that the communication demands of forensic contexts are understood by the justice workforce, and that policies and practices are introduced that better enable the identification and response to an individual's communication needs (Kippin et al., 2018; Rost & McGregor, 2012). For example, providing neurocognitive assessment upon an individual's entry into the justice system can support more responsive rehabilitation efforts and more equitable outcomes for adolescents with PAE (Reid et al., 2020).

A common finding amongst the research identified in this review is that many of the scores, for both the PAE and no/low-PAE groups, did not fall into impaired thresholds as used in FASD diagnostic guidelines, despite there being significant differences between groups as well as potential for functional communication problems. According to the revised Institute of Medicine Guideline for diagnosing FASD (Hoyme et al., 2016), impairment of a neurocognitive skill is defined as a score of ≥ 1.5 SDs below the mean while in both the Scottish and Australian Guidelines (Bower and Elliott, 2016, Scottish Intercollegiate Guidelines Network, 2019), impairment is defined as a score of ≥ 2 SDs below the mean. Our findings highlight the possibility that many adolescents who have PAE may not meet criteria for a FASD diagnosis based on their language and communication scores, while if they meet criteria based on scores for other diagnostic domains, they may not have their oral and written communication needs prioritised.

In the identification of communication impairments more broadly, in both clinical practice and research, there is no one cut-off score that is used universally (Bishop et al., 2016). It is important that consideration is given as to whether test scores are significantly different to those of their peers, and that, in addition to caregiver and teacher reports, direct assessment incorporates activities which are meaningful and relevant to the individual, to account for the functional impacts of communication difficulties (Bishop et al., 2016; Westby & Washington, 2017). In this review, we identified that just one study (McLachlan et al., 2014) considered functional assessment, in which supplemental language items specific to the Canadian legal system were incorporated into assessment of psycholegal abilities. Given that all the study participants were involved with the Canadian legal system, the supplemental items have practical relevance to the identification of specific psycholegal abilities needed to participate in the Canadian criminal justice system. In research and clinical practice related to PAE, comprehensive and direct assessment of communication skills using both standardised and functional tasks is important and should not be underestimated.

A further limitation that may arise from these thresholds for impairment is the lack of clarity regarding their appropriacy to warrant a neurodevelopmental disorder diagnosis among peoples from non-dominant languages and cultures (Bishop et al., 2016, Norbury and Sparks, 2013). The language/s used by an individual to communicate, as well as

assessment methods, should be carefully considered when planning and delivering assessment services to ensure that an individual's communication skills are appropriately and accurately examined.

Speech-language pathologists have a key role in assessment and intervention with individuals who have PAE (Popova et al., 2014). Further, SLP assessment is recommended in assessment guidelines for FASD (Bower and Elliott, 2016, Hoyme et al., 2016, Scottish Intercollegiate Guidelines Network, 2019). Increased speech-language pathologist involvement in clinical practice and research related to PAE and FASD is likely to advance a more nuanced understanding of the communication profiles of adolescents with PAE. This is important to inform more targeted assessment, supports and interventions into the future.

Strengths and limitations

We set a specific age range for inclusion in this review and followed a systematic process to search for and review studies. Our search was broad, including terms drawn from the speech, language, and literacy literature, as well as terms relating to cognitive processing skills that underlie communication skills. While we did not select PubMed in the initial search strategy, we included it in an additional search and found no further records that met the inclusion criteria.

We did not conduct a meta-analysis due to the limited number of studies identified, few studies reporting data for each outcome, as well as the methodological variations such as the PAE definitions used to allocate participants to groups. While we identified a small knowledge base with equivocal findings, we identified that the most assessed skills, which were semantic knowledge, semantic processing, and verbal learning and memory, were commonly weaker among adolescents with PAE compared to those with no/low-PAE.

Conclusions

There has been limited investigation of oral and written communication skills of adolescents with PAE compared to those with no/low-PAE. Variability between studies, as well as the limited research base make it difficult to compare study results and to draw conclusions. However, our results highlight that adolescents with PAE have weaker skills

in some areas of oral and written communication, as well as in verbal processing skills that underlie and support communication skills, compared to those with no/low-PAE. Both oral and written communication skills in the adolescent years underpin social and educational development and support the transition to becoming more independent. Our results emphasise that for adolescents with PAE, communication skills in both oral and written modalities should be comprehensively understood in assessment and when planning interventions.

Declarations of interest

None.

Funding

FASD Research Australia CRE PhD scholarship and Australian Government Research Training Program PhD Scholarship (NRK); FASD Research Australia Centre of Research Excellence (National Health and Medical Research Council of Australia grant #1110341) (RW).

CHAPTER 5:

Orofacial, oromotor, speech and voice characteristics of adolescent students in youth detention: A comparison of groups with and without PAE

Chapter overview

The systematic review detailed in the previous chapter highlighted a lack of understanding about speech skills of adolescents with PAE compared to those with no/low PAE. Motivated by this knowledge gap as well as the limited research related to speech skills of adolescents in youth justice, this chapter addresses research question 3 by detailing an examination of the orofacial, oromotor, speech and voice characteristics of adolescents in youth detention in WA, including a comparison of those with and without PAE.

While the term ‘young people’ is the term preferred by Department of Justice, this chapter is presented as the submitted and under re-review manuscript, in the format required for the intended journal. Therefore, the term ‘adolescents’ is used when referring to the participants of this study. As with the previous chapter, a small amount of reformatting has been undertaken to adhere to the format of the broader thesis. Repetition has been minimised where possible, although there may be some key literature that has been reported in previous chapters.

The citation for this publication is:

Kippin, N.R., Leitão, S., Watkins, R., Mutch, R., & Finlay-Jones, A. (under re-review).

Orofacial, oromotor, speech and voice characteristics of adolescent students in youth detention: A comparison of groups with and without prenatal alcohol exposure.

Abstract

Purpose: While research has established a high prevalence of language disorder in youth justice, orofacial, oromotor, speech and voice anomalies have been largely overlooked. There has been some documentation of these among individuals with prenatal alcohol exposure (PAE), and adolescents with PAE are over-represented in youth justice. The aims of this exploratory study were to 1) identify the prevalence of orofacial, oromotor, speech and voice anomalies among adolescent students of a school within a youth detention centre and 2) examine how these compare between those with and without PAE.

Materials and Methods: In a youth detention centre, in which both non-Aboriginal and Aboriginal young peoples were detained, a speech-language pathologist conducted non-standardised orofacial and oromotor examinations and spoken diadochokinesia (DDK) tasks with 95 students, 47% of whom had PAE. Speech and voice anomalies were also recorded. We analysed the data according to PAE.

Results: Features consistent with malocclusions, as well as anomalies with oromotor function, speech, and voice were observed among students, both with and without PAE. Stuttering and a monotone voice were only observed among those with PAE. No evidence of a difference was found between groups with and without PAE for DDK mean repetition rates.

Conclusions: The prevalence and implications of orofacial, oromotor, speech, and voice anomalies identified are important for informing assessment and service provision in youth justice, and strengthens the argument that SLP services are essential in youth detention. Considerations related to assessment with adolescents in youth detention, many of whom were Aboriginal young peoples, are discussed.

Key words: youth justice, speech, oromotor, prenatal alcohol exposure, fetal alcohol spectrum disorder

Introduction

Language disorder (LD) is highly prevalent among adolescents in youth justice, affecting 19% to 64% of those who have participated, or allegedly participated, in criminal behaviours (Bryan et al., 2007; Bryan et al., 2015; Lount, Purdy, et al., 2017; Sanger et al., 2001; Snow et al., 2016; Winstanley et al., 2019). A recent study in youth detention, which was part of the broader programme of research that the present study derives from, revealed that 56% of adolescents who were identified with LD also had fetal alcohol spectrum disorder (FASD) (Kippin et al., 2018). FASD is the diagnostic term for the severe and pervasive neurodevelopmental disorder associated with prenatal alcohol exposure (PAE) (Bower et al., 2017). Given the high prevalence and complexity of LD in youth justice, it is argued that the scope of practice of speech-language pathologists should include provision of services to adolescents in youth justice, and that SLP services be essential in youth detention centres (Snow, 2019).

However, orofacial, oromotor, speech and voice characteristics of adolescents in youth justice have been largely overlooked in research, resulting in a limited understanding of their communication and eating/swallowing needs. In the United Kingdom (UK), among 75 adolescents deemed persistent and prolific offenders, 8% were identified, through SLP assessment, to have a stutter, which is higher than the 1% in the general UK population (Gregory & Bryan, 2011). Malocclusions, which include malalignments of the maxilla and mandible, were also identified in 60% of adolescents in a Brazilian youth detention centre, through standardised assessment that included both clinical measures and patient perspectives (Oliveira et al., 2015). Older research, in the United States (US), revealed that of 30 adolescents in youth detention, 62% had articulation disorders, determined through SLP assessment (Zinkus & Gottlieb, 1983), also much higher than the 4% prevalence of speech delay among 6-year-old children in the US (Shriberg et al., 1999). In Canada, among 34 adolescents serving an adjudicated probation order and who had a diagnosis of FASD, 21% had articulation problems, and 13% had eating/swallowing difficulties (Conry & Lane, 2009).

Overall, the research base in relation to orofacial, oromotor, speech and voice anomalies of adolescents in youth justice is limited, but highlights an overlap of these

anomalies with PAE and FASD. Adolescents who have FASD are over-represented, and often un-identified, in youth justice (Hughes et al., 2016). This study involved the assessment of orofacial, oromotor, speech, and voice characteristics of adolescent students of a school within a youth detention centre, in which the world's highest known FASD prevalence in a criminal justice setting (36%) was recently identified (Bower et al., 2018).

PAE and FASD

PAE can affect fetal development and is associated with central nervous system disorders. Functional deficits can include difficulties with learning, daily living, and socialisation, which derive from neurocognitive problems in domains including executive function, language, attention, memory, motor skills and cognition (Mattson et al., 2019; McLachlan, Flannigan, et al., 2020). Structural deficits, which are present in some individuals with PAE, can be seen in growth deficiency and in dysmorphology of mid-facial structures (Hoyme et al., 2016). The three sentinel facial features associated with PAE are short palpebral fissures, a smooth philtrum, and a narrow upper lip compared to the lower lip (Bower et al., 2017). Dependent on the type and severity of functional and structural deficits, an individual with PAE may receive a FASD diagnosis. The Australian and Canadian FASD diagnostic guidelines include two categories: FASD with three sentinel facial features; and FASD with less than three sentinel facial features (Bower & Elliott, 2016; Cook et al., 2016). However, not all individuals with PAE will receive assessment or meet diagnostic criteria for FASD. Globally, the estimated prevalence of alcohol use in pregnancy is 10%, and levels of PAE vary across pregnancy (Muggli et al., 2016; Popova et al., 2017). The prevalence of FASD is much lower, at 7.7 per 1000 population (Lange et al., 2017). Alcohol use in pregnancy occurs in all socioeconomic strata, including in families of higher income and educational attainment (Muggli et al., 2016). However, there is a higher prevalence of FASD diagnoses among lower income families, those with less nutrient-rich diets, and in specific sub-populations, including criminal justice, Indigenous, special education, specialised clinical as well as child protection populations (Bingol et al., 1987; Popova et al., 2019). In addition to the Australian study that revealed a FASD prevalence of 36% in youth detention (Bower et

al., 2018), international FASD prevalence estimates in youth justice range between 11% and 23% (Hughes et al., 2016).

PAE and orofacial, oromotor, speech and voice anomalies

In addition to the three sentinel facial features that are considered in FASD diagnostic decisions, PAE, even at low levels, is associated with a spectrum of craniofacial features (Muggli et al., 2017). The bones, cartilage and nerves of the head and face derive from the neural crest, a group of embryological cells that are sensitive to, and can be disrupted by ethanol (Chen et al., 2011; Foroud et al., 2012; Sant'Anna & Tosello, 2006; Smith et al., 2014; Stettner et al., 2013). Palatal clefts, heightened palates and malocclusions are reported among individuals with FASD (Becker et al., 1990; Church et al., 1997; Terband et al., 2018). Among 125 South African children, deficits in mandibular growth were associated with PAE (Foroud et al., 2012), and measures of the maxilla and mandible could have clinical utility when a FASD diagnosis is being considered (Moore et al., 2001). While also present among individuals who do not have FASD, malocclusions are both more common and more severe among those who do have FASD (Blanck-Lubarsch et al., 2019a).

Children with PAE and FASD have also been identified with deficits in oromotor skills, particularly with tongue speed, coordination, and range of motion (Becker et al., 1990; Church et al., 1997), and PAE has been suggested to be a risk factor for stuttering (Ajdacic-Gross et al., 2010). Two recent studies involved comparisons of oromotor and speech skills of small samples of children with and without FASD diagnoses. Terband et al. (2018) assessed 36 boys, aged 4- to 10-years, identifying that both those with and without FASD demonstrated fronting of consonants. However, the boys with FASD, despite being older, had more occurrences of cluster reductions, speech sound substitutions and deletions, and were less intelligible than those who did not have FASD. The boys with FASD also made more errors with non-word repetition and exhibited weaker oromotor skills on standardised oral motor movement and spoken diadochokinesia (DDK) assessments. Bolinger and Dembowski (2019) identified no differences in speech-sound production between children with and without FASD, aged 3- to 9- years. However, the children with FASD, who were also older than those without FASD, but matched on

mental age, had weaker oromotor abilities on a standardised verbal motor production assessment. Bolinger and Dembowski (2019) suggested that disordered oromotor function could be a key contributor to compromised speech and articulation skills in children with FASD. Atypical vocal resonance and problems with laryngeal structure and function, affecting vocal quality, have also been reported among individuals with FASD (Becker et al., 1990; Church et al., 1997; Terband et al., 2018). While limited, the research base indicates that PAE is important to consider when examining orofacial, oromotor, speech and voice anomalies.

Assessment considerations in youth justice

Given the context for this study, there are several considerations for conducting assessments with adolescents in youth justice. Adverse and traumatic experiences are common (Meurk et al., 2019). For example, research has found high rates of prior sexual assault (Kinner et al., 2014), physical abuse (King et al., 2011), head injury (Kenny et al., 2008), and post-traumatic stress disorder (Borschmann et al., 2020) among adolescents in youth justice. In addition, neuro-disabilities are highly prevalent, yet often under-recognised (Hughes et al., 2012), and some adolescents may have associated sensory processing difficulties, such as with touch and body awareness (Hen-Herbst et al., 2020). For these reasons, some adolescents could have orofacial sensitivities or be hesitant to have their faces and mouths examined. Complex medical histories also highlight the potential for several factors, in addition to PAE, to compromise and contribute to communication and eating/swallowing problems.

Another consideration for assessment in youth justice is that, in Australia and internationally, Indigenous young peoples are over-represented. For example, in Australia, while making up just 6% of the total youth population, 50% of adolescents under youth justice supervision are Aboriginal and Torres Strait Islander young peoples (AIHW, 2020). Aboriginal and Torres Strait Islander peoples have experienced traumatic colonisation of their lands as well as systematic and institutional racism (Broome, 2010; Dudgeon et al., 2014). These, coupled with possible cultural differences to a consulting health professional, may influence an individual's feelings of safety and their participation

in assessment (S. Hamilton et al., 2020). Therefore, services may be at risk of not meeting the needs of an individual (Shepherd & Phillips, 2016).

Further, Indigenous peoples may use a first, or home, language, with its own speech-sound characteristics, that is both not the majority language nor the language of the population sample used in the standardisation of speech and language assessments (Laffey et al., 2014; Simpson & Wigglesworth, 2008). Concerns about using scores from standardised tests when considering a neurodevelopmental diagnosis among populations of minority languages and cultures have been raised (Farrugia-Bernard, 2018; Norbury & Sparks, 2013). In the US, Zinkus and Gottlieb (1983), who assessed the speech skills of culturally and linguistically diverse young peoples in youth detention, administered standardised speech assessments; however, they did not consider phonological and articulation variations due to cultural and linguistic diversity as articulation errors. In the Australian context, there is also a lack of culturally and linguistically appropriate assessment tools that can be used with Aboriginal and Torres Strait Islander young peoples. Use of standardised assessment can increase the risk that communication skills are not appropriately assessed or accurately described (Gould, 2008; Laffey et al., 2014; Simpson & Wigglesworth, 2008; Toohill et al., 2012). Therefore, non-standardised assessment approaches need to be considered (Armstrong et al., 2019; Gould, 2008; Norbury & Sparks, 2013). While there are also limitations to non-standardised assessment approaches, such as the potential for over- or under-identification of difficulties (Laffey et al., 2014), non-standardised approaches are an important component of assessment generally, as they can help to identify an individual's functional abilities and participation levels that may not otherwise be identified (McLeod & Bleile, 2004; Westby & Washington, 2017).

The current study

Limited understanding of orofacial, oromotor, speech and voice anomalies among adolescents in youth detention, where FASD is highly prevalent, yet under-identified, highlights a gap in knowledge and in the approaches taken in youth justice to plan for, provide and evaluate services. The current exploratory study was undertaken with a cohort

of adolescent students in youth detention, 47% of whom had PAE. Specifically, we aimed to answer the following questions:

1. How prevalent are orofacial, oromotor, speech and voice anomalies among a cohort of adolescent students in youth detention?
2. How do these anomalies and DDK mean repetition rates compare between adolescent students with and without PAE?

Materials and Methods

Ethics approval

This study was approved by the University of Western Australia Human Research Ethics Committee (HREC) (approval number RA/4/1/7116), the Western Australian Aboriginal Health Ethics Committee (approval number 582) and Curtin University HREC (approval number HRE2018-0117).

Participants

Participants were adolescent students of a school within a youth detention centre in which they were completing a custodial sentence. They were recruited between 2015 and 2016 for a cross-sectional study, which examined the prevalence of FASD among young people in the youth justice system (Passmore et al., 2016), the main results of which have been previously published (Bower et al., 2018). Participants in the prevalence study were required to have been sentenced, to have at least two weeks remaining for their sentence, and to be aged between 10- and 17.9-years. Of the 113 participants recruited into the prevalence study, 99 completed assessments with a speech-language pathologist (first author), paediatrician (fourth author), occupational therapist, and neuropsychology team.

In the current study, we report on a subgroup of these students who completed an orofacial examination and/or a spoken DDK task as part of the SLP assessment. Participation was voluntary, and students could decline tasks at any time. Four (4%) students, three of whom were Aboriginal young peoples, declined participation in both the orofacial examination and DDK task, resulting in 95 students, aged 13.7 to 17.9 years ($M = 16.2$ years, $SD = 1.3$ years), being included in this study. Students self-identified

their ethnicity as Aboriginal ($n = 70$, 74%) or non-Aboriginal ($n = 25$, 26%) which included 10 (11%) students of international ethnicity. Eight different Australian languages were spoken as first, or home, languages by the students (Kippin et al., 2018), the two most common being Aboriginal English ($n = 49$) and Standard Australian English ($n = 28$). All 95 students completed the orofacial examination, and 80 of these students also completed the DDK task (age: 13.7 to 17.9, $M = 16.3$, $SD = 1.3$). No students completed only the DDK task. Participant demographic data are provided in Table 4 according to PAE.

Prenatal alcohol exposure was assessed retrospectively during caregiver interviews by a research officer, who had a midwifery background (Freeman et al., 2019). This involved administration of the AUDIT-C, a validated screening tool which estimates the risk of harmful alcohol use (Bush et al., 1998). The questions related to frequency of drinking, number of standard drinks, and high-risk consumption (≥ 5 drinks of alcohol on one occasion) during pregnancy. Responses to the questions were scored and combined to estimate risk of harm. Using these scores and the categories provided in the Australian Guide to the Diagnosis of FASD (Bower & Elliott, 2016), students in this study were allocated to one of four groups: confirmed high-risk PAE (HR-PAE; $n = 28$), confirmed PAE (C-PAE; $n = 17$), no exposure with reported absence of PAE (No-PAE; $n = 40$), or unknown PAE (U-PAE; $n = 10$) for those with insufficient information. It is difficult to estimate a precise measure of PAE when PAE is confirmed (Freeman et al., 2019). Therefore, we have provided data according to the four groups mentioned, as well as a combined Total-PAE group ($n = 45$) consisting of both the HR-PAE and C-PAE groups. Information for PAE was obtained from the birth mother for most participants, followed by other relatives including fathers and grandmothers as well as formal documentation (Freeman et al., 2019).

Of the 15 students for whom DDK data was not available, nine completed the DDK task during the pilot phase of the study, and recorded data is missing (HR-PAE = 4; No-PAE = 5), two students were not administered the task due to time constraints (HR-PAE = 1; C-PAE = 1), and four students declined the task (HR-PAE = 2; C-PAE = 1; U-PAE = 1).

Table 4. Student demographic data according to prenatal alcohol exposure ($n = 95$).

	PAE Group				
	HR-PAE	C-PAE	Total-PAE	No-PAE	U-PAE
<i>n</i> (%)	28 (29%)	17 (18%)	45 (47%)	40 (42%)	10 (11%)
Female ^a	3 (11%)	0 (0%)	3 (7%)	3 (8%)	0 (0%)
Age, <i>M</i> (<i>SD</i>)	15.7 (1.2)	15.7 (1.3)	15.7 (1.2)	16.8 (1.1)	16.1 (1.0)
Engaged with school prior to detention ^b					
<i>Yes</i>	15 (54%)	15 (88%)	30 (67%)	21 (52.5%)	7 (70%)
<i>No</i>	13 (46%)	2 (12%)	15 (33%)	19 (47.5%)	3 (30%)
Last residential area					
<i>Metropolitan</i>	10 (36%)	3 (18%)	13 (29%)	30 (75%)	6 (60%)
<i>Regional</i>	18 (64%)	14 (82%)	32 (71%)	10 (25%)	4 (40%)
Consenting adult					
<i>Parent</i>	16 (57%)	10 (59%)	26 (58%)	35 (88%)	1 (10%)
<i>Guardian</i>	9 (32%)	4 (24%)	13 (29%)	4 (10%)	3 (30%)
<i>CPS</i>	3 (11%)	3 (18%)	6 (13%)	1 (3%)	6 (60%)
Ever involved with or known to CPS					
<i>Yes</i>	9 (32%)	3 (18%)	12 (27%)	8 (20%)	7 (70%)
<i>Unknown</i>	4 (14%)	3 (18%)	7 (16%)	9 (23%)	2 (20%)
<i>No</i>	15 (54%)	11 (65%)	26 (58%)	23 (58%)	1 (10%)
LOC ^c					
<i>Yes</i>	12 (43%)	6 (35%)	18 (40%)	21 (53%)	5 (50%)
<i>No</i>	16 (57%)	10 (59%)	26 (58%)	18 (45%)	5 (50%)
<i>Unknown</i>	-	1 (6%)	1 (2%)	1 (3%)	-

Note: HR-PAE = high risk prenatal alcohol exposure (PAE); C-PAE = confirmed PAE; U-PAE = unknown PAE; No-PAE = no reported PAE; ^a Excludes one male to female transgender student; CPS = government child protection services; ^bSelf-reported during interview with research officer; ^c Loss of consciousness (self-reported during the medical examination or caregiver-reported during caregiver interviews).

Few students were female (6%), and age differed by group (mean rank, $H(3) = 19.06$, $p < 0.001$). Planned comparisons revealed a difference in age between the Total-PAE and No-PAE groups ($U = 418.0$, $z = 4.24$, $p < 0.001$, $r = 0.5$), but not between the HR-PAE and C-PAE groups ($U = 234.0$, $z = 0.09$, $p = 0.93$, $r = < 0.1$). Most students were engaged with school prior to entering youth detention (61%), and most students lived in the metropolitan area (52%). Parents most commonly provided consent for both the Total-PAE and No-PAE groups, while government child protection services most commonly provided consent for the U-PAE group. Forty-four (46%) students were reported to have experienced a loss of consciousness or have been knocked out (LOC), at some time, while 49 (52%) were reported to have not.

Procedure

Students were recruited at the detention centre by a research officer who used simple explanations and pictorial aids to explain the assessment (Bower et al., 2018). Students were required to provide written assent to participate, and caregivers were required to provide written consent. Both the students and their caregivers completed standard case history interviews with the research officer, and the students undertook assessment with the four clinicians, previously mentioned. The SLP assessment included tasks related to oral and written language (Bower et al., 2018; Kippin et al., 2021; Kippin et al., 2018), in addition to the tasks reported here. Breaks were provided, and assessment could be completed over multiple days if required. At the time of the assessments, the clinicians were blind to student PAE status. During multidisciplinary assessment team meetings, in which each student's results were discussed and information about PAE was provided, the team finalised an assessment report. When necessary, recommendations for follow-up assessment and services were included in the reports. Assessment reports were provided to the students' caregivers, and with caregiver consent, to relevant Department of Justice staff. Assessment reports were also provided to the participants. Given the low levels of language and literacy skills of many of the students, feedback of results also involved simple verbal explanations and visual supports.

Assessment considerations

Several considerations for conducting assessment with adolescents in youth detention. The speech-language pathologist increased her knowledge about trauma and child development by attending professional development, and regularly reflected on her practices through mentoring sessions with a senior speech pathologist. Further, during the assessments, the speech-language pathologist ensured that she introduced herself and her role to all participants. While she had worked in the detention centre previously, in a different role, and already knew some of the participants, time within the assessment session was dedicated to building, or re-establishing, rapport through informal conversation and card games. Care was taken to prioritise each student's safety and autonomy. For example, tasks were only introduced when students appeared calm and responsive; tasks were explained and modelled simply and clearly; responses to any questions asked by the students were provided, which included drawing pictures to help convey responses; permission to touch a student's face was always sought; and a student's decision to participate in or decline tasks was respected.

Additional considerations for assessment also related to the over-representation of Aboriginal young peoples. At the time of this study, most adolescents in Western Australia's only youth detention centre were Aboriginal young peoples (73%) (Department of Justice, 2017). Ethical approval was obtained from the Western Australian Aboriginal Health Ethics Committee (see ethics approval above). The Aboriginal young peoples were potentially speakers of several Aboriginal languages in addition to Standard Australian English. Therefore, the speech-language pathologist became familiar with literature related to language and speech-sound differences between Aboriginal languages and Standard Australian English. She also sought information and advice about assessment from linguists and other speech-language pathologists who had expertise in Aboriginal languages and in assessment with adolescents in youth justice. Given the lack of appropriate assessments available to use with Australian Aboriginal young peoples, but the potential for adolescents in youth justice to have orofacial, oromotor, speech and voice anomalies, assessment involved a short evaluation using non-standardised tasks. A standard protocol was followed for each participant using a standard checklist and record form (Appendix 5). Questions related to the language/s spoken by students were also

included in case history questionnaires, and this information was used to inform the SLP assessment, the interpretation of data and the recommendations made.

The current study was nested within a larger programme of research, in which assessment time was restricted and language assessment was prioritised (Bower et al., 2018; Kippin et al., 2018). Therefore, if further investigations were required to confirm any concerns, for both Aboriginal and non-Aboriginal students, recommendations for follow-up were made in the assessment reports.

Measures

Orofacial checklist and oromotor task

Orofacial structure and function were examined using a standard checklist and record form (Appendix 5). The checklist incorporated items used in orofacial and oromotor assessment protocols of standard SLP practice (for example, Paul & Norbury, 2012); it included items related to the face, lips, jaw, tongue, oral cavity, and related cranial nerves. Each item was explained to the student using a standard set of simple instructions and modelling. The record sheet included checkboxes, as well as space to write qualitative comments, and took less than five minutes to complete. Features consistent with malocclusions (i.e., underbite: prognathia; overbite: retrognathia) were recorded by the speech-language pathologist on the standard record form (Appendix 5) and by the paediatrician within the medical assessment. Findings were discussed by the clinicians in team meetings, and final descriptions were agreed for all students.

Spoken oromotor skills were assessed using a maximum repetition rate (MRR) of spoken DDK. As discussed by Diepeveen et al. (2019), DDK uses non-meaningful stimuli to reduce the influence of linguistic knowledge. Spoken DDK examines the repeated production of each of the consonants, /p/, /t/, and /k/, each representing different levels of physiological complexity, i.e., the lips and tongue. The task commenced with monosyllabic repetitions of each consonant target followed by repetitions of the trisyllabic sequence, /pataka/. Following a model produced by the speech-language pathologist, students were given an opportunity to practise the target sequence and were then asked to produce the sequence as fast as they could in one breath until told to stop. A SONY voice recorder was used to record each student's productions, and the speech-language

pathologist made on-line notes of qualitative observations. Following assessment, the sound files were uploaded to PRAAT (Boersma & Weenink), a freely available software programme which plays audio recordings and visually displays audio recordings in sound-waveform. Using PRAAT, we measured the time taken for students to produce 10 repetitions of the monosyllabic sequences and four repetitions of the trisyllabic sequence, which has 12 syllables. We did not include the first syllabic sequence following inspiration as part of the set of repetitions. We determined the MRR by calculating the number of syllables produced per second, for example, 10 syllables in 1.41 seconds is 7.09 syllables per second, and for the trisyllabic sequence, 12 syllables in 1.68 seconds is 7.14 syllables per second. This procedure is in line with previous research examining DDK rates (Rvachew et al., 2005; Thoonen et al., 1996).

As DDK tasks require the execution of speeded fine-oromotor movements with various lip and tongue placements, they can aid the identification of central nervous system dysfunction including impaired motor speech (Rvachew et al., 2005). However, normative DDK data for adolescent age groups is limited (Kent et al., 1987), and little is known about DDK use with adolescents who have PAE, who are justice-involved, and who are Aboriginal young peoples. Therefore, in this study, we used student DDK data for exploratory purposes only, comparing MRR between students with and without PAE.

Speech and voice observations

A standard record sheet (Appendix 5) was used to record speech anomalies (e.g., articulation errors, stuttering) and voice anomalies (e.g., monotone, breathy). In line with previous research that examined speech skills among individuals in justice populations (Sample et al., 1989; Zinkus & Gottlieb, 1983), we did not consider phonological and articulation variations due to cultural and linguistic diversity as errors. For example, in home languages of Aboriginal peoples, interdental fricatives and affricates can be pronounced with voiced or voiceless stops, and consonant clusters, such as /st/ and /dr/ can be produced as /s/ and /d/, respectively (Butcher, 2008). A standardised norm-referenced speech/articulation assessment was not administered given that most participants were Aboriginal young peoples.

A data manager entered all orofacial, oromotor, speech, and voice data into SPSS, which the first author cross-checked for entry errors against hard copy forms. The first author also cross-checked the DDK MRR calculations exported to SPSS for a randomly selected 15% of students, and no errors were identified. Further, a second speech-language pathologist (second author) who was blind to student PAE status cross-checked the DDK data for a randomly selected 10% of students, against sound-waveforms of the audio-recordings in PRAAT (Boersma & Weenink). Differences for the monosyllable onset and offset times ranged from 0.00 to 0.05 seconds with an average of 0.014, and for the trisyllabic sequence, from 0.00 to 0.04 with an average of 0.013.

Statistical analysis

We assessed normality of distribution by visual inspection of the data and with the Shapiro-Wilk test. To compare age by group across three groups (Total-PAE, No-PAE, and U-PAE), we used the nonparametric Kruskal-Wallis H test, and across two groups (HR-PAE and C-PAE), we used the Mann-Whitney U Test. Age was not included as a covariate in the MRR analyses as we found no evidence of a linear relationship with age for any of the measures.

To compare outcomes according to PAE, we undertook planned comparisons of, 1) the Total-PAE and No-PAE groups and, 2) the HR-PAE and C-PAE groups. The U-PAE group was excluded from these analyses due to their exposure being unknown. We used the Chi Square Test for categorical data and the Mann-Whitney U Test for continuous data. We did not include loss of consciousness (LOC) as a covariate in our analysis as we found no evidence of an association between PAE and LOC (Total-PAE vs No-PAE: $X^2(1) = 1.39, p = 0.24$; HR-PAE vs C-PAE: $X^2(1) = 0.12, p = 0.73$), or any evidence that LOC was either associated with MRR or modified the effect of PAE on MRR ($0.46 < p < 0.88$). For all planned analyses, we assessed statistical significance using an alpha of 0.05. Effect sizes (ϕ and r) are reported as small = 0.1, medium = 0.3, and large = 0.5 (Cohen, 1992).

Results

Total Observations: Orofacial, speech and voice

A total of 64 of the 95 students (67%) presented with at least one orofacial, speech or voice anomaly (Tables 5 and 6), and 30 students (32%) presented with more than one. The remaining 31 of 95 students (33%) presented with no anomalies.

Of the students with at least one anomaly, 33 had PAE (52%) (HR-PAE: $n = 21$, C-PAE: $n = 12$), 25 had no PAE (39%), and six had unknown PAE (9%). Excluding students with unknown PAE, the number of students with at least one anomaly did not differ by Total-PAE and No-PAE groups ($X^2(1) = 1.15$, $p = 0.28$, $phi = 0.1$), or by HR-PAE and C-PAE groups ($X^2(1) = 0.11$, $p = 0.75$, $phi < 0.1$). Per student, the number of anomalies recorded ranged from zero to nine (HR-PAE: 0 to 9; C-PAE: 0 to 9; No-PAE: 0 to 6; U-PAE: 0 to 2). The Total-PAE and No-PAE groups did not differ in the distribution of the number of recorded anomalies ($U = 1011.5$, $z = 1.02$, $p = 0.31$, $r = 0.1$), nor did the HR-PAE and C-PAE groups ($U = 254.5$, $z = 0.40$, $p = 0.69$, $r = < 0.1$).

Orofacial observations

A total of 56 of the 95 students (59%) presented with at least one orofacial anomaly, the two most common being reduced jaw and tongue strength (Table 5). Students with PAE most commonly presented with features consistent with malocclusions, while students with no PAE most commonly presented with reduced jaw strength. Students with unknown PAE most commonly presented with a deviated palatine uvula.

Speech and voice observations

A total of 16 of 95 students (17%) presented with at least one speech or voice anomaly (Table 6). Five of these 16 students had both speech and voice anomalies, four of whom had PAE, and one who did not.

Regarding speech anomalies, four students (4%) demonstrated articulation and/or phonology errors, another four students (4%) had a lateral lisp, and two (2%) had a frontal lisp. Of the four students with articulation/phonology errors, three had PAE, and their errors included gliding of a liquid consonant, deletion of initial and final consonants, deletion of consonants in clusters, and weak syllable deletion. The one student with no

PAE was observed with errors of voicing an unvoiced consonant as well as fronting of a consonant.

Three of 95 students (3%) presented with a stutter, each of whom demonstrated secondary behaviours to stuttering, including head jerking, eye blinking, mouth groping, looking away, taking additional time, and changing their word choice. No student in the No-PAE and U-PAE groups was observed to stutter; however, one student, from the No-PAE group, reported that they had a stutter when they were younger.

Regarding voice anomalies, 12% of the 95 students presented with atypical voice characteristics. Among students with PAE, a monotone voice was the most common while among the students with no and unknown PAE, atypical resonance was the most common.

Oromotor task: DDK

Student performance for MRR varied from 3.15 to 8.77 syllables per second for monosyllabic sequences and from 4.92 to 8.28 for the trisyllabic sequence (Table 7). Excluding the U-PAE group, we found no difference between groups with and without PAE for the monosyllabic sequence MRR, /pa/ ($U = 688.0, z = 1.12, p = 0.26, r = 0.1$), /ta/ ($U = 647.5, z = 0.41, p = 0.68, r < 0.1$) or /ka/ ($U = 624.5, z = 0.06, p = 0.95, r < 0.1$), or for the trisyllabic sequence MMR, /pataka/ ($U = 565.5, z = 0.55, p = 0.58, r < 0.1$). We also found no difference between the HR-PAE and C-PAE groups for these same measures (/pa/: $U = 137.5, z = 0.32, p = 0.75, r < 0.1$; /ta/: $U = 129.5, z = 0.68, p = 0.50, r = 0.1$; /ka/: $U = 142.0, z = 0.50, p = 0.63, r < 0.1$; /pataka/: $U = 127.5, z = 0.75, p = 0.46, r = 0.1$).

Table 5. Orofacial observations according to prenatal alcohol exposure.

	PAE Group					
	<i>n</i> (%)	HR-PAE 28 (29%)	C-PAE 17 (18%)	Total-PAE 45 (47%)	No-PAE 40 (42%)	U-PAE 10 (11%)
Face & Lips						
Facial asymmetry @ rest		2 (7%)	3 (18%)	5 (11%)	3 (8%)	-
Unable to raise eyebrows		-	-	-	1 (3%)	-
Lip asymmetry on protrusion & retraction		2 (7%)	-	2 (4%)	1 (3%)	-
Reduced ROM		4 (14%)	2 (12%)	6 (13%)	4 (10%)	1 (10%)
Incoordination ^a		3 (11%)	1 (6%)	4 (9%)	1 (3%)	-
Total observations (<i>n</i> = 28)		11 (39%)	6 (21%)	17 (61%)	10 (36%)	1 (4%)
Individual students (<i>n</i> = 21)		7 (25%)	4 (24%)	11 (24%)	9 (23%)	1 (10%)
Jaw						
Malocclusions ^b		7 (25%)	1 (6%)	8 (18%)	2 (5%)	-
Asymmetrical when open		1 (4%)	-	1 (2%)	-	-
Crunchy/clicky jaw		1 (4%)	-	1 (2%)	1 ^c (3%)	-
Reduced ROM		5 (18%)	-	5 (11%)	1 (3%)	-
Reduced strength		4 (14%)	2 (12%)	6 (13%)	6 ^d (15%)	-
Total observations (<i>n</i> = 31)		18 (58%)	3 (10%)	21 (68%)	10 (32%)	-
Individual students (<i>n</i> = 23)		11 (39%)	3 (18%)	14 (31%)	9 (23%)	-
Tongue						
Deviated on protrusion		2 (7%)	2 (12%)	4 (9%)	2 (5%)	2 (20%)
Fasciculations		-	-	-	-	1 (10%)

Reduced ROM	3 (11%)	-	3 (7%)	2 (5%)	-
Reduced strength	4 (14%)	3 (18%)	7 (16%)	5 ^e (13%)	-
Incoordination	-	-	-	3 (8%)	-
Total observations (<i>n</i> = 29)	9 (31%)	5 (17%)	14 (48%)	12 (41%)	3 (10%)
Individual students (<i>n</i> = 26)	7 (25%)	5 (29%)	12 (27%)	11 (28%)	3 (30%)
Oral cavity & palate					
Deviated uvula	4 (14%)	1 (6%)	5 (11%)	3 (8%)	3 (30%)
Irregular uvula shape	-	2 (12%)	2 ^f (4%)	-	-
Total observations (<i>n</i> = 13)	4 (31%)	3 (23%)	7 (54%)	3 (23%)	3 (23%)
Individual students (<i>n</i> = 13)	4 (14%)	3 (18%)	7 (16%)	3 (8%)	3 (30%)
Total observations (<i>n</i> = 101)	42 (42%)	17 (17%)	59 (58%)	35 (35%)	7 (7%)
Total individuals (<i>n</i> = 56)	19 (68%)	10 (59%)	29 (64%)	22 (55%)	5 (50%)

Note: ROM = range of movement; ^aQuivering of lips/cheeks observed for one student in the HR-PAE group and one student in the No-PAE group; ^bFeatures consistent with malocclusions (i.e., retrognathia: overbite; prognathia: underbite); ^cStudent reported this was due to interpersonal violence; ^dOne student reported that they do not chew food much; ^eOne student reported a severely cut tongue at a young age; ^fNot bifid.

Table 6. Speech and voice observations of students according to prenatal alcohol exposure.

	PAE Group					
	<i>n</i> (%)	HR-PAE 28 (29%)	C-PAE 17 (18%)	Total-PAE 45 (47%)	No-PAE 40 (42%)	U-PAE 10 (11%)
Speech						
Speech errors ^a						
<i>Articulation/phonology</i>		2 (7%)	1 (6%)	3 (7%)	1 (3%)	-
<i>Lisp (lateral)</i>		2 (7%)	1 (6%)	3 (7%)	1 (3%)	-
<i>Lisp (frontal)</i>		-	-	-	2 (5%)	-
Motor-speech						
<i>Stutter</i>		1 ^b (4%)	2 ^c (12%)	3 (7%)	-	-
Total observations (<i>n</i> = 13)		5 (38%)	4 (31%)	9 (69%)	4 (31%)	-
Individual students (<i>n</i> = 11)		4 (14%)	3 (18%)	7 (16%)	4 (10%)	-
Voice						
Monotone		2 (7%)	2 (12%)	4 (9%)	-	-
Low volume		1 (4%)	2 (12%)	3 (7%)	2 (5%)	-
Rough		1 (4%)	2 (12%)	3 (7%)	1 (3%)	-
Breathy		-	1 (6%)	1 (2%)	-	-
Atypical resonance		1 (4%)	-	1 (2%)	3 (8%)	1 (10%)
Total observations (<i>n</i> = 19)		5 (26%)	7 (37%)	12 (63%)	6 (32%)	1 (5%)
Individual students (<i>n</i> = 12)		3 (11%)	4 (24%)	7 (16%)	4 (10%)	1 (10%)
Total observations (<i>n</i> = 32)		10 (31%)	11 (34%)	21 (66%)	10 (31%)	1 (3%)
Total individuals (<i>n</i> = 17)		5 (18%)	4 (24%)	9 (20%)	7 (18%)	1 (10%)

Note: ^aSpeech variations due to language diversity were not recorded as errors; ^bStudent with phrase repetitions, prolongations, blocking; ^cone student with sound repetitions, prolongations, blocking, and one student with word and phrase repetitions, blocking.

Table 7. Maximum repetition rate (MRR: syllables per second) according to prenatal alcohol exposure ($n = 80$).

	PAE Group						No-PAE		U-PAE	
	HR-PAE		C-PAE		Total-PAE					
	<i>n</i>		<i>n</i>		<i>n</i>		<i>n</i>		<i>n</i>	
/pa/										
Range	21	3.94 - 7.75	14	4.70 - 7.46	35	3.94 – 7.75	34	3.85 – 7.04	9	5.26 – 6.45
Mean (SD)		6.10 (0.96)		6.25 (0.77)		6.16 (0.88)		6.03 (0.71)		5.98 (0.39)
Median		6.25		6.45		6.37		6.04		5.92
Did not finish	-		1		1		1		-	
/ta/										
Range	20	4.37 – 7.94	15	4.20 – 6.67	35	4.20 – 7.94	35	3.52 – 8.77	9	5.10 – 6.29
Mean (SD)		5.73 (0.87)		5.80 (0.64)		5.76 (0.77)		5.72 (0.98)		5.48 (0.40)
Median		5.51		5.88		5.78		5.56		5.41
Did not finish	1		-		1		-		-	
/ka/										
Range	21	4.43 – 6.58	15	4.26 – 6.21	36	4.26 – 6.58	35	3.15 – 6.54	9	4.46 – 6.25
Mean (SD)		5.28 (0.64)		5.31 (0.58)		5.29 (0.61)		5.24 (0.12)		5.16 (0.55)
Median		5.16		5.21		5.19		5.21		5.18
Did not finish	-		-		-		-		-	
/pataka/										
Range	20	5.02 – 8.00	15	5.00 – 7.32	35	5.00 – 8.00	35	4.92 – 8.28	9	5.83 – 7.36
Mean (SD)		6.44 (0.89)		6.61 (0.60)		6.51 (0.77)		6.62 (0.84)		6.58 (0.55)
Median		6.23		6.63		6.49		6.67		6.52
Did not finish	1		-		1		-		-	

Discussion

Main findings

Within a youth detention centre, we conducted an exploratory study, examining the orofacial, oromotor, speech and voice characteristics of 95 students, 47% of whom had PAE. With regard to research question 1 of this chapter, 64 of 95 students (67%) exhibited at least one orofacial, oromotor, speech, or voice anomaly. Students most commonly presented with reduced jaw and tongue strength, reduced range of movement of the lips as well as features consistent with malocclusions. Of the 95 students, 11% exhibited speech errors, 3% had a stutter, and 12% had voice anomalies. These figures are higher than those identified in the general population of Australian school-aged children (1%, 0.3%, and 0.1% respectively) (McKinnon et al., 2007). These findings add to what is known about communication and potential eating/swallowing needs of adolescents in youth justice, strengthening the arguments for the scope of SLP services to include adolescents in youth justice, and that SLP services are essential in youth detention centres (Snow, 2019).

With regard to research question 2 of this chapter, we found no evidence that orofacial, oromotor, speech and voice anomalies differed according to whether a student had PAE or not. Given adolescents in youth justice commonly have complex health histories (Borschmann et al., 2020), factors additional to PAE may have contributed to the characteristics identified among students in this study. Regarding the 45 students with PAE, features consistent with malocclusions were the most common orofacial anomaly, present among 18% of students with PAE. Previous studies reported malocclusions (retrognathia/prognathia) in 10% to 55% of individuals with FASD (Becker et al., 1990; Church et al., 1997; Terband et al., 2018). Further, of the students with PAE, 13% exhibited speech anomalies, and 7% had a stutter. These figures are similar to pooled prevalence estimates of articulation disorders and stuttering (10% and 5%, respectively) among individuals with a FAS diagnosis (a diagnosis subsumed under FASD with three sentinel facial features) (Popova et al., 2016). Our results revealing that stuttering was only present in students with PAE may lend support to the suggestion that PAE is a risk factor for stuttering (Ajdacic-Gross et al., 2010). A self-reported resolved case of

stuttering for one student in the no-PAE group in our study also raises a question about the influence of PAE. The cause of stuttering is yet to be understood (Boulet et al., 2009), and further research into specific subtypes of stuttering and associated interventions is required (Ambrose et al., 2015; Baxter et al., 2015).

A further finding among the 45 students with PAE was that 13% presented with voice anomalies. A monotone voice was the most common characteristic observed, and was only observed among those with PAE. Abnormal prosody has been identified as a component of social communication difficulties in other clinical groups common to justice populations, including those who have schizophrenia (Colle et al., 2013; Stassen et al., 1995) and autism (McCann & Peppe, 2003; Shriberg et al., 2001). Given mental health disorders and autism can co-occur with FASD (Popova et al., 2016), further research may help to identify if PAE influences voice characteristics.

Assessment considerations

Prior to discussing the implications of our findings for adolescents in youth justice, it is important to reflect on outcomes related to assessment considerations in this study. Non-standardised assessment may have resulted in under- or over-identification of students' needs in relation to the outcomes examined. However, as the majority of students who took part were Aboriginal young peoples (74%), the use of standardised assessment would also likely have had implications for the accurate identification of students' needs (Laffey et al., 2014; Toohill et al., 2012). Given that accurate assessment is necessary to inform diagnostic decisions and support services, it will be important that, in Australia and internationally, culturally, and linguistically appropriate assessment methods, that can be used with Indigenous young peoples, are developed, and that reliability of non-standardised measures are established. Further, support for and growth of Indigenous peoples in justice, education, and health workforces are required for more equitable and culturally safe service provision (Shepherd & Phillips, 2016).

Orofacial and oromotor assessments, while completed by most students, were declined by some. While generally quick to complete, these assessments include a range of isolated and repeated oral movements which may feel awkward and embarrassing to complete. In this study, four students, three of whom were Aboriginal young peoples,

declined both the orofacial examination and DDK task, and a further four students, who were all Aboriginal young peoples, declined just the DDK task. One non-Aboriginal student who did complete the tasks shared, “[I] didn’t like the mouth stuff... moving my mouth and tongue around. It felt funny” (S. Hamilton et al., 2020, p. 321). No further commentary was provided for this student’s experience, and follow-up interviews with those who declined the tasks were not undertaken. Therefore, we do not know which, if any, factors potentially contributed to students declining or disliking the tasks. It will be important for speech-language pathologists who work in youth justice to consider how clinical practices might be experienced by individuals being assessed. It will also be important that SLP services are planned and delivered in a way that promotes recovery and healing given that many adolescents in youth justice experience systemic and institutional racism, trauma, poor social and emotional wellbeing, and neuro-disability (S. L. Hamilton, S. Maslen, D. Best, et al., 2020).

Restricted assessment time associated with research projects undertaken in youth justice also draws attention to the limited scope that these have in identifying and responding to adolescents’ needs. It also highlights the need for more comprehensive health care, including SLP services, to be embedded into youth justice systems.

Limitations

There is potential for misclassification of students in our study due to the reliance on memory and recall for information related to PAE as well as possible fears of stigmatisation (Freeman et al., 2019). This is a common issue raised in the PAE and FASD literature; however, it is unclear in what timeframe the most accurate PAE information can be obtained (Hannigan et al., 2010). Future research may benefit from access to collateral sources such as medical records. Dysmorphology related to FASD could lead to bias in observations; however, in this study, none of the participants had three sentinel facial features associated with PAE, so potential for bias due to dysmorphology was limited.

Our sample size and use of non-standardised assessment methods may have limited the precision of our prevalence estimates. Future research could use larger samples to generate normative data for this age range, which could potentially aid in the

identification of speech and motor-speech disorders. While orofacial, oromotor, speech and voice anomalies may also arise from head and neck injuries, we found no evidence of an association between LOC and PAE or MRR. We also lacked access to past medical records including details related to the timing of LOC. Future research examining LOC and PAE among adolescents may benefit from access to such records.

Implications

Notwithstanding assessment considerations of this study, our study involved a representative sample of adolescent students who were in youth detention at the time of this study (Bower et al., 2018). Therefore, our findings have important implications for adolescents in youth justice.

Compromise of orofacial features and oromotor skills can restrict space for teeth to grow, impact eating/swallowing, as well as promote mouth breathing which can dry the mouth and result in a lack of saliva to both nourish teeth and assist with swallowing and digestion (Becker et al., 1990; Blanck-Lubarsch et al., 2019a; Blanck-Lubarsch et al., 2019b; Oliveira et al., 2015). Medications to treat mental health problems can also dry the mouth, affecting swallowing and oral health (Sinha et al., 2015). Poor oral health, which has been identified in both children with FASD and adolescents in youth detention, can affect quality of life, and better oral health programmes in youth detention are required (Bolin & Jones, 2006; Da Silva & Wood, 2020; Oliveira et al., 2015). It is important that adolescents presenting with malocclusions are provided with regular orthodontic supervision to promote good oral health and reduce the risk of facial distortions (Blanck-Lubarsch et al., 2019a). Further, it is important that SLP services are available to adolescents in youth justice so that eating/swallowing function can be assessed, and if required, responded to.

Speech and motor-speech difficulties can be detrimental to an individual given both functional and emotional impacts. For example, being misunderstood by others and having low confidence in speech skills have been reported in adolescents in youth detention who have a stutter or cleft palate (Bryan, 2004). In an Australian youth detention centre, one 17-year-old adolescent was found to be frustrated with his extremely poor

speech and intelligibility; however, individualised SLP intervention resulted in both improved speech clarity and confidence (Snow et al., 2017; Snow & Woodward, 2016).

Speech-sound disorders are also important to consider in relation to literacy skills; they can affect accurate identification and manipulation of speech sounds, which can disrupt reading (decoding) and spelling proficiency (McLeod & Bleile, 2004). Given high rates of illiteracy in youth justice (Grigorenko et al., 2015), it is important that both language and speech difficulties among adolescents in youth justice are identified and addressed.

Implications of voice anomalies are also important to consider for adolescents in youth justice. Problems with an individual's voice can affect their ability to communicate and be understood, and atypical voice characteristics may be incorrectly perceived as part of aggressive or problematic behaviours (Hooper, 2004). Voice problems also have implications for adolescents' future occupational and economic success. For example, they can impede successful participation in tasks and activities required in the workplace (Roy et al., 2005). Medical treatment and SLP interventions may be required by some adolescents who have voice anomalies (Hooper, 2004; Peppard, 1996).

Further, SLP programmes related to vocal hygiene are needed for populations at increased risk of voice problems (Roy et al., 2005). Adolescents in youth justice have high rates of alcohol and tobacco use (Borschmann et al., 2020) and can be impulsive, potentially overusing the voice to yell and talk excessively (Angelillo et al., 2008). These factors can increase the risk for vocal pathology and voice problems (Angelillo et al., 2008; Peppard, 1996), and together with our findings, indicate that adolescents in youth justice are at increased risk of voice anomalies.

Providing comprehensive assessment and treatment services, including SLP services, in youth detention centres can be challenging. For example, the length of detainment of adolescents varies (Bolin & Jones, 2006), and the operational needs of facilities take priority (Swain et al., 2020). However, the research that exists, and the findings from this study, highlight the importance of SLP services being available to adolescents in youth justice (Snow, 2019).

Conclusion

In this study, we identified that adolescent students of a school within a youth detention centre, both with and without PAE, presented with orofacial, oromotor, speech and voice anomalies at a higher prevalence than occurs in community samples. Our study and our consideration of the impact of these anomalies underscore the importance of their identification, particularly in high-risk populations. Our results as well as our assessment considerations can help health care professionals, particularly speech-language pathologists, to plan for and provide services to address communication and eating/swallowing needs of adolescents in youth justice, including those with PAE and FASD.

Acknowledgements

We thank the adolescent students and their circles of care for participating in this project, as well as the Department of Justice custodial and non-custodial staff. Thank you to Sharynne Hamilton for providing feedback on an early draft of this paper, and to Professor Carol Bower and Professor Rhonda Marriott, two chief investigators for the Banksia Hill Study (in addition to RW & RM). Any material published or made publicly available by the authors cannot be considered as either endorsed by the Department of Justice or an expression of the policies or view of the Department. Any errors of omission or commission are the responsibility of the researchers.

Declarations of interest

The authors report no conflicts of interest.

Funding

National Health and Medical Research Council (NHMRC) (#1072072); NHMRC-funded FASD Research Australia Centre of Research Excellence (#1110341); FASD Research Australia CRE PhD scholarship; Australian Government Research Training Programme PhD Scholarship. The funding sources were not involved with the study design, the collection, analysis and interpretation of data, the writing of the manuscript, or the decision to submit the article for publication.

CHAPTER 6:

Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention in Western Australia

Chapter overview

To gain a better understanding of the language skills of adolescents in youth detention in WA, this chapter addresses research questions 2 and 4 by identifying the languages spoken, as well as examining the prevalence of LD and LD associated with FASD in this population.

This chapter is presented as a final peer-reviewed and published manuscript, in which the terms ‘youth’ and ‘young people’ are used instead of ‘adolescents’, and language disorder is used instead of LD (Appendix 6). As with the previous papers in this thesis, the formatting has been adapted to adhere to the format of the broader thesis document. Repetition has been minimised where possible, although there may be some key literature that has been reported in previous chapters.

The citation for this publication is:

Kippin, N.R., Leitão, S., Watkins, R., Finlay-Jones, A., Condon, C., Marriott, R., Mutch, R.C., & Bower, C. (2018). Language diversity, language disorder and fetal alcohol spectrum disorder among youth sentenced to detention in Western Australia. *International Journal of Law and Psychiatry*, 61, 40-49.
<https://doi.org/10.1016/j.ijlp.2018.09.004>

Abstract

Background: While studies confirm high prevalence of language disorder among justice-involved young people, little is known about the impact of fetal alcohol spectrum disorder (FASD) on language among this population. It is also not clear how language skills vary according to language diversity in Australian youth justice settings, where a disproportionate number of justice-involved youth are Aboriginal and may not speak Standard Australian English (SAE) as their first language. Language skills are important to understand, as language disorder and language difference can lead to a mismatch between the communication skills of a young person and the communication skills of the justice workforce with whom they are communicating. In the highly verbal environments that are common to justice systems, language disorder and language difference may result in a young person misunderstanding legal information and expectations placed on them and not being adequately understood by the justice workforce.

Methods: This study examined the language skills of 98 young people sentenced to detention in Western Australia (WA), who participated in a cross-sectional study examining the prevalence of FASD. Language skills assessed using standardised and non-standardised tasks were analysed by the three major language groups identified: speakers of SAE, Aboriginal English, and English as an additional language.

Results: We identified rich diversity of languages, and multilingualism was common. Most young people for whom English was not their first language demonstrated difficulties in SAE competence. Further, nearly one in two young people were identified with language disorder – over half of whom had language disorder associated with FASD.

Conclusions: This study has documented language diversity and the prevalence of language disorder associated with FASD among a representative sample of youth sentenced to detention in WA. Results underscore the need for the justice workforce to consider language difference when working with justice-involved youth, as well as language disorder and FASD. The findings also demonstrate the need for speech pathology to be embedded as core service in youth justice systems, working in collaboration with local cultural and language advisors and accredited interpreters. This

can better enable appropriate identification of and response to communication and associated rehabilitation needs of young people navigating youth justice systems.

Key words: language, communication, youth justice, young offender, fetal alcohol spectrum disorder, FASD

Introduction

Language and youth justice

Language skills are integral to communication; they are key to cultivating relationships, shaping identity, nurturing confidence, engaging with social, educational, and vocational endeavours, and advocating for needs (Coles et al., 2017; Martin, 2018). Language is also central to social and cultural determinants of health for Aboriginal people, as language skills enable storytelling and passing on of knowledge and history, which are vital for the sustainability and practice of culture (Commonwealth of Australia, 2012; Department of Health, 2017). While speech refers to the physical production or articulation of sounds, language includes vocabulary, grammar, morphology, and pragmatics (the social function of language), and allows people to understand what is said (receptive language), and to express their thoughts, needs and desires (expressive language) (Leitão, 2015). Language skills also enable internal dialogue, ‘self-talk’, which supports metalinguistic skills such as reflective and critical thinking (Salmon et al., 2016). In contrast, language disorder, which refers to significant, persistent, and quantifiable comprehension and/or expression difficulties, that are not attributed to speaking a different language, can increase risk of cultural isolation, social, emotional, and behavioural problems, academic difficulties, and premature school disengagement (American Psychiatric Association, 2013; Commonwealth of Australia, 2012; Durkin et al., 2017; Ripley & Yuill, 2005; Snowling et al., 2006). Associations between language disorder and offending behaviour have been identified (Brownlie et al., 2004; Hopkins et al., 2017), and offenders with more frequent and severe crimes are more likely to have language disorder than offenders with less frequent and severe crimes (Snow & Powell, 2011).

In youth justice settings, language disorder affects 50 to 60% of young people, independent of cognitive impairment (Anderson et al., 2016). Compared to the general youth population, this prevalence is much higher. For example, in Australia, it is estimated that 13% of five- to eighteen-year-old children have language disorder (McLeod & McKinnon, 2007). While externalising problems including behavioural and academic difficulties are often noted among justice-involved youth, language skills – also important

for self-regulation, social competence, and the transition to literacy – are often not considered, or responded to (Snow et al., 2012). In the justice system, language disorder can leave youth vulnerable in their navigation of complex and highly verbal processes, and facing numerous obstacles for their rehabilitation (Snow et al., 2012). When encountering police and participating in forensic interviews and court proceedings, communication skills are under heavy demand. They include the ability to understand instruction, recall and sequence events, perceive, and convey varying points of view, and repair misunderstandings (Snow et al., 2012). However, many justice-involved youth have difficulties with the communication skills needed for these interactions. For example, in England, when compared to non-justice involved youth, justice-involved youth express themselves with, and understand, fewer words (Hopkins et al., 2017), and in Australia, justice-involved youth are more likely than non-justice involved youth to omit key details when telling a story (Snow & Powell, 2008). Inconsistent and non-cohesive accounts may result, which may be perceived as poor compliance (Snow & Powell, 2008). As legal interviews revolve around storytelling, language disorder can undermine successful participation in legal contexts (Snow & Powell, 2008).

Fetal alcohol spectrum disorder (FASD) and youth justice

Another key driver of the need to understand language abilities among justice-involved youth is the high prevalence of FASD in justice settings. FASD is a severe neurodevelopmental disorder resulting from teratogenic effects of prenatal alcohol exposure (Bower et al., 2017). Diagnosis of FASD involves a comprehensive interdisciplinary team approach and, in Australia, requires evidence of significant impairment in at least three of ten neurodevelopmental domains: brain structure/neurology, attention, executive functioning, memory, language, motor skills, cognition, affect, adaptive skills/social communication, and academic achievement (Bower & Elliott, 2016). Children living with FASD have increased possibility of encountering adverse environmental circumstances such as maltreatment, violent and disruptive households, and caregivers with mental health difficulties, which can further compromise child development and can necessitate

involvement with government child protection services (Coggins et al., 2007; Price et al., 2017).

Receptive and expressive language disorder and chronic serous otitis media are among the most common disorders in FASD (Popova et al., 2016). Additionally, craniofacial anomalies, including of the branchial arches that form ear and hearing anatomy, have been identified among children with FASD (Bower & Elliott, 2016; Church et al., 1997; Church & Gerkin, 1988). Also prevalent are conduct disorder, difficulties with reasoning and controlling impulsive behaviour, and significant trouble interpreting social and emotional cues. Together, these difficulties can increase the risk of being easily led, problems navigating social relationships and participation in antisocial and offending behaviour (Fast & Conry, 2009; Streissguth et al., 2004). Compared to the global average of 7.7 cases of FASD per 1000 people, FASD prevalence in Canadian justice settings is estimated at 11–23% (Flannigan et al., 2018), while in Western Australia (WA), 36% of sentenced youth have recently been identified to be living with FASD (Bower et al., 2018).

As superficial chattiness is commonly observed among those living with FASD, it can be easy to overestimate their language capacities (Douglas, 2015; Hand et al., 2016). For professionals working in legal contexts, there are important consequences for not being aware of and identifying potential language and communication deficits that are common to FASD. Language disorder and impairment in other neurocognitive domains can increase the risk of interrogative suggestibility (for example, *Pora v The Queen*, 2015) and impede successful compliance with sentencing orders (Douglas, 2015; Flannigan et al., 2018). Justice professionals have identified that FASD is relevant to their work practices, which are often verbally mediated (for example, police interviews and court proceedings), and much of the justice workforce report that they would modify their language if they knew the client had FASD (Mutch et al., 2016). Given the dearth of studies describing language disorder associated with FASD among youth sentenced to detention, further research is required to support the justice workforce to respond better to the specific needs of youth in their care.

Language difference and youth justice

An additional consideration for youth justice systems world-wide is the high proportion of justice-involved youth who are from culturally and linguistically diverse backgrounds. For example, Aboriginal youth make up 73% of the Western Australian (WA) youth detention centre population (Department of Corrective Services, 2016), a proportion that is much higher than the 5% of Aboriginal youth in the total WA youth population (ABS, 2016). In addition to cultural differences, it is likely that difficulties encountered by Aboriginal young people in verbal contexts also reflect language differences that exist between Standard Australian English (SAE) and Aboriginal languages including Aboriginal English (AE) (Eades, 2008, 2012). In Australia, the national education curriculum reflects culture and language consistent with SAE, and a lack of acknowledgement and response to language difference has been identified as a contributor to education inequity for Aboriginal children (Freeman & Staley, 2017; Webb & Williams, 2018). Similarly, inequity of access to legal and justice services has been found to result from the failure of legal professionals to effectively understand and address language difference (Eades, 2008, 2012). This was highlighted in a recent case in the WA Court of Appeal, where an accredited interpreter was not present during police questioning and legal proceedings of an Aboriginal man who did not speak English as his first language (*Gibson v The State of Western Australia*, 2017). The Court heard that language difference between Gibson and the interviewing police, in addition to procedural errors and previously unidentified cognitive impairment would have likely resulted in Gibson having inadequate understanding of legal terminology and processes in which he was participating. After spending five years in prison, Gibson's conviction was overturned. Such cases, and the systemic failings relating to Aboriginal people and their over-representation in justice settings, indicate that current services need to be better equipped to provide equitable justice services to Aboriginal people (Commonwealth of Australia, 2017; Crawford, 2010)

The present study

We report here the language outcomes from a study examining the prevalence of FASD among youth sentenced to detention in WA (Bower et al., 2018). We undertook this study to estimate (i) the prevalence of languages spoken by youth in detention in WA, and (ii) the prevalence of language disorder among these youth, taking into account the

high proportion of Aboriginal young people and the diversity of languages in this population. In addition, we aimed to explore the association between language disorder and involvement with government child protection services, nonverbal cognitive impairment, and FASD. Given that language is one of the neurodevelopmental domains commonly impaired in FASD, we hypothesised that there would be a language ability difference between young people who met the criteria for FASD diagnosis and those who did not. Results from the nine domains assessed as part of the FASD prevalence study (excluding the affect regulation domain, which was not assessed) are reported by Bower et al. (2018).

Examining the language skills of justice-involved youth in WA represents an opportunity to understand language strengths and difficulties among this group where cultural and linguistic diversity is common, and where a high prevalence of FASD is documented (Bower et al., 2018). Identifying and integrating this information is a crucial first step in enabling the youth justice system to accommodate young peoples' language needs, and ultimately influence how youth can communicate with, and therefore participate in and benefit from their services.

Materials and Methods

Participants and setting

The participants in this study were part of a FASD prevalence study, which was undertaken among sentenced youth, at WA's Banksia Hill Detention Centre (Banksia Hill) during 2015 to 2016 (Bower et al., 2018; Passmore et al., 2016). Banksia Hill is the only youth detention centre in WA for 10 to 17-year-olds who are remanded or sentenced. During this study, the average daily population at Banksia Hill was 133 (94% male, 73% Aboriginal) (Department of Corrective Services, 2016). Participation was voluntary and only those who had been sentenced to detention could enrol. Of those approached by a research officer, 154 young people (93%) provided written assent, and of these, 113 caregivers provided written consent (Bower et al., 2018). Of the 99 participants who completed the FASD assessment, we report language results of 98 participants who completed at least one of the measures reported here. These participants, who included six females, 91 males, and one young person who identified as transgender, ranged in age

from 13.7 to 17.9 years (mean (M) = 16.2, standard deviation (SD) = 1.2). During caregiver interviews, the research officer asked about and recorded information on the participants' prenatal and developmental histories on a standard form developed for the study (Bower et al., 2018). Table 8 provides participant ethnicity, previous language disorder diagnoses, previous contact with a speech pathologist, history of ear and hearing problems, and diagnostic outcomes.

Table 8. Participant characteristics and diagnostic outcomes by language group (n=98)

	SAE		AE		EAL	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Ethnicity						
Australian non-Aboriginal	15	(54)	0	(0)	0	(0)
Australian Aboriginal	3	(11)	52	(100)	18	(100)
Other*	10	(36)	0	(0)	0	(0)
History of language disorder	0	(0)	3	(6)	0	(0)
Previous speech pathology contact	1	(4)	2	(4)	0	(0)
Ear and hearing problems**	2	(7)	10	(19)	3	(17)
FASD diagnosis	2	(7)	24	(46)	10	(55)
Nonverbal cognitive impairment	3	(11)	11	(21)	4	(22)
Language outcome						
Language disorder	6	(21)	35 [±]	(67)	4	(22)
Mild to moderate difficulties	10	(36)	12	(23)	3	(17)
Average and above	12	(43)	5	(10)	11	(61)

Note. *Participants of Asian, African, and New Zealand ethnicity. SAE: Standard Australian English; AE: Aboriginal English; EAL: English as an additional language; **Recurrent ear infections (3 or more) and/or grommets, *n* = 15 (additional eardrum surgery, *n* = 2; ongoing hearing difficulties, *n* = 3); [±]Language disorder was deemed present for one participant who completed the EAL test battery in addition to a score well below floor on the CELF-4 Screening Tool, due to administrative error.

Procedure

Following participant assent and caregiver consent, the research officer completed a standard interview with the participants. This included asking the participants to identify their first and any other languages. For participants who identified as speaking English as an additional language (EAL) to an Aboriginal language, their first and other languages were confirmed by their caregivers.

Assessment and measures

The assessment battery included measures for speakers of SAE, AE, and EAL. The lead speech pathologist (NRK) administered all language assessments. Tasks were randomised to reduce possible order effects. The number of participants who completed each of the assessment subtests is provided in Tables 10 and 11. In this study, after accounting for competency in any other languages, we use the terms ‘language disorder’ when there is no known associated biomedical condition (American Psychiatric Association, 2013), and ‘language disorder associated with ‘X’ when there is a known associated biomedical condition (Bishop et al., 2017), for example, language disorder associated with FASD.

Language

The Clinical Evaluation of Language Fundamentals, 4th edition, Australian (CELF-4) (Semel et al., 2006) was used to assess the language skills of the speakers of SAE and AE, and has previously been used to examine the language skills of justice-involved youth (Anderson et al., 2016). The CELF-4 subtests assess receptive and expressive vocabulary and grammar, phonological and working memory, and discourse comprehension. The test was normed on a sample of youth aged 13- to 21-years from “all Australian states and territories, and from both urban and rural regions” (p.13) and who identified ‘English’ as their most frequently used language (Semel et al., 2006). The CELF-4 Core and Index scores used for this study all have reliability coefficients ≥ 0.90 (Semel et al., 2006). For the purpose of this research, the CELF-4 severity ranges were collapsed from five (above average/ average/mild/ moderate/ severe) to three as follows: a standard score of ≥ 86 , was the criterion for ‘average and above’, 71–85 for ‘mild to

moderate difficulties', and ≤ 70 , for 'language disorder' – deemed present if one or more Core or Index score was ≤ 70 (≥ 2 SD below the mean).

A second speech pathologist (SL) reviewed a random sample of 20% of the response forms. Inter-rater agreement was 98% and 99% for the expressive subtests: Recalling Sentences and Formulated Sentences, respectively.

For the speakers of SAE, standardised scoring was applied. As there are no known standardised norm-referenced language or verbal cognitive assessments specifically for Aboriginal adolescents, both standardised and adapted assessment scoring were employed for speakers of AE. First, standardised scoring was undertaken according to the test guidelines.

Second, an adapted scoring method was employed for the expressive language subtests, similar to the approach undertaken by Pearce and Williams (2013), also drawing on the work of Butcher (2008), Department of Education (2012), Hudson (1983), and Malcolm (2013). This involved re-scoring the expressive subtests: Recalling Sentences and Formulated Sentences, to account for aspects of language difference including grammar, morphology, and semantics. Following data collection, the speech pathologist worked with an accredited interpreter to review the interpretation and scoring of the Aboriginal participants whose assessments were scored with both SAE and AE. Table 9 provides examples of adapted scoring of two items from each of the two CELF-4 subtests scored using both the standardised and adapted approaches.

For the speakers of EAL, the primary language measures employed were self- and caregiver-reported concerns with language and communication and a non-standardised non-word repetition (NWR) task, a measure of phonological short-term memory. While caregiver-reported concerns together with NWR have good utility in discriminating between multilingual speakers who have language disorder and multilingual speakers who do not have language disorder (Boerma & Blom, 2017; Li'el, 2017; Paradis et al., 2013), we have also included self-report in this study for the speakers of EAL, as it was not always possible to obtain information from caregivers. Caregiver-reports were obtained by the research officer and recorded on a standard form. Questions elicited information about each participant's early language development, communication skills as compared

to other children of the same age, and abilities to understand others and express themselves. Caregiver-reported concerns were deemed to signify language difficulties if caregivers reported for example: that the young person had delayed first language development; that communication skills were below that of the same-age peers; or that the young person had difficulties understanding others or expressing themselves verbally. Self-reported concerns were recorded on an interviewer-administered questionnaire, which was designed to elicit information about receptive and expressive language, based on a questionnaire used with justice-involved youth (Burrows & Yiga, 2012). This was administered by the lead speech pathologist. Self-reported concerns were deemed to signify language difficulties if participants reported that in both their first and other languages, for example: that they understand half or less of what others say, or forget what is said; that they need more time to understand what has been said; that they have difficulties saying what they want to say and being understood; or that they feel that their communication skills are below that of their same age peers.

The NWR task contained 16 non-words (one to five syllables in length), and was designed with a speech pathologist experienced in working with Aboriginal children, based on existing NWR tasks (Dollaghan & Campbell, 1998; Salter, 2013). Participants were presented with the non-words verbally, one at a time, and asked to repeat them. If the attempt was incorrect, the non-word was repeated up to three times. Difficulties were deemed as signifying phonological short-term memory difficulties if participants required three or more different words to be repeated. ‘Language disorder’ was deemed present if language and communication concerns were identified by caregivers and/or participants and difficulties were present on the NWR task. If only one of these criteria was met, language difficulties were deemed present, but a classification of language disorder was not made. Participants who had no reported concerns and no difficulties with NWR were deemed to have ‘average and above’ language skills.

The CELF-4 Screening Test (Semel et al., 2004) was also used with speakers of EAL to provide non-diagnostic, qualitative information about SAE language ability. This informed recommendations made for those working with the young people. Criterion scores are also available for this test for 9- to 21-year-olds.

Table 9. Examples of adapted scoring of two CELF-4 subtests to account for aspects of Aboriginal English

Subtest	Item	Participant response	Standardised scoring	Adapted scoring
Recalling Sentences	14.	<i>“The coach could not find the uniforms that the team wore last year”</i>	2 (from 3 possible points)	3/3. Plural marking is not required
	19.	<i>“The girl stopped to buy some milk, even though she was late for school”</i>	2 (from 3 possible points)	3/3. Quantity marking is not required
Formulated Sentences	16.	<i>“___Roads are closed because there was a crash”</i>	1 (out of 2 possible points)	2/2. Determiners are not required
	21.	<i>“<u>Until</u> the bicycle shop opens, you can buy a new bike”</i>	0 (out of 2 possible points)	2/2. ‘Until’ has the meaning of ‘when/if’

Note. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Adapted scoring drew on the work of Butcher (2008), Department of Education (2012), Hudson (1983), and Malcolm (2013), and the language expertise of the accredited interpreter.

Nonverbal cognition

Nonverbal cognition was measured as part of the neuropsychological assessment (Passmore et al., 2016) using the Perceptual Reasoning Index (PRI) from the Wechsler Abbreviated Scale of Intelligence, Second Edition (Wechsler, 2011), or the Full-Scale Intelligence Quotient (FSIQ) from the Wechsler Nonverbal Scale of Ability (Wechsler & Naglieri, 2006), both with reliability coefficients ≥ 0.90 . Impairment was based on a standard score of ≤ 70 on either measure.

Prenatal alcohol exposure (PAE) and FASD

During caregiver interviews, the research officer assessed PAE for the study participants using the Alcohol Use Disorders Identification Test–Consumption (Audit-C) (Bush et al., 1998) where possible, and drew on other sources (including relatives who had first-hand knowledge of the birth mother's pregnancy, or legal and health records) if information directly from the birth mother was not available. Using the Australian Guide to the Diagnosis of FASD (Bower & Elliott, 2016), the paediatrician (RCM), together with the interdisciplinary team, reviewed all the information gathered through the assessment process, including level of reported PAE, and determined whether a FASD diagnosis was warranted. The PAE and diagnostic outcomes of all nine assessed domains are reported by Bower et al. (2018).

Statistical analysis

IBM SPSS Statistics Version 25 was used to analyse the data. The Chi-square test of independence was used to assess associations between categorical data and, where normality assumptions were met, t-tests were used to examine differences within and between groups for scaled and standard scores, with an alpha of 0.05. Effect sizes are reported.

Ethics

This study was approved by the WA Aboriginal Health Ethics Committee (approval number 582), the University of WA Human Research Ethics Committee (HREC) (approval number RA/4/1/7116), and Curtin University HREC (approval number HRE2018-0117).

Results

Language groups of young people in detention

Eight first-languages were identified. The most common were AE and SAE (Table 8), followed by Aboriginal languages additional to English (EAL) from regional and remote regions of WA. Speakers of SAE ranged in age from 14.3 to 17.9 years ($M=16.9$, $SD=1.0$), speakers of AE from 13.7 to 17.9 years ($M=16.0$, $SD=1.1$), and speakers of EAL from 13.7 to 17.8 years ($M=15.5$, $SD=1.2$). Second and third languages included AE (18 participants), and languages from regional and remote WA (10 participants). Eight non-Australian languages from African, Asian, and Polynesian regions were reported as second and third languages. Overall, 19 different languages were identified, and 31 participants (32%) identified as multilingual.

Language disorder

Seventy participants demonstrated language skills below the average range expected for their age and 45 met the criteria for language disorder adopted for this study. Three of six females (50%) and 42 of 91 males (46%) had language disorder. Of the 28 participants confirmed as known to child protection government services, 46% were identified with language disorder, compared with 40% of the 52 participants confirmed as not known to child protection government services.

Speakers of SAE and AE

Standardised and adapted scoring for speakers of AE

Table 10 presents comparisons between the standardised and adapted scoring of the speakers of AE. Compared with standardised scoring, adapted scoring produced higher scores for the two CELF-4 subtests: Recalling Sentences, Formulated Sentences, and hence for the CELF-4 composite scores: Core Language Score, Expressive Language Index and Language Memory Index. Three participants who had met criteria for language disorder based on standardised scoring no longer met the criteria with adapted scoring, and were no longer identified as such.

Language skills of speakers of SAE and AE

Table 11 presents comparisons of language scores for the speakers of SAE and AE. The mean language scores of the SAE and AE speakers combined fell below the average range for each CELF-4 subtest, Core, and Index score. Table 12 presents the

CELF-4 language outcomes of speakers of SAE and AE by severity range. Less than half of the speakers of SAE and AE performed in the average and above range on each CELF-4 Core and Index score. Seventy-one percent scored below the average range for their age in receptive language, 59% in expressive language and 62% in language memory.

Language skills of speakers of English as an Additional Language (EAL)

Five of the 18 speakers of EAL had reported concerns with language development and communication skills. Two of these five had both caregiver- and self-reported concerns, one had caregiver-reported concerns only, and two had self-reported concerns only. Six of the 18 speakers of EAL required three or more non-words to be repeated in the NWR task and were deemed to have difficulties with phonological short-term memory. For language disorder to be deemed present, speakers of EAL needed to have caregiver-reported concerns and difficulties with phonological short-term memory (Boerma & Blom, 2017; Li'el, 2017; Paradis et al., 2013). We also considered self-reported concerns of language and communication skills if information could not be obtained from caregivers. Four of the 18 speakers of EAL had reported concerns (both caregiver- and self-reported concerns, $n=2$; caregiver-reported concerns only, $n=1$; self-reported concerns only, $n=1$) and difficulties with phonological short-term memory, and language disorder was therefore deemed present for them.

In addition, fifteen speakers of EAL completed the CELF-4 Screening Test, with scores ranging from six to 23. Based on their age, 23 was the expected criterion score for all 15 participants. Two achieved this score. Eleven (73%) participants scored ≤ 17 (the expected criterion score for a 9-year-old English speaker, and floor for any child aged 9 years or older).

Table 10. Comparisons of standardised and adapted scoring outcomes of the CELF-4 measures for speakers of Aboriginal English.

CELF-4 Measure	Standardised scoring		Adapted scoring	<i>t</i>	<i>p</i>	<i>d</i>
	<i>n</i>	<i>M (SD)</i>	<i>M (SD)</i>			
Recalling sentences	51	5.2 (3.2)	6.3 (3.4)	-9.5	<0.001	1.3
Formulated sentences	51	3.7 (3.0)	6.3 (4.0)	-9.3	<0.001	1.3
Core language score	50	65.7 (17.9)	72.2 (18.7)	-11.3	<0.001	1.6
Expressive language index	50	67.4 (17.2)	75.5 (18.6)	-11.5	<0.001	1.6
Language memory index	46	69.7 (16.5)	78.2 (17.7)	-11.3	<0.001	1.7

Note. Two-tailed *t*-tests and Cohen's *d*; CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Subtests have a mean of 10 and a SD of 3; and the Core and Index scores have a mean of 100 and a SD of 15.

Table 11. Comparisons of CELF-4 language scores for speakers of Standard Australia English (SAE) and Aboriginal English (AE)

CELF-4 Measure	Total		SAE		AE		<i>t</i>	<i>p</i>	<i>d</i>
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>			
Recalling sentences	79	6.7 (3.3)	28	7.3 (2.9)	51	6.3 (3.4)	1.28	0.202	0.31
Formulated sentences	79	6.7 (3.6)	28	7.4 (2.8)	51	6.3 (4.0)	1.37	0.176	0.30
Word classes–receptive	78	5.3 (3.1)	28	7.5 (2.8)	50	4.0 (2.4)	5.75	<0.001	1.32
Word classes–expressive	78	6.6 (3.7)	28	9.6 (3.2)	50	5.0 (2.9)	6.52	<0.001	1.52
Word classes–total	78	5.8 (3.4)	28	8.5 (3.2)	50	4.3 (2.6)	6.21	<0.001	1.43
Word definitions	78	6.6 (3.7)	28	9.3 (3.4)	50	5.2 (2.9)	5.72	<0.001	1.32
Understanding spoken paragraphs	74	6.0 (3.1)	28	7.2 (3.0)	46	5.3 (3.0)	2.73	0.008	0.66
Semantic relations	73	6.8 (3.2)	27	8.4 (2.9)	46	5.8 (3.0)	3.62	0.001	0.88
Core language score	78	78.2 (19.2)	28	88.8 (15.5)	50	72.2 (18.7)	3.98	<0.001	0.96
Receptive language index	73	77.2 (15.5)	27	87.0 (13.3)	46	71.5 (13.8)	4.69	<0.001	1.14
Expressive language index	78	80.2 (18.3)	28	88.7 (14.6)	50	75.5 (18.6)	3.25	0.002	0.79
Language memory index	73	80.8 (16.4)	27	85.3 (13.1)	46	78.2 (17.7)	1.82	0.072	0.46

Note. Two-tailed *t*-tests and Cohen's *d*. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Standardised scores are reported, except for the subtests and Core and Index scores that were re-scored with adapted scoring. Subtests have a mean of 10 and a SD of 3; and the Core and Index scores have a mean of 100 and a SD of 15.

Table 12. CELF-4 language outcomes of speakers of Standard Australian English (SAE) and Aboriginal English (AE) by severity range

CELF-4 Measure	Average and Above		Mild to Moderate Difficulties		Language Disorder		
	SAE	AE	SAE	AE	SAE	AE	
	Total	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>	
Core language score	78	16	13	9	11	3	26
Receptive language index	73	14	7	11	16	2	23
Expressive language index	78	17	15	8	15	3	20
Language memory index	73	13	15	9	17	5	14

Note. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition; Outcomes are based on standardised scores except for the measures that were re-scored with adapted scoring.

Language, nonverbal cognitive impairment and FASD

The mean language scores of the speakers of SAE and AE were compared by nonverbal cognitive impairment, as presented in Table 13. Performance of those with nonverbal cognitive impairment fell in the range of language disorder, while those without nonverbal cognitive impairment fell in the mild to moderate difficulties and average and above ranges for both SAE and AE speakers. However, there was no statistical association between language disorder and nonverbal cognitive impairment ($\chi^2 = 2.05$, $p = .15$, $\phi = 0.15$) for the total participant group (speakers of SAE, AE and EAL).

The mean language scores of the speakers of SAE and AE were compared by FASD diagnosis, as shown in Table 14. Participants with FASD scored lower on the Core and Index scores than those who did not have FASD (medium to large effect size). Of the participants who did not have nonverbal cognitive impairment, those with FASD also had lower Core and Index scores than those who did not have FASD (small to medium effect size).

Of the 45 participants who met the criteria for language disorder used in the current study, 25 (56%) were identified according to our criteria as having FASD, eight (18%) of whom were also identified with nonverbal cognitive impairment. Four of the 25 participants with language disorder associated with FASD only met criteria for

impairment on three neurodevelopmental domains (the minimum required to warrant a diagnosis of FASD). Of the 20 (44%) with language disorder who did not meet criteria for FASD, three (7%) were identified with nonverbal cognitive impairment. Among the SAE and AE speakers with language disorder, deficits in multiple language skills (the Core, or more than one Core and Index score) were identified in 16 (76%) of the participants with FASD and 14 (70%) who did not have FASD.

Language disorder, FASD, and history of ear or hearing concerns

Of the 25 participants who met our study criteria for language disorder associated with FASD, seven (28%) had a history of recurrent ear infections or grommets, two of whom also had additional eardrum surgery.

Discussion

We investigated the language skills of 13- to 17-year-old young people sentenced to detention in WA, where 73% of youth in detention identify as Aboriginal, and where high prevalence of FASD has been documented. As anticipated, broad diversity in languages was identified among the participants. Less than one third were first-language speakers of SAE and nearly one fifth did not speak an English language as their first language. Language diversity in youth justice differs across Australian states and territories. For example, 94% of justice-involved youth in the Northern Territory speak up to three languages other than English (Commonwealth of Australia, 2017), while in NSW, 0.4% of justice-involved youth are speakers of EAL (Justice Health and Forensic Mental Health Network, 2017). The rich heterogeneity of language repertoires among youth in detention should be recognised as significant strengths of the young people. They bring with them notable language backgrounds and are developing as multilingual learners and communicators (Freeman & Staley, 2017). Their language abilities nurture pride, self-esteem, and respect (Commonwealth of Australia, 2012). For Aboriginal people, sustaining culture and perpetuating history through ‘stories shared’ are integrally reliant on the ‘spoken word’, and being a story holder and a storyteller is venerated in Aboriginal cultures (Commonwealth of Australia, 2012). The interconnectedness of language and health outcomes needs to be acknowledged and considered in the way services are provided to Aboriginal young people (Department of Health, 2017).

Table 13. Comparison of CELF-4 language scores for speakers of Standard Australian English (SAE) and Aboriginal English (AE), by nonverbal cognitive impairment

CELF-4 Measure	With nonverbal cognitive impairment		Without nonverbal cognitive impairment		<i>t</i>	<i>p</i>	<i>d</i>
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>			
Core language score							
SAE	3	68.3 (11.4)	25	91.2 (14.1)	*		
AE	11	62.3 (19.8)	39	75.0 (17.6)	2.06	0.044	0.69
Receptive language index							
SAE	3	69.0 (9.2)	24	89.2 (12.1)	*		
AE	8	63.2 (18.1)	38	73.2 (12.4)	1.90	0.064	0.64
Expressive language index							
SAE	3	70.0 (10.4)	25	91.0 (13.5)	*		
AE	11	65.9 (19.6)	39	78.2 (17.6)	1.99	0.052	0.66
Language Memory Index							
SAE	3	69.7 (5.7)	24	87.3 (12.5)	*		
AE	8	67.1 (22.1)	38	80.5 (16.0)	2.00	0.051	0.69

Note. Two tailed *t*-tests and Cohen's *d*; *Insufficient numbers to support comparisons for SAE speakers. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Standardised scores are reported except for the measures that were re-scored with adapted scoring. Core and Index scores have a mean of 100 and a SD of 15.

Table 14. Comparison of CELF-4 mean language scores by FASD diagnosis and nonverbal cognitive impairment, for speakers of Standard Australian English (SAE) and Aboriginal English (AE)

CELF-4 Measure	Inclusive of nonverbal cognitive impairment							Excluding nonverbal cognitive impairment						
	With FASD			Without FASD				With FASD		Without FASD				
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>t</i>	<i>p</i>	<i>d</i>
Core Language Score														
SAE	2	87.0 (19.8)	26	88.9 (15.6)	*			2	87.0 (19.8)	23	91.6 (14.1)	*		
AE	22	64.6 (14.3)	28	78.2 (19.8)	2.70	0.010	0.78	13	68.2 (11.3)	26	78.4 (19.4)	1.74	0.089	0.64
Receptive Language Index														
SAE	2	82.0 (9.9)	25	87.4 (13.6)	*			2	82.0 (9.9)	22	89.9 (12.2)	*		
AE	19	67.6 (13.5)	27	74.2 (13.6)	1.62	0.112	0.49	13	69.9 (10.8)	25	74.9 (13.0)	1.18	0.247	0.41
Expressive Language Index														
SAE	2	86.0 (22.6)	26	89.0 (14.5)	*			2	86.0 (22.6)	23	91.4 (13.2)	*		
AE	22	67.5 (13.2)	28	81.7 (20.0)	3.02	0.004	0.84	13	70.5 (10.0)	26	82.0 (19.5)	2.42	0.020	0.74
Language Memory Index														
SAE	2	86.0 (17.0)	25	85.3 (13.2)	*			2	86.0 (17.0)	22	87.4 (12.5)	*		
AE	19	70.8 (13.2)	27	83.3 (18.8)	2.49	0.017	0.77	13	73.5 (8.9)	25	84.1 (17.8)	2.44	0.020	0.75

Note. Two sample *t*-tests and Cohen's *d*; *Insufficient numbers to support comparisons for SAE speakers. CELF-4: Clinical Evaluation of Language Fundamentals, 4th Edition; Standardised scores are reported except for the measures that were re-scored with adapted scoring. Core and Index scores have a mean of 100 and a SD of 15.

Considering competency in SAE is also a critical step in enabling youth justice systems to better respond to young peoples' communication needs. Indeed, SAE is the common currency of verbal exchange in justice systems in Australia. We found that most of the speakers of EAL, who had an average age of 15 years, scored at or below the expected range of a 9-year-old across vocabulary, semantics, following instructions and recalling verbal information in SAE. The distinct gap identified between chronological age and age of SAE performance raises concern that SAE language expectations may be placed on young people who do not have the capacity to meet them. For example, (Lount, Hand, et al., 2017) identified that young people in the New Zealand youth justice system experienced difficulties understanding legal proceedings and felt a lack of control, even where their primary language was the same as that used in the court room. In WA, legislation requires language ability to be considered in the justice system. The *Young Offenders Act 1994* mandates that communication with young people employs simple language that they are likely to understand, for example, when: serving notices and issuing fines (Sections 43, 59); explaining court proceedings and orders (Sections 44, 52, 137); and making the rules of a detention centre known (Section 181). Although interpreter services exist, they are not always used (for example, *Gibson v The State of Western Australia*, 2017). Further, Eades (2008) explains that interpreters are often not used for speakers of AE, and unnoticed language differences, including conceptualisation, and thinking, can increase risk for suggestibility. Our findings of diversity in first languages and low levels of SAE competence among speakers of EAL indicate that language supports in youth justice need to be prioritised and evaluated for their effectiveness.

When examining language disorder, it is important to note that 'language disorder' itself may be over- or under-identified due to language difference, and 'language difference' needs to be acknowledged and accounted for when undertaking communication and verbal cognitive assessments (Gould, 2008). According to the criteria in this study, 71% of young people did not demonstrate language skills consistent with their age and nearly one in two met criteria for language disorder. While many of the Aboriginal participants in the current study referred to "English" as their first language, the researchers understood the language used to be reflective of both AE and SAE, and adapted scoring and interpretation of participants' performance was undertaken in addition

to standardised scoring where possible. Berry and Hudson (1997) discuss the lack of differentiation between AE and SAE, and the potential for supports to focus on developing young peoples' awareness of the differences in their languages and matching their language use to the context. The development of these higher-order language (metalinguistic) skills can be supported by teachers and other service providers who are working with Aboriginal students (Webb & Williams, 2018). Failure to respond to language differences may potentially lead to a mismatch in expectations related to English language use between Aboriginal young people and their non-Aboriginal peers and service providers.

Considering the complexity of language difference, our study was able to determine a prevalence of language disorder similar to the 52% and 46% identified among justice-involved youth in other states in Australia (Snow & Powell, 2008, 2011), and the 44% identified among justice-involved youth in England (Hopkins et al., 2017). Our findings are also similar to youth justice samples that included both Aboriginal and non-Aboriginal participants (Justice Health and Forensic Mental Health Network, 2017; Snow et al., 2016). These comparative studies in Australia and in England applied similar language disorder criteria. When compared with typically developing youth who may offend, youth with language disorder may be less able to self-advocate and provide coherent explanations to police and lawyers about alleged events or criminal behaviour (Snow & Powell, 2011). Additional neurocognitive deficits, such as impairments of executive function and memory can further increase risk for suggestibility and manipulation by those around them (Douglas, 2015). In the current study, eleven (24%) of the 45 participants with language disorder also met criteria for impairment in nonverbal cognition, eight of whom also met criteria for FASD. These participants would likely experience significant challenges as they navigate youth justice and detention centre settings, and may fail to meet the social, academic, and occupational expectations associated with their transition out of detention. Upon further testing, they may be considered to have an intellectual disability and therefore receive supports, for example, through disability services. Similar service provision may not be considered for those with language disorder who do not have nonverbal cognitive impairment. Further, this group of young people may appear more competent than they are due to their higher intellectual

functioning, and this may result in their communication difficulties being misinterpreted as non-compliance or rudeness (Snow & Powell, 2008; Snow et al., 2012). Improved service capacity is needed to better identify and respond to language disorder among justice-involved youth.

The only known Australian study to consider language skills in the context of FASD and youth justice included a self-report measure for FASD, and no participants reported they had a FASD diagnosis (Snow et al., 2016). Our study, which reports the language results from a FASD assessment, identified that overall, young people with FASD had lower language scores when compared to young people without FASD, even among those who did not have nonverbal cognitive impairment. Further, among the 25 young people identified with language disorder associated with FASD according to our study's criteria, a similar degree of impairment in both receptive and expressive language was apparent. These young people will struggle to express themselves in a manner that reflects their chronological age and to adequately understand what is said to them by others. This is consistent with the profile of non-justice-involved youth with FASD (Proven et al., 2014), and with the profile of justice-involved youth with FASD, of whom most were sentenced to a community order (Conry & Lane, 2009). Regardless of FASD diagnosis however, most of the young people in our study who were identified with language disorder were vulnerable across multiple language skills. Our findings likely reflect that language development is sensitive to developmental and environmental circumstances, and young people who become involved in youth justice are at increased risk of these and of having language disorder (Anderson et al., 2016; Commonwealth of Australia, 2017; Kinner et al., 2014). Further research exploring prenatal alcohol exposure, adverse environmental risks and language disorder is needed (Price et al., 2017), and is important in better understanding the effects of historical and sociocultural factors that may have led to drinking in pregnancy, such as the effects of colonisation and the separation of children from families experienced by Indigenous peoples (Australian Human Rights Commission, 1997; Rogers et al., 2013). The confluence of risk circumstances experienced by justice-involved youth denotes a need for targeted therapeutic interventions. Therapy and services for these young people need to be informed by their language abilities and culture (Gregory & Bryan, 2011; Rogers et al.,

2013; Snow & Powell, 2011), and targeting areas of need, rather than a diagnosis, such as FASD, is recommended (Adnams et al., 2007; Helgesson et al., 2018). In addition to the *Young Offenders Act 1994* mentioned above, the WA Youth Custodial Rules (YCR) (Department of Justice, 2016) require, for example, that programmes be “developmentally, culturally and linguistically appropriate” (YCR 221, p.2); that health services provide “a clear explanation of any proposed treatment, including risks and alternatives” (YCR 710, p.1); and that interpreters are accessible (YCR 302, 710). Adherence to these YCR is particularly important for justice-involved youth with language disorder. They have been identified to report more frequent self-harm and use of illicit substances, compared with justice-involved youth without language disorder (Hughes et al., 2017), suggesting the need for provision of a personalised and prescriptive approach to health, educational, psychological, and criminogenic programmes. Prior to this study, the language diversity and language needs of youth in detention in WA were not understood. Therefore, youth justice programmes have potentially been at risk of not meeting the language, health, and rehabilitation needs of young people with previously unidentified language disorder or low English competency.

To date, speech pathology services have been under-recognised and under-utilised in justice settings in Australia and world-wide. Speech-language pathologists are tertiary trained allied health professionals who specialise in the assessment and treatment of communication (speech and language) and swallowing disorders. Due to the high prevalence of language disorder among justice-involved youth, and communication disorders frequently co-occurring with and contributing to mental health, behaviour, and learning problems, speech pathologists can play a key role in supporting health outcomes, access to support, and equitable justice processes (Caire, 2009; Coles et al., 2017; Martin, 2018).

Snow and Woodward (2016) implemented speech and language intervention in an Australian youth detention centre with six young people (including four Aboriginal and Torres Strait Islander participants). The young peoples' case histories included prenatal opiate exposure, substance misuse, lived trauma, written language difficulties, school exclusion, violent behaviour, and mental health disorders. All six participants demonstrated gains in language and communication skills, for example, comprehension,

interpretation of non-literal language, conflict resolution, verbal expression of thoughts and feelings, and confidence in their talking. In England, benefits of speech pathology services have also been demonstrated among repeat and serious offenders (Gregory & Bryan, 2011). The authors reported that among those reassessed after language and social communication skills therapy, measurable gains were made. Evaluation of both intervention studies revealed that youth justice staff also benefited – they developed increased understanding of communication problems, which informed how they supported and provided services to young people (Bryan & Gregory, 2013; Snow et al., 2017). There are opportunities in police and court settings for language disorder and FASD to be responded to. Court-appointed communication assistants (also known as intermediaries), who are often speech pathologists with additional training, can provide impartial services to help facilitate communication between legal parties and defendants, witnesses and victims who have language or other neurocognitive and mental health disorders (Plotnikoff & Woolfson, 2015; Stewart et al., 2015; Talking Trouble Aotearoa New Zealand, 2018). In WA, the *Evidence Act 1906* (Section 106F) permits this type of service provision. Results from our study highlight the need to implement a communication assistant service or similar in WA's youth justice system. Undertaking this in collaboration with local cultural advisors and existing accredited interpreter services will be important to ensure a culturally and linguistically sensitive model is developed.

Our findings confirm the high prevalence of previously unidentified language disorder among justice-involved youth. Only three young people in this study had previously been identified with language disorder, and notably, all three were identified with FASD (without nonverbal cognitive impairment), one prior to, and two during the FASD prevalence study (Bower et al., 2018). All young people in this study had been to school, and the proportion of participants with language disorder who were confirmed as known to government child protection services reflects that found in previous research (Snow & Powell, 2011). Of those with language disorder associated with FASD, 28% had a history of ear and hearing problems. This highlights the missed opportunities within multiple services to identify and respond to language and neurocognitive vulnerability earlier in a child's life.

Strengths of this study included our consultation with clinicians and researchers across Australia to refine the language assessment of young people in a justice setting and in the context of language diversity. The involvement of accredited interpreters in this study was an invaluable means of facilitating two-way learning with the research team about language development, language difference, and language disorder. With a lack of standardised norm-referenced language assessments available for use with Aboriginal adolescents, local Aboriginal cultural and language advisors and accredited interpreters have a critical role to play in the development and administration of tools that consider and examine communication skills of Aboriginal youth. Voluntary participation may have led to selection bias, however over 70% of those eligible to participate were recruited, which resulted in a representative sample of youth in detention participating (Bower et al., 2018). Limitations of this study include being unable to observe and assess a full range of communication skills in the setting of a youth detention centre and difficulties obtaining caregiver reports. Caregiver-reports for the speakers of EAL were sought in consideration of language ability, however we also considered self-reported information, which was gathered by the lead speech pathologist who was experienced and familiar with working with Aboriginal youth at Banksia Hill prior to this study in a different role. The practical difficulties of language assessment demonstrated in this study reflect the complex reality that clinicians are faced with, as they work with justice-involved populations.

Conclusion

We have documented rich language diversity, as well as high levels of communication vulnerability and language disorder among youth sentenced to detention in WA. The number of languages spoken by justice-involved populations and the high prevalence of both language disorder and FASD increases the level of complexity the current youth justice workforce encounter in their professional interactions with, and therapeutic services provided to, young people. Together with previous studies, our findings highlight the importance of speech pathologists in assessing and understanding language needs of justice-involved youth. Our findings indicate that speech pathology is warranted as a core service in the WA youth justice system to better identify and respond to the communication needs of young people in their care. Further, collaborative approaches with local cultural and language advisors, including accredited interpreters are

required in WA's youth justice system, so that culturally and linguistically appropriate resources and methods can be used to better identify communication strengths and difficulties. Further research is recommended to examine the impact of language diversity, language disorder, and FASD on the effectiveness of health, educational, psychological, and criminogenic rehabilitation programmes provided in justice settings.

Acknowledgements

We thank: the participants and their caregivers; Telethon Kids Banksia Hill Study and investigator teams, particularly Jacinta Freeman, Carmela Pestell and Roslyn Giglia; Kulunga Aboriginal Research Development Unit; Aboriginal Interpreting Western Australia; Claire Salter, Ian Malcolm, Pamela Snow, and others consulted from around Australia; the Department for Communities and Department of Justice including Banksia Hill staff. Any material published or made publicly available by the authors cannot be considered as either endorsed by the Department of Justice or an expression of the policies or view of the Department. Any errors of omission or commission are the responsibility of the researchers.

Funding

National Health and Medical Research Council, Australia (NHMRC, #1072072); Australian Government Research Training Programme Scholarship and FASD Research Australia CRE PhD scholarship (NRK); NHMRC Research Fellowship, Australia (#634341) (CB); REW, CB, RCM are investigators on the NHMRC-funded FASD Research Australia CRE (#1110341).

Declarations of interest

None.

CHAPTER 7:

The oral and written narrative language skills of adolescent students in youth detention and the impact of language disorder

Chapter Overview

The finding of high prevalence of LD among adolescents in youth detention in WA, together with the lack of research about text-level language skills of adolescents in youth justice, motivated the examination of the text-level oral and written language skills of this population and the impact of LD. This chapter addresses research question 5. However, given the language diversity identified in the previous chapter, and the lack of text-level assessment tools to use with Aboriginal adolescents, only the texts produced by adolescents who were speakers of SAE were examined. This was important due to the depth of analysis of functional language skills undertaken. This decision was made in consultation with research stakeholders who are Aboriginal peoples.

This chapter is presented as the final peer-reviewed and published manuscript, in which the term ‘adolescents’ is used when referring to the participants of this study (Appendix 8). As with the previous papers in this thesis, the formatting has been adapted to adhere to the format of the broader thesis document. Repetition has been minimised where possible, although there may be some key literature that has been reported in previous chapters.

The citation for this publication is:

Kippin, N.R., Leitão, S., Finlay-Jones, A., Baker, J., & Watkins, R. (2021). The oral and written narrative language skills of adolescent students in youth detention and the impact of language disorder. *Journal of Communication Disorders, 90*, 106088.

<https://doi.org/10.1016/j.jcomdis.2021.106088>

Abstract

Background: Unmet language and literacy needs are common among young people who are involved with youth justice systems. However, there is limited research regarding the functional text-level language skills of this population with regard to narrative macrostructure (story grammar) and microstructure (semantics and syntax) elements.

Methods: In this study, we examined macrostructure and microstructure elements in the oral and written narrative texts of 24 adolescent students of a youth detention centre. The students, who were aged 14- to 17- years, were all speakers of Standard Australian English, and 11 (46%) students met criteria for language disorder (LD).

Findings: When we compared the narratives according to modality of language, the students demonstrated stronger narrative language skills in the written modality compared to the oral. However, when we compared the narratives according to language ability, we found that the impact of LD on inclusion of macrostructure elements was greater in the oral modality, and for microstructure elements, was greater in the written modality. Errors in written conventions were common among both students with and without LD.

Conclusions: Our results indicate that both the modality of language as well as the presence of LD should be considered when young people are required to participate in forensic contexts including programmes that address educational and rehabilitation needs. Our results indicate a need for consistent text-level language assessment to better identify and respond to functional difficulties within language and literacy. There is potential for SLP services to enhance comprehensive assessment as well as inform educational and rehabilitation programmes for young people who are involved with youth justice systems.

Key words: language disorder, literacy, youth justice, education, young offender

Introduction

In Australia, school-aged young people, aged 10 years and over, can be charged with a criminal offence (AIHW, 2020). Between 2018 and 2019, 10,820 young Australian people were either under youth justice community or detention supervision at some stage due to involvement in criminal behaviour (AIHW, 2020). Both preceding and following involvement with youth justice systems, these young people commonly experience harm to their health, wellbeing, and development (Borschmann et al., 2020). As discussed by Snow (2019), neurodevelopmental disabilities are common, and compromised communication skills, including language disorder (LD), is widespread. Up to 80% of young Australian people in custodial facilities have below age-appropriate language skills, and approximately one in two have LD (Justice Health and Forensic Mental Health Network, 2017; Kippin et al., 2018; Snow & Powell, 2011; Snow et al., 2016). Internationally, poor language skills and LD are also common in youth justice populations. For example, LD has been identified in 19% of female young people in detention in the United States (US) (Sanger et al., 2001) and up to 67% of both female and male young people involved with youth justice services in the United Kingdom (UK) (Bryan et al., 2007; Winstanley et al., 2019).

Research that has examined the language skills of young people involved with youth justice has typically employed standardised measures at word and sentence levels (Anderson et al., 2016; Noel & Westby, 2014). However, a young person's ability to effectively learn at school and interact with others depends on both oral and written language skills at the text-level, that is, extended language units that comprise several sentences. In Australia, there is an expectation that secondary students can comprehend and produce a range of oral and written academic texts, within the genres of narrative and expository texts (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2010a; 2010b). Chatting with friends about the weekend, for example, demands simple and informal language, while producing an engaging and detailed story in a school exam or a compelling argument in a school debate demands complex, formal, and structured language. Indeed, the ability to use and modify language according to the purpose and demands of a range of situations is characteristic of a literate student (ACARA, 2010b).

Such skills underpin success in educational, occupational, and social endeavours beyond the school years and into adulthood.

Students with language problems who have become involved with youth justice have reported feelings of frustration when they are unable to comprehend the language used in learning environments such as the classroom (Sanger et al., 2000). They have also reported low self-confidence in relation to their academic abilities (Hopkins et al., 2016). An earlier meta-analysis of the relationship between academic performance and criminal behaviour identified that weak academic skills predict the frequency and severity of criminal behaviour, particularly among males (Maguin & Loeber, 1996). Importantly, educational achievement during youth detention has the potential to result in increased school re-engagement as well as less frequent and less serious criminal behaviours post-release (Blomberg et al., 2011). In the current study, we examine the oral and written text-level language skills of young people who are involved with youth justice, specifically, their narrative language skills. Narrative language skills are of particular interest in youth justice populations, as they not only contribute to academic success, but are also necessary in the provision of an account in an evidentiary context.

Narrative texts and the school curriculum

A narrative text is a story; the development of proficient narrative language skills enables individuals to understand and share stories with others. Narratives, like other genres, have specific macrostructure and microstructure elements (Hall-Mills & Apel, 2015). School students need to demonstrate proficiency with these elements in their text comprehension and production (ACARA, 2010a, 2010b). For narrative texts, macrostructure refers to the inclusion, organisation and sequence of story grammar elements that reflect key events. Events of a narrative are generally conveyed sequentially or causally (Naremore et al., 1995). This structure promotes coherence, allowing an audience to follow the plot and appreciate the relationships between events. In a Western school context, oral and written narratives are typically taught to contain a beginning, middle and end; a story grammar structure described by Stein and Glenn (1979) (Whitworth et al., 2015). The beginning establishes the scene for the audience, such as orientation to time, characters, and location. The middle of the narrative contains the

initiating event, a reaction from the characters and a plan of action in response to the event. These elements convey the perspectives and intentions of the characters, which in turn give the audience insight into the motivations behind a character's actions. The conclusion of a narrative provides the outcomes in relation to the actions taken as well as a resolution of the story. Narrative macrostructure relies upon a student's ability to manage and structure multiple pieces of literal and implied information to support audience comprehension. Analysis of a student's macrostructure elements provides insight into their language and literacy skills in relation to the demands of the school curriculum. For example, Australian secondary school students are required to: create structured, detailed, and coherent texts; select and sequence content appropriately; and share and interpret a range of viewpoints (ACARA, 2010a; 2010b).

Narrative competence also includes skills that relate to narrative microstructure, that is, the smaller linguistic elements of syntax (grammar) and semantics (vocabulary). These elements create internal structure and cohesion within and between sentences, such as the use of connectors to join ideas and the use of nouns and pronouns to refer to and maintain connections between characters and concepts (Haslett, 1983; Shapiro & Hudson, 1991). Sentences of increasing complexity are expected in the texts of secondary students as they expand and clarify their ideas (ACARA, 2010b). Cohesive language, which guides an audience through a text, is also expected and usually produced (ACARA, 2010a). A variety of words and adverbial phrases support the creation of detailed texts. Specific to the written modality, accurate punctuation is important for defining sentence boundaries, and accurate spelling supports reader comprehension (ACARA, 2010a, 2010b).

Both macrostructure and microstructure elements characterise a well-formed narrative, and while their use demonstrates a student's sophistication and creativity with oral and written academic-style texts, they also reflect aspects of language and cognitive skill development. As discussed by Khan et al. (2016), emergence of complex narrative language skills is associated with developments in working memory and executive functions in late childhood. At this developmental period, well-structured and cohesive multi-episode narratives, that include information related to cause and effect, are expected (Applebee, 1978; Westby, 1984). Students who have not acquired the expected level of language and cognitive development are unlikely to be able to construct a coherent and

cohesive plot with embellishment in their oral and written texts. They will likely experience problems in the creation, sequence, and structure of ideas in oral presentations, essays, and creative writing tasks. Adolescent students who have LD are commonly observed to experience difficulties with the initiation and elaboration of ideas in academic writing tasks (Starling et al., 2011), and they exhibit weak syntactic and semantic skills at the narrative text level (Koutsoftas & Gray, 2012; Wetherell et al., 2007). These language and literacy difficulties will undoubtedly continue throughout the secondary school years and beyond. Individuals who struggle with communication skills are at increased risk of premature termination of formal education, social exclusion, and mental health disorders; they may struggle to sustain employment and to develop close relationships (Clegg et al., 2005; Conti-Ramsden et al., 2018). The identification of school students who lack mastery of oral and written language is needed to better support education attainment and life skill development.

Narrative texts and young people involved with youth justice

A small body of prior research has demonstrated that young people involved with youth justice have difficulties with narrative texts. For example, Snow and colleagues (Humber & Snow, 2001; Snow & Powell, 2005) examined the inclusion of narrative macrostructure elements (setting, initiating event, internal response, plan, attempt, direct outcome, and resolution) in an oral storytelling task involving a picture stimulus. They identified that young people involved with youth justice included fewer story grammar elements than a comparison group of school students, particularly a story's plan, direct outcome, and resolution; this suggests problems with conveying cause-effect relationships to an audience. They further identified that of the young people involved with youth justice, those with LD were significantly weaker in conveying a story's setting, plan, and attempt than those who did not have LD (Snow & Powell, 2008). The additional underrepresentation of macrostructure elements demonstrates that LD affects the ability to provide sufficient information in a logical manner to support listener comprehension (Snow & Powell, 2008). Narrative analysis has also revealed that when compared to young people who were not involved in youth justice, young people who were violent offenders produced oral narratives with more macrostructure elements related to factual information about harm they had caused to others, but fewer elements related to feelings,

thoughts and goals, suggesting problems demonstrating empathy and social cognition (Wainryb et al., 2010). In forensic contexts, such as police interviews and restorative justice conferences, intact narrative language skills are important for presenting key information in an order that makes sense to an audience and for conveying reasons that underlie behaviours. Weak narrative macrostructure can therefore have negative consequences for movement through the justice process. This highlights the importance of comprehensive language assessment so that accommodations can be put in place to better facilitate two-way communication.

Little is known regarding the microstructure of narrative texts within this population. However, in expository texts, young people, on youth justice community orders, have been found to produce fewer different words and less syntactically complex texts when compared to non-offending peers, suggesting that this population struggles to communicate complex information (Hopkins et al., 2017). Further, at the conversational discourse-level of language, young females in youth detention have been found to avoid communication that requires them to use language related to negotiations, instead using negative behaviours in an attempt to solve problems (Sanger et al., 2000).

Language production in the written modality is also important to consider given its importance to communication and education. Written language, while drawing on oral language skills for text generation, is less constrained by immediacy, allowing a writer to formulate, write and revise content at a desired pace (Loban, 1976). It is also more literary in style, adhering to formal text structures as well as spelling and punctuation conventions (DeVito, 1967; Spencer & Petersen, 2018). As such, the linguistic complexity of written texts can be greater than that of oral texts (DeVito, 1967; Haslett, 1983). However, a study undertaken more than 30 years ago in the US, in which text-level writing was examined across four different tasks, revealed that young people involved with youth justice lacked the level of written mastery required to graduate from school (Sinatra, 1984). A more recent study in the US also reported that young people in youth detention were well behind the level expected for text-level writing, as measured with standardised assessment (Green et al., 2018). These findings are not surprising given both weak oral language skills mentioned above as well as weak written language skills at word and sentence levels of language identified within youth justice populations (Grigorenko et al., 2015; Putnins,

1999; Snowling et al., 2000). Skills specific to written language do not develop as primary neurodevelopmental skills, but instead, as secondary skills underpinned by language and cognitive abilities (DeVito, 1967; Geary, 2008). Therefore, when oral language skills are compromised, which is common in youth justice populations, they are likely to manifest as written language difficulties and contribute to academic failure (Koutsoftas & Gray, 2012; Snow & Powell, 2011). However, the current knowledge base about written text-level language skills of young people involved with youth justice is sparse and lacks detailed examination of macrostructure and microstructure elements. Therefore, it is not known if, and what, specific written language skills need to be considered and taught when working with young people in youth justice contexts.

Investment in language and literacy skills during the adolescent years is important. Poor school performance is one of the most common barriers to successful community re-entry, as identified by young people involved with youth justice (Mathur et al., 2019). Moreover, strong associations have been identified between weak academic skills and rates of recidivism (Katsiyannis et al., 2008). Importantly, a study in the UK found that 61% of 13- to 18-year-old young people involved with youth justice aspired to attaining improved language and literacy skills (Hopkins et al., 2016). However, detention centre staff, including educators, lack the resources and knowledge required to respond to these young peoples' needs and to provide a quality education (Hamilton et al., 2019). Understanding the functional text-level oral and written language skills of youth justice populations is necessary and can inform an educational therapeutic response (Grigorenko et al., 2015; Joffe, 2018).

The current study

In this study, we examined the production of macrostructure and microstructure elements in narrative texts within a sample of school-aged young people sentenced to youth detention and compared the inclusion and accuracy of these elements for oral and written modalities. Motivated by the high prevalence of LD and academic difficulties among this population, we also investigated whether narrative performance differed according to language ability. As young people who are involved with youth justice are

typically exposed to education or training programmes, we refer to our sample of young people hereon, as students.

Our research questions were as follows:

- 1) What macrostructure (story grammar) and microstructure (syntactic and semantic) elements are used by students in youth detention when producing narrative texts, and how do these compare across two modalities (oral and written)?
- 2) How does the production of macrostructure and microstructure elements in oral and written narrative texts compare between those with LD and those without (the comparison group)?
- 3) What percentage of participants demonstrate errors in the microstructure elements of written conventions (spelling and sentence boundaries) in a narrative text, and how does this compare between those with LD and those without?

Materials and Methods

Ethics approval

This study was approved by the University of Western Australia Human Research Ethics Committee (HREC) (approval number RA/4/1/7116), the Western Australian Aboriginal Health Ethics Committee (approval number 582) and Curtin University HREC (approval number HRE2018-0117).

Participants

Study participants were students at Western Australia's Banksia Hill Detention Centre (BHDC). The students were recruited during 2015 and 2016 as part of a National Health and Medical Research Council (NHMRC) funded study that examined the prevalence of fetal alcohol spectrum disorder (FASD) and other neuro-disabilities among young people in youth justice (Bower et al., 2018). Of the 113 students who assented and were consented to participate in the broader prevalence study, 102 students participated in a SLP assessment that is described in the study protocol (Passmore et al., 2016). Inclusion in the current study required students to be first-language speakers of Standard

Australian English (SAE) and to have completed one or both text-level language tasks, detailed below, during the SLP assessment.

Of the 30 students who met inclusion criteria, data was available for 24 students, with a mean age of 17 years (range: 14 years 6 months to 17 years 11 months, $SD = 0.9$ years). Table 15 shows the demographic data for the 24 students according to group. Most students were male and from the metropolitan area; nearly two thirds of the LD group expressed that they did not like school. Most of the students had experienced multiple school suspensions, and over one third of students recalled that they had been expelled from school at least once. Table 16 shows the breakdown of the number, group, and age of the students who completed each of the narrative tasks.

Table 15. Demographic characteristics of the 24 participants according to group.

	Language disorder		Comparison	
	<i>n</i> = 11	(%)	<i>n</i> = 13	(%)
Male	10	(91)	12	(92)
Ethnicity				
Australian: non-Aboriginal	6	(55)	7	(54)
Australian: Aboriginal	2	(18)	1	(8)
Australian: Other ^a	3	(27)	5	(38)
Last residential area				
Metropolitan	11	(100)	12	(92)
Regional	0	(0)	1	(8)
Known to child protection				
Yes	3	(27)	4	(31)
Unknown	3	(27)	2	(15)
No	5	(45)	7	(54)
Engaged in school at the time of entering detention ^b				
Yes	5	(45)	7	(54)
No	6	(55)	6	(46)
Liked school ^b				
Yes	4	(36)	8	(62)
No	7	(64)	5	(38)
Last school year attended ^b				

Year 7 to 8	2	(18)	1	(8)
Year 9 to 10	6	(55)	8	(62)
Year 11 to 12	3	(27)	4	(31)
Number of school suspensions ^b				
0	1	(9)	1	(8)
1 – 4	2	(18)	5	(38)
5 - 9	1	(9)	2	(15)
10 +	7	(64)	5	(38)
School expulsion ^b				
No	5	(45)	8	(62)
Yes ^c	5	(45)	4	(31)
Other ^d	1	(9)	1	(8)
Recurrent ear infections/grommets ^e				
Yes	1	(9)	1	(8)
No	10	(91)	12	(92)

Note: ^aAfrican, Asian and Polynesian ethnicity; ^bReported by young person; ^cNumber of times expelled ranged from 1 to 4 however one student in the language disorder group did not recall the frequency; ^dTerms included voluntary removal and transferred to another school; ^eReported by caregivers.

Table 16. The number and mean age of participants in years according to narrative modality completed and group.

	<i>n</i>	<i>Age</i>	<i>(SD)</i>
Both oral and written	16	17.2	(0.9)
Oral ^a			
Language disorder	10	17.4	(0.8)
Comparison	13	17.0	(1.0)
Written ^b			
Language disorder	8	17.5	(0.5)
Comparison	9	16.9	(1.0)

Note: ^aAudio-recording was not available for four participants, one participant declined the task, one was not administered the task, and one required extensive prompting and therefore their narrative was not representative of narrative generation; ^b10 participants were not administered the task due to the task being included following the pilot phase of assessments, two participants declined the task, and one was not administered the task.

Procedure

Students were recruited by a research officer who was based at BHDC. The recruitment process was described previously (Bower et al., 2018; Freeman et al., 2019). In summary, the research officer spoke to the students about the research project and asked if they would like to participate. For students who wanted to take part, the research officer contacted their legal caregivers to share information about the project and to seek consent. Participation was voluntary, and written participant assent and written caregiver consent were required. The assent and consent process involved the research officer using simple explanations and picture supports to aid the students' understanding of the assessment purpose and process. The students and their caregivers confirmed the language/s used during interviews with the research officer. The speech-language pathologist (first author) further ascertained the language/s used by asking the students about the language background of their families, by examining language transcripts with certified interpreters as well as by drawing on research related to differences between SAE and Aboriginal English (Kippin et al., 2018).

As part of a comprehensive multi-disciplinary neurodevelopmental assessment, the students undertook a language assessment with the speech-language pathologist who had experience working with young people at BHDC in a different role. Language assessment was administered in a quiet allocated room at BHDC over a two-hour period, with breaks provided. Our previous research reported the results of the multidisciplinary team assessment (Bower et al., 2018) and the SLP assessment (Kippin et al., 2018) including the results of the Core and Index scores from the Clinical Evaluation of Language Fundamentals (CELF-4) (Semel et al., 2006). The CELF-4 Core and Index scores were used in the current study to allocate students to LD and comparison groups. In the current study, we define LD as a Core or Index score ≥ 1.5 standard deviations (SDs) below the mean. This score has been previously used to identify LD among school-aged populations and was found to align with functional difficulties in meeting school curriculum targets (Norbury et al., 2016). Students with a score of ≤ 1.5 SDs below the mean were assigned to the comparison group. As reported in the study protocol (Passmore et al., 2016), nonverbal cognition was assessed as part of a neuropsychological assessment with the Wechsler Abbreviated Scale of Intelligence, Second Edition (Wechsler, 2011) or

the Wechsler Nonverbal Scale of Ability (Wechsler & Naglieri, 2006). Students were eligible to participate, regardless of nonverbal cognition skills.

Eleven (46%) of the 24 students met our study criteria for LD (age: *mean years* = 17.3, *SD* = 0.7 years) and 13 (54%) students did not (comparison group) (age: *mean years* = 17.0, *SD* = 1.0 years). Five (21%) of the students in the LD group had CELF-4 language scores ranging from 1.5 SDs below the mean to 1.9 SDs below the mean, one (4%) of whom also had nonverbal cognitive impairment (NVCi; ≥ 2 SDs below the mean). The remaining six (25%) students in the LD group had CELF-4 language scores in the severe range (≥ 2 SDs below the mean), one (4%) of whom had NVCi, and a further one (4%) who had FASD. Of the comparison group, who did not meet criteria for LD, one (4%) student had FASD however none had NVCi.

Text-level language assessment

Oral narrative text production

The oral narrative was elicited from the students using a non-standardised task. Students were shown a set of six black and white pictures by the speech-language pathologist that depicted ‘The flowerpot incident’ (Kossatz, 1972; Snow & Powell, 2005), and asked to tell a story to accompany the pictures. This procedure is similar to those used in previous research with young people involved with youth justice (Humber & Snow, 2001; Snow & Powell, 2005, 2008). With student assent, oral narratives were audio-recorded on a hand-held SONY audio-recorder and later transcribed verbatim for analysis. An example of a target story depicted in the picture stimulus is provided by Snow and Powell (2005):

“There is a man walking along the street with his dog. A pot plant/vase falls from the balcony/from above and hits him on the head. The man becomes very angry about this. So, he decides to go in and sort it out. He goes into the building/up the stairs and bangs on the door. A lady comes to the door and gives the dog a bone. The man is not angry anymore/Instead of yelling at her, they become friends/he decided he liked her”, (p.252).

Written narrative production

Following elicitation of the oral narrative, the students produced a written narrative. With the above-mentioned picture stimuli visible to both the student and speech-language pathologist, the students were asked to write the story. They were provided with lined paper and a pen or pencil to complete this task, as well as unlimited time. Written narratives were collected for transcription and analysis.

Narrative macrostructure and microstructure measures

Macrostructure and microstructure elements were assessed in narrative texts produced by the students in the oral and written modalities. As detailed in Appendix 7a, the primary outcome measures for macrostructure were the numbers of students who included each of the macrostructure elements: orientation to the characters and setting (time and place), initiating events, responses, plan, actions, direct consequences, and the resolutions. These elements are similar to those assessed in previous research that has examined text-level language skills (Humber & Snow, 2001; Snow & Powell, 2005, 2008; Whitworth et al., 2015).

The primary outcome measures for microstructure included cohesion, syntactic complexity, and semantics, also detailed in Appendix 7b. Cohesion was measured by examining students' referencing of characters and concepts at the point of their initial introduction (introduction reference) and thereafter on subsequent referrals (tie reference). In line with research on cohesion undertaken by Thorne and Coggins (2016), we calculated an introduction reference rate by dividing the number of appropriate introduction references by the total number (appropriate + inappropriate) of introduction references; this was converted to a percentage. Similarly, we calculated a tie reference rate by dividing the number of appropriate tie references by the total number (appropriate + inappropriate) of tie references; this was converted to a percentage (Thorne & Coggins, 2016). Syntactic complexity was measured by calculating the number and length of utterances, the number of sentence types of increasing complexity, the number and type of connectors, the rate of clauses per utterance and the number of adverbial phrases. Semantic ability was measured by calculating the number and type of vocabulary items. In the written modality, we also examined errors in the use of the written conventions of spelling, capitalisation, and full stops (Miller et al., 2016). These measures are commonly

included in adolescent language assessment (Joffe, 2018; Petersen, 2010). They are typically included in standard language sample analysis (Miller et al., 2011; Miller et al., 2016), and are elements that relate to the Australian school curriculum (ACARA, 2010a; 2010b).

Narrative transcription and coding

At the time of data collection, the lead speech-language pathologist (first author) transcribed the oral narratives from audio-recordings and analysed the oral and written narratives to inform the assessment reports. A research assistant then independently reviewed the transcripts and audio-recordings and transcribed the written narratives from students' handwritten records. Following this, the lead speech-language pathologist again reviewed and checked all audio-recordings and transcripts.

To prepare the transcripts for coding and analysis of macrostructure and microstructure elements, the lead speech-language pathologist segmented the narratives into C-units and excluded mazes (revisions and fillers, such as “um”) in accordance with the Systematic Analysis of Language Transcription (SALT) Clinician's Guide (Miller et al., 2016). The SALT programme is a software programme designed to analyse language samples that are elicited during everyday functional language tasks, allowing frequency counts of measures such as the number of different words and mean length of utterance (Miller et al., 2015). The programme is employed in SLP research and clinical practice for analysing language at word, sentence, and text-levels as well as in conversational discourse (Miller et al., 2016). Our coding protocol (Appendix 7a and 7b) for macrostructure and microstructure elements was developed to be used with the SALT software (Miller et al., 2015) and drew on coding schemes currently used in international clinical practice and research (Miller et al., 2016; Snow & Powell, 2005; Thorne & Coggins, 2016; Whitworth et al., 2016).

To finalise the coding protocol, two speech-language pathologists (first and second authors) coded three oral and three written narratives together, and a speech-language pathologist (fourth author), who has extensive clinical experience with adolescent oral and written language, reviewed the coding protocol. The lead speech-language pathologist then independently coded and formatted the remaining oral and written narratives

according to the finalised coding protocol. The second speech-language pathologist (second author), who was blind to student language skill status, independently checked a randomly selected sample of 15% of all coded narratives. Between the two speech-language pathologists, there was 97% consistency for coding in the oral narratives and 98% consistency for coding in the written narratives; agreement was reached on these discrepancies through team discussion. Data for the analysis set, which were derived with the SALT software (Miller et al., 2015), were exported to IBM SPSS Statistics Version 26. The exported data were cross checked against a randomly selected 10% of all coded narratives. There were no discrepancies.

Statistical analysis

Due to small sample sizes, non-parametric statistical tests were employed. Following descriptive statistics to examine narrative macrostructure and microstructure elements, we compared narrative performance ($n = 16$) across the oral and written modalities using McNemar's Test for paired nominal data, and the Wilcoxon signed-rank test for paired scaled data. Then, to compare narrative performance between students with LD (oral: $n = 10$; written: $n = 8$) to students without LD (comparison group; oral: $n = 13$; written: $n = 9$), we used the Fisher's Exact test for independent categorical data, as well as the Mann-Whitney U-test for independent scaled data. Finally, to compare errors in written conventions according to group, we used the Fisher's Exact test. For all analyses, we assessed statistical significance with an alpha of 0.05. Effect sizes (ϕ and r) were calculated according to the test used, and are reported as small (0.1), medium (0.3), or large (0.5) (Cohen, 1992). The first author conducted the statistical analyses, and these were cross-checked by the fifth author.

Results

The results are presented according to the research questions, starting with macrostructure, followed by microstructure and written conventions.

What macrostructure elements are used by students in youth detention when producing narrative texts, and how do these compare across modalities (oral and written)?

Inclusion of macrostructure elements was variable for the 16 students who completed narratives in both the oral and written modalities (Table 17). For example, all

students included orientation to the main character, but few included orientation to time. When we compared inclusion of macrostructure elements across modalities, we found no evidence of a difference.

Table 17. Comparison of the number of students who included each macrostructure element according to narrative modality.

	Oral modality		Written modality		<i>t</i>	<i>p</i>
	<i>n</i> = 16	(%)	<i>n</i> = 16	(%)		
Orientation						
<i>Main character (man)</i>	16	(100)	16	(100)	-	-
<i>Secondary character (dog)</i>	7	(44)	11	(69)	1.50	0.22
<i>Location</i>	7	(44)	8	(50)	0.00	1.00
<i>Time</i>	3	(19)	4	(25)	0.00	1.00
Initiating Events						
<i>1: Pot plant fell/dropped</i>	15	(94)	14	(88)	0.00	1.00
<i>2: Pot plant hit the man's head</i>	15	(94)	15	(94)	-	-
Responses						
<i>Internal (man was angry/hurt)</i>	13	(81)	12	(75)	0.00	1.00
<i>Physical (man yelled)</i>	12	(75)	14	(88)	0.25	0.63
Plan						
<i>Plan (he decided to go in)</i>	2	(13)	5	(31)	1.33	0.25
Actions						
<i>1: Man walked in/upstairs</i>	14	(88)	14	(88)	-	-
<i>2: He banged on the door</i>	13	(81)	14	(88)	0.00	1.00
Direct Consequences						
<i>1: Lady came out/greeted the man</i>	12	(75)	14	(88)	0.50	0.50
<i>2: She gave the dog a bone</i>	12	(75)	12	(75)	-	-
Resolution						
<i>Internal (He likes her)</i>	11	(69)	9	(56)	0.25	0.63
<i>Physical (man kisses her hand)</i>	9	(56)	9	(56)	-	-

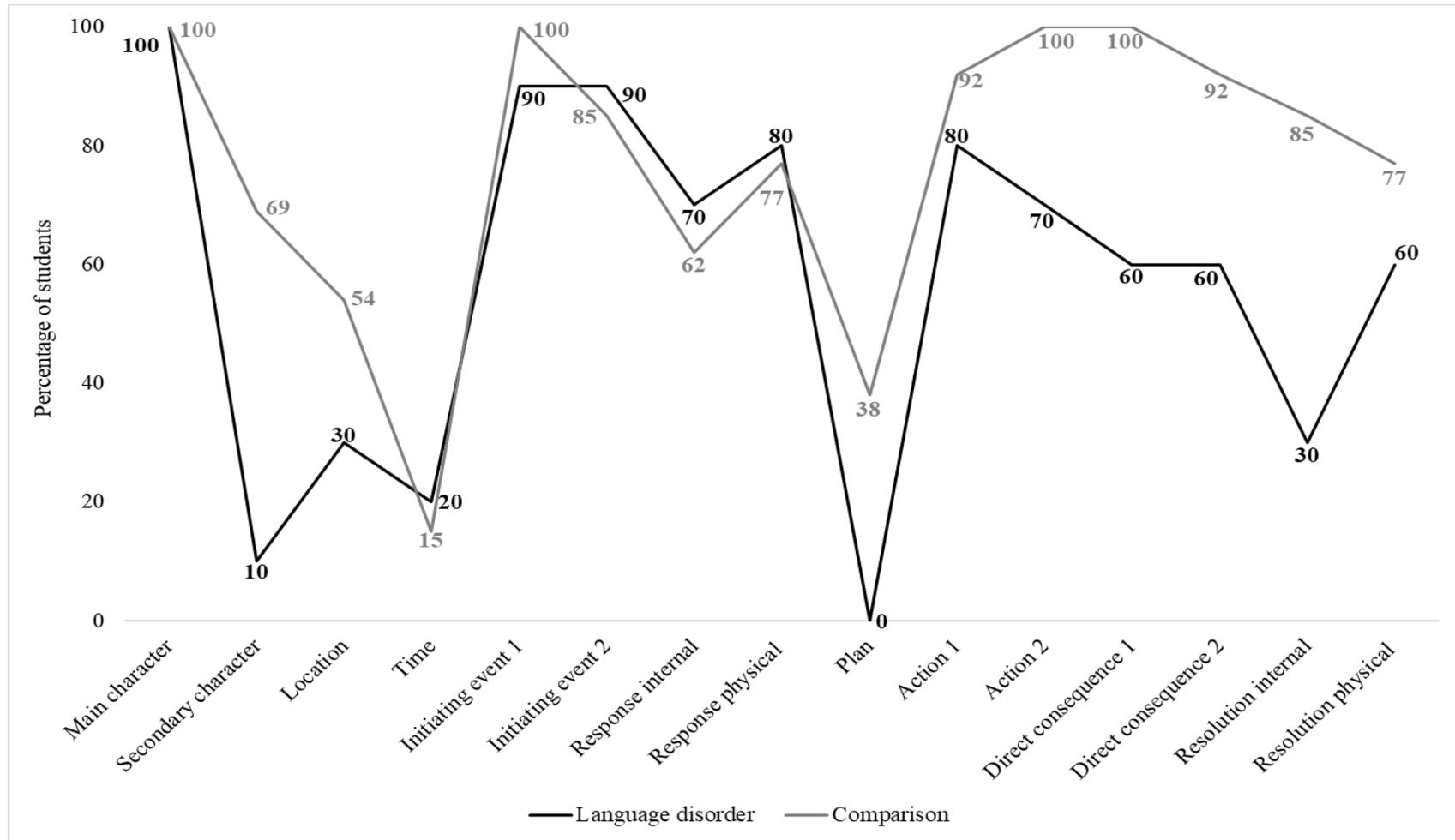
Note: McNemar's Test.

How does the production of macrostructure elements in oral and written narrative texts compare between those with and without LD?

Among the 23 students who completed the oral narrative task (Figure 2) and the 17 students who completed the written narrative task (Figure 3), we found variability between groups with and without LD for inclusion of narrative macrostructure elements. In the oral modality, orientation to a secondary character (the dog, who plays a key role in a direct consequence and the resolution of the story) was included by fewer students in the LD group ($p = 0.01$, $\phi = 0.6$) while in the written modality, there was no evidence of a difference between groups ($p = 0.34$, $\phi = 0.3$). In both modalities, there was a difference between groups for inclusion of a plan (regarding the main character's intention). No student in the LD group included this element however some of the comparison group did (oral: $p = 0.05$, $\phi = 0.5$; written: $p = 0.03$, $\phi = 0.6$). In the oral narrative, fewer of the LD group included direct consequence 1 ($p = 0.02$, $\phi = 0.5$) however in the written narrative, there was no evidence of a difference between groups ($p = 0.08$, $\phi = 0.5$). Similarly, in the oral narrative, fewer of the LD group included resolution-internal ($p = 0.01$, $\phi = 0.6$) however in the written narrative, there was no evidence of a difference between groups ($p = 0.06$; $\phi = 0.5$).

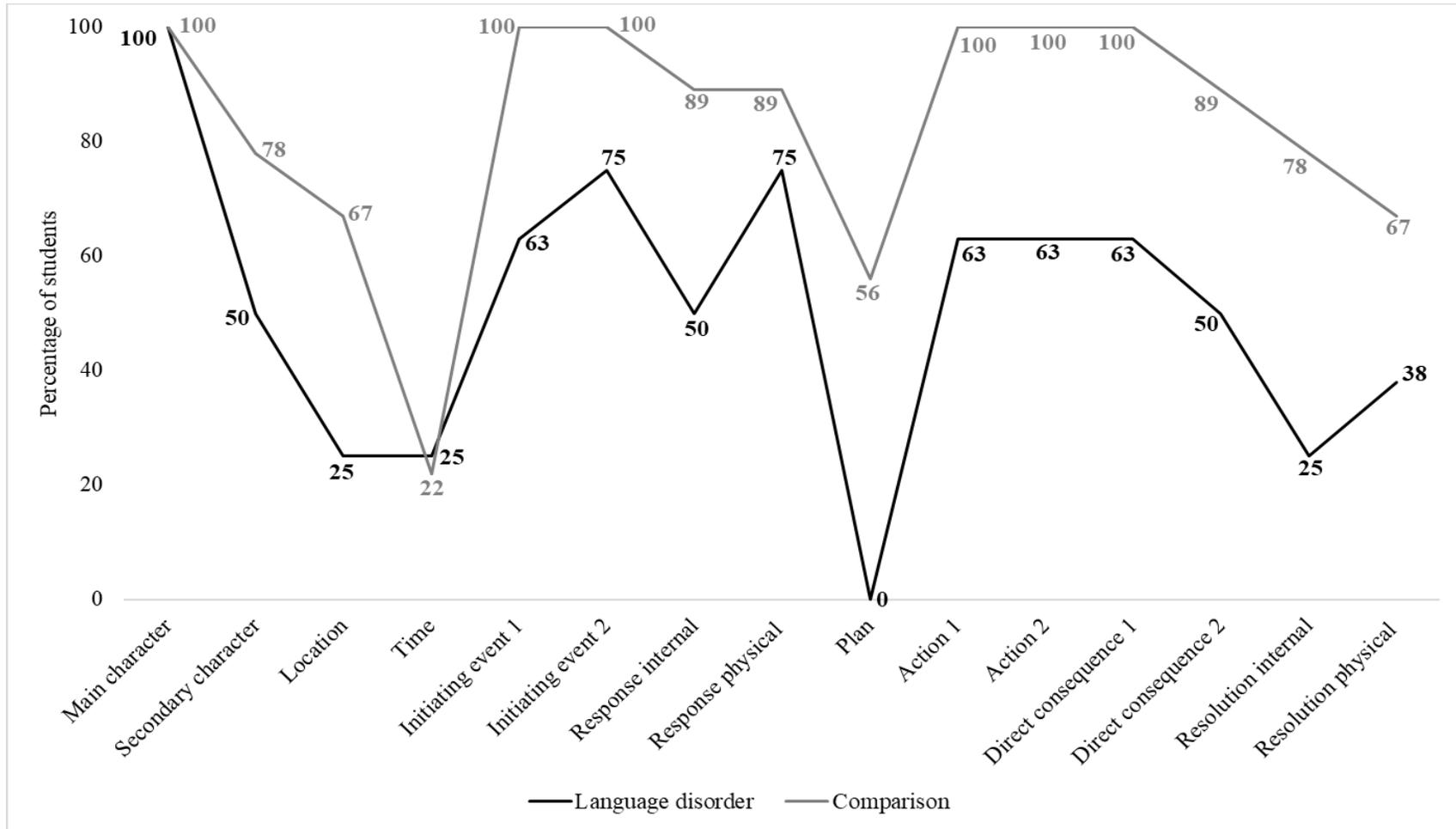
In both modalities, there was no evidence of a difference between groups for inclusion of the remaining macrostructure elements: orientation to location (oral: $p = 0.40$, $\phi = 0.2$; written: $p = 0.15$, $\phi = 0.4$), orientation to time (oral: $p = 1.00$, $\phi = 0.1$; written: $p = 1.00$, $\phi < 0.1$), initiating event 1 (oral: $p = 0.44$, $\phi = 0.2$; written $p = 0.08$, $\phi = 0.5$), initiating event 2 (oral: $p = 1.00$, $\phi = 0.1$; written: $p = 0.21$, $\phi = 0.4$), response-internal (oral: $p = 1.00$, $\phi = 0.1$; written: $p = 0.13$, $\phi = 0.4$), response-physical (oral: $p = 1.00$, $\phi < 0.1$; written: $p = 0.58$, $\phi = 0.2$), action 1 (oral: $p = 0.56$, $\phi = 0.2$; written: $p = 0.08$, $\phi = 0.5$), action 2 (oral: $p = 0.07$, $\phi = 0.4$; written: $p = 0.08$, $\phi = 0.5$), direct consequence 2 (oral: $p = 0.13$, $\phi = 0.4$; written: $p = 0.13$, $\phi = 0.4$), and resolution-physical (oral: $p = 0.65$, $\phi = 0.2$; written: $p = 0.35$, $\phi = 0.3$).

Figure 2. Comparison of the percentage of students with and without language disorder who included each narrative macrostructure element in the oral modality.



Note: Language disorder: $n = 10$; Comparison: $n = 13$

Figure 3. Comparison of the percentage of students with and without language disorder who included each narrative macrostructure element in the written modality.



Note: Language disorder: $n = 8$; Comparison: $n = 9$

What microstructure elements are used by students in youth detention when producing narrative texts, and how do these compare across two modalities (oral and written)?

Table 18 shows comparisons of microstructure element use according to modality for the 16 students who completed both the oral and written tasks.

Cohesion. When compared to the oral narratives, the written narratives had a higher rate of appropriate introduction references.

Complexity. The oral narratives contained a greater number of utterances (and utterances of shorter length) than the written narratives. In contrast, the written narratives contained more complex sentence structures and included a greater number of subordinating connectors, clauses per utterance, and adverbials of time and reason.

Semantics. There was only a difference between modalities for verbs relating to linguistic behaviours (e.g., said, shouted, yelled); the written narratives contained a greater number of linguistic verbs than the oral narratives. For the remaining vocabulary items, there was no evidence of a difference between modalities however the frequency of their use was consistently lower in the oral modality compared to the written.

How does the production of microstructure elements in oral and written narrative texts compare between those with and without LD?

Table 19 shows comparisons of microstructure element use according to group and modality for the students who completed at least one of two narrative tasks.

Cohesion: Within the oral modality, the LD group used fewer appropriate introduction and tie references than the comparison group. In the written modality, there was no evidence of a difference between groups.

Complexity: Within the oral modality, there was a difference for subordinating connectors only whereby the LD group used less than one overall. Within the written modality, there was also a difference for subordinating connectors as well as for utterance length, clauses per utterance, and adverbials of time and place. The students with LD used a greater number of compound sentence structures while students in the comparison group used a greater number of complex sentence structures.

Semantics: In the oral modality, there was no evidence of a difference between the LD and comparison groups for any vocabulary item however students with LD generally used a smaller number and type of vocabulary items. In the written modality, there was a difference between the groups whereby students with LD used fewer words (total and type), including verbs (total and type), prepositions (total and type) and adjectives (type).

What percentage of students in youth detention demonstrate errors in the microstructure elements of written conventions (spelling and sentence boundaries) in a narrative text, and how does this compare between students with and without LD?

Of the 17 written narratives, 13 (76%) had one or more spelling errors, 16 (94%) had one or more capitalisation errors, and 14 (82%) had one or more full stop errors. While the percentage of students who made each error type was variable according to group, there was no evidence of a difference between groups (spelling errors: LD = 63%, comparison = 89%, $p = 0.29$, $phi = 0.3$; capitalisation errors: LD = 100%, comparison = 89%, $p = 1.00$, $phi = 0.2$; full stop errors: LD = 100%, comparison = 67%, $p = 0.21$, $phi = 0.4$).

Table 18. Comparison of microstructure elements according to narrative modality for the 16 students who completed both the oral and written tasks.

	Oral modality		Written modality		<i>z</i>	<i>p</i>	<i>r</i>
	<i>n</i> = 16		<i>n</i> = 16				
	Mean	(SD)	Mean	(SD)			
Cohesion							
Introduction RR (%)	71.6	(17.6)	84.4	(17.6)	2.55	0.01*	0.5
Tie RR (%)	94.4	(11.2)	95.7	(6.5)	0.18	0.86	<0.1
Complexity							
Utterances	7.8	(2.8)	6.2	(2.2)	2.14	0.03*	0.4
Utterance length (w)	9.1	(2.3)	13.8	(4.7)	3.15	<0.01*	0.6
Utterance length (m)	10.3	(2.5)	15.4	(5.1)	3.10	<0.01*	0.6
Sentence type							
<i>Simple</i>	2.3	(1.6)	1.8	(1.3)	0.93	0.35	0.2
<i>Compound</i>	1.5	(1.1)	0.8	(0.9)	1.63	0.10	0.3
<i>Complex</i>	0.8	(1.3)	2.4	(2.2)	2.96	<0.01*	0.5
<i>Compound-complex</i>	0.4	(0.7)	0.2	(0.5)	0.95	0.34	0.2
Simple connectors	4.9	(2.6)	3.8	(2.3)	1.46	0.14	0.3
Subordinating connectors	1.1	(1.5)	2.5	(2.6)	2.45	0.01*	0.4
Clauses per utterance ^a	1.1	(0.2)	1.5	(0.4)	2.98	<0.01*	0.5
Adverbials							
<i>Of time</i>	0.3	(0.6)	1.6	(1.2)	2.75	<0.01*	0.5
<i>Of place</i>	4.3	(1.6)	4.6	(2.1)	0.36	0.72	0.1
<i>Of manner</i>	0.7	(1.1)	1.0	(1.6)	0.60	0.55	0.1

<i>Of degree</i>	0.6	(1.2)	0.7	(1.4)	0.41	0.68	0.1
<i>Of reason</i>	0.1	(0.3)	0.4	(0.5)	2.24	0.03*	0.4
Semantics							
Words	70.2	(29.1)	85.0	(44.5)	1.16	0.24	0.2
Words (type)	43.4	(14.0)	51.4	(22.2)	1.65	0.10	0.3
Verbs	12.2	(5.0)	14.2	(6.7)	0.95	0.34	0.2
Verbs (type)	10.6	(4.4)	12.3	(5.6)	0.86	0.39	0.2
Verb - Linguistic	0.9	(1.1)	1.6	(1.4)	2.31	0.02*	0.4
Verb - Cognitive	0.8	(1.3)	1.1	(1.5)	0.64	0.52	0.1
Verb - Sensory	0.4	(0.6)	0.6	(0.7)	0.71	0.48	0.1
Prepositions	8.9	(4.2)	11.1	(6.4)	1.42	0.16	0.3
Prepositions (type)	6.2	(3.0)	7.7	(3.9)	1.64	0.10	0.3
Emotion words	1.6	(1.3)	1.8	(2.1)	0.16	0.88	<0.1
Adjectives	2.7	(1.8)	4.8	(4.8)	1.81	0.07	0.3
Adjectives (type)	2.3	(1.4)	3.8	(4.3)	1.27	0.21	0.2

Note: Wilcoxon signed-rank test; RR = reference rate; (w) = in words; (m) = in morphemes; ^aSubordination Index; * $p \leq 0.05$.

Table 19. Comparison of microstructure elements according to group for both the oral and written modalities for the students who completed at least one of two narrative tasks.

	Oral modality							Written modality						
	LD		Comparison		<i>z</i>	<i>p</i>	<i>r</i>	LD		Comparison		<i>z</i>	<i>p</i>	<i>r</i>
	<i>n</i> = 10		<i>n</i> = 13					<i>n</i> = 8		<i>n</i> = 9				
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)				
Cohesion														
Introduction RR (%)	60.6	(16.6)	78.0	(13.4)	2.18	0.03*	0.5	72.9	(19.6)	90.9	(14.5)	1.85	0.07	0.5
Tie RR (%)	87.6	(12.6)	99.3	(2.5)	2.74	0.01*	0.6	96.1	(5.5)	95.8	(7.4)	0.0	1.00	0.0
Complexity														
Utterances	6.8	(2.2)	8.5	(2.7)	1.80	0.07	0.4	6.3	(1.8)	6.0	(2.5)	0.44	0.66	0.1
Utterance length (w)	8.5	(1.6)	9.2	(2.4)	0.37	0.71	0.1	9.3	(1.6)	17.3	(2.8)	3.37	<0.01*	0.8
Utterance length (m)	9.9	(1.9)	10.4	(2.6)	0.19	0.85	<0.1	10.4	(1.7)	19.3	(2.9)	3.46	<0.01*	0.8
Sentence type														
<i>Simple</i>	2.7	(1.5)	2.2	(2.3)	1.24	0.21	0.3	2.3	(1.6)	1.3	(0.9)	1.11	0.27	0.3
<i>Compound</i>	1.3	(1.0)	1.7	(1.1)	0.88	0.38	0.2	1.5	(0.9)	0.3	(0.5)	2.61	0.01*	0.6
<i>Complex</i>	0.3	(0.7)	1.1	(1.4)	1.84	0.07	0.4	0.8	(1.2)	3.6	(2.1)	2.62	0.01*	0.5
<i>Compound-complex</i>	0.2	(0.4)	0.6	(0.8)	1.40	0.16	0.3	0.0	(0.0)	0.3	(0.7)	1.37	0.17	0.2
Simple connectors	4.7	(2.5)	5.8	(2.1)	1.13	0.26	0.2	3.1	(1.9)	4.8	(2.5)	1.36	0.17	0.3
Subordinating connectors	0.2	(0.6)	1.5	(1.5)	2.45	0.01*	0.5	0.5	(1.1)	4.0	(2.5)	2.91	<0.01*	0.7
Clauses per utterance ^a	1.1	(0.1)	1.2	(0.2)	1.15	0.25	0.2	1.2	(0.4)	1.8	(0.4)	2.37	0.02*	0.6
Adverbials														
<i>Of time</i>	0.3	(0.7)	0.3	(0.6)	0.13	0.90	<0.1	0.8	(1.0)	2.1	(1.1)	2.24	0.03*	0.5

<i>Of place</i>	3.9	(1.5)	4.2	(1.4)	0.58	0.56	0.1	3.0	(0.8)	5.8	(1.9)	3.04	<0.01*	0.7
<i>Of manner</i>	0.3	(0.5)	0.6	(1.3)	0.00	1.00	0.0	0.5	(0.8)	1.3	(2.1)	0.34	0.74	0.1
<i>Of degree</i>	0.3	(1.0)	0.5	(1.1)	0.75	0.45	0.2	0.6	(1.1)	0.7	(1.7)	0.54	0.59	0.1
<i>Of reason</i>	0.0	(0.0)	0.3	(0.6)	1.59	0.11	0.3	0.3	(0.5)	0.4	(0.5)	0.81	0.42	0.2
Semantics														
Words	57.1	(18.4)	77.4	(27.0)	1.71	0.09	0.4	57.3	(15.9)	105.6	(49.2)	2.21	0.03*	0.5
Words (type)	36.5	(7.9)	47.4	(13.7)	1.90	0.06	0.4	37.3	(9.1)	61.9	(23.9)	2.56	0.01*	0.6
Verbs	10.7	(2.8)	13.4	(5.3)	1.09	0.27	0.2	9.6	(2.1)	17.6	(7.2)	2.58	0.01*	0.6
Verbs (type)	9.2	(2.6)	11.5	(4.6)	0.97	0.33	0.2	8.5	(2.0)	15.2	(5.8)	2.43	0.02*	0.6
Verb - Linguistic	0.6	(0.7)	1.2	(1.2)	1.0	0.32	0.2	1.0	(1.1)	1.90	(1.5)	1.31	0.19	0.3
Verb - Cognitive	0.4	(0.7)	1.1	(1.4)	1.46	0.14	0.3	0.4	(0.7)	1.7	(1.7)	1.83	0.07	0.4
Verb - Sensory	0.5	(0.7)	0.3	(0.5)	0.60	0.55	0.1	0.5	(0.8)	0.6	(0.7)	0.22	0.83	0.1
Prepositions	7.0	(2.2)	9.8	(4.3)	1.68	0.09	0.4	7.0	(1.7)	14.3	(6.9)	2.34	0.02*	0.6
Prepositions (type)	5.0	(1.7)	7.0	(3.0)	1.69	0.09	0.4	5.1	(1.5)	9.7	(4.0)	2.48	0.01*	0.6
Emotion words	1.1	(1.2)	1.5	(1.3)	0.87	0.39	0.2	0.9	(0.8)	2.6	(2.5)	1.69	0.09	0.4
Adjectives	2.0	(1.5)	2.6	(1.9)	0.67	0.50	0.1	2.3	(2.1)	6.7	(5.5)	1.84	0.07	0.4
Adjectives (type)	1.8	(1.1)	2.3	(1.6)	0.67	0.50	0.1	1.6	(1.3)	5.4	(5.2)	2.01	0.05*	0.4

Note: Mann-Whitney U test; LD = language disorder; RR = reference rate; (w) = in words; (m) = in morphemes; ^aSubordination Index; * $p \leq 0.05$.

Discussion

In this study, we examined the oral and written text-level language skills of students in youth detention (mean age of 17 years), specifically, their skills in narrative macrostructure (story grammar) and microstructure (syntax and semantics). All participants' narratives were characterised by a lack of key detail, and some narratives contained ambiguous referencing to characters and concepts. The written narratives were also characterised by errors in spelling and poor management of sentence boundaries. Weaknesses in oral and written text-level language skills among the group overall may be a result of suboptimal education, premature school disengagement and neurodevelopmental disability (S. L. Hamilton, S. Maslen, R. Watkins, et al., 2020; Hamilton et al., 2019).

Overall, when comparing students' narratives across modalities, the inclusion of macrostructure elements was similar. However, the participants as a group demonstrated stronger skills in cohesion, sentence complexity and semantics in the written modality. Overall, this finding highlights that modality of text production affects narrative performance. The students may have taken more care in the writing task due to both the formality and permanency of written language (DeVito, 1967; Spencer & Petersen, 2018), and they may have benefited from rehearsal in the oral modality as the picture stimulus used in the oral task was the same as that used in the written task. Further, the slower pace of writing reduces immediate cognitive loading, which may have allowed students to capitalise on the language skills they had, thus extending the linguistic complexity they initially demonstrated in the oral modality (E. L. Fisher et al., 2019; Haslett, 1983; Loban, 1976; Spencer & Petersen, 2018).

This first finding however does not tell the whole story. As expected, LD also affected narrative performance. Students who had LD were outperformed by those who did not in both the oral and written modalities. They included fewer narrative macrostructure elements, particularly in the oral modality. In line with previous research, this finding indicates that young people in youth justice populations who have LD struggle more than those who do not to efficiently organise and provide adequate information when telling a story orally (Snow & Powell, 2008).

In the written modality, while inclusion of macrostructure elements was variable, there were fewer differences between those with and without LD. For both groups, some factors associated with written tasks, as discussed above, may have provided support. However, the additional language, cognitive and motor demands associated with spelling, sentence boundary management and handwriting may have resulted in the inclusion of fewer elements. In a previous study of 10-year-old school students, Koutsoftas and Gray (2012) identified that inclusion of story grammar elements in a written narrative did not differ between those with and without LD. However, syntactic and semantic skills differed between their participant groups. This is in line with our findings that the students with LD demonstrated weaker narrative microstructure skills, particularly in the written modality, including fewer complex sentences and subordinating connectors as well as fewer adverbial phrases and less diverse vocabulary. It could be that microstructure in the written modality in particular was restricted for the students with LD due to both weaker foundational oral language skills and additional language, cognitive and motor demands (Koutsoftas & Gray, 2012; Spencer & Petersen, 2018). In contrast, students who did not have LD (but who also made errors with written conventions) were able to extend the linguistic sophistication of their narratives in the written modality. Our results demonstrate how language ability can affect narrative performance in both the oral and written modalities. This highlights the need to consistently evaluate the functional text-level language and literacy skills of young people in youth justice in addition to standardised assessments of language ability. This is important so that students' needs in everyday language and literacy tasks are better identified, and interventions are better informed.

A key finding of our study is that for both the oral and written modalities, no student with LD included a plan (the macrostructure element related to character intent). Similarly, Snow and Powell (2008) found that among young people involved with youth justice, those who had LD were less likely to include a plan in their oral narratives. Our study extended this finding into the written modality. Moreover, inclusion of the plan was the only difference in macrostructure between the groups in the written modality.

In a narrative, omission of key details that relate to intent or goal directed behaviours can indicate problems with the ability to infer meaning from implicit information, including the motivations of others. In addition, omission of these details can indicate

difficulties with the ability to appreciate and produce the level of information required to convey cause and effect to an audience (Applebee, 1978; Snow & Powell, 2005; Westby, 1984). This highlights potential difficulties with skills in social cognition including theory of mind (ToM), which is the ability to appreciate one's own and others' mental and emotional states, as well as social problem solving, which is the ability to realise the relationships between events, characters, and concepts (Noel & Westby, 2014; Wainryb et al., 2010). Compromised language, social and cognitive skills are common to youth justice populations (Winstanley et al., 2019), which can have implications for learning and socioemotional functioning. Wainryb et al. (2010) identified that young people with violent offending behaviour show few instances reflecting ToM in personal narratives about the harm they have caused to others. Snow and Powell (2008) identified that young people who are violent offenders are more likely to have LD compared to those convicted of lesser offences. Such language and cognitive skills are important to consider in forensic contexts including in rehabilitation programmes, as young people may have difficulties appreciating the needs and experiences of others, as well as verbally expressing their own needs, feelings, and emotions (Snow et al., 2016; Winstanley et al., 2019).

Complex language is regarded as important for facilitating development of skills in social cognition (Farrant et al., 2006). Preliminary research with a small group of males involved with youth justice has shown that SLP intervention that targets text-level language, ToM and social problem solving can improve language skills related to narrative production and possibly, aspects of social cognition (Noel & Westby, 2014). This highlights the potential benefit of involving SLP services in assessment and therapeutic interventions for young people who are involved with youth justice.

Cohesion was weaker in the oral modality compared to the written overall and in the oral modality for the students who had LD. Failure to appropriately introduce characters and concepts results in poor orientation to the 'who' and 'what' of a story with subsequent effect on audience comprehension. While correct references, including pronouns, may be used later in a story to refer to characters and concepts, a poor initial orientation places an increased burden on the audience to infer information. The weaker cohesion in the oral narratives of the students with LD could suggest more difficulties taking account of the audience's needs when sharing a story. However, there was no evidence of a difference

for cohesion between groups in the written modality. This might be attributed to the small sample size or to other factors associated with written tasks, which offer opportunities for text revisions.

The finding that students with LD (compared to those without) produced fewer complex sentences and had weaker semantic skills, particularly in the written stories, is unsurprising given that weak syntax and vocabulary are characteristic of individuals with LD (Rice & Hoffman, 2015; Starling et al., 2011). Development of both syntactic and semantic skills is important for the acquisition and ongoing development of language skills. A strong foundation in these language skills underpins language transition to a more formal and academic style of oral language as well as to a more literary style of written language which is important for meeting the requirements of the school curriculum (ACARA, 2010a, 2010b; Spencer & Petersen, 2018). Our findings highlight that for this population, assessment of, and intervention for, text-level syntactic and semantic skills are required to support this transition. Fewer group differences for microstructure in the oral modality also demonstrate that LD is not always obvious, and that functional effects of LD can present differently depending on the demands of a task (Starling et al., 2011; Wetherell et al., 2007). This finding may also call into question the classification of students' abilities based on standardised assessment scores. Our results emphasise the importance of comprehensive assessment, including functional assessment, to better identify specific areas of difficulty that are likely to restrict effective participation and success in educational and forensic contexts.

Strengths & Limitations

The students in this study were from a larger study whose participant group reflected a representative sample of young people in the youth detention (Bower et al., 2018). Given the language diversity of youth justice populations (Kippin et al., 2018) and our inclusion criteria to include speakers of SAE only, it is not known whether the findings of this study apply to first language speakers of other languages. This is an important area for future research, as all young people involved with Australian youth justice systems are exposed to practices and processes which are typically administered with SAE.

While the current study's sample was small, our findings for macrostructure inclusion in the oral modality being both variable among all students and weaker among those with LD are in line with previous research with youth justice populations (Snow & Powell, 2005, 2008). We have extended the evidence base by also including examination of narrative microstructure elements, and comparing both macrostructure and microstructure elements across oral and written modalities as well as between students with and without LD. Further, our examination of microstructure skills in narrative texts adds to what is known about the microstructure skills in expository texts of young people involved with youth justice compared to non-offending peers (Hopkins et al., 2017).

Our comprehensive profiling of narratives of students in youth detention has highlighted specific and functional language and literacy needs of this population group, which are important to consider when planning and delivering services. Standardised assessment is important to ascertain capacity and classify health conditions however assessment which examines functional abilities of an individual is necessary to identify specific limitations that affect participation in meaningful tasks (Westby & Washington, 2017). In an educational setting, it is common practice for students to be given predetermined prompts from which to generate texts (Hall-Mills & Apel, 2015). Therefore, the elicitation of narratives using a picture stimulus has enabled us to identify specific areas of oral and written text-level language that are likely to restrict students' participation and success. In justice settings, this is particularly important, as teachers need practical information and resources to better respond to students' longstanding academic difficulties. Further, as forensic contexts require two-way communication, information related to how a young person can communicate is important to inform equitable justice processes and practices.

It is important to note that the picture sequence used in this study was in view of both the students and the speech-language pathologist for both the oral and written tasks. Such a joint focus has the potential to alter the level of detail required by an audience, and as a result, the amount of detail provided by a narrator. However, a picture sequence can reduce a narrator's cognitive load by placing less demand on executive functions such as working memory and information organisation (Westby & Washington, 2017). Therefore, use of the picture stimulus in our study likely provided an opportunity for the students to

showcase their narrative skills as best they could in both the oral and written modalities. A previous study in a youth justice setting identified that a picture stimulus can result in improved text-level writing compared to no prompt, a verbal prompt, and a written prompt (Sinatra, 1984). A strength of our study was the finding that some students were able to extend their language skills when provided with the same task in the written modality. This highlights that language and literacy needs do differ among this population group which further emphasises the importance of comprehensive language assessment.

The use of a prompt may limit the ability to generalise our results to how a student performs with functional narrative text production without visual supports. Future research with larger samples should examine the oral and written text-level language skills of young people undertaking tasks specific to forensic contexts, such as giving an account in a legal interview as well as participating in psychological programmes which draw on the recall and discussion of events and experiences.

Implications

The reporting of insufficient and inconsistent details in a narrative has important implications for both forensic and education contexts. In a police interview, for example, such communicative behaviour could be perceived as rudeness and non-compliance (Snow & Powell, 2008), and may impede investigation into all the events that occurred. In a psychological intervention, problems with narrative language could affect how adequately and explicitly a young person can share, reflect on, and clarify their experiences and feelings (Noel & Westby, 2014). This could impede a young person gaining benefit from the justice process, and could also be detrimental for victims of crime. For example, despite letters of apology playing an important role in restorative justice processes and the closure of incidents for victims, some letters do not make their way to victims due to the quality of written language being poor (Soppitt & Irving, 2014). It will be important that young people involved with youth justice, who have weak language skills, are better identified so that two-way communication, in both oral and written modalities, can be better facilitated.

In a school context, a confusing or overly simple story shared by a student could be perceived negatively by peers, which could affect the establishment of friendships.

Individuals with LD are less likely than those who do not to have close friends (Clegg et al., 2005). Further, a teacher may give a poorly produced text a low score, and potentially, may link academic failure to behaviour problems, rather than to weak language skills (Humber & Snow, 2001). Some students might demonstrate relative strengths in some areas of macrostructure and microstructure however poor management of sentence boundaries and errors in spelling can reduce the overall quality of a text, making its reading laborious and affecting academic achievement (ACARA, 2010a, 2010b). A student who produces text-level language at a lesser developmental level, especially in the secondary school years, requires targeted oral and written language intervention. This is important so that they can better meet the requirements of the school curriculum, attain an education, and broaden their occupational opportunities.

Previous work demonstrates that SLP intervention can result in language and literacy gains among secondary school students (Ebbels et al., 2016; Spencer et al., 2017). It is also possible and beneficial for youth justice services to invest in SLP interventions to improve language and literacy outcomes of young people (Gregory & Bryan, 2011; Noel & Westby, 2014; Snow, 2019). In the youth detention centre where this study took place, education staff have reported the value of speech-language pathologist and occupational therapist (OT) input, as part of our broader research project, and have called for speech-language pathologists, OTs, and educational psychologists to be employed to support educational and rehabilitation programmes (Hamilton et al., 2019). An Australian economic evaluation of the impact of SLP services on criminal justice outcomes revealed a cost saving of \$1,716 to \$4,843 per young person as well as potential reductions in antisocial behaviour and recidivism when SLP services are provided to a young person upon their initial contact with youth justice services (Dowse et al., 2020). The results from our current and previous study (Kippin et al., 2018) provide justification for oral and written language interventions and SLP services to be introduced to youth justice services in WA and more broadly to other services that are accessed by young people who are in, or at risk of, contact with youth justice. This is important for improving the response to young peoples' unmet language and literacy needs.

Conclusion

In this study, we have identified and described text-level language difficulties in macrostructure and microstructure for both oral and written narrative texts produced by a sample of students in youth detention. Students with LD demonstrated weaker text-level language skills in both modalities however both students with and without LD exhibited difficulties with narrative macrostructure and microstructure elements. The extent of text-level language difficulties revealed in our study, particularly among those with LD, as well as the implications of these difficulties, demonstrate that investment in the language and literacy skills of this population is required. Targeted language interventions need to be developed, implemented, and evaluated with this population, and the potential benefit for involving SLP services in this work should be examined.

Funding

National Health and Medical Research Council (NHMRC) (#1072072); NHMRC-funded FASD Research Australia Centre of Research Excellence (#1110341); Australian Government Research Training Programme PhD Scholarship. The funding sources were not involved with the study design; the collection, analysis, and interpretation of the data; the writing of the manuscript; or the decision to submit the article for publication.

Declarations of interest

None.

CRedit authorship contribution statement

Natalie R. Kippin: Conceptualization, Methodology, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. Suze Leitão: Supervision, Formal analysis, Writing - review & editing. Amy Finlay-Jones: Supervision, Writing - review & editing. Jennifer Baker: Mentorship, Data interpretation, Writing - review & editing. Rochelle Watkins: Supervision, Formal analysis, Writing - review & editing.

Acknowledgements

We thank: the BHDC students and their circles of care for participating in this study; Department of Justice custodial and non-custodial staff; research assistants, Lauren Willis and Christine Astell; and the Banksia Hill Study team, in particular, Professor Carol

Bower, Clinical Associate Professor Raewyn Mutch, and Professor Rhonda Marriott. Any material published or made publicly available by the authors cannot be considered as either endorsed by the Department of Justice or an expression of the policies or view of the Department. Any errors of omission or commission are the responsibility of the researchers.

CHAPTER 8:

Thesis discussion

Chapter overview

In this programme of research, I identified and described the communication skills of adolescents in WA's youth detention centre, a context in which FASD is highly prevalent and Aboriginal young peoples are over-represented. Motivation for this research came from the absence of knowledge related to both the oral and written communication skills of this specific population, as well as the limited understanding of the overlap of FASD with language and speech disorders in youth justice and community adolescent populations more broadly. Findings, strengths, and limitations, as well as implications of each of the four studies undertaken in this research were comprehensively discussed in Chapters 4 through to 7. Here, a summary of these is provided in the context of the overall programme of research. This is followed by highlights of research translation to date and the conclusion. As with previous chapters, the term preferred by Department of Justice is 'young people'; however, the term 'adolescents' is used in this chapter for consistency with the introductory Chapters 1 and 2.

Main Findings

Most adolescents in youth detention in WA (71%) were first or home language speakers of an Australian Aboriginal language, which included Aboriginal English and six other Aboriginal languages. Less than one third of the adolescents were speakers of SAE as a first or home language. Findings of rich language diversity and variable skills in SAE among speakers of Aboriginal languages highlights that SAE competence of adolescents should not be assumed in youth justice contexts. The language/s spoken by adolescents should always be identified, and measures, such as certified interpreters and language experts, put in place to promote more equitable legal proceedings as well as linguistically appropriate rehabilitation and educational programmes.

Language diversity in a population with high prevalence of both LD and FASD is also an important finding of this research. As identified in the systematic review (Chapter 4), studies that examined communication skills of adolescents with PAE and FASD did

not typically report on languages spoken, and some studies excluded adolescents whose first language was not English. In this programme of research, knowledge of an individual's first or home language informed selection of assessment protocol and subsequent interpretation of data. This knowledge also informed recommendations made by the SLP in the assessment reports for ongoing supports and services. Language and culture are inextricably linked with health and wellbeing for Aboriginal and Torres Strait Islander peoples (Department of Health, 2017), which again highlights the importance of taking account of adolescents' languages as was done in this research.

Turning to LD, 45% of adolescents were identified with LD in the severe range, taking account of their first or home language. This finding is consistent with those of previous studies undertaken in other Australian youth justice settings (Justice Health and Forensic Mental Health Network, 2017; Snow & Powell, 2008, 2011; Snow et al., 2016). A new finding for the Australian youth justice context is the substantial overlap of LD with FASD; 56% of the adolescents with LD were identified as having LD associated with FASD. Such high overlap is in line with findings of the systematic review undertaken as part of this research, which revealed that adolescents with PAE generally have weaker skills in expressive vocabulary and semantic knowledge, semantic processing, verbal learning, and memory, as well as written language. However, gaps identified in the research base, related to the word learning process and syntax, highlight that little is known about how adolescents with PAE learn new vocabulary and concepts and how they access the school curriculum, given complex syntax is required to produce and process academic texts.

A deeper examination of narrative language skills resulted in the identification of widespread difficulties with text-level language production in both oral and written modalities among the adolescents in youth detention in WA. When considering the impact of LD in the moderate and severe ranges, adolescents with LD exhibited substantially greater difficulties in both modalities compared to those who did not meet criteria for LD. These findings build on and extend those of previous studies which have examined text-level language skills of adolescents in youth justice, but not investigated both oral and written modalities. The functional impacts of LD on text-level language production were demonstrated, but the findings also revealed that the difficulties extended beyond those

who met the study's criteria for LD. This highlights the importance of functional text-level language assessment of all adolescents in youth justice, not just those who meet a pre-determined score on a standardised language test. Previous research in LD shows that an individual may achieve a score within 1 SD on a language test, yet have significant functional communication problems, affecting participation in social interactions, education, and employment (Bishop et al., 2016).

The smaller sample size of participants in the narrative study did not allow for comparison of narratives between adolescents with and without PAE. However, previous studies have revealed weaker skills with narrative macrostructure element inclusion as well as with cohesion and vocabulary among children and adolescents with FASD compared to those without FASD (Ganthous et al., 2017; Thorne & Coggins, 2016). This suggests that had the sample size allowed an examination of the adolescents' narratives according to PAE, it is likely that those with PAE would demonstrate weaker narrative language skills. This hypothesis is supported by results from Chapters 4 and 6, which showed that adolescents with PAE and FASD generally had weaker language skills than those with no/low PAE.

Orofacial, oromotor, speech and voice anomalies were also identified as more prevalent among adolescents in youth detention, compared to community samples, also taking account of phonological variations due to language diversity. These anomalies were observed in both adolescents with and without PAE; however, stuttering and a monotone voice were only observed among adolescents with PAE. While there was considerable variation across the PAE and no-PAE groups in outcomes of: the number of adolescents with at least one anomaly; the number of anomalies per adolescent; and the DDK MRR, there was no evidence of a difference between these groups in these outcomes. This emphasises the importance of routine speech assessment of all adolescents in youth detention. Findings of orofacial and oromotor anomalies may also suggest difficulties with eating and swallowing for this population. Few studies had previously described orofacial, oromotor, speech and voice anomalies of adolescents in youth justice, and little was known about how speech and voice characteristics compared between adolescents with and without PAE, as identified through the systematic review (Chapter 4). Such emerging

insights into these characteristics among adolescents in youth justice, with and without PAE, will be valuable for informing future SLP assessment and intervention services.

This programme of research has made a unique and significant contribution to better understanding the oral and written communication as well as orofacial and oromotor profiles of adolescents in youth justice. The complex profiles identified emphasise the critical need for SLP services in youth justice in WA.

Strengths and Limitations

A major strength of this research being nested within a broader research study that examined FASD in youth justice was the involvement of a wide range of stakeholders and study members. These included government and non-government agencies, community reference and advisory groups, and a multidisciplinary research and clinical team, all of which included Aboriginal and non-Aboriginal peoples. This meant that the research was informed, supported, and conducted within the parameters agreed upon, by representatives from several agencies, communities, and professions. As a result, successful completion of a complex and multi-year project, undertaken in a secure setting, was achieved. Undertaking research in justice settings can be difficult due to obstacles inherent to these settings. For example: much time is required to determine and agree on the scope of research with stakeholders and to obtain ethics approvals; pre-determined programs can limit access to individuals in detention; and processes to manage researcher fatigue, stress and vicarious trauma are required (Quina et al., 2007; Simpson et al., 2017).

This research included direct SLP assessment with adolescents in youth detention as part of a multi-disciplinary team assessment that also considered PAE and FASD. As a result, communication skills of the adolescents could be examined in the contexts of both youth justice and PAE and FASD. This is the first programme of research in Australia to do so. Therefore, the findings provide important new insights into the communication profiles of adolescents in youth detention in Australia, specifically that there was considerable overlap of LD and FASD, and that orofacial, oromotor, speech and voice anomalies also occurred in this population. Findings will be important for informing future SLP assessment and intervention services in youth justice contexts as well as in education and health contexts more broadly. However, caution is warranted in generalising the

findings of the observational studies to other populations. Each of the three observational studies undertaken as part of this research investigated just one population of adolescents in youth detention. While findings related to LD prevalence and oral narrative skills are consistent with those of previous research in Australia, replication of this research, particularly in relation to PAE and FASD, orofacial, oromotor, speech and voice characteristics as well as written narrative language skills, is required to better understand how the results compare across adolescents in youth justice nationally and internationally. Further, while the systematic review revealed that, generally, adolescents with PAE have weaker semantic skills than those with no/low PAE, the research base is small, and little is known about how other communication skills, including those related to syntax and speech compare between adolescents with and without PAE.

Advantages of conducting this research within a secure facility included having a well-defined study population and a population who is poorly serviced by speech-language pathologists. While the adolescents could not be observed in their home and community environments, which limited the scope of assessment, working within a detention centre allowed engagement with the adolescents in one location. This potentially supported recruitment and participation in the overarching Banksia Hill Study. With caregiver consent, timely feedback of results to the adolescents as well as to psychological, custodial, and educational staff working directly with adolescents, was enabled. As a result, assessment findings and recommendations could be taken up soon after assessment.

It is important that strengths and limitations of research in relation to working with Aboriginal peoples are openly communicated to help plan and conduct successful decolonising health research into the future (Morton-Ninomiya & Pollock, 2017). A major methodological limitation of this research being nested within the broader FASD prevalence study is that assessment and interpretation of data was mostly informed by a deficit model. This is problematic given the diverse social, cultural, and linguistic backgrounds of the adolescents in youth detention in WA, and that identifying and promoting an individual's assets through strength-based assessment is required to support healing and recovery (S. L. Hamilton, S. Maslen, D. Best, et al., 2020). However, prior to the Banksia Hill Study, the languages used by adolescents in youth detention in WA were

unknown, so SLP assessment specific to characteristics of each language was difficult. However, an important strength of the current programme of research was the considerations made by the speech-language pathologist in relation to first, or home, languages, particularly for studies 2 (Chapter 5) and 3 (Chapter 6). Assessment protocols included questions being asked about languages spoken by the adolescents and their families, so that the language repertoires and linguistic strengths of the adolescents and their families could begin to be better understood by both clinicians and other service providers. Further, the speech-language pathologist implemented three assessment protocols based on an adolescent's first or home language: one for speakers of SAE; one for speakers of Aboriginal English; and another for speakers of other Aboriginal languages. This is the first known SLP research in an Australian justice context to do so. The speech-language pathologist also organised for certified interpreters from Aboriginal Interpreting WA to help facilitate SLP assessment and interpret data for the participants whose first, or home, language was not SAE. The interpreters also helped facilitate feedback with some caregivers. There is potential for over- or under- identification of LD as well as orofacial, oromotor, speech and voice anomalies due to the use of modified and non-standardised assessment approaches. However, all efforts were made by the speech-language pathologist to provide accurate assessment and include speakers of Aboriginal languages in the programme of research as much as possible, given the over-representation of Aboriginal young peoples in youth detention and of Indigenous peoples who have FASD. It will be important that future research includes identification of the social, cultural and linguistic assets of the study population prior to any assessment being conducted to inform and promote a more holistic and inclusive assessment model than that of a deficit model. Further, including a qualitative component would be beneficial to understand what the adolescents think about their own communication skills, the role of language diversity in their identities, and to understand their experiences with justice systems in relation to their communication skills.

Text-level language skills in both the oral and written modalities were not examined among non-SAE speakers. This resulted in a small sample size for the narrative analysis study and the inability to compare language skills according to the presence or absence of PAE. However, given the range of different languages spoken and limited

frameworks with which to appropriately elicit and analyse narrative language of adolescents who speak Aboriginal languages, the speech-language pathologist consulted with colleagues, who were Aboriginal peoples. It was recommended, and agreed upon, that narrative analysis be limited to only SAE speakers. As a result, narrative analysis involved the novel comparison of narrative language skills between oral and written modalities, not addressed in prior research. Functional assessment related to narrative language production, as well as speech and voice characteristics, are important strengths of this programme of research. It is important that assessment practices consider functional impacts of an individual's abilities, so that potential difficulties that restrict activity levels and participation in meaningful and relevant activities can be identified and addressed (McLeod & Bleile, 2004; Westby & Washington, 2017). Exclusion of participants who were not first language speakers of SAE limits the generalisation of research findings related to the text-level language skills of adolescents in youth detention in WA, which may also impede planning and provision of required services more broadly.

Implications for future research and practice

The outcomes of the studies presented in this thesis lead to several implications for future research and practice. Firstly, the finding of rich language diversity highlights that it is important to take account of adolescents' language repertoires in youth justice as well as PAE and FASD contexts to promote more equitable assessment, supports and interventions. Further research is also required to develop more culturally sensitive assessment tools to be used with Australian adolescents who are speakers of Aboriginal languages. It is vital that Aboriginal and Torres Strait Islander peoples lead and inform directions for such work, and that support for, and development of, Aboriginal and Torres Strait Islander peoples in SLP clinical and research roles are prioritised. Speech Pathology Australia's recent inclusion of a Reconciliation Action Plan in the Association's strategic plan is an important step towards a more culturally responsive SLP peak body (Speech Pathology Australia, 2018). Linguists also play an important role in understanding characteristics of languages. In Australia, linguists are actively involved in research in forensic contexts, including that related to linguistically sensitive legal processes (Eades, 2015; University of Sydney, n.d.). Given that involvement of speech-language pathologists is growing in justice settings, research collaborations between speech-

language pathologists, Aboriginal and Torres Strait Islander peoples and linguists will be important to guide culturally and linguistically sensitive assessment and diagnostic services. Such collaborations will help to identify more specific communication skills of adolescents that the youth justice workforce need to consider as they plan and deliver services.

With regards to LD, researchers continue to identify high prevalence among adolescents in youth justice, but unlike this programme of research, few examine overlaps of LD with FASD. Persistent difficulties with syntax and semantics are characteristic of LD (Gillam et al., 2021; Rice & Hoffman, 2015), and given that LD is common among individuals with FASD, and can have implications for social and educational success, further investigations of how communication profiles of adolescents with LD compare to those with LD associated with FASD are required. In relation to how oral and written communication skills compare between adolescents with and without PAE, further research is needed, particularly in relation to phonological processing skills that underpin word learning, as well as syntactical skills necessary for processing sentence- and text-level language. Further research into the effects of PAE on speech and voice characteristics among adolescents is also required, and identifying the most appropriate methods for conducting speech and voice assessment with adolescents in youth justice, with and without PAE, is an important priority. A better understanding of the communication profiles of adolescents in youth justice as well as those with PAE and FASD is important. This knowledge can help to achieve accurate diagnoses and identify appropriate supports and interventions. It can also help to inform much needed evidence-based screening tools and clinical guidelines for working with individuals in forensic contexts (McLachlan, Mullally, et al., 2020). However, as discussed in Chapter 4, methodological variations in PAE and FASD research, including PAE definitions used to allocate participants to groups, are factors that limit the ability to draw robust conclusions about the effects of PAE on adolescent communication skills. Consistency in how PAE is assessed and defined in future research will help facilitate more accurate understanding, assessment, and diagnosis of communication difficulties in the context of PAE.

The high prevalence of LD, with and without FASD, as well as widespread text-level language difficulties identified in this research demonstrate that many adolescents

in youth justice are likely to struggle with the communication skills required in legal proceedings. Adolescents in youth justice report that good communication skills are important for presenting a defence and help to be perceived favourably by judiciary (Hopkins, Clegg & Stackhouse, 2016). A range of interview guidelines and recommendations have been developed to help facilitate two-way communication in forensic contexts; however, evaluation of these, including examination of the evidence base underpinning them, is required to help inform future recommendations and best practice guidelines (Brown et al., 2020; Sowerbutts et al., 2021). Police in Scotland reported that their most frequent strategy for responding to individuals with compromised communication skills is to seek support from colleagues with more specialised training (MacRae & Clark, 2020). However, this practice requires that an individual's communication difficulties are identified, and that those colleagues with specialised training are both available and have adequate knowledge about language and speech to appropriately provide support and intervene. Also in the UK, judges and counsel have increased their knowledge about ways to help facilitate communication in criminal trials; however, their attempts to do so are not always developmentally appropriate or successful, and highlight the need for more specialist input (O'Mahony, 2016).

As discussed in Chapter 6, intermediaries, who are often speech pathologists, can be appointed to provide impartial communication assistance to help facilitate legal proceedings (Plotnikoff & Woolfson, 2015). This specialist role is better established in the UK, and is more commonly involved in cases related to alleged child abuse; however, it is emerging in other countries including New Zealand and some parts of Australia, and the scope of the service has extended into cases involving adolescent defendants (Howard, McCann, et al., 2019c). Research undertaken in the New Zealand youth justice system, in which Indigenous adolescents are over-represented, demonstrates that the communication expertise of intermediaries is highly valued in legal proceedings, including those proceedings that also involve family members and victims (Howard, McCann, et al., 2019a, 2019b; Howard et al., 2020; Howard, McCann, Ewing, et al., 2019). As intermediary services slowly increase in Australia, a trial of such services in WA's youth justice system will be important to identify the most appropriate and effective ways in

which the services can be implemented, particularly given the over-representation of Aboriginal young peoples in youth justice.

Findings from the programme of research reported in this thesis, the broader Banksia Hill Study, and relevant published literature (Anderson et al., 2016; Bryan et al., 2015; Law et al., 2013; Snow, 2019), strongly underscore the need for SLP assessment and intervention services in youth justice. As discussed in previous chapters, SLP assessment is important for identifying communication difficulties, and SLP intervention can improve communication skills among adolescents in youth justice. Cost savings can be achieved from SLP services through addressing poor language and literacy skills, which can reduce criminogenic risk (Dowse et al., 2020). In the UK, a youth offending team recognised as a national leader within youth justice, includes SLP services (Milton Keynes Youth Offending Team, 2019), and a multidisciplinary team working with other youth offending teams deem the role of SLP services as critical (Garland et al., 2019). In Queensland, Australia, several speech-language pathologists are employed by youth justice, working in collaboration with other staff members and providing services to adolescents on both custodial and community-based orders (Martin, 2019). Less comprehensive SLP services are provided in youth justice in some other Australian states and territories. Notably, data from SLP assessments undertaken in South Australia's youth justice system has informed their youth justice state plan, which includes implementation of a revised assessment approach and strengthening of allied health services (Department of Human Services, 2020; Hackett et al., 2020). However, in WA, where this study was undertaken, no SLP services are routinely provided to adolescents in youth justice.

When SLP services are implemented in youth justice in WA and elsewhere, research to evaluate and further inform these will be important. The research base regarding SLP interventions with adolescents in Australia is limited, and in youth justice, is restricted to short intervention trials (Utley & Hopf, 2021); therefore, it is unclear what effects SLP services have in the long-term for adolescents in youth justice in Australia as well as how to best allocate SLP services in such settings (Snow, 2019). Further, interventions that have targeted language, literacy, and communication skills among individuals with FASD have been undertaken with children, and little is known about the impact of such interventions among adolescents with FASD (Ordenewitz et al., 2021; Reid

et al., 2015). These gaps in research are important to address given that adolescents with unidentified LD are 2.5 times more likely to reoffend than those without LD, and are likely to require rehabilitation and educational programmes to be planned and delivered in ways in which communication needs are addressed (Winstanley et al., 2020). This points to the importance of including speech-language pathologists in multidisciplinary youth justice teams as well as undertaking research to examine the impacts SLP services have on adolescent and offending outcomes.

Potential barriers to implementing SLP services in youth justice have been identified in previous research. For example, security and safety are prioritised in youth justice settings, meaning financial resources may be restricted, and adolescents may be detained for only a short period of time, potentially limiting the effectiveness and impact of programmes that cease upon release (Rogers-Adkinson et al., 2008; Snow et al., 2015; Stevens, 2010). However, these types of factors should not impede the provision of services designed to take account of the oral and written communication needs of adolescents. There are consistent high rates of return to youth detention, and for some adolescents, periods of sentenced detention extend into months and years (AIHW, 2019). This underscores the urgent need for SLP services to be provided as part of rehabilitation efforts. As highlighted earlier in this thesis, addressing the needs of adolescents is critical to support skill development in the short-term and support their transition to greater independence in adulthood, and potentially, parenthood.

Programmes and interventions delivered in youth justice are important for reducing recidivism. For example, in WA, the core objective of the Department of Justice's Youth Justice Service is to "reduce reoffending through programmes and services..." (Department of Justice, 2020, p. 212). Recently, explicit and systematic phonic-based reading instruction has been implemented in Banksia Hill Detention Centre to improve adolescents' reading and spelling skills, and a short case-study featured in a Department of Justice report describes improvements in both reading skills and confidence for one adolescent (Department of Justice, 2020). Music, army cadets, sports, and hospitality programmes are also provided in youth detention in WA, with reported outcomes including improved literacy skills (Department of Justice, 2020). However, there are no data related to the impact of any programmes or services on both literacy

skills and recidivism rates of the youth detention population. Given recidivism rates are consistently high and difficulties with oral and written communication skills are widespread among adolescents in youth detention in WA, a critical review of programmes and an evaluation of their impacts and efficacy on adolescents with and without LD and FASD is important. With custodial detainment of one adolescent costing \$1,339 per day during 2019-20 (Department of Justice, 2020), it is important that the effects of programmes and services designed to improve oral and written communication skills and reduce recidivism are understood. A partnership between the Department of Justice and child-health researchers may be a useful vehicle through which this research could be conducted.

Findings from this research are likely to be relevant to adult justice populations. They too have high levels of identified oral and written language difficulties as well as FASD. For example, in the UK, communication problems were identified in 80% of adolescents and adults (individuals aged 16 years and above) who were in a forensic support service due to having a learning disability and contact with the criminal justice system (McNamara, 2012). In Canada, FASD was identified in 18% of adults undertaking community and prison-based orders (McLachlan et al., 2019). However, the research base related to the communication skills of adult justice populations is small, highlighting a limited understanding of their communication needs and an opportunity for SLP research to inform assessment and intervention practices (Morken et al., 2021).

Oral and written communication problems as well as FASD are also common, yet undiagnosed, in populations that cross over with youth justice, including child welfare and mental health services (Popova et al., 2019; Snow, McLean, et al., 2020; Snow et al., 2019). The findings reported in this thesis thus also have implications for assessment and intervention in these contexts. Comprehensive and collaborative services are required for all children who have experienced early life adversity (Rogers-Adkinson & Stuart, 2007). It will be important that speech-language pathologists are involved in such services to help ensure language and literacy skills are adequately understood and development of social and educational skills are better supported (Snow et al., in press).

As has been highlighted earlier, language and speech disorders as well as FASD also occur among children and adolescents in general community populations. Accordingly, primary and secondary schools have important opportunities, and an obligation, to help identify and respond to students' oral and written communication needs. Increasing teachers' knowledge about the domains of language, such as semantics and syntax, can better equip teachers to make informed observations of a student's communication skills (Tommerdahl, 2009). Providing training on practical ways in which to address potential communication and learning difficulties is also important (Duquette et al., 2006, 2007; Pei et al., 2015). Schools also have an opportunity to include SLP services as part of multidisciplinary diagnostic and intervention teams to confirm and address potential communication and learning concerns (Pei et al., 2017; Petrenko et al., 2014). There is a key role for speech-language pathologists to work in collaboration with school staff, upskilling teachers and implementing both indirect and direct language intervention for students (Ritzman & Sanger, 2007; Starling, 2018; Utley & Hopf, 2021).

It is important to acknowledge that most individuals with communication disorders do not become involved in criminal behaviours. However, the links between compromised communication skills and poor educational outcomes, behaviour problems and youth offending are well documented and underscore the importance of acknowledging oral and written communication problems as important criminogenic risk factors that need to be addressed (Fitzsimons & Clark, 2021; Sanger et al., 2006). Few adolescents in youth justice ever receive SLP services prior to their involvement with youth justice (Fitzsimons & Clark, 2021; Hughes et al., 2017; Snow et al., 2016; Winstanley et al., 2020). However, adolescents with identified LD who have received intervention transition into adulthood with less contact with police services when compared to adolescents without LD (Winstanley, Webb, et al., 2018). This highlights the potential impacts of SLP intervention for adolescents with LD, with and without FASD. It also provides important rationale for inclusion of SLP services in youth justice and other contexts in which individuals with communication disorders and FASD are involved.

Finally, training of health professionals in relation to FASD diagnosis is an identified priority area in Australia (Finlay-Jones et al., 2020). Such training will be crucial for speech-language pathologists, given the occurrence of communication

problems with FASD, and that SLP services are likely to be one of the initial health care services accessed by families with a child at risk of FASD (Popova et al., 2014). Lack of speech-language pathologists in FASD diagnostic teams has been reported as a significant gap resulting in individuals' needs going unmet (Longstaffe et al., 2017). Development and testing of supports and interventions for individuals with PAE and FASD are also required (Finlay-Jones et al., 2020). Involvement of speech-language pathologists in this work will be important to help inform comprehensive services that can support an individual's functioning in a range of contexts and into adulthood.

Translation and impacts of this research

As a result of this programme of research and the broader Banksia Hill Study, SLP services are recommended as part of multidisciplinary team assessments for adolescents in youth justice (Appendix 9). Since this research was undertaken, speech-language pathologists have been involved in some Western Australian court-ordered neurocognitive assessments in both youth and adult justice contexts. It is anticipated that the results of this research and the broader Banksia Hill Study will continue to inform SLP services in the WA justice system into the future (Appendix 10). Preliminary discussions have occurred with Department of Justice as well as Speech Pathology Australia to help plan for SLP services in Banksia Hill Detention Centre. However, at the time of submission of this thesis, SLP services were yet to be implemented.

There has been interest from the Department of Justice regarding intermediary services for WA (Appendix 10). A proposal to design a component of an intermediary training programme was requested, and this was provided in collaboration with Aboriginal Interpreting WA given that language diversity and LD were identified in this research. A formal intermediary service is yet to be implemented in WA; however, increased understanding about the implications for LD has led to speech-language pathologists being involved in some recent legal proceedings, in both youth and adult justice contexts in WA, to help facilitate two-way communication. Further, at the request of the WA Police, feedback was provided on a revision of an interview guide used when adolescents and adults with suspected FASD and other neurocognitive impairments are being interviewed. The WA Police team involved in interviews related to child sexual abuse also

sought information and advice about how they can improve their interviewing practices. Collaboration between WA Police and Curtin University has been established to support further discussion and research.

Findings from this research, as well as practical strategies that may help youth justice staff work with adolescents, have been included in a workforce training programme as part of the Banksia Hill Study (Passmore et al., 2020). The training programme was found to increase knowledge, attitudes, and intent of staff to appropriately manage adolescents with neurodevelopmental disorders (Passmore et al., 2020). This four-hour face-to-face programme continues to be delivered to youth and adult justice workforces as well as to police, education, child protection and disability sector workforces around Australia (Telethon Kids Institute, 2021).

Key findings from this programme of research and the Banksia Hill Study have been included in reports and submissions to several government bodies in WA and nationally (see page xii). In 2020, the Australian Government and the Coalition of Aboriginal and Torres Strait Islander Peak Organisations (2020) specified that justice, social and emotional wellbeing, early childhood, Aboriginal languages, and housing were priority areas for improving health and wellbeing outcomes among Aboriginal and Torres Strait Islander peoples. Therefore, planned research translation activities include ongoing advocacy, promoting the importance of considering communication difficulties and FASD in health, educational and justice contexts.

A FASD Australia Centre of Research (CRE) Excellence PhD scholarship supported this programme of research (Appendix 11). Being a member of both the FASD CRE and Banksia Hill Study provided opportunities to share research findings at local and national levels, visit other Australian youth detention centres to learn about their services, and become involved with FASD Hub Australia's Advisory Group. Outcomes of this involvement included development of a fact sheet for health professionals on social communication problems among children with FASD (Kippin et al., 2020) and contribution to the development of a language guide designed to promote respectful engagement with individuals who have FASD and their families (FASD Hub Australia,

2019). Finally, findings from this research will be used to help inform the revision of the Australian Guide to the Diagnosis of FASD, which is currently underway.

Conclusion

This programme of research involved the examination of the communication skills of adolescents in youth detention in WA. Standard Australian English was not the majority first or home language of the adolescents, yet competence in this language is required to participate in Australian justice, health, and educational contexts. Further, LD, including LD associated with FASD was highly prevalent, and speech and voice anomalies were observed at a higher prevalence than that in community populations. This programme of research is the first in Australia to identify the overlap of oral communication deficits with PAE and FASD in a justice population. Written language difficulties were also identified, particularly among adolescents with LD. Findings provide important insights into the communication profiles and needs of adolescents in youth detention. They also highlight the potential for inequitable service access in youth justice given that legal proceedings as well as educational and rehabilitation programmes are language-dense and typically administered through verbal communication. Findings from this programme of research strongly support previous arguments that SLP services are critical in youth justice to help respond to the unmet oral and written communication needs of adolescents (Bryan et al., 2015; Snow, 2019). It is important that future SLP research and clinical practice in youth justice includes consideration of PAE and FASD to facilitate accurate diagnoses and guide provision of required supports and interventions. Adolescents with communication problems as well as orofacial and oromotor anomalies that could result in eating and swallowing difficulties are over-represented in youth justice in WA, and SLP services to address these are urgently needed.

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Appendices

Appendix 1: Study publication (Chapter 4) – International Journal of Language and Communication Disorders

Received: 27 November 2020 | Revised: 21 January 2021 | Accepted: 18 May 2021

DOI: 10.1111/1460-6984.12644



REVIEW

Oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared with those with no/low PAE: A systematic review

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Funding information

FASD Research Australia CRE PhD scholarship and Australian Government Research Training Program PhD Scholarship (NRK); FASD Research Australia CRE (National Health and Medical Research Council of Australia grant number 1110341) (RW/AFJ).

Abstract

Background: Prenatal alcohol exposure (PAE) is associated with growth deficits and neurodevelopmental impairment including foetal alcohol spectrum disorder (FASD). Difficulties with oral and written communication skills are common among children with PAE; however, less is known about how communication skills of adolescents who have PAE compare with those who do not. Adolescence is a critical time for development, supporting the transition into adulthood, but it is considered a high-risk period for those with FASD.

Aims: We conducted a systematic review to synthesize evidence regarding oral and written communication skills of adolescents with PAE or FASD and how they compare with those with no PAE.

Methods & Procedures: A comprehensive search strategy used seven databases: Cochrane Library, Cinahl, Embase, Medline, PsycInfo, Eric and Web of Science. Included studies reported on at least one outcome related to oral and written communication for a PAE (or FASD) group as well as a no/low PAE group, both with age ranges of 10–24 years. Quality assessment was undertaken.

Main Contribution: Communication skills most often assessed in the seven studies included in this review were semantic knowledge, semantic processing, and verbal learning and memory. These communication skills, in addition to reading and spelling, were commonly weaker among adolescents with PAE compared with those with no/low PAE. However, the findings were inconsistent across studies, and studies differed in their methodologies.

Conclusions & Implications: Our results emphasize that for adolescents with PAE, communication skills in both oral and written modalities should be comprehensively understood in assessment and when planning interventions. A key limitation of the existing literature is that comparison groups often include some participants with a low level of PAE, and that PAE definitions used to allocate participants to groups differ across studies.

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KEYWORDS

language, literacy, communication, prenatal alcohol exposure, foetal alcohol spectrum disorder, adolescence

What this paper adds

What is already known on the subject

- PAE and FASD are associated with deficits in oral and written communication skills. Studies to date have mostly focused on children with a FASD diagnosis as well as combined groups of children and adolescents with FASD or PAE. There is a gap in what is known about oral and written communication skills of adolescents, specifically, who have PAE or FASD. This has implications for the provision of assessment and supports during a period of increased social and academic demands.

What this study adds to existing knowledge

- This review provides systematic identification, assessment and synthesis of the current literature related to oral and written communication skills of adolescents with PAE compared with those with no/low PAE. The review revealed a small knowledge base with inconsistent methodologies and findings across studies. However, the findings overall highlight that adolescents with PAE have weaker skills in oral and written language than those with no/low PAE. Results are discussed in relation to education, social and emotional well-being, and forensic contexts.

What are the potential or actual clinical implications of this work?

- Findings emphasize that for adolescents with PAE, comprehensive assessment of both oral and written communication skills, through both standardized and functional tasks, should be undertaken. Speech–language pathologists have a key role in assessment with individuals who have PAE.

INTRODUCTION**Prenatal alcohol exposure (PAE) and foetal alcohol spectrum disorder (FASD)**

PAE is a global public health concern. Alcohol can affect foetal development, potentially resulting in a range of neurodevelopmental impairments, including FASD (McCormack et al. 2017). Globally, the prevalence of alcohol use in pregnancy is 10%, however variation is considerable within and across countries (Popova et al. 2017). In Australia, for example, one study in which children were randomly selected from a government database and their parents were interviewed face to face reported that 30% of preg-

nancies involved PAE (Hutchinson et al. 2013). In another Australian study, in which women were from a prospective pregnancy cohort study and interviewed via telephone, PAE was identified in 61% of pregnancies (McCormack et al. 2017). Following pregnancy recognition, just over one in four pregnancies in Australia continue to involve PAE (Muggli et al. 2016). Globally, approximately 8% of children with PAE receive a diagnosis of FASD (Lange et al. 2017). Pooled prevalence estimates of FASD among children and youth in the general community range from < 1% to 2% (Lange et al. 2017). However, the prevalence is much higher among specific sub-populations, such as in special education (3–8%) and child welfare populations (5–31%) (Popova et al. 2019).

Duration and dose of PAE are associated with risk of psychosocial and behaviour problems which extend into early adulthood (Day et al. 2013), and PAE of ≥ 1 ounce (oz) of absolute alcohol (AA) per week¹ is associated with structural changes and reduced volume of the brain (Chen et al. 2012). Individuals with a FASD diagnosis demonstrate severe impairments across a wide range of neurocognitive domains, including attention, memory, language, executive function, cognition, motor skills and affect regulation (Mattson et al. 2019). These impairments confer additional vulnerability for the acquisition and use of adaptive functioning and academic skills (Lynch et al. 2017, McLachlan et al. 2020). Neurodevelopmental impairment associated with PAE can also be compounded by exposure to childhood trauma and other adversities (Hyter 2007, Kambertz et al. 2019). While neurodevelopmental impairment can occur among children with trauma alone, it is more common among those with both trauma and FASD (Henry et al. 2007).

PAE and skills related to oral and written communication

Communication skills are a key consideration in FASD diagnostic assessments and in the provision of services to support functioning (Bower and Elliott 2016, Scottish Intercollegiate Guidelines Network 2019). Speech-sound, word- and sentence-level language difficulties were first observed among children and adolescents of parents with alcohol use problems in France in the late 1960s (Lemoine et al. 2003). In the 1970s, standardized assessment of the communication skills of 45 young children with a diagnosis of foetal alcohol syndrome (FAS: a diagnosis subsumed under the diagnosis of FASD) in the United States revealed that 80% demonstrated speech, language or voice deficits (Iosub et al. 1981). In Australia, parent-reported language delay at 2 years of age was not associated with PAE at low levels (≤ 20 g of AA per occasion, less than weekly²); however, language delay was more common among those with higher levels of PAE in trimesters two and three of pregnancy (O'Leary et al. 2009). More recently, in Canada, among children of high-risk drinkers, a 50% increased risk of parent-reported communication delay in early childhood was identified (Netelenbos et al. 2020).

Several studies show that individuals with FASD or PAE (without a diagnosis of FASD) demonstrate impairments across multiple verbal skills. In general, the research focuses on children with a FASD diagnosis, combined groups of children and adolescents with FASD or PAE, and adolescents with PAE that was assessed for part of the pregnancy, rather than for all three trimesters in pregnancy. Weak verbal memory skills are seen in children

with FASD and adolescents with PAE (Becker et al. 1990, Olson et al. 1998, Willford et al. 2004). Hearing loss is also common among children with FASD (McLaughlin et al. 2019). Such deficits affect the encoding and consolidation of speech and language, and in turn, compromise learning within oral language domains of phonology, semantics and syntax (grammar). Individuals with FASD have been found to lack adequate semantic knowledge, including receptive and expressive vocabulary (Wyper and Rasmussen 2011), and those with PAE are slower to access and retrieve vocabulary items based on semantic and phonemic constraints (Mattson and Riley 1999). Using semantic knowledge for language-related problem-solving tasks is also difficult for individuals with FASD (Rasmussen and Bisanz 2009, Wyper and Rasmussen 2011). Grammatical skills can also be compromised, impeding both comprehension and formulation of language at sentence and text levels (Kodituwakku et al. 2006, Wyper and Rasmussen 2011).

Oral language skills are foundational to learning how to read, spell and write (Nation 2019, Wagner and Torgesen 1987). Both oral and written language skills are critical for academic and occupational success, therefore it is important to consider both these modalities. Studies with children who have FASD, either separate to or in a combined group with adolescents, have found compromised reading and spelling abilities (Adnams et al. 2007, Glass et al. 2015). These studies have also shown that underlying these difficulties are weaknesses in phonological awareness, phoneme manipulation, decoding (mapping graphemes to phonemes) and encoding (mapping phonemes to graphemes) (Adnams et al. 2007, Glass et al. 2015). According to the Simple View of Reading, skills in both decoding and semantic knowledge are required for reading comprehension (Nation 2019), and weak reading comprehension skills have also been found among individuals with PAE, with and without FASD (Mattson et al. 1998, Vaurio et al. 2011). Further, rapid naming skills, which are strongly associated with reading fluency (Norton and Wolf 2012), were also found to be weak (Glass et al. 2015).

PAE, communication skills and adolescence

Some studies have reported that deficits with communication skills among individuals with FASD or PAE become more severe with increasing age. Increasing deficits in overall receptive and expressive language ability have been identified (de Beer et al. 2010, Proven et al. 2014) as well as in specific skills, such as grammar (Wyper and Rasmussen 2011) and verbal fluency (Rasmussen and Bisanz

2009). It is not surprising that deficits in communication skills become more severe with age given the increasing social and academic demands as well as fewer parent and teacher supports. Individuals with FASD struggle with the complex language and cognitive skills required to navigate learning and social situations (Duquette et al. 2006, Skorka et al. 2020). Consequently, the transition from primary to high school as well as from adolescence into young adulthood is particularly problematic (Lynch et al. 2017, Skorka et al. 2020).

Adolescence begins at the commencement of puberty (a biological event); however, the end of adolescence differs according to country and community, and can align with social and cultural achievements, such as educational attainment, social competence and financial independence (Blakemore 2018). Adolescence is a critical time for the development of neurocognitive skills which support the establishment of greater independence as well as influence social, educational, health and economic trajectories (Dahl et al. 2018). Thus, adolescent health has emerged as an internationally recognized priority area concerned with health and well-being, encompassing both the adolescent (10–19 years) and youth (15–24 years) age ranges (Patton et al. 2016, Viner et al. 2012).

The development of communication skills is particularly important during adolescence, with growth in skills related to semantic knowledge, morphology and syntax as well as metacognitive verbs, figurative and pragmatic language (Nippold 2016, Spencer 2018). Adolescents become increasingly capable of producing and comprehending more complex oral and written language. This in turn contributes to successful participation in social, academic and occupational contexts. However, during adolescence, the development of communication skills can be often overlooked, and communicative competence assumed, given that development of communication skills is less visible compared with early childhood years (Spencer 2018). Given the significance of oral and written communication skill development within adolescence and beyond, specific attention to the communication skills of adolescents with PAE is warranted.

Previous systematic reviews

Four systematic reviews report communication outcomes as part of their investigation of individuals with FASD or PAE. A systematic review and meta-analysis, by Popova et al. (2016), of the comorbid conditions among children, adolescents and adults with a diagnosis of FAS established receptive (82%) and expressive language disorder (76%) as two of the most common comorbid conditions. Articulation, motor-speech and voice problems were also commonly noted; however, detailed communication pro-

files were not reported given that the focus of the review related to a wide range of comorbidities (Popova et al. 2016). Price et al. (2017) systematically reviewed research related to the impact of both PAE and trauma on development; they identified that for 0–16-year-olds, exposure to both trauma and PAE can have a compounding effect, resulting in a higher risk of communication problems, including with phonological awareness, speech, vocabulary, grammar as well as verbal memory, compared with exposure to one of these factors alone. Flak et al. (2014) systematically reviewed and meta-analysed research related to the association between PAE and child neurodevelopment; they failed to find an association between mild, moderate and binge levels of PAE and expressive vocabulary, verbal intelligence, semantic verbal fluency and reading for 0–14-year-olds. Due to the complex and dynamic nature of neurodevelopment, Flak et al. (2014) raised a concern about analysing results from studies with a wide age range of participants. Irner (2012) undertook a systematic review on the association between PAE and other substance exposures *in-utero* and developmental outcomes in adolescence. They included studies with and without comparisons between PAE and no/low PAE groups, as well as studies with participant groups with children, adolescents and adults. They concluded that PAE, especially at high levels (more than or equal to five alcohol drinks per occasion), is associated with developmental deficits, including in verbal skills and academic achievement, and highlighted the impact on development that social adversity and other drug exposures may also have.

A further two systematic reviews specifically focused on PAE and communication skills among infants and young children, but are equivocal in their findings as to whether PAE, at varying levels, is associated with weaker communication outcomes (Hendricks et al. 2019, O’Keeffe et al. 2014). The current review aimed to address a gap in previous reviews, namely the need to synthesize nuanced data on communication profiles of adolescents to provide a comprehensive understanding of how both PAE and FASD affect oral and written communication outcomes during this developmental period.

Current study

Our objective was to systematically review and synthesize literature to identify the communication profiles of adolescents (10–24 years) with PAE, and to examine how they compare with those with no/low PAE. Detailed insights into the specific communication profiles of adolescents with PAE can help to drive assessment, support and therapeutic approaches that are developmentally and neurocognitively appropriate for this age group.

Materials and methods

We conducted and report this systematic review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al. 2009). Our protocol was registered with PROSPERO (ID: CRD42019077187).

Eligibility criteria

This review included only English-language, peer-reviewed and published studies that had both a PAE (or FASD) group and a no/low PAE group. For inclusion in this review, PAE needed to have been assessed for each group. In this review, we used the age range consistent with that used in adolescent health (Patton et al. 2016, Viner et al. 2012); all participants in both the PAE and no/low PAE groups needed to be aged 10–24 years. Studies in which the age range of participants fell outside of this age criterion were excluded, unless data were provided specifically for those in the required age range. We contacted the authors if a study did not specify the age range of the participants. Studies were eligible if they included data (mean/SD) from standardized or non-standardized assessments for at least one outcome related to oral or written communication skills.

Search strategy and information sources

Our search strategy included terms for (1) adolescents, (2) PAE and FASD, (3) control groups and (4) outcomes related to oral and written communication skills examined when a diagnosis of FASD is being considered, for example, speech, language, verbal memory, verbal fluency and literacy (Bower and Elliott 2016, Scottish Intercollegiate Guidelines Network 2019). An example of our search strategy is provided (see table S1 in the additional supporting information). We did not include individual subtest outcomes related to mathematics, social communication or social problem solving. While composite verbal IQ and verbal comprehension scores include data related to these skills, they also include data related to vocabulary, similarities and general knowledge, and are considered to reflect overall verbal ability (Wechsler 1991). Therefore, we have included the verbal IQ and verbal comprehension composite scores. Further, we did not include verbal tasks which require switching and are considered measures of inhibition, for example, the switching subtest scores for verbal fluency and rapid naming.

The databases searched were the Cochrane Library, Cinahl, Embase, Medline, PsycInfo, Eric and Web of Science. We used MeSH headings as well as title and abstract truncation relevant to each electronic database, and our search strategy was reviewed by an experienced university librarian. The search included studies published from 1967 onwards and was conducted in March 2019. Before our final reporting, we conducted the search again for studies published during 2019 and up to 6 July 2020.

Study selection

The search results were exported to Endnote (X8.2) and uploaded to Covidence, a web-based software program for systematic reviews (Veritas Health, Innovation). Following the removal of duplicates, the first author and a second (SL/RW/AFJ) independently screened 100% of titles and abstracts. The same method was carried out for full-text screening of 100% of the remaining results. We resolved disagreements by team discussion.

Quality assessment

The first author and a second (RW/AFJ) independently assessed the methodological quality of the included studies using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (Kmet et al. 2004). Studies were assessed for their design, participant recruitment, assessment and outcomes as well as reporting of results and confounders. Items can be scored 0 = no, 1 = partial, 2 = yes, or N/A if not applicable. Items 5–7 can be excluded for observational studies; however, we included item 6 as it relates to blinding of investigators which is an important item to consider in quality assessment (National Health and Medical Research Council 1999). Raw scores were converted to percentages and used to categorize study quality as strong (> 80%), good (70–80%), adequate (50–69%) or limited (< 50%) (Lee et al. 2008) (table 1). Disagreements were resolved by team discussion.

Data extraction

The first author extracted data related to study characteristics from the included studies, using a template that we developed based on guidelines from the National Health and Medical Research Council (1999). The extracted data were related to study design and participant

TABLE 1 Included study and participant characteristics of five of the eight included studies

Reference, country	Design	Groups	n	Age (years) Range	Mean	Male (%)	Ethnicity/Race (%)	Social strata	QA (%)
Furtado and de Sa Roriz (2016), Brazil	Cohort	PAE	28	11–13	11.9 (0.4)	43	–	Low ^d	71Good
Lewis et al. (2015), USA ^a	Cohort	No/low PAE PAE + heavy	28 19	12–23 13–16	12.0 (0.3) 14.4 (0.6)	50 43	– African American: 100	Low Medium ^e	– 83Strong
		PAE + moderate	21				African American: 100		
		No/low PAE	251				African American: 100		
McLachlan et al. (2014), Canada	Case control	PAE (FASD)	50	12–23	17.6 (1.8)	80	–	–	79Good
Howell et al. (2006), USA ^b	Cohort	No/low PAE PAE + dysmorphic	50 46	12–23 13–17	17.5 (1.3) 15.1 (1.1)	82 48	– African American: 98	– Low ^f	– 75Good
		PAE – dysmorphic	82		14.9 (0.8)	39	African American: 96	Low	
		No/low PAE	53		14.9 (0.8)	44	African American: 96	Low	
Doyle et al. (2018), USA ^c	Cohort	PAE	142	10–16	12.9 (2.1)	52	White: 59; Hispanic: 20	Medium ^g	71Good
		No/low PAE	160	13.5 (2.1)		51	White: 61; Hispanic: 24	Medium	

Notes: ^aDetroit participants only.

^bThe same participants, but different outcomes and ages, are reported by Coles et al. (2010) (see table S2 in the additional supporting information).

^cThe same participants, but different outcomes, are reported by Panczakiewicz et al. (2016) (see table S2 in the additional supporting information).

^dBased on parent education.

^eBased on the Hollingshead Four Factor Index of Socioeconomic Status (individual group data not provided).

^fBased on geographical location.

^gBased on parent education and SES data provided by Panczakiewicz et al. (2016); QA = quality assessment score.

TABLE 2 Definitions of PAE by group for the included studies

Reference	Group definitions of PAE	
	PAE	No/low PAE
Furtado and de Sa Roriz (2016)	Any positive answer to alcohol consumption questions; score ≥ 1 on an assessment of high-risk drinking (T-ACE); alcohol abuse/dependence	Alcohol abstinence in pregnancy; score of 0 on T-ACE assessment; no alcohol diagnosis
Lewis et al.	Heavy: ≥ 1.0 oz AA per day during pregnancy Moderate: 0.5–0.99 oz AA per day during pregnancy	< 0.5 oz AA per day during pregnancy
McLachlan et al. (2014)	Participant has a FASD diagnosis	No known, documented, or suspected PAE
Howell et al.	≥ 2 drinks per week during pregnancy	No PAE
Doyle et al.	> 4 drinks per occasion or > 13 drinks per week on average during pregnancy; Alcohol abuse/dependence; PAE suspected AND criteria met for FAS	≤ 1 drink per week on average and never > 2 drinks per occasion during pregnancy ^d

Notes: AA, absolute alcohol. A total of 0.6 fluid ounces (fl oz) of AA = one standard drink in the United States (National Institute on Alcohol Abuse and Alcoholism, 2020); FAS, foetal alcohol syndrome (diagnosis subsumed under FASD).

^aDetroit sample only.

^bThe same participants, but different outcomes and age, are reported by Coles et al. (2010).

^cThe same participants, but different outcomes, are reported by Panczakiewicz et al. (2016).

^dDefinition used by Panczakiewicz et al. (2016): less than one drink per week on average and never more than two drinks per occasion during pregnancy.

characteristics (table 1), as well as the definitions used for PAE and the methods used to guide FASD diagnostic decisions (table 2). We extracted outcomes of interest (i.e., mean/SD) and the respective assessments administered (table 3). All extracted data were cross-checked by a second author (SL/AFJ/RW). We classified outcomes according to oral language domains, verbal processing skills that underlie communication skills, and written language skills. Two speech–language pathologists (NK and SL) reviewed each administered assessment task and classified outcomes accordingly. Discrepancies were resolved through team discussion.

Statistical analysis

Pooled samples *t*-tests in SPSS were undertaken to examine between group differences when studies reported group comparisons with more than two groups, and when post-hoc tests were reported without *p*-values. Where effect sizes were not reported for between-group comparisons, we calculated these with Cohen's *d*, and for one study with unequal group sizes (Lewis et al. 2015), with Hedge's *g* (*d/g*: small = 0.2, medium = 0.5, large = 0.8) (Cohen 1988).

Results

Study selection

As shown in figure 1, the initial search yielded 4264 records following the removal of 2577 duplicates. Title and abstract screening resulted in 165 records being retained for full-text screening from which 158 records were excluded. We achieved interrater agreement of 98% at the title and abstract screening stage and 95% at the full text screening stage. Team discussion resulted in 100% consensus at each stage. Reasons for full-text exclusion included incorrect participant population ($n = 130$), comparator group ($n = 5$), outcomes ($n = 21$) and language ($n = 2$). The remaining seven search results were consistent with the inclusion criteria and were included in this review. No further studies were identified as meeting the inclusion criteria when the search was rerun in July 2020.

Study and participant characteristics

Study and participant characteristics of five of the seven included studies are reported in table 1. Three of the seven

TABLE 3 Assessments and outcomes reported in the included studies

Reference	Assessment and Subtest	Outcomes
Oral language		
Semantic knowledge and organization		
<i>Word definitions: Spoken definitions of vocabulary items</i>		
Furtado et al. (2016)	WISC-III: Language ^a	PAE (mean = 10.8, SD = 3.3), no/low PAE (mean = 10.3, SD = 2.1), $p = 0.48$, $d = 0.2$
McLachlan et al. (2014)	CMR: Vocabulary	FASD (mean = 5.7, SD = 3.2) < no/low PAE (mean = 8.2, SD = 2.4), $p < 0.01$, $d = 0.9$
	CMR: Vocabulary ^b	FASD (mean = 11.3, SD = 4.4) < no/low PAE (mean = 14.8, SD = 4.0), $p < 0.01$, $d = 0.9$
Howell et al. (2006)	WISC-III: Vocabulary	PAE + dysmorphic (mean = 4.1, SD = 2.4) < no/low PAE (mean = 5.8, SD = 2.4), $p < 0.01$, $d = 0.7$ PAE-dysmorphic (mean = 5.4, SD = 3.3), no/low PAE, $p = 0.34$, $d = 0.2$
Panczakiewicz et al. (2016)	DAS-II: Word definitions	Female: PAE (mean = 44.2, SD = 11.2) < no/low PAE (mean = 51.9, SD = 9.2), $p < 0.01$, $d = 0.8$ Male: PAE (mean = 48.3, SD = 8.0) < no/low PAE (mean = 56.1, SD = 9.8), $p < 0.01$, $d = 0.9$
<i>General knowledge: Spoken responses to general knowledge questions, such as 'how many days are there in a week?'</i>		
Furtado et al. (2016)	WISC-III: Knowledge ^a	PAE (mean = 8.1, SD = 3.0), no/low PAE (mean = 8.1, SD = 3.3), $p = 0.97$, $d < 0.1$
<i>Similarities: Spoken explanations supported by reasoning, e.g., 'In what way are milk and water alike?'</i>		
Furtado et al. (2016)	WISC-III: Similarities	PAE (mean = 10.8, SD = 3.9), no/low PAE (mean = 10.4, SD = 3.4), $p = 0.68$, $d = 0.1$
Howell et al. (2006)	WISC-III: Similarities	PAE + dysmorphic (mean = 6.0, SD = 3.3) < no/low PAE (mean = 7.3, SD = 2.6), $p = 0.03$, $d = 0.4$ PAE - dysmorphic (mean = 7.4, SD = 3.4), no/low PAE, $p = 0.86$, $d < 0.1$

(Continues)

TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
Panczakiewicz et al. (2016)	DAS-II: Verbal Similarities	Female: PAE (mean = 41.1, SD = 10.0) < no/low PAE (mean = 49.0, SD = 8.3), $p < 0.01$, $d = 0.9$ Male: PAE (mean = 46.2, SD = 8.1) < no/low PAE (mean = 51.1, SD = 9.8), $p < 0.01$, $d = 0.5$
<i>Sentence recognition: Recognition of semantically identical sentences related to interrogation warnings</i>		
McLachlan et al. (2014)	CMR: Sentence recognition	FASD (mean = 9.3, SD = 3.2) < no/low PAE (mean = 10.6, SD = 1.2), $p < 0.01$, $d = 0.9$
	CMR: Sentence recognition ^b	FASD (mean = 14.3, SD = 2.3) < no/low PAE (mean = 15.7, SD = 1.7), $p < 0.01$, $d = 0.9$
<i>Paraphrasing: Spoken paraphrasing of sentences related to interrogation warnings</i>		
McLachlan et al. (2014)	CMR: Paraphrasing	FASD (mean = 4.9, SD = 2.0) < no/low PAE (mean = 6.3, SD = 1.9), $p < 0.01$, $d = 0.7$
	CMR: Paraphrasing ^b	FASD (mean = 7.0, SD = 2.7) < no/low PAE (mean = 9.2, SD = 2.4), $p < 0.01$, $d = 0.9$
Verbal processing skills		
<i>Verbal intelligence</i>		
<i>Verbal IQ and VCI: The combined scores of verbal subtests</i>		
Furtado et al. (2016)	WISC-III: Verbal IQ	PAE (mean = 95.8, SD = 15.6), no/low PAE (mean = 98.2, SD = 16.6), $p = 0.59$, $d = 0.2$
Howell et al. (2006)	WISC-III: Verbal IQ	PAE + dysmorphic (mean = 72.4, SD = 14.2) < no/low PAE (mean = 80.3, SD = 10.9), $p < 0.01$, $d = 0.6$ PAE – dysmorphic (mean = 80.5, SD = 15.9), no/low PAE, $p = 0.93$, $d < 0.1$
	WISC-III: VCI	PAE + dysmorphic (mean = 73.4, SD = 14.5) < no/low PAE (mean = 81.1, SD = 10.8), $p < 0.01$, $d = 0.6$ PAE – dysmorphic (mean = 81.0, SD = 16.1), no/low PAE, $p = 0.99$, $d < 0.1$
<i>Phonological and semantic processing: Access to and retrieval of lexical items</i>		

(Continues)

TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
<i>Verbal fluency: Spoken production of vocabulary items that meet semantic/phonemic as well as time constraints</i>		
Furtado et al. (2016)	Verbal fluency: F-A-S ⁶	PAE (mean = 17.5, SD = 6.0), no/low PAE (mean = 18.0, SD = 7.2), $p = 0.79$, $d < 0.1$
	Verbal fluency: animals ⁴	PAE (mean = 13.6, SD = 3.6) < no/low PAE (mean = 15.8, SD = 4.4), $p = 0.05$, $d = 0.5$
Doyle et al. (2018)	NEPSY-II: Word generation (semantic and initial)	PAE (mean = 7.3, SD = 3.0) < no/low PAE (8.3, SD = 3.0), $p < 0.01$, $d = 0.3$
Panczakiewicz et al. (2016)	NEPSY-II: Word generation (semantic)	Female: PAE (mean = 10.5, SD = 4.1) < no/low PAE (mean = 12.4, SD = 3.2), $p < 0.01$, $d = 0.5$ Male: PAE (mean = 9.9, SD = 3.6) < no/low PAE (mean = 11.9, SD = 3.5), $p < 0.01$, $d = 0.7$
<i>Rapid naming: Rapid spoken naming of printed letters and numbers</i>		
Doyle et al. (2018)	NEPSY-II: Speeded naming (letters and numbers)	PAE (mean = 8.2, SD = 2.8) < no/low PAE (mean = 9.0, SD = 2.4), $p < 0.01$, $d = 0.3$
<i>Verbal working memory</i>		
<i>Digit span (total): Spoken recall of a sequence of orally presented digits, forwards and backwards</i>		
Furtado et al. (2016)	WISC-III: Digit span (total)	PAE (mean = 9.3, SD = 3.2), no/low PAE (mean = 8.7, SD = 2.3), $p = 0.41$, $d = 0.2$
Howell et al. (2006)	WISC-III: Digit span (total)	PAE + dysmorphic (mean = 7.8, SD = 3.2), no/low PAE (mean = 8.0, SD = 3.1), $p = 0.85$, $d < 0.1$ PAE - dysmorphic (mean = 8.0, SD = 2.8), no/low PAE, $p = 0.91$, $d < 0.1$

(Continues)

TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
Verbal learning and memory		
<i>Memory for names: Listening to and spoken recall of names associated with pictures of faces</i>		
Panczakiewicz et al. (2016)	NEPSY-II: Memory for names delayed	Female: PAE (mean = 7.6, SD = 3.8) < no/low PAE (mean = 9.8, SD = 3.1), $p < 0.01$, $d = 0.6$ Male: PAE (mean = 7.3, SD = 3.8) < no/low PAE (mean = 10.0, SD = 2.7), $p < 0.01$, $d = 0.8$
<i>Narrative memory: Listening to and immediate recall of a verbally provided story (text-level of language)</i>		
Panczakiewicz et al. (2016)	NEPSY-II: Narrative memory immediate recall	Female: PAE (mean = 8.1, SD = 3.2) < no/low PAE (mean = 10.3, SD = 3.2), $p < 0.01$, $d = 0.7$ Male: PAE (mean = 8.7, SD = 3.2) < no/low PAE (mean = 10.9, SD = 3.4), $p < 0.01$, $d = 0.7$
<i>Word list learning and recall: Listening to and spoken recall of a series of words within different time intervals</i>		
Furtado et al. (2016)	RAVLT: Immediate recall	PAE (mean = 7.1, SD = 1.5), no/low PAE (mean = 6.7, SD = 1.9), $p = 0.39$, $d = 0.2$
	RAVLT: Total recall	PAE (mean = 57.8, SD = 4.7), no/low PAE (mean = 55.9, SD = 6.7), $p = 0.21$, $d = 0.3$
	RAVLT: Recall 30 minute	PAE (mean = 13.5, SD = 1.6), no/low PAE (mean = 13.1, SD = 1.8), $p = 0.38$, $d = 0.2$
	RAVLT: Recognition	PAE (mean = 14.9, SD = 0.4), no/low PAE (mean = 14.5, SD = 1.0), $p = 0.09$, $d = 0.5$
	RAVLT: Proactive interference	PAE (mean = 1.1, SD = 0.4), no/low PAE (mean = 1.2, SD = 1.0), $p = 0.46$, $d = 0.2$

(Continues)



TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
Coles et al.	RAVLT: Retroactive interference	PAE (mean = 0.69, SD = 0.49), no/low PAE (mean = 0.72, SD = 0.06), $p = 0.75$, $d < 0.1$
	VSRT: Learning slope	PAE + dysmorphic (mean = 0.27, SD = 0.14) < no/low PAE (mean = 0.36, SD = 0.13), $p < 0.01$, $d = 0.7$ PAE - dysmorphic (mean = 0.32, SD = 0.14), no/low PAE, $p = 0.13$, $d = 0.3$
	VSRT: Total recall	PAE + dysmorphic (mean = 7.1, SD = 2.1) < no/low PAE (mean = 8.5, SD = 1.4), $p < 0.01$, $d = 0.8$ PAE - dysmorphic (mean = 7.8, SD = 1.7) < no/low PAE, $p < 0.01$, $d = 0.5$
	VSRT: 8th trial	PAE + dysmorphic (mean = 8.4, SD = 2.5) < no/low PAE (mean = 10.3, SD = 1.8), $p < 0.01$, $d = 0.9$ PAE - dysmorphic (mean = 9.3, SD = 2.1) < no/low PAE, $p < 0.01$, $d = 0.5$
	VSRT: Long-term storage	PAE + dysmorphic (mean = 8.3, SD = 3.3) < no/low PAE (mean = 10.5, SD = 2.0), $p < 0.01$, $d = 0.8$ PAE - dysmorphic (mean = 9.6, SD = 2.7) < no/low PAE, $p = 0.04$, $d = 0.4$
	VSRT: Consistent long-term retrieval	PAE + dysmorphic (mean = 5.8, SD = 3.4) < no/low PAE (mean = 8.6, SD = 2.9), $p < 0.01$, $d = 0.9$ PAE - dysmorphic (mean = 7.1, SD = 3.0) < no/low PAE, $p < 0.01$, $d = 0.5$
	VSRT: Delayed recall 30 min	PAE + dysmorphic (mean = 6.3, SD = 3.0) < no/low PAE (mean = 8.5, SD = 2.6), $p < 0.01$, $d = 0.8$ PAE - dysmorphic (mean = 7.6, SD = 2.8), no/low PAE, $p = 0.08$, $d = 0.3$

(Continues)

TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
Lewis et al. (2015)	CVLT-C: Immediate	PAE + heavy (mean = 6.8, SD = 1.8), no/low PAE (mean = 7.1, SD = 1.7), $p = 0.46$, $g = 0.2$
		PAE + moderate (mean = 6.6, SD = 1.9), no/low PAE, $p = 0.20$, $g = 0.3$
		PAE + heavy (mean = 46.8, SD = 7.3), no/low PAE (mean = 50.4, SD = 8.1), $p = 0.06$, $g = 0.4$
	CVLT-C: Total learning	PAE + moderate (mean = 49.4, SD = 8.9), no/low PAE, $p = 0.59$, $g = 0.1$
		PAE + heavy (mean = 9.0, SD = 1.9) < no/low PAE (mean = 10.5, SD = 2.3), $p < 0.01$, $g = 0.7$
		PAE + moderate (mean = 10.3, SD = 2.3), no/low PAE, $p = 0.70$, $g = 0.1$
	CVLT-C: Short delay recall	PAE + heavy (mean = 9.4, SD = 1.8) < no/low PAE (mean = 10.9, SD = 2.1), $p < 0.01$, $g = 0.7$
		PAE + moderate (mean = 10.7, SD = 2.1), no/low PAE, $p = 0.68$, $g = 0.1$
		PAE + heavy (mean = 93.4, SD = 5.7) < no/low PAE (mean = 96.4, SD = 4.1), $p = 0.04$, $g = 0.7$
	CVLT-C: Recognition discrimination	PAE + moderate (mean = 94.6, SD = 6.0), no/low PAE, $p = 0.18$, $g = 0.4$
Written language		
<i>Reading</i>		
Letter identification, word reading, and sentence-level reading comprehension (WRAT-4); non-word and word reading (WIAT-1); receptive vocabulary and text-level reading (ITBS)		

(Continues)



TABLE 3 (Continued)

Reference	Assessment and Subtest	Outcomes
McLachlan et al. (2014)	WRAT-4: Reading	FASD (mean = 5.2, SD = 2.2) < no/low PAE (mean = 7.8, SD = 3.0), $p < 0.01$, $d = 1.0$
Howell et al. (2006)	WIAT-II: Basic reading	PAE + dysmorphic (mean = 78.2, SD = 14.5), no/low PAE (mean = 82.9, SD = 13.7), $p = 0.10$, $d = 0.3$ PAE - dysmorphic (mean = 82.5, SD = 15.8), no/low PAE, $p = 0.90$, $d < 0.1$
	ITBS: Reading	PAE + dysmorphic (mean = 18.2, SD = 17.1) < no/low PAE (mean = 30.5, SD = 24.0), $p < 0.01$, $d = 0.6$ PAE - dysmorphic (mean = 32.8, SD = 25.2), no/low PAE, $p = 0.59$, $d = 0.1$
Spelling		
<i>Spelling of single words</i>		
Howell et al. (2006)	WIAT-II: Spelling	PAE + dysmorphic (mean = 78.5, SD = 15.6) < no/low PAE (mean = 85.0, SD = 15.3), $p = 0.04$, $d = 0.4$ PAE - dysmorphic (mean = 83.4, SD = 16.3), no/low PAE, $p = 0.55$, $d = 0.1$

Notes: WISC-III, Wechsler Intelligence Scale for Children—Third Edition (scaled/standard scores) (Wechsler 1991); CMR, Grisso's Comprehension of Miranda Rights (score range: 0–12 (vocabulary, recognition) 0–8 (paraphrasing))(Grisso 1998); DAS-II, Differential Ability Scales—Second Edition (T -scores) (Elliott 2007); DKEFS, Delis–Kaplan Executive Function System (scaled scores) (Delis et al. 2001); NEPSY-II, Developmental Neuropsychological Assessment—Second Edition (scaled scores) (Korkman et al. 2007); RAVLT, Rey Auditory Verbal Learning Test (Brazilian standardization: Diniz et al. 2000); VSRT, Verbal Selective Reminding Test (learning slope/number of words) (Buschke and Fuld 1974); CVLT-C, California Verbal Learning Test, Children's version (number of words/percentages) (Delis et al. 1994); WRAT-4, Wide Range Achievement Test, Fourth Edition (combined scaled score) (Wilkinson and Robertson 2006); WIAT-II, Wechsler Individual Achievement Test, First Edition (standard scores) (Wechsler 1992); and ITBS, Iowa Test of Basic Skills (percentiles) (Hoover et al. 1996).

^aEquivalent to the Vocabulary and Information subtests.

^bCanadian supplementary.

^cVerbal IQ subtests = Information, Similarities, Arithmetic, Vocabulary, Comprehension and Digit span, and Verbal Comprehension. Index subtests = Information, Similarities, Vocabulary and Comprehension.

^dBrazilian standardization.

^eAuthors reported $p = 0.004$.

^fAuthors reported $p = 0.06$; however, in our analysis we accounted for Hartley's test for equal variance, $p = 0.008$; Cohen's d and Hedge's g effect sizes: small = 0.2, medium = 0.5 and large = 0.8.

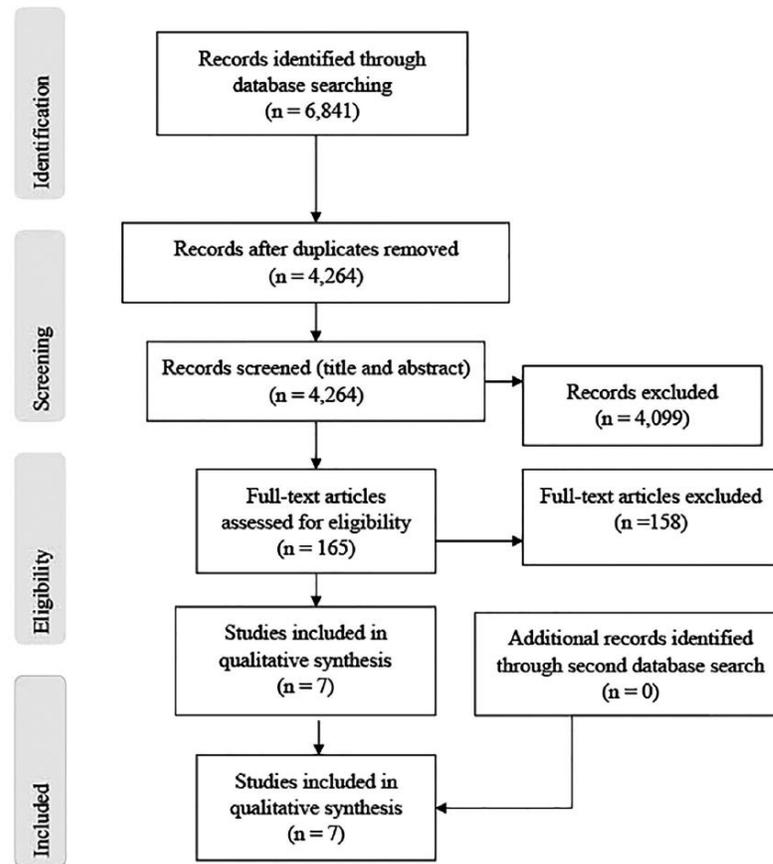


FIGURE 1 PRISMA flow diagram showing the process and selection of included studies (Moher et al. 2009)

studies contained unique participant groups from Brazil, Canada and the United States (Furtado and de Sa Roriz 2016, Lewis et al. 2015, McLachlan et al. 2014), and are reported in table 1. Two of the seven studies, also from the United States, reported data for the same participants, but on different outcomes and ages (Coles et al. 2010, Howell et al. 2006). We report the study and participant characteristics for the study with the largest sample (Howell et al. 2006) in table 1 while study and participant characteristics for the other study are provided in table S2 in the additional supporting information. The remaining two of seven studies are from the Collaborative Initiative on Fetal Alcohol Spectrum Disorders (CIFASD) research group, also in the United States, who reported data for the same participants, but on different outcomes (Doyle et al. 2018, Panczakiewicz et al. 2016). We include the study and participant characteristics for the study that reported data for one combined PAE and one no/low PAE group

(Doyle et al. 2018) in table 1. Study and participant characteristics for the remaining study, with PAE subgroups according to gender, are provided in table S2 in the additional supporting information.

All included studies were observational, and all but one were cohort in design. There was a total of 388 adolescents in the PAE groups, and 542 in the no/low PAE groups (table 1). One study reported on participants who were involved with the criminal justice system (McLachlan et al. 2014), while the remaining reported on participants recruited in clinic (Furtado and de Sa Roriz 2016, Howell et al. 2006, Lewis et al. 2015) or community and clinic (Doyle et al. 2018) settings. Where data are provided, the PAE and no/low PAE groups included a similar percentage of female and male participants. The participant groups reported by Howell et al. (2006) and Lewis et al. (2015) included all or mostly African American participants, while Doyle et al. (2018) included mostly white



participants. Data for ethnicity and race were not provided in the remaining two studies. The languages of the participant groups were not reported in any study. However, Furtado and de Sa Roriz (2016) administered tests normed with Brazilian children, and studies from the CIFASD research group excluded participants if English was not their primary language, or if they had been adopted from abroad after 5 years of age or within 2 years of assessment.

Studies that reported sociodemographic data for both the PAE and no/low PAE groups showed that participants were classified as being of low and medium sociodemographic strata (table 1). There were no between-group differences for the reported variables, with the exception of Furtado and de Sa Roriz (2016) whose groups differed on maternal religion only. Only one study (Howell et al. 2006) reported whether the participants lived with their biological families (PAE + dysmorphic: $n = 76\%$; PAE - dysmorphic: $n = 78\%$; no/low PAE: $n = 93\%$).

Intelligence scores (full-scale IQ or general conceptual ability) for both the PAE and no/low PAE groups were reported for all the included studies except one (Lewis et al. 2015) in which a score for all participants combined was reported. The IQ scores of the PAE and no/low PAE groups in one study (Furtado and de Sa Roriz 2016) were not different. However, the IQ scores of the PAE groups in two studies (Doyle et al. 2018, McLachlan et al. 2014) were lower than those of the no/low PAE groups. Further, IQ scores of the PAE + dysmorphic group in another study (Howell et al. 2006) were lower than those of both the PAE - dysmorphic and no/low PAE groups. Doyle et al. (2018), who did not adjust for intelligence, cited Dennis et al. (2009) who argues against adjusting for IQ in studies related to populations with neurodevelopmental disorders. For the studies that have controlled for IQ and other variables, details are reported within the results on communication outcomes below.

PAE definitions and FASD determination

Definitions of PAE and no/low PAE groups differed between studies and are based on scores from measures used to assess alcohol dependence or thresholds for daily/weekly alcohol use (table 2). For those studies that used daily/weekly thresholds, the thresholds were reported by number of alcoholic drinks or amount of AA. In the United States, where the studies that used thresholds took place, one standard drink is equal to 0.6 oz of AA (National Institute on Alcohol Abuse and Alcoholism). Based on this definition, PAE thresholds ranged from more than or equal to two standard drinks per week to more than or equal to 13 standard drinks per week during pregnancy for the PAE groups. For the no/low PAE groups, thresh-

old ranged from alcohol abstinence to less than one standard drink per day during pregnancy. The one study with a FASD group, rather than a PAE group (McLachlan et al. 2014), used a published FASD diagnostic guideline (Chudley et al. 2005).

Quality assessment

Quality assessment outcomes of the included studies ranged from good to strong (table 1). Areas of weakness included inadequate description of the study question or objective, limited provision of participant characteristics, lack of investigator blinding and possible measurement errors when assessing PAE (Sayal 2007) (see table S3 in the additional supporting information).

Communication outcomes

Across studies, data were reported for multiple tasks related to oral language skills, verbal processing skills that underlie and support communication skills and written language skills (table 3). Oral communication outcomes predominantly drew on semantic knowledge and organization, with no reported measures of speech or syntactic skills in any study.

Oral language

Semantic knowledge and organization

Four studies reported on five different tasks related to semantic knowledge and organization. McLachlan et al. (2014) compared outcomes among adolescents with FASD to those with no/low PAE, while three studies examined outcomes among those with PAE and no/low PAE. Howell et al. (2006) reported on subgroups within the PAE group (\pm dysmorphic) and Panczakiewicz et al. (2016) reported on male and female subgroups within both the PAE and no/low PAE groups.

In the comparison of adolescents with FASD with those with no/low PAE, McLachlan et al. (2014) reported between-group differences for all six measures (vocabulary, sentence recognition and paraphrasing with and without Canadian supplementary versions). In comparisons of adolescents with PAE versus no/low PAE, results were mixed. Furtado and de Sa Roriz (2016) found no differences between groups for vocabulary, general knowledge or similarities. Howell et al. (2006), who conducted post-hoc between-group analyses, found a difference between

the PAE + dysmorphic subgroup and the no/low PAE group for vocabulary, but not for similarities. However, in our analysis using pooled samples *t*-tests, we identified a difference between these two groups for both vocabulary and similarities. Panczakiewicz et al. (2016) identified a difference on word definitions and similarities between the PAE and no/low PAE groups.

McLachlan et al. (2014) identified that IQ was predictive of all six outcomes (vocabulary, sentence recognition and paraphrasing with and without Canadian supplementary versions), and after controlling for IQ that reading was also associated with the six outcomes. However, when controlling for both IQ and reading, group membership was not predictive of any of the six outcomes. Panczakiewicz et al. (2016) identified that among their participants, age did not interact with any of their outcomes for semantics. Overall, within the language domain of semantics, measures of word definitions were the most administered tasks. Group differences on these were common, with those in the PAE groups demonstrating weaker skills than those in the no/low PAE groups in most studies.

Verbal processing skills

Verbal intelligence

Two studies reported on communication-related skills as measured by verbal IQ and verbal comprehension, comparing outcomes of adolescents with PAE and no/low PAE. Furtado and de Sa Roriz (2016), who excluded participants with an IQ < 70 or a language disorder, reported no group differences for verbal IQ, and both groups scored in the average range. Howell et al. (2006) included participants with intellectual and language disorders; they identified differences for both verbal IQ and verbal comprehension between the PAE + dysmorphic subgroup and the no/low PAE group, and both PAE subgroups and the no/low PAE group scored below the average range on the measures.

Phonological and semantic processing skills

Three studies reported on two different tasks related to access and retrieval of lexical items. All three compared outcomes of adolescents with PAE and no/low PAE. Doyle et al. (2018) and Panczakiewicz et al. (2016) reported on the same participants. Furtado and de Sa Roriz (2016) identified a difference for semantic verbal fluency, but not for phonemic verbal fluency. Doyle et al. (2018) and Panczakiewicz et al. (2016) identified group differences for two word-generation measures (semantic only, and semantic and initial letter combined) and a speeded naming mea-

sure. Panczakiewicz et al. (2016) found that age did not interact with the outcome for word generation.

Verbal working memory

Two studies reported on a digit span task. Howell et al. (2006) included subgroups within the PAE group (\pm dysmorphic). Both Howell et al. (2006) and Furtado and de Sa Roriz (2016) found no between-group differences for digit span (total: forwards and backwards).

Verbal learning and memory

Four studies administered three different tasks related to verbal learning and memory. All four compared outcomes of adolescents with PAE and no/low PAE. Panczakiewicz et al. (2016) reported data for different subgroups in both the PAE and no/low PAE groups (male and female), and Coles et al. (2010) and Lewis et al. (2015) reported data for subgroups within the PAE group (\pm dysmorphic, and heavy and moderate). For verbal processing skills that underlie and support communication skills, semantic processing as well as verbal learning and memory were the most commonly reported measures. Group differences were identified for these measures across most studies, with the PAE groups demonstrating weaker skills than the no/low PAE groups.

Panczakiewicz et al. (2016) identified differences between the PAE and no/low PAE groups for a word-level memory measure (memory for names) and a text-level memory measure (narrative memory). For outcomes related to word-list learning, Furtado and de Sa Roriz (2016) found no differences between groups for any of the measures. In contrast, Coles et al. (2010) identified group differences between both PAE subgroups (\pm dysmorphic) and the no/low PAE group for four of six measures (total recall, trial 8, long-term storage, consistent long-term retrieval), and between the PAE + dysmorphic subgroup and the no/low PAE group for the remaining two of six measures (learning slope and delayed recall). Lewis et al. (2015), who included heavy and moderate PAE subgroups, and whose no/low PAE group had the highest threshold for no/low PAE, identified differences between the PAE + heavy subgroup and the no/low PAE group for three of five measures (short delay recall, long delay recall and recognition discrimination).

Panczakiewicz et al. (2016) identified that age did not interact with memory outcomes. When controlling for IQ, Coles et al. (2010) found that the results changed for total recall only, and only between the PAE – dysmorphic subgroup and the no/low PAE group. Coles et al. (2010) also

examined forgetting across groups by analyzing delayed recall in the context of total recall, long-term storage and consistent long-term retrieval. There was no difference between groups for forgetting. When Lewis et al. (2015) controlled for socioeconomic status, maternal vocabulary and maternal smoking in pregnancy, differences between the groups remained. Lewis et al. also identified that outcomes were not related to prenatal exposure to marijuana or cocaine.

Written language skills

Reading

Two studies reported on reading using three different measures. McLachlan et al. (2014) compared outcomes among adolescents with FASD and no/low PAE, while Howell et al. (2006) compared outcomes between PAE subgroups (\pm dysmorphic) and a no/low PAE group. McLachlan et al. (2014) identified differences between the FASD and no/low PAE groups for their reading measure (combined score for identification of letters, word reading, and sentence-level reading comprehension). Howell et al. (2006) also identified a difference for one reading measure (combined score for receptive vocabulary and text-level reading) between the PAE + dysmorphic subgroup and the no/low PAE group, but not for another reading measure (non-word and word-reading).

Spelling

Just one study reported on spelling. Howell et al. (2006), who included two PAE subgroups (\pm dysmorphic), did not identify a difference between groups in their post-hoc tests. However, in our analysis, we identified a difference between the PAE + dysmorphic subgroup and the no/low PAE group for single-word spelling.

Discussion

We synthesized the published, peer-reviewed literature on oral and written communication skills of adolescents who have PAE compared with those with no/low PAE. Studies included in this review demonstrated that participants with PAE generally had weaker skills in vocabulary and semantic knowledge, semantic processing, verbal learning and memory, as well as reading and spelling compared with those with no/low PAE. However, these findings were inconsistent across studies and measures. For the domain of oral language, two studies found between-

group differences on all measures of semantic knowledge and organization, and another found differences on all tasks but only for the comparison between adolescents with PAE plus dysmorphic features and those with no/low PAE. One found no difference on any task. For verbal processing skills, one study found differences on semantic verbal fluency but not phonemic verbal fluency, verbal IQ, working memory, or verbal learning and memory. Another study found differences on verbal IQ, for just adolescents with PAE plus dysmorphic features compared with those with no/low PAE, but not for working memory. Two studies found differences on both tasks administered (semantic verbal fluency and rapid naming, and semantic verbal fluency and learning and memory, respectively). Another study identified differences on all six subtests of a verbal learning and memory task; however, on two of these subtests, between group differences were not observed for the comparison involving the PAE group who did not have dysmorphic features. A further study identified differences for three out of five subtests of a verbal learning and memory task, but only for comparisons involving adolescents with heavy levels of PAE and those with no/low PAE. For written language skills, one study found between group differences for reading, while the other reported differences for spelling and one of two reading tasks, but only for comparisons involving adolescents with PAE plus dysmorphic features. Studies were rated as having either good or strong quality.

In line with the findings of previous systematic reviews, methodological differences for the included studies potentially contributed to mixed findings. Together, with the small number of studies identified and included, this limits our capacity to draw robust conclusions from the extant literature. We identified inconsistency in the definitions used to allocate participants to groups based on PAE levels. No safe level of PAE has been identified, methods used to assess PAE vary, and the effect of alcohol on the foetus can be influenced by other exposures, timing and dose of PAE, as well as individual differences in alcohol metabolism (Popova et al. 2017). Misclassification of participants is likely to have also occurred within the included studies due to caregiver-fears of stigmatization as well as memory and recall bias (Sayal 2007). Furthermore, assessment and diagnostic guidelines for FASD differ internationally. Accordingly, it is possible that the definitions used to allocate research participants to PAE groups will continue to lack consistency. To determine the source of variation in communication profiles of individuals with and without PAE, it will be important that there is consistency in the ways in which PAE is assessed and defined in future research.

Previous systematic reviews related to individuals with FASD or PAE and which reported communication

outcomes emphasize a need to consider additional confounding factors. While socioeconomic status (SES) was considered in most studies in this review, most reported on adolescents from medium and low socioeconomic strata, highlighting a dearth of knowledge related to higher SES groups. Given that PAE is also associated with educational attainment and economic advantage (Hutchinson et al. 2013, McCormack et al. 2017, Muggli et al. 2016), research with groups from medium to high SES will contribute to a better understanding of the effects of PAE on communication skills. This review revealed that little is known about the communication skills of adolescents with PAE in relation to caregiving and trauma backgrounds. We further identified that most studies lacked data related to the languages spoken of the participants. The languages used, as well as the culture and caregiving environment of a child heavily influences language skill development (Norbury and Sparks 2013). Therefore, it is important that future research considers and accounts for these variables.

We identified that participants were assessed predominantly using tasks that draw on semantic knowledge and organization. Vocabulary knowledge is enriched within the lexicon, and the breadth, depth and organization of semantic knowledge promotes the ability to efficiently appreciate and convey meaning (Levelt 1995). Semantic knowledge is fundamental to educational and occupational success (Lowe et al. 2018). In this review, we found that expressive vocabulary skills were generally weaker among adolescents with PAE compared with those with no/low PAE. Receptive vocabulary skills are also important when examining semantic skills; however, data for receptive vocabulary were not reported in any of the included studies.

Semantic knowledge and organization were also assessed on other measures such as similarities, sentence recognition, paraphrasing, semantic processing and reading comprehension. Across most studies, adolescents with PAE performed more poorly than those with no/low PAE. This may reflect the influence of their weaker expressive vocabulary knowledge on more complex word- and sentence-level language-based tasks and highlights the importance of examining vocabulary and semantic skills comprehensively.

Word learning involves the encoding and mapping of phonological (sound based) and semantic representations of words (Brackenbury and Pye 2005). Phonological representations are encoded using phonological memory skills (Gathercole 2006). Semantic representations, which are thought to develop through syntactic, semantic, pragmatic and social-cognitive cues, map onto their respective phonological representations (Brackenbury and Pye 2005,

Stackhouse and Wells 1997). A robust measure of phonological memory skills is non-word repetition (Gathercole 2006); however, none of the included studies reported non-word repetition data. Individual subtest data for digit span forwards, also a measure of phonological memory (Rasmussen 2005), was also not reported. Research with 9-year-old children with PAE and no/low PAE has shown that the patterns of neural activation involved in phonological memory differ, indicating atypical phonological skills among those with PAE (Diwadkar et al. 2013). Further, the transition from visual to verbal memory strategies, which draws on phonological memory skills, occurs in late childhood and early adolescence among children with FASD, which is much later than for children without FASD (Rasmussen et al. 2009). The lack of evidence about phonological memory skills identified in this review makes it difficult to draw conclusions about if, and how, phonological memory skills of adolescents with PAE compare with those with no/low PAE, and how they relate to word learning and semantic knowledge.

In the studies included in this review, participants were also assessed on verbal working-memory and verbal learning and memory measures. While we identified no between-group differences in verbal working memory, there was an identified trend for verbal learning and memory skills to decrease according to the presence of dysmorphology (Coles et al. 2010) and the level of PAE (Lewis et al. 2015). Age-related specialization of neural systems that underlies memory skills occurs across childhood and adolescence (Bathelt et al. 2018). However, PAE is associated with smaller brain volumes and atypical brain structures, including those important for memory (Chen et al. 2012, Willoughby et al. 2008). Therefore, a growth deficit related to PAE might contribute to atypical neural development and weaker verbal learning and memory skills among adolescents with PAE.

Using different methods, Lewis et al. (2015) and Coles et al. (2010), whose studies differed on sample size, participant age, assessment task and PAE definitions, examined the deficits underlying weaker learning and memory performance among their PAE groups. Coles et al. (2010) suggested that memory difficulties among their participants with PAE are linked to encoding problems rather than a tendency to forget learned information. Lewis et al. (2015) suggested that memory difficulties among their participants with PAE are linked to problems with retention as well as inefficient strategies to access and retrieve words. Further, as discussed by Lewis et al. (2015) and Furtado and de Sa Roriz (2016), a semantic clustering strategy, which can support memory and recall, is used less frequently and effectively by individuals who have PAE. The findings in this review for verbal fluency show that



semantic information is accessed and retrieved less efficiently by adolescents with PAE. A specific deficit in semantic skills was posited by Furtado and de Sa Roriz (2016) as being a key consequence of PAE, given that semantic verbal fluency was the only verbal measure in their study in which group differences were identified, and that children who have FASD have abnormal neural activation of a language processing area in the temporal lobe (Sowell et al. 2007). Access to and retrieval of words is complex, and thought to be supported by the robustness of stored phonological and semantic representations as well as the ability to use retrieval cues (Brackenbury and Pye 2005, Levelt 1995). While limited, our findings indicate that in assessment of memory and learning skills with adolescents with PAE, it is important to consider both lexical storage and retrieval strategies.

Few studies in this review examined reading and spelling skills. However, those that did indicated that adolescents with PAE perform more poorly. As reading requires skills in both the decoding of graphemes, as well as in receptive language, weaknesses in one or both can compromise reading ability (Nation 2019). Howell et al. (2006) identified that the receptive vocabulary and text-level reading comprehension score was lower among adolescents with PAE. As these participants' scores for non-word and word reading were similar for both groups, albeit below the expected level for their age, it is likely that receptive language skills, rather than decoding skills, underlie the between-group difference for the reading scores. This is supported by our findings in the domain of semantic knowledge. In addition, Doyle et al. (2018) showed that adolescents with PAE have weaker rapid naming skills, which has implications for decoding, word recognition and reading fluency (Norton and Wolf 2012). As a result, both reading and spelling skills can be compromised. Our findings highlight that for adolescents with PAE, assessment should consider phonological processing, decoding and receptive language skills, and the impact these have on literacy skill development.

Several studies included in this review reported on communication measures that draw on grammar comprehension and expression. For example, tasks involving sentence and text levels of language require grammatical skills, in addition to semantic and memory skills, to support language processing (Levelt 1995). However, none of the studies used measures of grammar, nor reported directly on grammatical skills. Therefore, it is unclear how the grammatical skills of adolescents who have PAE compare with those with no/low PAE, and what implications there are for their communication ability.

Implications for clinical practice and research

Our findings are important to functioning and well-being in adolescence and have implications for clinicians working across a variety of settings. For example, in a school setting, students who lack competence in oral and written communication skills are likely to have problems with the comprehension and production of both oral and written texts (Lowe et al. 2018, Nippold et al. 2009). As a result, a student may have difficulty extending and demonstrating their knowledge, and in turn, meeting the requirements of the school curriculum. A pilot speech–language pathology intervention study with 9-year-old students with FASD revealed that gains in language and literacy skills can be made (Adnams et al. 2007), suggesting an important role for speech–language pathologists within schools to deliver services to improve language and literacy outcomes of students with PAE and FASD. However, there is a dearth of research investigating language and literacy interventions for adolescent students who have PAE. Given our findings that adolescents with PAE have difficulties with both oral and written communication skills, and that completing school is important to adolescent students who have FASD (Duquette et al. 2006), future research investigating the effectiveness of language and literacy interventions is required to inform clinical practice.

Our findings are also relevant to social and emotional well-being. Language skills are critical to supporting the recognition and labelling of emotions (Griffiths et al. 2020). Among children and adolescents with FASD, strengths in emotion recognition support adaptive functioning in the classroom (Crawford et al. 2020), and expressive vocabulary skills are associated with social perspective-taking (Stevens et al. 2015). Given that social and emotional well-being are areas of identified difficulty for children and adolescents who have PAE (Coggins et al. 2007, Kjellmer and Olswang 2013, Schonfeld et al. 2005), it is imperative that assessment and service provision with them includes consideration of communication skills.

Weak communication skills also have implications for forensic contexts, compromising psycho-legal abilities and, potentially, success in rehabilitation and educational programmes (McLachlan et al. 2014, Rost and McGregor 2012). Adolescents and adults who have either or both FASD and language deficits are over-represented, yet often under-identified, in justice settings (Kippin et al. 2018, McLachlan et al. 2019). Therefore, it is critical that the communication demands of forensic contexts are understood by the justice workforce, and that policies and practices are introduced that better enable the identification and response to an individual's communication needs

(Kippin et al. 2018, Rost and McGregor 2012). For example, providing neurocognitive assessment upon an individual's entry into the justice system can support more responsive rehabilitation efforts and more equitable outcomes for young people with PAE (Reid et al. 2020).

A common finding amongst the research identified in this review is that many of the scores, for both the PAE and no/low PAE groups, did not fall into impaired thresholds as used in FASD diagnostic guidelines, despite there being significant differences between groups as well as potential for functional communication problems. According to the revised Institute of Medicine Guideline for diagnosing FASD (Hoyme et al. 2016), impairment of a neurocognitive skill is defined as a score of ≥ 1.5 SDs below the mean while in both the Scottish and Australian Guidelines (Bower and Elliott 2016, Scottish Intercollegiate Guidelines Network 2019) impairment is defined as a score of ≥ 2 SDs below the mean. Our findings highlight the possibility that many adolescents who have PAE may not meet criteria for a FASD diagnosis based on their language and communication scores, while if they meet criteria based on scores for other diagnostic domains, they may not have their oral and written communication needs prioritized.

In the identification of communication impairments more broadly, in both clinical practice and research, there is no one cut-off score that is used universally (Bishop et al. 2016). It is important that consideration is given as to whether test scores are significantly different to those of their peers, and that, in addition to caregiver and teacher reports, direct assessment incorporates activities that are meaningful and relevant to the individual, to account for the functional impacts of communication difficulties (Bishop et al. 2016, Westby and Washington 2017). In this review, we identified that just one study (McLachlan et al. 2014) considered functional assessment, in which supplemental language items specific to the Canadian legal system were incorporated into assessment of psycho-legal abilities. Given that all the study participants were involved with the Canadian legal system, the supplemental items have practical relevance to the identification of specific psycho-legal abilities needed to participate in the Canadian criminal justice system. In research and clinical practice related to PAE, comprehensive and direct assessment of communication skills using both standardized and functional tasks is important and should not be underestimated.

A further limitation that may arise from these thresholds for impairment is the lack of clarity regarding their appropriacy to warrant a neurodevelopmental disorder diagnosis among peoples from non-dominant languages and cultures (Bishop et al. 2016, Norbury and Sparks 2013). The language(s) used by an individual to communicate, as well as assessment methods, should be carefully con-

sidered when planning and delivering assessment services to ensure that an individual's communication skills are appropriately and accurately examined.

Speech-language pathologists have a key role to play in assessment and intervention with individuals who have PAE (Popova et al. 2014). Further, speech-language pathology assessment is recommended in assessment guidelines for FASD (Bower and Elliott 2016, Hoyme et al. 2016, Scottish Intercollegiate Guidelines Network 2019). Increased speech-language pathology involvement in clinical practice and research related to PAE and FASD is likely to advance a more nuanced understanding of the communication profiles of adolescents with PAE. This is important to inform more targeted assessment, supports and interventions into the future.

Strengths and limitations

We set a specific age range for inclusion in this review and followed a systematic process to search for and review studies. Our search was broad, including terms drawn from the speech, language and literacy literature, as well as terms relating to cognitive processing skills that underlie communication skills. While we did not select PubMed in the initial search strategy, we included it in an additional search and found no further records that met the inclusion criteria.

We did not conduct a meta-analysis due to the limited number of studies identified, few studies reporting data for each outcome, as well as the methodological variations such as the PAE definitions used to allocate participants to groups. While we identified a small knowledge base with equivocal findings, we identified that the most assessed skills, which were semantic knowledge, semantic processing, and verbal learning and memory, were commonly weaker among adolescents with PAE compared with those with no/low PAE.

CONCLUSIONS

There has been limited investigation of oral and written communication skills of adolescents with PAE compared with those with no/low PAE. Variability between studies, as well as the limited research base, make it difficult to compare study results and draw conclusions. However, our results highlight that adolescents with PAE have weaker skills in some areas of oral and written communication, as well as in verbal processing skills that underlie and support communication skills, compared with those with no/low PAE. Both oral and written communication skills in the adolescent years underpin social and educational

development and support the transition to becoming more independent. Our results emphasize that for adolescents with PAE, communication skills in both oral and written modalities should be comprehensively understood in assessment and when planning interventions.

NOTES

- ¹ In the United States, one standard alcoholic drink = 0.6 fl oz or 14 g of AA (National Institute on Alcohol Abuse and Alcoholism, 2020).
² In Australia, one standard alcoholic drink = 10 g of AA (Department of Health, 2020).

DECLARATION OF INTEREST

None.

AVAILABILITY

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Kippin, N. R., Leitão, S., Watkins, R., & Finlay-Jones, A.. Oral and written communication skills of adolescents with prenatal alcohol exposure (PAE) compared with those with no/low PAE: A systematic review. *International Journal of Language & Communication Disorders*. 2021;56:694–718.
<https://doi.org/10.1111/1460-6984.12644>

Appendix 2: PsycInfo search strategy (19 March 2019).

1. (Adoles* or teen* or youth* or young or juvenile* or (school adj1 age*) or child* or student* or minor or minors or pubescent* or school*).ab,ti.
 2. Fetal alcohol syndrome.sh. or (Prenatal exposure.sh. and (alcohol* or ethanol or drink*).ab,ti.)
 3. (Fasd or (alcohol adj1 expos*) or (f?etal adj1 alcohol)).ab,ti.
 4. ((peri?natal\$ or pre?natal\$ or neo?nat\$) and (alcohol* or ethanol or drink*)).ab,ti.
 5. 2 or 3 or 4
 6. 1 and 5
 7. ((no* adj1 exposed) or control* or compar* or group* or sample* or non?exposed or placebo or (usual adj1 care) or (no adj1 treatment) or un?exposed or (typical* adj1 develop*)).ab,ti.
 8. (Executive function or verbal memory or short term memory).sh. or exp language/ or exp verbal communication/ or exp communication skills/ or exp language development/ or exp verbal ability/ or exp Communication disorders/ or exp academic achievement/ or exp ear disorders/ or exp learning disorders/ or exp linguistics/
 9. (cognit* or intelligence or IQ or neuro?psych* or neuro?cognit* or verbal or linguistic\$ or voice or hear\$ or speech or language or communicat\$ or semantic* or discourse* or (sentence adj1 repetition*) or speak* or phonem* or convers* or reasoning or (abstract adj1 th*) or expression or (problem adj1 solv*) or (verbal adj1 working adj1 memory) or narrative* or comprehen\$ or vocal or verbal or articulat* or auditor* or cleft or palate or dysarthri* or malocclusion or oral or read* or writ* or spell* or litera\$ or illiter* or academic or (rapid adj1 naming) or (rapid adj1 auto*) or gramma\$ or synta\$ or (word adj1 association*) or laryn\$ or stutter\$ or clutter\$ or stammer\$ or fluen* or (motor adj1 speech) or vocabulary or dyslexi\$ or dysgraphi\$ or (specific adj1 learning) or phonolog\$ or listen* or alexithymi* or naming or orthograph* or MGR or (mental adj1 graphemic) or (learning adj1 disorder*) or (learning adj1 impair*)).ti,ab.
 10. 8 or 9
 11. 6 and 7 and 10
 12. 11 not (rodent* or animal*).ab,ti.
-

Appendix 3: Study and participant characteristics for included studies that reported on the same participant groups in Table 1 (Chapter 4).

Author & Country	Design	Groups	n	Age		Male (%)	Ethnicity/Race (%)	Social strata	QA (%)
				Range	Mean				
Coles et al. (2010), US ¹	Cohort	PAE+dysmorphic	47	20 - 24	22.7 (2.1)	49	African American: 98	Low ⁴	87.5
		PAE-dysmorphic	74		22.5 (1.8)	34	African American: 99	Low	Strong
		No/low-PAE	59		22.8 (1.8)	39	African American: 100	Low	
Panczakiewicz et al (2016), US ^{2,3}	Cohort	PAE (Female)	57	10 - 16	13.1 (1.8)	0	White: 44; Hispanic: 19	Medium ⁵	71
		PAE (Male)	66		13.2 (2.2)	100	White: 61; Hispanic: 14	Medium	Good
		No/low-PAE (Female)	66		13.6 (2.0)	0	White: 55; Hispanic: 26	Medium	
		No/low-PAE (Male)	70		13.8 (2.1)	100	White: 54; Hispanic: 17	Medium	

Note: ¹Same participants as those reported by Howell et al. (2006); ² Same participants as those reported by Doyle et al. (2018); ³ Adolescent group only; ⁴Based on geographic location; ⁵ Based on Hollingshead Four Factor Index of SES; QA: quality assessment score.

Appendix 4: Quality assessment of seven included studies.

Item	Unique participants			Same participants		Same participants	
	Furtado & de Sa Roriz (2016)	Lewis et al. (2015)	McLachlan et al. (2014)	Howell et al. (2006)	Coles et al. (2010)	Doyle et al. (2018)	Panczakiewicz et al. (2016)
Question/objective	1	2	2	1	1	1	1
Study design	2	2	2	2	2	2	2
Participant selection	1	1	1	1	2	1	1
Participant characteristics	1	1	1	1	1	1	1
Blinding of investigators	0	2	0	2	2	0	2
Outcome/Exposure	1	1	1	1	1	1	1
Sample size	1	1	2	2	2	2	2
Analytic methods	2	2	2	2	2	2	2
Estimate of variance	2	2	2	2	2	2	2
Controlled for confounding	2	2	2	1	2	1	1
Results	2	2	2	1	2	2	1
Conclusions	2	2	2	2	2	2	1
Total score	17 (71%)	20 (83%)	19 (79%)	18 (75%)	21 (87.5%)	17 (71%)	17 (71%)

Note: Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (Kmet, Lee, & Cook, 2004).

Appendix 5: Orofacial and oromotor checklist and record form

Record sheet		
Name:	Age:	Date:
Item	√	Comments/other observations
Face & Lips (facial nerve, CN VII)		
Facial symmetry at rest		
Independently raise eyebrows/open & close eyes		
Lip symmetry at rest		
Lip symmetry on retraction and protrusion		
Lip coordination (alternating ooo-eee):		
Jaw/Masseter (trigeminal nerve, CN V)		
Symmetrical / Occlusion		
Symmetrical when open		
ROM (vertical / lateral / rotatory)		
Strength (open & close)		
Sensation of face		
Tongue (hypoglossal nerve, CN XII)		
Symmetrical at rest		
Symmetrical on protrusion		
ROM (vertical, lateral, buccal sulcus)		
Strength (left and right)		
Coordination (alternating kalakala...)		
Oral cavity & palate (vagus nerve, CN X)		
Hard and soft palate intact (visual only)		
Symmetrical uvula		
Speech anomalies		
E.g., articulation errors, stuttering		
Voice anomalies		
E.g., monotone, breathy		

Other notes:

Maximum repetition rate with diadochokinesia

	Time from	Time to	Total time	Syllables per second	Comments
/pa/					
/ta/					
/ka/					
/pataka/					

Orofacial/oromotor checklist instructions

Materials: Pen torch, gloves, tongue depressor

1. Explain that you will look at the students' face and inside their mouth.
2. Always seek permission to touch their face for items requiring this.
3. Model each task to the student

Item	Instruction
Face & Lips (facial nerve, CN VII)	
Facial symmetry at rest	Make an observation
Raise eyebrows/open & close eyes	Ask student to do this independently
Lip symmetry at rest	Make an observation
Lip symmetry on retraction & protrusion	Ask student to make the /ee/ sound while smiling as wide as they can, and the /oo/ sound, and then do these repeatedly. Observe coordination.
Lip coordination (ooo-eee):	
Jaw/Masseter (trigeminal nerve, CN V)	
Symmetrical / Occlusion	Make an observation/confer with doctor for malocclusion
Symmetrical when open	Ask student to open their mouth

ROM (vertical / lateral / rotatory)	Observe range for each movement
Strength (open & close)	Place fingers under student's chin. Ask them to open their jaw (against slight pressure). Hold their chin with a finger and thumb. Ask them to close their mouth (against slight pressure). Palpate both masseters and ask student to clench and unclench their jaw. Feel for muscle bulk.
Tongue (hypoglossal nerve, CN XIII)	
Symmetrical at rest	Ask the student to open their mouth. Make an observation of their tongue.
Symmetrical on protrusion	Ask student to stick out their tongue
ROM (vertical, lateral, buccal sulcus)	Observe range for each tongue movement
Strength (left and right)	Place fingers on student's cheek. Ask them to use their tongue to push against your fingers. Apply slight pressure to see if they can hold their tongue in place.
Coordination (alternating movement, kalakala...)	Ask the student to say /kalakala/ repeatedly. Observe the coordination of the alternating movement.
Oral cavity & palate (vagus nerve, CN X)	
Hard and soft palate intact (visual only)	Ask student to open their mouth and observe the palate. Do not place fingers inside the student's mouth.
Symmetrical uvula	Record observations

Speech and voice	
Speech anomalies	Record observations
Voice anomalies	Record observations



Contents lists available at ScienceDirect

International Journal of Law and Psychiatry

journal homepage: www.elsevier.com/locate/ijlawpsy



Language diversity, language disorder, and fetal alcohol spectrum disorder among youth sentenced to detention in Western Australia



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ARTICLE INFO

Keywords:

Language
Communication
Youth justice
Young offender
Fetal alcohol spectrum disorder
FASD

ABSTRACT

Background: While studies confirm high prevalence of language disorder among justice-involved young people, little is known about the impact of Fetal Alcohol Spectrum Disorder (FASD) on language among this population. It is also not clear how language skills vary according to language diversity in Australian youth justice settings, where a disproportionate number of justice-involved youth are Aboriginal and may not speak Standard Australian English (SAE) as their first language. Language skills are important to understand, as language disorder and language difference can lead to a mismatch between the communication skills of a young person and the communication skills of the justice workforce with whom they are communicating. In the highly verbal environments that are common to justice systems, language disorder and language difference may result in a young person misunderstanding legal information and expectations placed on them and not being adequately understood by the justice workforce.

Methods: This study examined the language skills of 98 young people sentenced to detention in Western Australia (WA), who participated in a cross-sectional study examining the prevalence of FASD. Language skills assessed using standardised and non-standardised tasks were analysed by the three major language groups identified: speakers of SAE, Aboriginal English and English as an additional language.

Results: We identified rich diversity of languages, and multilingualism was common. Most young people for whom English was not their first language demonstrated difficulties in SAE competence. Further, nearly one in two young people were identified with language disorder – over half of whom had language disorder associated with FASD.

Conclusions: This study has documented language diversity and the prevalence of language disorder associated with FASD among a representative sample of youth sentenced to detention in WA. Results underscore the need for the justice workforce to consider language difference when working with justice-involved youth, as well as language disorder and FASD. The findings also demonstrate the need for speech pathology to be embedded as core service in youth justice systems, working in collaboration with local cultural and language advisors and accredited interpreters. This can better enable appropriate identification of and response to communication and associated rehabilitation needs of young people navigating youth justice systems.

Abbreviations: FASD, Fetal alcohol spectrum disorder; WA, Western Australia; CELF-4, Clinical Evaluation of Language Fundamentals 4th Edition

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<https://doi.org/10.1016/j.ijlp.2018.09.004>

Received 3 July 2018; Received in revised form 19 September 2018; Accepted 19 September 2018

Available online 10 November 2018

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1. Introduction

1.1. Language and youth justice

Language skills are integral to communication; they are key to cultivating relationships, shaping identity, nurturing confidence, engaging with social, educational and vocational endeavours, and advocating for needs (Coles, Gillett, Murray, & Turner, 2017; Martin, 2018). Language is also central to social and cultural determinants of health for Aboriginal people, as language skills enable storytelling and passing on of knowledge and history, which is vital for the sustainability and practice of culture (Commonwealth of Australia, 2012; Department of Health, 2017). While speech refers to the physical production or articulation of sounds, language includes vocabulary, grammar, morphology and pragmatics (the social function of language), and allows people to understand what is said (receptive language), and to express their thoughts, needs and desires (expressive language) (Leitão, 2015). Language skills also enable internal dialogue, 'self-talk', which supports metalinguistic skills such as reflective and critical thinking (Salmon, O'Kearney, Reese, & Fortune, 2016). In contrast, language disorder, which refers to significant, persistent and quantifiable comprehension and/or expression difficulties, that are not attributed to speaking a different language, can increase risk of cultural isolation, social, emotional and behavioural problems, academic difficulties and premature school disengagement (American Psychiatric Association, 2013; Commonwealth of Australia, 2012; Durkin, Toseeb, Botting, Pickles, & Conti-Ramsden, 2017; Ripley & Yuill, 2005; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). Associations between language disorder and offending behaviour have been identified (Brownlie et al., 2004; Hopkins, Clegg, & Stackhouse, 2017), and offenders with more frequent and severe crimes are more likely to have language disorder than offenders with less frequent and severe crimes (Snow & Powell, 2011).

In youth justice settings, language disorder affects 50 to 60% of young people, independent of cognitive impairment (Anderson, Hawes, & Snow, 2016). Compared to the general youth population, this prevalence is much higher. For example, in Australia, it is estimated that 13% of five- to eighteen-year-old children have language disorder (McLeod & McKinnon, 2007). While externalising problems including behavioural and academic difficulties are often noted among justice-involved youth, language skills – also important for self-regulation, social competence, and the transition to literacy – are often not considered, or responded to (Snow, Powell, & Sanger, 2012). In the justice system, language disorder can leave youth vulnerable in their navigation of complex and highly verbal processes, and facing numerous obstacles for their rehabilitation (Snow et al., 2012). When encountering police and participating in forensic interviews and court proceedings, communication skills are under heavy demand. They include the ability to understand instruction, recall and sequence events, perceive and convey varying points of view, and repair misunderstandings (Snow et al., 2012). However, many justice-involved youth have difficulties with the communication skills needed for these interactions. For example, in England, when compared to non-justice involved youth, justice-involved youth express themselves with, and understand, fewer words (Hopkins et al., 2017), and in Australia, justice-involved youth are more likely than non-justice involved youth to omit key details when telling a story (Snow & Powell, 2008). Inconsistent and non-cohesive accounts may result, which may be perceived as poor compliance (Snow & Powell, 2008). As legal interviews revolve around storytelling, language disorder can undermine successful participation in legal contexts (Snow & Powell, 2008).

1.2. Fetal alcohol spectrum disorder (FASD) and youth justice

Another key driver of the need to understand language abilities among justice-involved youth is the high prevalence of FASD in justice

settings. FASD is a severe neurodevelopmental disorder resulting from teratogenic effects of prenatal alcohol exposure (Bower et al., 2017). Diagnosis of FASD involves a comprehensive interdisciplinary team approach and, in Australia, requires evidence of significant impairment in at least three of ten neurodevelopmental domains: brain structure/neurology, attention, executive functioning, memory, language, motor skills, cognition, affect, adaptive skills/social communication, and academic achievement (Bower & Elliott, 2016). Children living with FASD have increased possibility of encountering adverse environmental circumstances such as maltreatment, violent and disruptive households, and caregivers with mental health difficulties, which can further compromise child development and can necessitate involvement with government child protection services (Coggins, Timler, & Olswang, 2007; Price, Cook, Norgate, & Mukherjee, 2017).

Receptive and expressive language disorder and chronic serous otitis media are among the most common disorders in FASD (Popova et al., 2016). Additionally, craniofacial anomalies, including of the branchial arches that form ear and hearing anatomy, have been identified among children with FASD (Bower & Elliott, 2016; Church, Eldis, Blakley, & Bawle, 1997; Church & Gerkin, 1988). Also prevalent are conduct disorder, difficulties with reasoning and controlling impulsive behaviour, and significant trouble interpreting social and emotional cues. Together, these difficulties can increase the risk of being easily led, problems navigating social relationships and participation in anti-social and offending behaviour (Fast & Conry, 2009; Streissguth et al., 2004). Compared to the global average of 7.7 cases of FASD per 1000 people, FASD prevalence in Canadian justice settings is estimated at 11–23% (Flannigan, Pei, Stewart, & Johnson, 2018), while in Western Australia (WA), 36% of sentenced youth have recently been identified to be living with FASD (Bower et al., 2018).

As superficial chattiness is commonly observed among those living with FASD, it can be easy to overestimate their language capacities (Douglas, 2015; Hand, Pickering, Kedge, & McCann, 2016). For professionals working in legal contexts, there are important consequences for not being aware of and identifying potential language and communication deficits that are common to FASD. Language disorder and impairment in other neurocognitive domains can increase the risk of interrogative suggestibility (for example, *Pora v The Queen*, 2015) and impede successful compliance with sentencing orders (Douglas, 2015; Flannigan et al., 2018). Justice professionals have identified that FASD is relevant to their work practices, which are often verbally mediated (for example, police interviews and court proceedings), and much of the justice workforce report that they would modify their language if they knew the client had FASD (Mutch, Jones, Bower, & Watkins, 2016). Given the dearth of studies describing language disorder associated with FASD among youth sentenced to detention, further research is required to support the justice workforce to respond better to the specific needs of youth in their care.

1.3. Language difference and youth justice

An additional consideration for youth justice systems world-wide is the high proportion of justice-involved youth who are from culturally and linguistically diverse backgrounds. For example, Aboriginal youth make up 73% of the Western Australian (WA) youth detention centre population (Department of Corrective Services, 2016), a proportion that is much higher than the 5% of Aboriginal youth in the total WA youth population (Australian Bureau of Statistics, 2016). In addition to cultural differences, it is likely that difficulties encountered by Aboriginal young people in verbal contexts also reflect language differences that exist between Standard Australian English (SAE) and Aboriginal languages including Aboriginal English (AE) (Eades, 2008, 2012).

In Australia, the national education curriculum reflects culture and language consistent with SAE, and a lack of acknowledgement and response to language difference has been identified as a contributor to education inequity for Aboriginal children (Freeman & Staley, 2017;

Webb & Williams, 2018). Similarly, inequity of access to legal and justice services has been found to result from the failure of police, lawyers and courts to effectively understand or address language difference (Eades, 2008, 2012). This was highlighted in a recent case in the WA Court of Appeal, where an accredited interpreter was not present during police questioning and legal proceedings of an Aboriginal man who did not speak English as his first language (*Gibson v The State of Western Australia*, 2017). The Court heard that language difference between Gibson and the interviewing police, in addition to procedural errors and previously unidentified cognitive impairment would have likely resulted in Gibson having inadequate understanding of legal terminology and processes in which he was participating. After spending five years in prison, Gibson's conviction was overturned. Such cases, and the systemic failings relating to Aboriginal people and their over-representation in justice settings, indicate that current services need to be better equipped to provide equitable justice services to Aboriginal people (Commonwealth of Australia, 2017; Crawford, 2010).

1.4. The present study

We report here the language outcomes from a study examining the prevalence of FASD among youth sentenced to detention in WA (Bower et al., 2018). We undertook this study to estimate (i) the prevalence of languages spoken by youth in detention in WA, and (ii) the prevalence of language disorder among these youth, taking into account the high proportion of Aboriginal young people and the diversity of languages in this population. In addition, we aimed to explore the association between language disorder and involvement with government child protection services, nonverbal cognitive impairment, and FASD. Given that language is one of the neurodevelopmental domains commonly impaired in FASD, we hypothesised that there would be a language ability difference between young people who met the criteria for FASD diagnosis and those who did not. Results from the nine domains assessed as part of the FASD prevalence study (excluding the affect regulation domain, which was not assessed) are reported by Bower et al. (2018).

Examining the language skills of justice-involved youth in WA represents an opportunity to understand language strengths and difficulties among this group where cultural and linguistic diversity is common, and where a high prevalence of FASD is documented (Bower et al., 2018). Identifying and integrating this information is a crucial first step in enabling the youth justice system to accommodate young peoples' language needs, and ultimately influence how youth can communicate with, and therefore participate in and benefit from their services.

2. Methods

2.1. Participants and setting

The participants in this study were part of a FASD prevalence study, which was undertaken among sentenced youth, at WA's Banksia Hill Detention Centre (Banksia Hill) during 2015 to 2016 (Bower et al., 2018; Passmore et al., 2016). Banksia Hill is the only youth detention centre in WA for 10 to 17-year-olds who are remanded or sentenced. During this study, the average daily population at Banksia Hill was 133 (94% male, 73% Aboriginal) (Department of Corrective Services, 2016). Participation was voluntary and only those who had been sentenced to detention could enrol. Of those approached by a research officer, 154 young people (93%) provided written assent and, of these, 113 caregivers provided written consent (Bower et al., 2018). Of the 99 participants who completed the FASD assessment, we report language results of 98 participants who completed at least one of the measures reported here. These participants, who included six females, 91 males, and one young person who identified as transgender, ranged in age from 13.7 to 17.9 years (mean (M) = 16.2, standard deviation

(SD) = 1.2). During caregiver interviews, the research officer asked about and recorded information on the participants' prenatal and developmental histories on a standard form developed for the study (Bower et al., 2018). Table 2 provides participant ethnicity, previous language disorder diagnoses, previous contact with a speech pathologist, history of ear and hearing problems, and diagnostic outcomes.

2.2. Procedure

Following participant assent and caregiver consent, the research officer completed a standard interview with the participants. This included asking the participants to identify their first and any other languages. For participants who identified as speaking English as an addition language (EAL) to an Aboriginal language, their first and other languages were confirmed by their caregivers.

2.3. Assessment and measures

The assessment battery included measures for speakers of SAE, AE, and EAL. The lead speech pathologist (NRK) administered all language assessments. Tasks were randomised to reduce possible order effects. The number of participants who completed each of the assessment subtests is provided in Tables 3 and 4. In this study, after accounting for competency in any other languages, we use the terms 'language disorder' when there is no known associated biomedical condition (American Psychiatric Association, 2013), and 'language disorder associated with 'X'' when there is a known associated biomedical condition (Bishop, Snowling, Thompson, & Greenhalgh, 2017), for example, language disorder associated with FASD.

2.3.1. Language

The Clinical Evaluation of Language Fundamentals, 4th edition, Australian (CELF-4) (Semel, Wiig, & Secord, 2006) was used to assess the language skills of the speakers of SAE and AE, and has previously been used to examine the language skills of justice-involved youth (Anderson et al., 2016). The CELF-4 subtests assess receptive and expressive vocabulary and grammar, phonological and working memory, and discourse comprehension. The test was normed on a sample of youth aged 13- to 21-years from "all Australian states and territories, and from both urban and rural regions" (p.13) and who identified 'English' as their most frequently used language (Semel et al., 2006). The CELF-4 Core and Index scores used for this study all have reliability coefficients ≥ 0.90 (Semel et al., 2006). For the purpose of this research, the CELF-4 severity ranges were collapsed from five (above average/ average/ mild/ moderate/ severe) to three as follows: a standard score of ≥ 86 , was the criterion for 'average and above', 71–85 for 'mild to moderate difficulties', and ≤ 70 , for 'language disorder' – deemed present if one or more Core or Index score was ≤ 70 (≥ 2 SD below the mean).

A second speech pathologist (SL) reviewed a random sample of 20% of the response forms. Inter-rater agreement was 98% and 99% for the expressive subtests: Recalling Sentences and Formulated Sentences, respectively.

For the speakers of SAE, standardised scoring was applied. As there are no known standardised norm-referenced language or verbal cognitive assessments specifically for Aboriginal adolescents, both standardised and adapted assessment scoring were employed for speakers of AE. First, standardised scoring was undertaken according to the test guidelines.

Second, an adapted scoring method was employed for the expressive language subtests, similar to the approach undertaken by Pearce and Williams (2013), also drawing on the work of Butcher (2008), Department of Education (2012), Hudson (1983), and Malcolm (2013). This involved re-scoring the expressive subtests: Recalling Sentences and Formulated Sentences, to account for aspects of language difference including grammar, morphology and semantics. Following data collection, the speech pathologist worked with an accredited interpreter to

Table 1
Examples of adapted scoring of two CELF-4 subtests to account for aspects of Aboriginal English.

Subtest	Item	Participant response	Standardised scoring	Adapted scoring
Recalling Sentences	14.	"The coach could not find the uniforms that the team wore last year"	2 (from 3 possible points)	3/3. Plural marking is not required
	19.	"The girl stopped to buy some milk, even though she was late for school"	2 (from 3 possible points)	3/3. Quantity marking is not required
Formulated Sentences	16.	"_Roads are closed because there was a crash"	1 (out of 2 possible points)	2/2. Determiners are not required
	21.	"_Until the bicycle shop opens, you can buy a new bike"	0 (out of 2 possible points)	2/2. 'Until' has the meaning of 'when/if'

Note. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Adapted scoring drew on the work of Butcher (2008), Department of Education (2012), Hudson (1983), and Malcolm (2013), and the language expertise of the accredited interpreter.

review the interpretation and scoring of the Aboriginal participants whose assessments were scored with both SAE and AE. Table 1 provides examples of adapted scoring of two items from each of the two CELF-4 subtests scored using both the standardised and adapted approaches.

For the speakers of EAL, the primary language measures employed were self- and caregiver-reported concerns with language and communication and a non-standardised non-word repetition (NWR) task, a measure of phonological short-term memory. While caregiver-reported concerns together with NWR have good utility in discriminating between multilingual speakers who have language disorder and multilingual speakers who do not have language disorder (Boerma & Blom, 2017; Li'el, 2017; Paradis, Schneider, & Duncan, 2013), we have also included self-report in this study for the speakers of EAL, as it was not always possible to obtain information from caregivers. Caregiver-reports were obtained by the research officer and recorded on a standard form. Questions elicited information about each participant's early language development, communication skills as compared to other children of the same age, and abilities to understand others and express themselves. Caregiver-reported concerns were deemed to signify language difficulties if caregivers reported for example: that the young person had delayed first language development; that communication skills were below that of the same-age peers; or that the young person had difficulties understanding others or expressing themselves verbally. Self-reported concerns were recorded on an interviewer-administered questionnaire, which was designed to elicit information about receptive and expressive language, based on a questionnaire used with justice-involved youth (Burrows & Yiga, 2012). This was administered by the lead speech pathologist. Self-reported concerns were deemed to signify language difficulties if participants reported that in both their first and other languages, for example: that they understand half or less of what others say, or forget what is said; that they need more time to understand what has been said; that they have difficulties saying what they want to say and being understood; or that they feel that their communication skills are below that of their same age peers.

The NWR task contained 16 non-words (one to five syllables in length), and was designed with a speech pathologist experienced in working with Aboriginal children, based on existing NWR tasks (Dollaghan & Campbell, 1998; Salter, 2013). Participants were presented with the non-words verbally, one at a time, and asked to repeat them. If the attempt was incorrect, the non-word was repeated up to three times. Difficulties were deemed as signifying phonological short term memory difficulties if participants required three or more different words to be repeated.

'Language disorder' was deemed present if language and communication concerns were identified by caregivers and/or participants and difficulties were present on the NWR task. If only one of these criteria was met, language difficulties were deemed present, but a classification of language disorder was not made. Participants who had no reported concerns and no difficulties with NWR were deemed to have 'average and above' language skills.

The CELF-4 Screening Test (Semel, Wiig, & Secord, 2004) was also used with speakers of EAL to provide non-diagnostic, qualitative information about SAE language ability. This informed recommendations made for those working with the young people. Criterion scores are also available for this test for 9- to 21-year olds.

2.3.2. Nonverbal cognition

Nonverbal cognition was measured as part of the neuropsychological assessment (Passmore et al., 2016) using the Perceptual Reasoning Index (PRI) from the Wechsler Abbreviated Scale of Intelligence, Second Edition (Wechsler, 2011), or the Full Scale Intelligence Quotient (FSIQ) from the Wechsler Nonverbal Scale of Ability (Wechsler & Naglieri, 2006), both with reliability coefficients ≥ 0.90 . Impairment was based on a standard score of ≤ 70 on either measure.

2.3.3. Prenatal alcohol exposure (PAE) and FASD

During caregiver interviews, the research officer assessed PAE for the study participants using the Alcohol Use Disorders Identification Test–Consumption (Audit-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) where possible, and drew on other sources (including relatives who had first-hand knowledge of the birth mother's pregnancy, or legal and health records) if information directly from the birth mother was not available. Using the Australian Guide to the Diagnosis of FASD (Bower & Elliott, 2016), the paediatrician (RCM), together with the interdisciplinary team, reviewed all the information gathered through the assessment process, including level of reported PAE, and determined whether a FASD diagnosis was warranted. The PAE and diagnostic outcomes of all nine assessed domains are reported by Bower et al. (2018).

2.4. Statistical analysis

IBM SPSS Statistics Version 25 was used to analyse the data. The Chi-square test of independence was used to assess associations between categorical data and, where normality assumptions were met, *t*-tests were used to examine differences within and between groups for scaled and standard scores, with an alpha of 0.05. Effect sizes are reported.

2.5. Ethics

This study was approved by the WA Aboriginal Health Ethics Committee (approval number 582), the University of WA Human Research Ethics Committee (HREC) (approval number RA/4/1/7116), and Curtin University HREC (approval number HRE2018-0117).

3. Results

3.1. Language groups of young people in detention

Eight first-languages were identified. The most common were AE and SAE (Table 2), followed by Aboriginal languages additional to English (EAL) from regional and remote regions of WA. Speakers of SAE ranged in age from 14.3 to 17.9 years ($M = 16.9$, $SD = 1.0$), speakers of AE from 13.7 to 17.9 years ($M = 16.0$, $SD = 1.1$), and speakers of EAL from 13.7 to 17.8 years ($M = 15.5$, $SD = 1.2$). Second and third languages included AE (18 participants), and languages from regional and remote WA (10 participants). Eight non-Australian languages from African, Asian and Polynesian regions were reported as second and third languages. Overall, 19 different languages were identified and 31 participants (32%) identified as multilingual.

Table 2
Participant characteristics and diagnostic outcomes by language group (n = 98).

	SAE		AE		EAL	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Ethnicity						
Australian non-Aboriginal	15 (54)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Australian Aboriginal	3 (11)	52 (100)	18 (100)	18 (100)	18 (100)	18 (100)
Other*	10 (36)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
History of language disorder	0 (0)	3 (6)	0 (0)	0 (0)	0 (0)	0 (0)
Previous speech pathology contact	1 (4)	2 (4)	0 (0)	0 (0)	0 (0)	0 (0)
Ear and hearing problems**	2 (7)	10 (19)	3 (17)	3 (17)	3 (17)	3 (17)
FASD diagnosis	2 (7)	24 (46)	10 (55)	10 (55)	10 (55)	10 (55)
Nonverbal cognitive impairment	3 (11)	11 (21)	4 (22)	4 (22)	4 (22)	4 (22)
Language outcome						
Language disorder	6 (21)	35* (67)	4 (22)	4 (22)	4 (22)	4 (22)
Mild to moderate difficulties	10 (36)	12 (23)	3 (17)	3 (17)	3 (17)	3 (17)
Average and above	12 (43)	5 (10)	11 (61)	11 (61)	11 (61)	11 (61)

Note. *Participants of Asian, African, and New Zealand ethnicity. SAE: Standard Australian English; AE: Aboriginal English; EAL: English as an additional language; **Recurrent ear infections (3 or more) and/or grommets, n = 15 (additional eardrum surgery, n = 2; ongoing hearing difficulties, n = 3); † Language disorder was deemed present for one participant who completed the EAL test battery in addition to a score well below floor on the CELF-4 Screening Tool, due to administrative error.

3.2. Language disorder

Seventy-four participants demonstrated language skills below the average range expected for their age and 45 met the criteria for language disorder adopted for this study. Three of six females (50%) and 42 of 91 males (46%) had language disorder. Of the 28 participants confirmed as known to child protection government services, 46% were identified with language disorder, compared with 40% of the 52 participants confirmed as not known to child protection government services.

3.3. Speakers of SAE and AE

3.3.1. Standardised and adapted scoring for speakers of AE

Table 3 presents comparisons between the standardised and adapted scoring of the speakers of AE. Compared with standardised scoring, adapted scoring produced higher scores for the two CELF-4 subtests: Recalling Sentences, Formulated Sentences, and hence for the CELF-4 composite scores: Core Language Score, Expressive Language Index and Language Memory Index. Three participants who had met criteria for language disorder based on standardised scoring no longer met the criteria with adapted scoring, and were no longer identified as such.

Table 3
Comparisons of standardised and adapted scoring outcomes of the CELF-4 measures for speakers of Aboriginal English.

CELF-4 measure	Standardised scoring		Adapted scoring		t	p	d
	n	M (SD)	M (SD)				
Recalling sentences	51	5.2 (3.2)	6.3 (3.4)	-9.5	< 0.001	1.3	
Formulated sentences	51	3.7 (3.0)	6.3 (4.0)	-9.3	< 0.001	1.3	
Core language score	50	65.7 (17.9)	72.2 (18.7)	-11.3	< 0.001	1.6	
Expressive language index	50	67.4 (17.2)	75.5 (18.6)	-11.5	< 0.001	1.6	
Language memory index	46	69.7 (16.5)	78.2 (17.7)	-11.3	< 0.001	1.7	

Note. Two-tailed t-tests and Cohen's d; CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Subtests have a mean of 10 and a SD of 3; and the Core and Index scores have a mean of 100 and a SD of 15.

3.3.2. Language skills of speakers of SAE and AE

Table 4 presents comparisons of language scores for the speakers of SAE and AE. The mean language scores of the SAE and AE speakers combined fell below the average range for each CELF-4 subtest, Core, and Index score. Table 5 presents the CELF-4 language outcomes of speakers of SAE and AE by severity range. Less than half of the speakers of SAE and AE performed in the average and above range on each CELF-4 Core and Index score. Seventy-one percent scored below the average range for their age in receptive language, 59% in expressive language and 62% in language memory.

3.4. Language skills of speakers of English as an Additional Language (EAL)

Five of the 18 speakers of EAL had reported concerns with language development and communication skills. Two of these five had both caregiver- and self-reported concerns, one had caregiver-reported concerns only, and two had self-reported concerns only. Six of the 18 speakers of EAL required three or more non-words to be repeated in the NWR task and were deemed to have difficulties with phonological short term memory. For language disorder to be deemed present, speakers of EAL needed to have caregiver-reported concerns and difficulties with phonological short term memory (Boerma & Blom, 2017; Li'el, 2017; Paradis et al., 2013). We also considered self-reported concerns of language and communication skills if information could not be obtained from caregivers. Four of the 18 speakers of EAL had reported concerns (both caregiver- and self-reported concerns, n = 2; caregiver-reported concerns only, n = 1; self-reported concerns only, n = 1) and difficulties with phonological short term memory, and language disorder was therefore deemed present for them.

In addition, fifteen speakers of EAL completed the CELF-4 Screening Test, with scores ranging from six to 23. Based on their age, 23 was the expected criterion score for all 15 participants. Two achieved this score. Eleven (73%) participants scored ≤ 17 (the expected criterion score for a 9-year old English speaker, and floor for any child aged 9 years or older).

3.5. Language, nonverbal cognitive impairment and FASD

The mean language scores of the speakers of SAE and AE were compared by nonverbal cognitive impairment, as presented in Table 6. Performance of those with nonverbal cognitive impairment fell in the range of language disorder, while those without nonverbal cognitive impairment fell in the mild to moderate difficulties and average and above ranges for both SAE and AE speakers. However, there was no statistical association between language disorder and nonverbal cognitive impairment ($\chi^2 = 2.05, p = .15, \phi = 0.15$) for the total participant group (speakers of SAE, AE and EAL).

The mean language scores of the speakers of SAE and AE were compared by FASD diagnosis, as shown in Table 7. Participants with FASD scored lower on the Core and Index scores than those who did not have FASD (medium to large effect size). Of the participants who did not have nonverbal cognitive impairment, those with FASD also had lower Core and Index scores than those who did not have FASD (small to medium effect size).

Of the 45 participants who met the criteria for language disorder used in the current study, 25 (56%) were identified according to our criteria as having FASD, eight (18%) of whom were also identified with nonverbal cognitive impairment. Four of the 25 participants with language disorder associated with FASD only met criteria for impairment on three neurodevelopmental domains (the minimum required to warrant a diagnosis of FASD). Of the 20 (44%) with language disorder who did not meet criteria for FASD, three (7%) were identified with nonverbal cognitive impairment. Among the SAE and AE speakers with language disorder, deficits in multiple language skills (the Core, or more than one Core and Index score) were identified in 16 (76%) of the participants with FASD and 14 (70%) who did not have FASD.

Table 4
Comparisons of CELF-4 language scores for speakers of Standard Australia English (SAE) and Aboriginal English (AE).

CELF-4 measure	Total		SAE		AE		t	p	d
	n	M (SD)	n	M (SD)	n	M (SD)			
Recalling sentences	79	6.7 (3.3)	28	7.3 (2.9)	51	6.3 (3.4)	1.28	0.202	0.31
Formulated sentences	79	6.7 (3.6)	28	7.4 (2.8)	51	6.3 (4.0)	1.37	0.176	0.30
Word classes–receptive	78	5.3 (3.1)	28	7.5 (2.8)	50	4.0 (2.4)	5.75	< 0.001	1.32
Word classes–expressive	78	6.6 (3.7)	28	9.6 (3.2)	50	5.0 (2.9)	6.52	< 0.001	1.52
Word classes–total	78	5.8 (3.4)	28	8.5 (3.2)	50	4.3 (2.6)	6.21	< 0.001	1.43
Word definitions	78	6.6 (3.7)	28	9.3 (3.4)	50	5.2 (2.9)	5.72	< 0.001	1.32
Understanding spoken paragraphs	74	6.0 (3.1)	28	7.2 (3.0)	46	5.3 (3.0)	2.73	0.008	0.66
Semantic relations	73	6.8 (3.2)	27	8.4 (2.9)	46	5.8 (3.0)	3.62	0.001	0.88
Core language score	78	78.2 (19.2)	28	88.8 (15.5)	50	72.2 (18.7)	3.98	< 0.001	0.96
Receptive language index	73	77.2 (15.5)	27	87.0 (13.3)	46	71.5 (13.8)	4.69	< 0.001	1.14
Expressive language index	78	80.2 (18.3)	28	88.7 (14.6)	50	75.5 (18.6)	3.25	0.002	0.79
Language memory index	73	80.8 (16.4)	27	85.3 (13.1)	46	78.2 (17.7)	1.82	0.072	0.46

Note. Two-tailed t-tests and Cohen's d. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Standardised scores are reported, except for the subtests and Core and Index scores that were re-scored with adapted scoring. Subtests have a mean of 10 and a SD of 3; and the Core and Index scores have a mean of 100 and a SD of 15.

3.6. Language disorder, FASD, and history of ear or hearing concerns

Of the 25 participants who met our study criteria for language disorder associated with FASD, seven (28%) had a history of recurrent ear infections or grommets, two of whom also had additional eardrum surgery.

4. Discussion

We investigated the language skills of 13- to 17-year old young people sentenced to detention in WA, where 73% of youth in detention identify as Aboriginal, and where high prevalence of FASD has been documented. As anticipated, broad diversity in languages was identified among the participants. Less than one third were first-language speakers of SAE and nearly one fifth did not speak an English language as their first language. Language diversity in youth justice differs across Australian states and territories. For example, 94% of justice-involved youth in the Northern Territory speak up to three languages other than English (Commonwealth of Australia, 2017), while in NSW, 0.4% of justice-involved youth are speakers of EAL (New South Wales Government, 2017). The rich heterogeneity of language repertoires among youth in detention should be recognised as significant strengths of the young people. They bring with them notable language backgrounds and are developing as multilingual learners and communicators (Freeman & Staley, 2017). Their language abilities nurture pride, self-esteem and respect (Commonwealth of Australia, 2012). For Aboriginal people, sustaining culture and perpetuating history through ‘stories shared’ are integrally reliant on the ‘spoken word’, and being a story holder and a story teller is venerated in Aboriginal cultures (Commonwealth of Australia, 2012). The interconnectedness of

Table 6
Comparison of CELF-4 language scores for speakers of Standard Australian English (SAE) and Aboriginal English (AE), by nonverbal cognitive impairment.

CELF-4 Measure	With nonverbal cognitive impairment		Without nonverbal cognitive impairment		t	p	d
	n	M (SD)	n	M (SD)			
Core language score							
SAE	3	68.3 (11.4)	25	91.2 (14.1)	*		
AE	11	62.3 (19.8)	39	75.0 (17.6)	2.06	0.044	0.69
Receptive language index							
SAE	3	69.0 (9.2)	24	89.2 (12.1)	*		
AE	8	63.2 (18.1)	38	73.2 (12.4)	1.90	0.064	0.64
Expressive language index							
SAE	3	70.0 (10.4)	25	91.0 (13.5)	*		
AE	11	65.9 (19.6)	39	78.2 (17.6)	1.99	0.052	0.66
Language memory index							
SAE	3	69.7 (5.7)	24	87.3 (12.5)	*		
AE	8	67.1 (22.1)	38	80.5 (16.0)	2.00	0.051	0.69

Note. Two tailed t-tests and Cohen's d; *Insufficient numbers to support comparisons for SAE speakers. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition. Standardised scores are reported except for the measures that were re-scored with adapted scoring. Core and Index scores have a mean of 100 and a SD of 15.

language and health outcomes needs to be acknowledged and considered in the way services are provided to Aboriginal young people (Department of Health, 2017).

Considering competency in SAE is also a critical step in enabling youth justice systems to better respond to young peoples'

Table 5
CELF-4 language outcomes of speakers of Standard Australian English (SAE) and Aboriginal English (AE) by severity range.

CELF-4 measure	Total	Average and above		Mild to moderate difficulties		Language disorder	
		SAE	AE	SAE	AE	SAE	AE
		n	n	n	n	n	n
Core language score	78	16	13	9	11	3	26
Receptive language index	73	14	7	11	16	2	23
Expressive language index	78	17	15	8	15	3	20
Language memory index	73	13	15	9	17	5	14

Note. CELF-4: Clinical Evaluation of Language Fundamentals, Fourth Edition; Outcomes are based on standardised scores except for the measures that were re-scored with adapted scoring.

Table 7

Comparison of CELF-4 mean language scores by FASD diagnosis and nonverbal cognitive impairment, for speakers of Standard Australian English (SAE) and Aboriginal English (AE).

CELF-4 measure	Inclusive of nonverbal cognitive impairment							Excluding nonverbal cognitive impairment						
	With FASD			Without FASD				With FASD			Without FASD			
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>t</i>	<i>p</i>	<i>d</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>t</i>	<i>p</i>	<i>d</i>
Core language score														
SAE	2	87.0 (19.8)	26	88.9 (15.6)	*			2	87.0 (19.8)	23	91.6 (14.1)	*		
AE	22	64.6 (14.3)	28	78.2 (19.8)	2.70	0.010	0.78	13	68.2 (11.3)	26	78.4 (19.4)	1.74	0.089	0.64
Receptive language index														
SAE	2	82.0 (9.9)	25	87.4 (13.6)	*			2	82.0 (9.9)	22	89.9 (12.2)	*		
AE	19	67.6 (13.5)	27	74.2 (13.6)	1.62	0.112	0.49	13	69.9 (10.8)	25	74.9 (13.0)	1.18	0.247	0.41
Expressive language index														
SAE	2	86.0 (22.6)	26	89.0 (14.5)	*			2	86.0 (22.6)	23	91.4 (13.2)	*		
AE	22	67.5 (13.2)	28	81.7 (20.0)	3.02	0.004	0.84	13	70.5 (10.0)	26	82.0 (19.5)	2.42	0.020	0.74
Language memory index														
SAE	2	86.0 (17.0)	25	85.3 (13.2)	*			2	86.0 (17.0)	22	87.4 (12.5)	*		
AE	19	70.8 (13.2)	27	83.3 (18.8)	2.49	0.017	0.77	13	73.5 (8.9)	25	84.1 (17.8)	2.44	0.020	0.75

Note. Two sample *t*-tests and Cohen's *d*; *Insufficient numbers to support comparisons for SAE speakers. CELF-4: Clinical Evaluation of Language Fundamentals, 4th Edition; Standardised scores are reported except for the measures that were re-scored with adapted scoring. Core and Index scores have a mean of 100 and a SD of 15.

communication needs. Indeed, SAE is the common currency of verbal exchange in justice systems in Australia. We found that most of the speakers of EAL, who had an average age of 15 years, scored at or below the expected range of a 9-year-old across vocabulary, semantics, following instructions and recalling verbal information in SAE. The distinct gap identified between chronological age and age of SAE performance raises concern that SAE language expectations may be placed on young people who do not have the capacity to meet them. For example, Lount, Hand, Purdy, and France (2017) identified that young people in the New Zealand youth justice system experienced difficulties understanding legal proceedings and felt a lack of control, even where their primary language was the same as that used in the court room. In WA, legislation requires language ability to be considered in the justice system. The *Young Offenders Act 1994* (Government of Western Australia, 2018a) mandates that communication with young people employs simple language that they are likely to understand, for example, when: serving notices and issuing fines (Sections 43, 59); explaining court proceedings and orders (Sections 44, 52, 137); and making the rules of a detention centre known (Section 181). Although interpreter services exist, they are not always used (for example, Gibson vs The State of Western Australia, 2017). Further, Eades (2008) explains that interpreters are often not used for speakers of AE, and unnoticed language differences, including conceptualisation and thinking, can increase risk for suggestibility. Our findings of diversity in first languages and low levels of SAE competence among speakers of EAL indicate that language supports in youth justice need to be prioritised and evaluated for their effectiveness.

When examining language disorder, it is important to note that 'language disorder' itself may be over- or under-identified due to language difference, and 'language difference' needs to be acknowledged and accounted for when undertaking communication and verbal cognitive assessments (Gould, 2008). According to the criteria in this study, 75% of young people did not demonstrate language skills consistent with their age and nearly one in two met criteria for language disorder. While many of the Aboriginal participants in the current study referred to "English" as their first language, the researchers understood the language used to be reflective of both AE and SAE, and adapted scoring and interpretation of participants' performance was undertaken in addition to standardised scoring where possible. Berry and Hudson (1997) discuss the lack of differentiation between AE and SAE, and the potential for supports to focus on developing young peoples' awareness of the differences in their languages and matching their language use to the context. The development of these higher-order language

(metalinguistic) skills can be supported by teachers and other service providers who are working with Aboriginal students (Webb & Williams, 2018). Failure to respond to language differences may potentially lead to a mismatch in expectations related to English language use between Aboriginal young people and their non-Aboriginal peers and service providers.

Considering the complexity of language difference, our study was able to determine a prevalence of language disorder similar to the 52% and 46% identified among justice-involved youth in other states in Australia (Snow & Powell, 2008, 2011), and the 44% identified among justice-involved youth in England (Hopkins et al., 2017). Our findings are also similar to youth justice samples that included both Aboriginal and non-Aboriginal participants (New South Wales Government, 2017; Snow, Woodward, Mathis, & Powell, 2016). These comparative studies in Australia and in England applied similar language disorder criteria. When compared with typically developing youth who may offend, youth with language disorder may be less able to self-advocate and provide coherent explanations to police and lawyers about alleged events or criminal behaviour (Snow & Powell, 2011). Additional neurocognitive deficits, such as impairments of executive function and memory can further increase risk for suggestibility and manipulation by those around them (Douglas, 2015). In the current study, eleven (24%) of the 45 participants with language disorder also met criteria for impairment in nonverbal cognition, eight of whom also met criteria for FASD. These participants would likely experience significant challenges as they navigate youth justice and detention centre settings, and may fail to meet the social, academic and occupational expectations associated with their transition out of detention. Upon further testing, they may be considered to have an intellectual disability and therefore receive supports, for example, through disability services. Similar service provision may not be considered for those with language disorder who do not have nonverbal cognitive impairment. Further, this group of young people may appear more competent than they are due to their higher intellectual functioning, and this may result in their communication difficulties being misinterpreted as non-compliance or rudeness (Snow et al., 2012; Snow & Powell, 2008). Improved service capacity is needed to better identify and respond to language disorder among justice-involved youth.

The only known Australian study to consider language skills in the context of FASD and youth justice included a self-report measure for FASD, and no participants reported they had a FASD diagnosis (Snow & Woodward, 2016). Our study, which reports the language results from a FASD assessment, identified that overall, young people with FASD had

lower language scores when compared to young people without FASD, even among those who did not have nonverbal cognitive impairment. Further, among the 25 young people identified with language disorder associated with FASD according to our study's criteria, a similar degree of impairment in both receptive and expressive language was apparent. These young people will struggle to express themselves in a manner that reflects their chronological age and to adequately understand what is said to them by others. This is consistent with the profile of non-justice-involved youth with FASD (Proven, Ens, & Beaudin, 2014), and with the profile of justice-involved youth with FASD, of whom most were sentenced to a community order (Conry & Lane, 2009). Regardless of FASD diagnosis however, most of the young people in our study who were identified with language disorder were vulnerable across multiple language skills. Our findings likely reflect that language development is sensitive to developmental and environmental circumstances, and young people who become involved in youth justice are at increased risk of these and of having language disorder (Anderson et al., 2016; Commonwealth of Australia, 2017; Kinner et al., 2014). Further research exploring prenatal alcohol exposure, adverse environmental risks and language disorder is needed (Price et al., 2017), and is important in better understanding the effects of historical and socio-cultural factors that may have led to drinking in pregnancy, such as the effects of colonisation and the separation of children from families experienced by first nations peoples (Commonwealth of Australia, 1997; Rogers, McLachlan, & Roesch, 2013).

The confluence of risk circumstances experienced by justice-involved youth denotes a need for targeted therapeutic interventions. Therapy and services for these young people need to be informed by their language abilities and culture (Gregory & Bryan, 2011; Rogers et al., 2013; Snow & Powell, 2011), and targeting areas of need, rather than a diagnosis, such as FASD, is recommended (Adnams et al., 2007; Helgesson et al., 2018). In addition to the *Young Offenders Act* mentioned above, the WA Youth Custodial Rules (YCR) (Department of Justice, 2016) require, for example, that programs be “developmentally, culturally and linguistically appropriate” (YCR 221, p.2); that health services provide “a clear explanation of any proposed treatment, including risks and alternatives” (YCR 710, p.1); and that interpreters are accessible (YCR 302, 710). Adherence to these YCR is particularly important for justice-involved youth with language disorder. They have been identified to report more frequent self-harm and use of illicit substances, compared with justice-involved youth without language disorder (Hughes et al., 2017), suggesting the need for provision of a personalised and prescriptive approach to health, educational, psychological, and criminogenic programs. Prior to this study, the language diversity and language needs of youth in detention in WA were not understood. Therefore, youth justice programs have potentially been at risk of not meeting the language, health, and rehabilitation needs of young people with previously unidentified language disorder or low English competency.

To date, speech pathology services have been under-recognised and under-utilised in justice settings in Australia and world-wide. Speech pathologists are tertiary trained allied health professionals who specialise in the assessment and treatment of communication (speech and language) and swallowing disorders. Due to the high prevalence of language disorder among justice-involved youth, and communication disorders frequently co-occurring with and contributing to mental health, behaviour, and learning problems, speech pathologists can play a key role in supporting health outcomes, access to support, and equitable justice processes (Caire, 2009; Coles et al., 2017; Martin, 2018).

Snow and Woodward (2016) implemented speech and language intervention in an Australian youth detention centre with six young people (including four Aboriginal and Torres Strait Islander participants). The young peoples' case histories included prenatal opiate exposure, substance misuse, lived trauma, written language difficulties, school exclusion, violent behaviour, and mental health disorders. All six

participants demonstrated gains in language and communication skills, for example, comprehension, interpretation of non-literal language, conflict resolution, verbal expression of thoughts and feelings, and confidence in their talking. In England, benefits of speech pathology services have also been demonstrated among repeat and serious offenders (Gregory & Bryan, 2011). The authors reported that among those reassessed after language and social communication skills therapy, measurable gains were made. Evaluation of both intervention studies revealed that youth justice staff also benefited – they developed increased understanding of communication problems, which informed how they supported and provided services to young people (Bryan & Gregory, 2013; Snow, Bagley, & White, 2017).

There are opportunities in police and court settings for language disorder and FASD to be responded to. Court-appointed communication assistants (also known as intermediaries), who are often speech pathologists with additional training, can provide impartial services to help facilitate communication between legal parties and defendants, witnesses and victims who have language or other neurocognitive and mental health disorders (Plotnikoff & Woolfson, 2015; Stewart, Woodward, & Hepner, 2015; Talking Trouble Aotearoa New Zealand, 2018). In WA, the *Evidence Act 1906* (Section 106F) permits this type of service provision (Government of Western Australia, 2018b). Results from our study highlight the need to implement a communication assistant service or similar in WA's youth justice system. Undertaking this in collaboration with local cultural advisors and existing accredited interpreter services will be important to ensure a culturally and linguistically sensitive model is developed.

Our findings confirm the high prevalence of previously unidentified language disorder among justice-involved youth. Only three young people in this study had previously been identified with language disorder, and notably, all three were identified with FASD (without non-verbal cognitive impairment), one prior to, and two during the FASD prevalence study (Bower et al., 2018). All young people in this study had been to school, and the proportion of participants with language disorder who were confirmed as known to government child protection services reflects that found in previous research (Snow & Powell, 2011). Of those with language disorder associated with FASD, 28% had a history of ear and hearing problems. This highlights the missed opportunities within multiple services to identify and respond to language and neurocognitive vulnerability earlier in a child's life.

Strengths of this study included our consultation with clinicians and researchers across Australia to refine the language assessment of young people in a justice setting and in the context of language diversity. The involvement of accredited interpreters in this study was an invaluable means of facilitating two-way learning with the research team about language development, language difference, and language disorder. With a lack of standardised norm-referenced language assessments available for use with Aboriginal adolescents, local Aboriginal cultural and language advisors and accredited interpreters have a critical role to play in the development and administration of tools that consider and examine communication skills of Aboriginal youth. Voluntary participation may have led to selection bias, however over 70% of those eligible to participate were recruited, which resulted in a representative sample of youth in detention participating (Bower et al., 2018). Limitations of this study include being unable to observe and assess a full range of communication skills in the setting of a youth detention centre and difficulties obtaining caregiver reports. Caregiver-reports for the speakers of EAL were sought in consideration of language ability, however we also considered self-reported information, which was gathered by the lead speech pathologist who was experienced and familiar with working with Aboriginal youth at Banksia Hill prior to this study in a different role. The practical difficulties of language assessment demonstrated in this study reflect the complex reality that clinicians are faced with, as they work with justice-involved populations.

5. Conclusion

We have documented rich language diversity, as well as high levels of communication vulnerability and language disorder among youth sentenced to detention in WA. The number of languages spoken by justice-involved populations and the high prevalence of both language disorder and FASD increases the level of complexity the current youth justice workforce encounter in their professional interactions with, and therapeutic services provided to, young people. Together with previous studies, our findings highlight the importance of speech pathologists in assessing and understanding language needs of justice-involved youth. Our findings indicate that speech pathology is warranted as core service in the WA youth justice system to better identify and respond to the communication needs of young people in their care. Further, collaborative approaches with local cultural and language advisors, including accredited interpreters are required in WA's youth justice system, so that culturally and linguistically appropriate resources and methods can be used to better identify communication strengths and difficulties. Further research is recommended to examine the impact of language diversity, language disorder, and FASD on the effectiveness of health, educational, psychological, and criminogenic rehabilitation programs provided in justice settings.

Acknowledgements

We thank: the participants and their caregivers; Telethon Kids Banksia Hill project and investigator teams, particularly Jacinta Freeman, Carmela Pestell and Roslyn Giglia; Kulunga Aboriginal Research Development Unit; Aboriginal Interpreting Western Australia; Claire Salter, Ian Malcolm, Pamela Snow, and others consulted from around Australia; the Department for Communities and Department of Justice including Banksia Hill staff. Any material published or made publicly available by the authors cannot be considered as either endorsed by the Department of Justice or an expression of the policies or view of the Department. Any errors of omission or commission are the responsibility of the researchers.

Funding

National Health and Medical Research Council, Australia (NHMRC, #1072072); Australian Government Research Training Program Scholarship and FASD Research Australia CRE PhD scholarship (NRK); NHMRC Research Fellowship, Australia (#634341) (CB); REW, CB, AF-J, RCM are investigators on the NHMRC-funded FASD Research Australia CRE (#1110341).

Declarations of interest

None.

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Appendix 7a: Coding protocol for narrative macrostructure elements.

Story grammar	Code	Explanation
Orientation	[OC]	Orientation to the main character (i.e., the man). e.g., C A man [OC] was walking
	[OL]	Orientation to the location (e.g., down the street, to his friend's house). e.g., C A man was walking down the street [OL]
	[OT]	Orientation to time (e.g., morning, afternoon, one day). e.g., C One day [OT] a man was walking
	[OO]	Orientation to the other character (i.e., dog). e.g., C A man was walking his dog [OO]
Initiating Events	[IE1]	The initiating event (i.e., causal event; the cause of the events that follow).
	[IE2]	First element (directionality of the pot plant – falls/drops). Second element (where it falls – reference to the man's head). e.g., The pot falls [IE1] and hits him on the head [IE2] If the narrative refers to one element only, then only use the relevant code. e.g., The pot hit his head [IE2] (no reference to directionality) If there are no initiating events, then the plan, events, direct consequences and resolutions cannot be coded for the purpose of this protocol.
Responses	[RI]	The internal and physical responses to the initiating event.
	[RP]	Internal element (The man's internal response/emotion, e.g., angry, mad) Physical element (The man's observable response, e.g., he yelled; he waved his stick in the air). e.g., The man was angry [RI] and he yelled up at the person [RP] If the narrative refers to one element only, then only use the relevant code. e.g., The man waved his stick in the air [RP]
Plan	[P]	The main character's plan about what he intends to do next/goal directed behaviour. Links the action with reasoning. e.g., He decides to go up the stairs to sort it out [P] e.g., He goes upstairs to confront [P] whoever done it If the intention is not given, but there is an action, do not use [P]. e.g., He walks upstairs (no intent given)

Actions	[A1]	Physical actions taken by the main character to solve the problem.
	[A2]	First element (related to the man going upstairs/into the building). Second element (related to the main banging on the door). e.g., He goes upstairs [A1] and bangs on the door [A2] If the narrative refers to one element only, then only use the relevant code. e.g., He bangs her door [A2]
Direct	[DC1]	The direct consequences related to the actions of the main character.
Consequences	[DC2]	First element (Related to the lady answering the door/engaging with the man in some way). Second element (Related to the lady giving the dog a bone/engaging with the dog in some way). e.g., A lovely lady comes out [DC1] and gives the dog a bone [DC2] If the narrative refers to one element only, then only use the relevant code. e.g., the lady says hello to the man [DC1] e.g., the lady pats the dog [DC2] If the utterance does not reflect awareness that the person who opens the door is the same person who knocked over the plant from the balcony, then do not use these codes. e.g., The man kept on walking home and his wife opened the door
Resolutions	[ResI]	A statement that demonstrates a change in the man's demeanour/feelings.
	[ResP]	Internal element (change in the man's emotions e.g., from sad to happy). Physical element (action of the man to demonstrate his change in feeling). e.g., The man was happy [ResI] and kissed her hand [ResP] If the narrative refers to one element only, then only use the relevant code. e.g., The man liked her [ResI] e.g., The man took off his hat and kissed her hand [ResP]

Note: Coding protocol adapted from Snow and Powell (2005) and Whitworth et al., (2015, 2016) for use in the SALT software program (Miller et al., 2015).

Appendix 7b: Coding protocol for narrative microstructure elements.

C-unit Segmentation

1. Segment the oral and written narratives into c-units (a main clause with all its dependent clauses) according to the SALT Clinician’s Guide (Miller et al., 2016, Chapter 8 and Appendix O).
 2. For utterances that contain ellipted subjects, segment these according to the Curtin University Discourse Protocol (Whitworth, Claessen, & Leitão, 2016, Section 3). If there is an ellipted subject, the utterance is one C-unit.
-

Coding

Linguistic element	Code	Explanation
Standard SALT conventions		See SALT Clinician’s Guide
Source: Miller et al. (2016, Appendix N)		
Introduction and tie references	Appropriate introduction references	
	[indefintro]	Introduction of an indefinite character or concept e.g., C a man [indefintro] was walking e.g., C someone [indefintro] dropped a pot [indefintro]
	[defintro]	Introduction of a definite character or concept where there is supporting context e.g., C He walks to the entrance [defintro] (The apartment has been introduced prior to this utterance, so the entrance has appropriate supporting context) e.g., C he kisses her on the hand [defintro] (The lady has been introduced prior to this utterance, so the hand has appropriate supporting context)
	[possintro]	Possessive introduction of a character or concept e.g., C A man was walking down the street with his dog [possintro] e.g., C He waved his walking_stick [possintro] in the air.

Inappropriate introduction references

[ambigintro] Introduction of a character or concept, such as the use of a definite form not supported by context on first mention.

e.g., C **the man**[ambigintro] is walking (as the first utterance)

e.g., C **the lady**[ambigintro] came out with a bone (where the lady has not been introduced earlier in the story)

[pnintro] Pronominal introduction of a character or concept on first mention.

e.g., C **he**[pnintro] was walking his dog

e.g., C he got angry and yelled at **her**[pnintro] (The lady has not been introduced prior to this utterance)

Appropriate tie references

[ntie] Reference to a character or concept on subsequent referral and using a nominal form

e.g., C As **the man**[ntie] passed a balcony... (the man has already been introduced)

e.g., She gave **his dog**[ntie] a bone (the dog has been introduced previously).

[pntie] Reference to a character or concept on subsequent referral and using a pronominal form.

e.g., C **He**[pntie] screamed (the man has already been introduced)

e.g., C **She**[pntie] gave the dog a bone (the lady has already been introduced)

Inappropriate tie reference

[ambigntie] Reference to a character or concept on subsequent referral and using a nominal form

e.g., C she gave **a dog**[ambigntie] a bone (should be 'the' dog, or 'his' dog, as the dog was introduced earlier).

[ambigpntie] Reference to a character or concept on subsequent referral and using a pronominal form.

e.g., C the lady gave **him**[ambigpntie] a bone (it isn't clear if the bone was given to the man or the dog)

Sentence Type	[Simp]	Simple sentence: Utterance of a single clause
Sources: ACARA (2010c), Miller et al. (2016); codes created for this study.	[Comp]	Compound sentence: At least two independent clauses joined with a connector. Note: Compound sentences will go over two or more C-units due to segmentation rules. C a man was walking to his friend's house. C and[CC:and] a flower_pot dropped on his head [Comp].
	[Complex]	Complex sentence: One or more subordinate clauses. E.g., C he walked upstairs to confront the lady [Complex] (where 'to' reflects the subordinator, 'in order to') Complex sentence can have a non-finite clause e.g., C he banged on the door demanding them to come out [Complex]. Where there is omission of the subordinate 'that' where 'that' can be inferred, it is scored as a complex sentence. If the omitted subordinator is obligatory for cohesion in dialogue, then don't score it as a complex (SALT Clinician's Guide, page 218). Utterances with dialogue/direct speech may reflect complex sentences e.g., he seen this old lady and thought, "I'm not going to go off at her" [Complex].
	[CPCX]	Compound-complex sentence. Two clauses and a subordinate clause. Note: Sentences may go over two or more C-units due to segmentation rules. e.g., C the lady came out with a bone for the dog. C and[CC:and] then he showed his respect by[SC:by] taking his hat off and kissing her hand [CPCX].
	[CC]	Simple connector. e.g., and, and then, then, but, or, yet, so (where so is not used for subordination, e.g. 'so that'). e.g., C the plant fell and [CC] hit him on the head e.g., C he yelled but [CC] nobody answered
Connectors	[CC]	
Sources: Miller et al. (2016, p.210), ACARA (2010c); codes created for this study.		

		For sentences with multiple verb phrases connected with ‘and’, code these with [CC]. If the ‘and’ is at the start of a new sentence and the sentence is not considered a compound or complex (i.e. the ‘and’ is used as a filler), do not consider it as a connector. If the ‘and’ is used to join two nouns e.g. The man and his dog..., do not code the ‘and’ as a connector, as it does not reflect a phrasal connector.
	[SC]	Subordinating connector, e.g., if, because, while, so (that), as, like, to (in order to), when e.g., C he kissed her hand while [SC] the dog ran off happily e.g., C the man kissed the lady on the hand because [SC] he liked her
Subordination Index	[SI-X]	See SALT Clinician’s Guide for explanation of each code.
	[SI-0]	Some examples:
Source: Miller et al. (2016, Appendix P)	[SI-1]	e.g., C and then (yeah) [SI-X].
	[SI-2]	e.g., C an old lady ah shake hands I think [SI-X]
	[SI-3]	e.g., C (and yeah) the end [SI-0].
	etc...	e.g., C starts banging on the door [SI-0] (noun is missing) e.g., C the dog was very happy [SI-1]. e.g., C she opens the door and gives the puppy a bone [SI-1]. e.g., C he knocked on the door to go off at the lady [SI-2]. e.g., C when the old lady answered the door she apologised for what had happened and gave the man’s dog who was also with him a bone [SI-3]. e.g., C when the door opened he saw it was a lady [SI-3]. (‘that’ is inferred, i.e., he saw that it was a lady)
Adverbials	[AT]	Of time e.g., C as he was walking [AT] a pot dropped on his head
Codes created for this study		e.g., C when he got upstairs [AT] he banged on the door

[AP]	Of place at the phrase level (use [PP] for word level prepositions). e.g., C a man was walking up [PP] the road [AP] e.g., C he knocked on [PP] the door [AP] Note: ‘inside’ and ‘upstairs’ are coded as [PP]
[AM]	Of manner (the manner of an action) e.g., C he knocked on the door loudly [AM] e.g., C the dog ran off happily [AM]
[AD]	Of degree (the degree of an action) e.g., C he was so [AD] scared e.g., C she was really [AD] nice
[AR]	Of reason e.g., C he changed his mind because he liked her [AR] e.g., C he banged on the door to go off at the person [AR]
Verbs	Total and type of verbs are automatically calculated as a standard SALT measures Note: A gerund (-ing form when it is a subject, complement or object, is not coded as a verb) e.g., he start/ed yelling (where start is the verb and yelling is a gerund).
Source: Miller, Andriacchi, & Nockerts (2011, p.17); Codes created for this study.	Specific verb types
	[VL] Verb: linguistic e.g., said, shouted, yelled, barked
	[VC] Verb: cognitive e.g., think, believe, like, decided, love
	[VS] Verb: sensory e.g., look, see, saw
Emotion	[Emot] Vocabulary that is specific to a feeling or emotion, e.g., angry, happy, mad, liked
Code created for this study	e.g., C he was angry [Emot] and yelled

<p>Prepositions</p> <p>Source: ACARA (2010c), Miller, Andriacchi, & Nockerts (2011, p.17); code created for this study.</p>	<p>[PP]</p>	<p>Vocabulary which relates to:</p> <ul style="list-style-type: none"> a) time or space (e.g., in, on, down, at, to, inside, upstairs), b) a modifier, c) something belonging to, relating to, connected with, a reason for, a purpose for. <p>A preposition can be used in an adverbial clause structure.</p> <p>e.g., C a man walked down[PP] the street</p> <p>e.g., C a pot fell from[PP] a balcony</p> <p>e.g., C he was walking with[PP] his dog</p>
<p>Adjectives</p> <p>Source: ACARA (2010), Miller et al., (2016), p.222); code created for this study.</p>	<p>[Adj]</p>	<p>Vocabulary that describes, identifies, quantifies a noun or pronoun, e.g., old, little, several, and vocabulary relating to emotions/feelings</p> <p>e.g., C a little[Adj] lady opened the door</p> <p>e.g., C he was angry[Emot][Adj]</p>
<p>Standard SALT written conventions</p>		<p>See SALT Clinician’s Guide page 77 for descriptions and codes for errors for spelling, capitalisation, and full stops.</p>

Note: ACARA: Australian Curriculum, Assessment and Reporting Authority.



The oral and written narrative language skills of adolescent students in youth detention and the impact of language disorder

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ARTICLE INFO

Keywords:
Language disorder
Literacy
Youth justice
Education
Young offender

ABSTRACT

Background: Unmet language and literacy needs are common among young people who are involved with youth justice systems. However, there is limited research regarding the functional text-level language skills of this population with regard to narrative macrostructure (story grammar) and microstructure (semantics and syntax) elements.

Methods: In this study, we examined macrostructure and microstructure elements in the oral and written narrative texts of 24 adolescent students of a youth detention centre. The students, who were aged 14- to 17- years, were all speakers of Standard Australian English, and 11 (46%) students met criteria for language disorder (LD).

Findings: When we compared the narratives according to modality of language, the students demonstrated stronger narrative language skills in the written modality compared to the oral. However, when we compared the narratives according to language ability, we found that the impact of LD on inclusion of macrostructure elements was greater in the oral modality, and for microstructure elements, was greater in the written modality. Errors in written conventions were common among both students with and without LD.

Conclusions: Our results indicate that both the modality of language as well as the presence of LD should be considered when young people are required to participate in forensic contexts including programs that address educational and rehabilitation needs. Our results indicate a need for consistent text-level language assessment to better identify and respond to functional difficulties within language and literacy. There is potential for speech-language pathology services to enhance comprehensive assessment as well as inform educational and rehabilitation programs for young people who are involved with youth justice systems.

1. Introduction

In Australia, school-aged young people, aged 10 years and over, can be charged with a criminal offence (Australian Institute of

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<https://doi.org/10.1016/j.jcomdis.2021.106088>

Received 31 January 2020; Received in revised form 2 December 2020; Accepted 1 February 2021

Available online 13 February 2021

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Health and Welfare (AIHW), 2020). Between 2018 and 2019, 10,820 young Australian people were either under youth justice community or detention supervision at some stage due to involvement in criminal behaviour (AIHW, 2020). Both preceding and following involvement with youth justice systems, these young people commonly experience harm to their health, wellbeing, and development (Borschmann et al., 2020). As discussed by Snow (2019), neurodevelopmental disabilities are common, and compromised communication skills, including language disorder (LD), are widespread. Up to 80% of young Australian people in custodial facilities have below age-appropriate language skills, and approximately one in two have LD (Justice Health & Forensic Mental Health Network, 2017; Kippin et al., 2018; Snow & Powell, 2011; Snow, Woodward, Mathis, & Powell, 2016). Internationally, poor language skills and LD are also common in youth justice populations. For example, LD has been identified in 19% of female young people in detention in the United States (US) (Sanger, Moore-Brown, Magnuson, & Svoboda, 2001) and up to 67% of both female and male young people involved with youth justice services in the United Kingdom (UK) (Bryan, Freer, & Furlong, 2007; Winstanley, Webb, & Conti-Ramsden, 2019).

Research that has examined the language skills of young people involved with youth justice has typically employed standardised measures at word and sentence levels (Anderson, Hawes, & Snow, 2016; Noel & Westby, 2014). However, a young person's ability to effectively learn at school and interact with others depends on both oral and written language skills at the text-level, that is, extended language units that comprise several sentences. In Australia, there is an expectation that secondary students can comprehend and produce a range of oral and written academic texts, within the genres of narrative and expository texts (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2010a; 2010b). Chatting with friends about the weekend, for example, demands simple and informal language, while producing an engaging and detailed story in a school exam or a compelling argument in a school debate demands complex, formal and structured language. Indeed, the ability to use and modify language according to the purpose and demands of a range of situations is characteristic of a literate student (ACARA, 2010b). Such skills underpin success in educational, occupational and social endeavours beyond the school years and into adulthood.

Students with language problems who have become involved with youth justice have reported feelings of frustration when they are unable to comprehend the language used in learning environments such as the classroom (Sanger, Creswell, Dworak, & Schultz, 2000). They have also reported low self-confidence in relation to their academic abilities (Hopkins, Clegg, & Stackhouse, 2016). An earlier meta-analysis of the relationship between academic performance and criminal behaviour identified that weak academic skills predict the frequency and severity of criminal behaviour, particularly among males (Maguin & Loeber, 1996). Importantly, educational achievement during youth detention has the potential to result in increased school re-engagement as well as less frequent and less serious criminal behaviours post-release (Blomberg, Bales, Mann, Piquero, & Berk, 2011). In the current study, we examine the oral and written text-level language skills of young people who are involved with youth justice, specifically, their narrative language skills. Narrative language skills are of particular interest in youth justice populations, as they not only contribute to academic success, but are also necessary in the provision of an account in an evidentiary context.

1.1. Narrative texts and the school curriculum

A narrative text is a story; the development of proficient narrative language skills enables individuals to understand and share stories with others. Narratives, like other genres, have specific macrostructure and microstructure elements (Hall-Mills & Apel, 2015). School students need to demonstrate proficiency with these elements in their text comprehension and production (ACARA, 2010a, 2010b). For narrative texts, macrostructure refers to the inclusion, organisation and sequence of story grammar elements that reflect key events. Events of a narrative are generally conveyed sequentially or causally (Naremore, Densmore, & Harman, 1995). This structure promotes coherence, allowing an audience to follow the plot and appreciate the relationships between events. In a Western school context, oral and written narratives are typically taught to contain a beginning, middle and end; a story grammar structure described by Stein and Glenn (1979) (Whitworth, Claessen, Leitão, & Webster, 2015). The beginning establishes the scene for the audience, such as orientation to time, characters and location. The middle of the narrative contains the initiating event, a reaction from the characters and a plan of action in response to the event. These elements convey the perspectives and intentions of the characters, which in turn give the audience insight into the motivations behind a character's actions. The conclusion of a narrative provides the outcomes in relation to the actions taken as well as a resolution of the story. Narrative macrostructure relies upon a student's ability to manage and structure multiple pieces of literal and implied information to support audience comprehension. Analysis of a student's macrostructure elements provides insight into their language and literacy skills in relation to the demands of the school curriculum. For example, Australian secondary school students are required to: create structured, detailed, and coherent texts; select and sequence content appropriately; and share and interpret a range of viewpoints (ACARA, 2010a; 2010b).

Narrative competence also includes skills that relate to narrative microstructure, that is, the smaller linguistic elements of syntax (grammar) and semantics (vocabulary). These elements create internal structure and cohesion within and between sentences, such as the use of connectors to join ideas and the use of nouns and pronouns to refer to and maintain connections between characters and concepts (Haslett, 1983; Shapiro & Hudson, 1991). Sentences of increasing complexity are expected in the texts of secondary students as they expand and clarify their ideas (ACARA, 2010b). Cohesive language, which guides an audience through a text, is also expected and usually produced (ACARA, 2010a). A variety of words and adverbial phrases support the creation of detailed texts. Specific to the written modality, accurate punctuation is important for defining sentence boundaries, and accurate spelling supports reader comprehension (ACARA, 2010a, 2010b).

Both macrostructure and microstructure elements characterise a well-formed narrative, and while their use demonstrates a student's sophistication and creativity with oral and written academic-style texts, they also reflect aspects of language and cognitive skill development. As discussed by Khan et al. (2016), emergence of complex narrative language skills is associated with developments in

working memory and executive functions in late childhood. At this developmental period, well-structured and cohesive multi-episode narratives, that include information related to cause and effect, are expected (Applebee, 1978; Westby, 1984). Students who have not acquired the expected level of language and cognitive development are unlikely to be able to construct a coherent and cohesive plot with embellishment in their oral and written texts. They will likely experience problems in the creation, sequence and structure of ideas in oral presentations, essays and creative writing tasks. Adolescent students who have LD are commonly observed to experience difficulties with the initiation and elaboration of ideas in academic writing tasks (Starling, Munro, Togher, & Arciuli, 2011), and they exhibit weak syntactic and semantic skills at the narrative text level (Koutsoftas & Gray, 2012; Wetherell, Botting, & Conti-Ramsden, 2007). These language and literacy difficulties will undoubtedly continue throughout the secondary school years and beyond. Individuals who struggle with communication skills are at increased risk of premature termination of formal education, social exclusion and mental health disorders; they may struggle to sustain employment and to develop close relationships (Clegg, Hollis, Mawhood, & Rutter, 2005; Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018). The identification of school students who lack mastery of oral and written language is needed to better support education attainment and life skill development.

1.2. Narrative texts and young people involved with youth justice

A small body of prior research has demonstrated that young people involved with youth justice have difficulties with narrative texts. For example, Snow and colleagues (Humber & Snow, 2001; Snow & Powell, 2005) examined the inclusion of narrative macrostructure elements (setting, initiating event, internal response, plan, attempt, direct outcome and resolution) in an oral storytelling task involving a picture stimulus. They identified that young people involved with youth justice included fewer story grammar elements than a comparison group of school students, particularly a story's plan, direct outcome and resolution; this suggests problems with conveying cause-effect relationships to an audience. They further identified that of the young people involved with youth justice, those with LD were significantly weaker in conveying a story's setting, plan, and attempt than those who did not have LD (Snow & Powell, 2008). The additional under-representation of macrostructure elements demonstrates that LD affects the ability to provide sufficient information in a logical manner to support listener comprehension (Snow & Powell, 2008). Narrative analysis has also revealed that when compared to young people who were not involved in youth justice, young people who were violent offenders produced oral narratives with more macrostructure elements related to facts about harm they had caused to others but fewer elements related to feelings, thoughts and goals, suggesting problems demonstrating empathy and social cognition (Wainryb, Komolova, & Florsheim, 2010). In forensic contexts, such as police interviews and restorative justice conferences, intact narrative language skills are important for presenting key information in an order that makes sense to an audience and for conveying reasons that underlie behaviours. Weak narrative macrostructure can therefore have negative consequences for movement through the justice process. This highlights the importance of comprehensive language assessment so that accommodations can be put in place to better facilitate two-way communication.

Little is known regarding the microstructure of narrative texts within this population. However, in expository texts, young people on youth justice community orders have been found to produce fewer different words and less syntactically complex texts when compared to non-offending peers, suggesting that this population struggles to communicate complex information (Hopkins, Clegg, & Stackhouse, 2017). Further, at the conversational discourse-level of language, young females in youth detention have been found to avoid communication that requires them to use language related to negotiations, instead using negative behaviours in an attempt to solve problems (Sanger et al., 2000).

Language production in the written modality is also important to consider given its importance to communication and education. Written language, while drawing on oral language skills for text generation, is less constrained by immediacy, allowing a writer to formulate, write and revise content at a desired pace (Loban, 1976). It is also more literary in style, adhering to formal text structures as well as spelling and punctuation conventions (DeVito, 1967; Spencer & Petersen, 2018). As such, the linguistic complexity of written texts can be greater than that of oral texts (DeVito, 1967; Haslett, 1983). However, a study undertaken more than 30 years ago in the US, in which text-level writing was examined across four different tasks, revealed that young people involved with youth justice lacked the level of written mastery required to graduate from school (Sinatra, 1984). A more recent study in the US also reported that young people in youth detention were well behind the level expected for text-level writing, as measured with standardised assessment (Green, Shippen, & Flores, 2018). These findings are not surprising given both weak oral language skills mentioned above as well as weak written language skills at word and sentence levels of language identified within youth justice populations (Grigorenko et al., 2015; Putnins, 1999; Snowling, Adams, Bowyer-Crane, & Tobin, 2000). Skills specific to written language do not develop as primary neurodevelopmental skills, but instead, as secondary skills underpinned by language and cognitive abilities (DeVito, 1967; Geary, 2008). Therefore, when oral language skills are compromised, which is common in youth justice populations, they are likely to manifest as written language difficulties and contribute to academic failure (Koutsoftas & Gray, 2012; Snow & Powell, 2011). However, the current knowledge base about written text-level language skills of young people involved with youth justice is sparse and lacks detailed examination of macrostructure and microstructure elements. Therefore, it is not known if, and what, specific written language skills need to be considered and taught when working with young people in youth justice contexts.

Investment in language and literacy skills during the adolescent years is important. Poor school performance is one of the most common barriers to successful community re-entry, as identified by young people involved with youth justice (Mathur, Clark, Hartzell, LaCroix, & McTier, 2019). Moreover, strong associations have been identified between weak academic skills and rates of recidivism (Katsiyannis, Ryan, Zhang, & Spann, 2008). Importantly, a study in the UK found that 61% of 13- to 18-year old young people involved with youth justice aspired to attaining improved language and literacy skills (Hopkins et al., 2016). However, detention centre staff, including educators, lack the resources and knowledge required to respond to these young peoples' needs and to provide a quality

Table 1
Demographic characteristics of the 24 participants according to group.

	Language disorder		Comparison	
	n = 11 (%)		n = 13 (%)	
Male	10	(91)	12	(92)
Ethnicity				
Australian: non-Aboriginal	6	(55)	7	(54)
Australian: Aboriginal	2	(18)	1	(8)
Australian: other ^a	3	(27)	5	(38)
Last residential area				
Metropolitan	11	(100)	12	(92)
Regional	0	(0)	1	(8)
Known to child protection				
Yes	3	(27)	4	(31)
Unknown	3	(27)	2	(15)
No	5	(45)	7	(54)
Engaged in school at the time of entering detention ^b				
Yes	5	(45)	7	(54)
No	6	(55)	6	(46)
Liked school ^b				
Yes	4	(36)	8	(62)
No	7	(64)	5	(38)
Last school year attended ^b				
Year 7 to 8	2	(18)	1	(8)
Year 9 to 10	6	(55)	8	(62)
Year 11 to 12	3	(27)	4	(31)
Number of school suspensions ^b				
0	1	(9)	1	(8)
1–4	2	(18)	5	(38)
5–9	1	(9)	2	(15)
10+	7	(64)	5	(38)
School expulsion ^b				
No	5	(45)	8	(62)
Yes ^c	5	(45)	4	(31)
Other ^d	1	(9)	1	(8)
Recurrent ear infections/grommets ^e				
Yes	1	(9)	1	(8)
No	10	(91)	12	(92)

Note: ^aAfrican, Asian and Polynesian ethnicity. ^bReported by young person. ^cNumber of times expelled ranged from 1 to 4 however one student in the language disorder group did not recall the frequency. ^dTerms included voluntary removal and transferred to another school. ^eReported by caregivers.

education (Hamilton et al., 2019). Understanding the functional text-level oral and written language skills of youth justice populations is necessary and can inform an educational therapeutic response (Grigorenko et al., 2015; Joffe, 2018).

1.3. The current study

In this study, we examined the production of macrostructure and microstructure elements in narrative texts within a sample of school-aged young people sentenced to youth detention and compared the inclusion and accuracy of these elements for oral and written modalities. Motivated by the high prevalence of LD and academic difficulties among this population, we also investigated whether narrative performance differed according to language ability. As young people who are involved with youth justice are typically exposed to education or training programs, we refer to our sample of young people hereon, as students.

Our research questions were as follows:

- 1) What macrostructure (story grammar) and microstructure (syntactic and semantic) elements are used by students in youth detention when producing narrative texts, and how do these compare across two modalities (oral and written)?
- 2) How does the production of macrostructure and microstructure elements in oral and written narrative texts compare between those with LD and those without (the comparison group)?
- 3) What percentage of participants demonstrate errors in the microstructure elements of written conventions (spelling and sentence boundaries) in a narrative text, and how does this compare between those with LD and those without?

2. Materials and methods

2.1. Ethics approval

This study was approved by the University of Western Australia Human Research Ethics Committee (HREC) (approval number RA/

Table 2
The number and mean age of participants in years according to narrative modality completed and group.

	<i>n</i>	Age	(<i>SD</i>)
Both oral and written	16	17.2	(0.9)
Oral ^a			
Language disorder	10	17.4	(0.8)
Comparison	13	17.0	(1.0)
Written ^b			
Language disorder	8	17.5	(0.5)
Comparison	9	16.9	(1.0)

Note: ^a Audio-recording was not available for four participants, one participant declined the task, one was not administered the task, and one required extensive prompting and therefore their narrative was not representative of narrative generation. ^bTen participants were not administered the task due to the task being included following the pilot phase of assessments, two participants declined the task, and one was not administered the task.

4/1/7116), the Western Australian Aboriginal Health Ethics Committee (approval number 582) and Curtin University HREC (approval number HRE2018-0117).

2.2. Participants

Study participants were students at Western Australia's Banksia Hill Detention Centre (BHDC). The students were recruited during 2015 and 2016 as part of a National Health and Medical Research Council (NHMRC) funded study that examined the prevalence of fetal alcohol spectrum disorder (FASD) and other neuro-disabilities among young people in youth justice (Bower et al., 2018). Of the 113 students who assented and were consented to participate in the broader prevalence study, 102 students participated in a speech-language pathology assessment that is described in the study protocol (Passmore et al., 2016). Inclusion in the current study required students to be first-language speakers of Standard Australian English (SAE) and to have completed one or both text-level language tasks, detailed below, during the speech-language pathology assessment.

Of the 30 students who met inclusion criteria, data was available for 24 students, with a mean age of 17 years (range: 14 years 6 months to 17 years 11 months, *SD* = 0.9 years). Table 1 shows the demographic data for the 24 students according to group. Most students were male and from the metropolitan area; nearly two thirds of the LD group expressed that they did not like school. Most of the students had experienced multiple school suspensions, and over one third of students recalled that they had been expelled from school at least once. Table 2 shows the breakdown of the number, group, and age of the students who completed each of the narrative tasks.

2.3. Procedure

Students were recruited by a research officer who was based at BHDC. The recruitment process was described previously (Bower et al., 2018; Freeman et al., 2019). In summary, the research officer spoke to the students about the research project and asked if they would like to participate. For students who wanted to take part, the research officer contacted their legal caregivers to share information about the project and to seek consent. Participation was voluntary, and written participant assent and written caregiver consent were required. The assent and consent process involved the research officer using simple explanations and picture supports to aid the students' understanding of the assessment purpose and process. The students and their caregivers confirmed the language/s used during interviews with the research officer. The speech-language pathologist (SLP: first author) further ascertained the language/s used by asking the students about the language background of their families, by examining language transcripts with certified interpreters as well as by drawing on research related to differences between SAE and Aboriginal English (Kippin et al., 2018).

As part of a comprehensive multi-disciplinary neurodevelopmental assessment, the students undertook a language assessment with the SLP who had experience working with young people at BHDC in a different role. Language assessment was administered in a quiet allocated room at BHDC over a two-hour period, with breaks provided. Our previous research reported the results of the multidisciplinary team assessment (Bower et al., 2018) and the speech-language pathology assessment (Kippin et al., 2018) including the results of the Core and Index scores from the Clinical Evaluation of Language Fundamentals (CELF-4) (Semel, Wiig, & Secord, 2006). The CELF-4 Core and Index scores were used in the current study to allocate students to LD and comparison groups. In the current study, we define LD as a Core or Index score ≥ 1.5 standard deviations (*SDs*) below the mean. This score has been previously used to identify LD among school-aged populations, and was found to align with functional difficulties in meeting school curriculum targets (Norbury et al., 2016). Students with a score of ≤ 1.5 *SDs* below the mean were assigned to the comparison group. As reported in the study protocol (Passmore et al., 2016), nonverbal cognition was assessed as part of a neuropsychological assessment with the Wechsler Abbreviated Scale of Intelligence, Second Edition (Wechsler, 2011) or the Wechsler Nonverbal Scale of Ability (Wechsler & Naglieri, 2006). Students were eligible to participate, regardless of nonverbal cognition skills.

Eleven (46%) of the 24 students met our study criteria for LD (age: *mean years* = 17.3, *SD* = 0.7 years) and 13 (54%) students did not (comparison group) (age: *mean years* = 17.0, *SD* = 1.0 years). Five (21%) of the students in the LD group had CELF-4 language scores ranging from 1.5 *SDs* below the mean to 1.9 *SDs* below the mean, one (4%) of whom also had nonverbal cognitive impairment (NVCI; ≥ 2 *SDs* below the mean). The remaining six (25%) students in the LD group had CELF-4 language scores in the severe range (≥ 2 *SDs*

below the mean), one (4%) of whom had NVCI, and a further one (4%) who had FASD. Of the comparison group, who did not meet criteria for LD, one (4%) student had FASD however none had NVCI.

2.4. Text-level language assessment

2.4.1. Oral narrative text production

The oral narrative was elicited from the students using a non-standardised task. Students were shown a set of six black and white pictures by the SLP that depicted 'The flowerpot incident' (Kossatz, 1972; Snow & Powell, 2005), and asked to tell a story to accompany the pictures. This procedure is similar to those used in previous research with young people involved with youth justice (Humber & Snow, 2001; Snow & Powell, 2005, 2008). With student assent, oral narratives were audio-recorded on a hand-held SONY audio-recorder and later transcribed verbatim for analysis. An example of a target story depicted in the picture stimulus is provided by Snow and Powell (2005):

"There is a man walking along the street with his dog. A pot plant/vase falls from the balcony/from above and hits him on the head. The man becomes very angry about this. So, he decides to go in and sort it out. He goes into the building/up the stairs and bangs on the door. A lady comes to the door and gives the dog a bone. The man is not angry anymore/Instead of yelling at her, they become friends/he decided he liked her" (p. 252).

2.4.2. Written narrative production

Following elicitation of the oral narrative, the students produced a written narrative. With the above-mentioned picture stimuli visible to both the student and SLP, the students were asked to write the story. They were provided with lined paper and a pen or pencil to complete this task, as well as unlimited time. Written narratives were collected for transcription and analysis.

2.4.3. Narrative macrostructure and microstructure measures

Macrostructure and microstructure elements were assessed in narrative texts produced by the students in the oral and written modalities. As detailed in Appendix A, the primary outcome measures for macrostructure were the numbers of students who included each of the macrostructure elements: orientation to the characters and setting (time and place), initiating events, responses, plan, actions, direct consequences and the resolutions. These elements are similar to those assessed in previous research that has examined text-level language skills (Humber & Snow, 2001; Snow & Powell, 2005, 2008; Whitworth et al., 2015).

The primary outcome measures for microstructure included cohesion, syntactic complexity and semantics, also detailed in Appendix A. Cohesion was measured by examining students' referencing of characters and concepts at the point of their initial introduction (introduction reference) and thereafter on subsequent referrals (tie reference). In line with research on cohesion undertaken by Thorne and Coggins (2016), we calculated an introduction reference rate by dividing the number of appropriate introduction references by the total number (appropriate + inappropriate) of introduction references; this was converted to a percentage. Similarly, we calculated a tie reference rate by dividing the number of appropriate tie references by the total number (appropriate + inappropriate) of tie references; this was converted to a percentage (Thorne & Coggins, 2016). Syntactic complexity was measured by calculating the number and length of utterances, the number of sentence types of increasing complexity, the number and type of connectors, the rate of clauses per utterance and the number of adverbial phrases. Semantic ability was measured by calculating the number and type of vocabulary items. In the written modality, we also examined errors in the use of the written conventions of spelling, capitalisation and full stops (Miller, Andriacchi, Nockerts, Westerveld, & Gillon, 2016). These measures are commonly included in adolescent language assessment (Joffe, 2018; Petersen, 2010). They are typically included in standard language sample analysis (Miller, Andriacchi, & Nockerts, 2011, 2016), and are elements that relate to the Australian school curriculum (ACARA, 2010a, 2010b).

2.5. Narrative transcription and coding

At the time of data collection, the lead SLP (first author) transcribed the oral narratives from audio-recordings and analysed the oral and written narratives to inform the assessment reports. A research assistant then independently reviewed the transcripts and audio-recordings and transcribed the written narratives from students' handwritten records. Following this, the lead SLP again reviewed and checked all audio-recordings and transcripts.

To prepare the transcripts for coding and analysis of macrostructure and microstructure elements, the lead SLP segmented the narratives into C-units and excluded mazes (revisions and fillers, such as "um") in accordance with the Systematic Analysis of Language Transcription (SALT) Clinician's Guide (Miller et al., 2016). The SALT program is a software program designed to analyse language samples that are elicited during everyday functional language tasks, allowing frequency counts of measures such as the number of different words and mean length of utterance (Miller, Gillon, & Westerveld, 2015). The program is employed in speech-language pathology research and clinical practice for analysing language at word, sentence and text-levels as well as in conversational discourse (Miller et al., 2016). Our coding protocol (Appendix A) for macrostructure and microstructure elements was developed to be used with the SALT software (Miller et al., 2015) and drew on coding schemes currently used in international clinical practice and research (Miller et al., 2016; Snow & Powell, 2005; Thorne & Coggins, 2016; Whitworth, Claessen, & Leitão, 2016).

To finalise the coding protocol, two SLPs (first and second authors) coded three oral and three written narratives together, and an SLP (fourth author), who has extensive clinical experience with adolescent oral and written language, reviewed the coding protocol.

Table 3
Comparison of the number of students who included each macrostructure element according to narrative modality.

	Oral modality		Written modality		t	p
	n = 16	(%)	n = 16	(%)		
Orientation						
Main character (man)	16	(100)	16	(100)	–	–
Secondary character (dog)	7	(44)	11	(69)	1.50	0.22
Location	7	(44)	8	(50)	0.00	1.00
Time	3	(19)	4	(25)	0.00	1.00
Initiating events						
1: Pot plant fell/dropped	15	(94)	14	(88)	0.00	1.00
2: Pot plant hit the man's head	15	(94)	15	(94)	–	–
Responses						
Internal (man was angry/hurt)	13	(81)	12	(75)	0.00	1.00
Physical (man yelled)	12	(75)	14	(88)	0.25	0.63
Plan						
Plan (he decided to go in)	2	(13)	5	(31)	1.33	0.25
Actions						
1: Man walked in/upstairs	14	(88)	14	(88)	–	–
2: He banged on the door	13	(81)	14	(88)	0.00	1.00
Direct Consequences						
1: Lady came out/greeted the man	12	(75)	14	(88)	0.50	0.50
2: She gave the dog a bone	12	(75)	12	(75)	–	–
Resolution						
Internal (He likes her)	11	(69)	9	(56)	0.25	0.63
Physical (man kisses her hand)	9	(56)	9	(56)	–	–

Note: McNemar's test.

The lead SLP then independently coded and formatted the remaining oral and written narratives according to the finalised coding protocol. The second SLP (second author), who was blind to student language skill status, independently checked a randomly selected sample of 15% of all coded narratives. Between the two SLPs, there was 97% consistency for coding in the oral narratives and 98% consistency for coding in the written narratives; agreement was reached on these discrepancies through team discussion. Data for the analysis set, which were derived with the SALT software (Miller et al., 2015), were exported to IBM SPSS Statistics Version 26. The exported data were cross checked against a randomly selected 10% of all coded narratives. There were no discrepancies.

2.6. Statistical analysis

Due to small sample sizes, non-parametric statistical tests were employed. Following descriptive statistics to examine narrative macrostructure and microstructure elements, we compared narrative performance ($n = 16$) across the oral and written modalities using McNemar's Test for paired nominal data, and the Wilcoxon signed-rank test for paired scaled data. Then, to compare narrative performance between students with LD (oral: $n = 10$; written: $n = 8$) to students without LD (comparison group; oral: $n = 13$; written: $n = 9$), we used the Fisher's Exact test for independent categorical data, as well as the Mann-Whitney U test for independent scaled data. Finally, to compare errors in written conventions according to group, we used the Fisher's Exact test. For all analyses, we assessed statistical significance with an alpha of 0.05. Effect sizes (ϕ and r) were calculated according to the test used, and are reported as small (0.1), medium (0.3), or large (0.5) (Cohen, 1992). The first author conducted the statistical analyses, and these were cross-checked by the fifth author.

3. Results

The results are presented according to the research questions, starting with macrostructure, followed by microstructure and written conventions.

3.1. What macrostructure elements are used by students in youth detention when producing narrative texts, and how do these compare across modalities (oral and written)?

Inclusion of macrostructure elements was variable for the 16 students who completed narratives in both the oral and written modalities (Table 3). For example, all students included orientation to the main character, but few included orientation to time. When we compared inclusion of macrostructure elements across modalities, we found no evidence of a difference.

3.2. How does the production of macrostructure elements in oral and written narrative texts compare between those with and without LD?

Among the 23 students who completed the oral narrative task (Fig. 1) and the 17 students who completed the written narrative task (Fig. 2), we found variability between groups with and without LD for inclusion of narrative macrostructure elements. In the oral

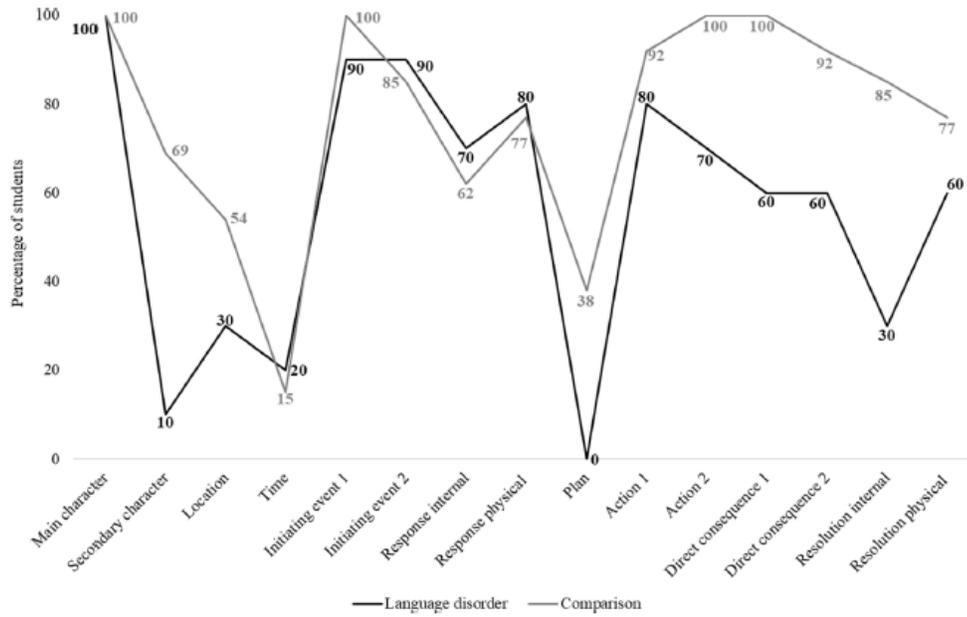


Fig. 1. Comparison of the percentage of students with and without language disorder who included each narrative macrostructure element in the oral modality.

Note: Language disorder: $n = 10$; comparison: $n = 13$.

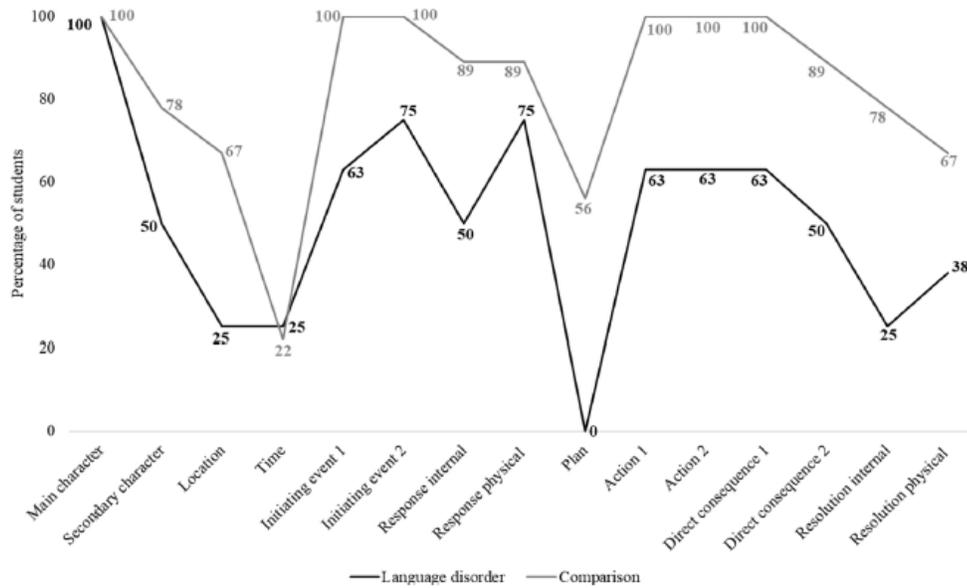


Fig. 2. Comparison of the percentage of students with and without language disorder who included each narrative macrostructure element in the written modality.

Note: Language disorder: $n = 8$; comparison: $n = 9$.

Table 4
Comparison of microstructure elements according to narrative modality for the 16 students who completed both the oral and written tasks.

	Oral modality		Written modality		<i>z</i>	<i>p</i>	<i>r</i>
	<i>n</i> = 16		<i>n</i> = 16				
	Mean	(<i>SD</i>)	Mean	(<i>SD</i>)			
Cohesion							
Introduction RR (%)	71.6	(17.6)	84.4	(17.6)	2.55	0.01*	0.5
Tie RR (%)	94.4	(11.2)	95.7	(6.5)	0.18	0.86	<0.1
Complexity							
Utterances	7.8	(2.8)	6.2	(2.2)	2.14	0.03*	0.4
Utterance length (w)	9.1	(2.3)	13.8	(4.7)	3.15	<0.01*	0.6
Utterance length (m)	10.3	(2.5)	15.4	(5.1)	3.10	<0.01*	0.6
Sentence type							
Simple	2.3	(1.6)	1.8	(1.3)	0.93	0.35	0.2
Compound	1.5	(1.1)	0.8	(0.9)	1.63	0.10	0.3
Complex	0.8	(1.3)	2.4	(2.2)	2.96	<0.01*	0.5
Compound-complex	0.4	(0.7)	0.2	(0.5)	0.95	0.34	0.2
Simple connectors	4.9	(2.6)	3.8	(2.3)	1.46	0.14	0.3
Subordinating connectors	1.1	(1.5)	2.5	(2.6)	2.45	0.01*	0.4
Clauses per utterance ^a	1.1	(0.2)	1.5	(0.4)	2.98	<0.01*	0.5
Adverbials							
Of time	0.3	(0.6)	1.6	(1.2)	2.75	<0.01*	0.5
Of place	4.3	(1.6)	4.6	(2.1)	0.36	0.72	0.1
Of manner	0.7	(1.1)	1.0	(1.6)	0.60	0.55	0.1
Of degree	0.6	(1.2)	0.7	(1.4)	0.41	0.68	0.1
Of reason	0.1	(0.3)	0.4	(0.5)	2.24	0.03*	0.4
Semantics							
Words	70.2	(29.1)	85.0	(44.5)	1.16	0.24	0.2
Words (type)	43.4	(14.0)	51.4	(22.2)	1.65	0.10	0.3
Verbs	12.2	(5.0)	14.2	(6.7)	0.95	0.34	0.2
Verbs (type)	10.6	(4.4)	12.3	(5.6)	0.86	0.39	0.2
Verb – linguistic	0.9	(1.1)	1.6	(1.4)	2.31	0.02*	0.4
Verb – cognitive	0.8	(1.3)	1.1	(1.5)	0.64	0.52	0.1
Verb – sensory	0.4	(0.6)	0.6	(0.7)	0.71	0.48	0.1
Prepositions	8.9	(4.2)	11.1	(6.4)	1.42	0.16	0.3
Prepositions (type)	6.2	(3.0)	7.7	(3.9)	1.64	0.10	0.3
Emotion words	1.6	(1.3)	1.8	(2.1)	0.16	0.88	<0.1
Adjectives	2.7	(1.8)	4.8	(4.8)	1.81	0.07	0.3
Adjectives (type)	2.3	(1.4)	3.8	(4.3)	1.27	0.21	0.2

Note: Wilcoxon signed-rank test; RR = reference rate; (w) = in words; (m) = in morphemes. ^aSubordination index; **p* ≤ 0.05.

modality, orientation to a secondary character (the dog, who plays a key role in a direct consequence and the resolution of the story) was included by fewer students in the LD group (*p* = 0.01, *phi* = 0.6) while in the written modality, there was no evidence of a difference between groups (*p* = 0.34, *phi* = 0.3). In both modalities, there was a difference between groups for inclusion of a plan (regarding the main character's intention). No student in the LD group included this element however some of the comparison group did (oral: *p* = 0.05, *phi* = 0.5; written: *p* = 0.03, *phi* = 0.6). In the oral narrative, fewer of the LD group included direct consequence 1 (*p* = 0.02, *phi* = 0.5) however in the written narrative, there was no evidence of a difference between groups (*p* = 0.08, *phi* = 0.5). Similarly, in the oral narrative, fewer of the LD group included resolution-internal (*p* = 0.01, *phi* = 0.6) however in the written narrative, there was no evidence of a difference between groups (*p* = 0.06; *phi* = 0.5).

In both modalities, there was no evidence of a difference between groups for inclusion of the remaining macrostructure elements: orientation to location (oral: *p* = 0.40, *phi* = 0.2; written: *p* = 0.15, *phi* = 0.4), orientation to time (oral: *p* = 1.00, *phi* = 0.1; written: *p* = 1.00, *phi* < 0.1), initiating event 1 (oral: *p* = 0.44, *phi* = 0.2; written: *p* = 0.08, *phi* = 0.5), initiating event 2 (oral: *p* = 1.00, *phi* = 0.1; written: *p* = 0.21, *phi* = 0.4), response-internal (oral: *p* = 1.00, *phi* = 0.1; written: *p* = 0.13, *phi* = 0.4), response-physical (oral: *p* = 1.00, *phi* < 0.1; written: *p* = 0.58, *phi* = 0.2), action 1 (oral: *p* = 0.56, *phi* = 0.2; written: *p* = 0.08, *phi* = 0.5), action 2 (oral: *p* = 0.07, *phi* = 0.4; written: *p* = 0.08, *phi* = 0.5), direct consequence 2 (oral: *p* = 0.13, *phi* = 0.4; written: *p* = 0.13, *phi* = 0.4), and resolution-physical (oral: *p* = 0.65, *phi* = 0.2; written: *p* = 0.35, *phi* = 0.3).

3.3. What microstructure elements are used by students in youth detention when producing narrative texts, and how do these compare across two modalities (oral and written)?

Table 4 shows comparisons of microstructure element use according to modality for the 16 students who completed both the oral and written tasks.

Table 5
Comparison of microstructure elements according to group for both the oral and written modalities for the students who completed at least one of two narrative tasks.

	Oral modality						Written modality							
	LD		Comparison		<i>z</i>	<i>p</i>	<i>r</i>	LD		Comparison		<i>z</i>	<i>p</i>	<i>r</i>
	<i>n</i> = 10		<i>n</i> = 13					<i>n</i> = 8		<i>n</i> = 9				
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)				
Cohesion														
Introduction RR (%)	60.6	(16.6)	78.0	(13.4)	2.18	0.03*	0.5	72.9	(19.6)	90.9	(14.5)	1.85	0.07	0.5
Tie RR (%)	87.6	(12.6)	99.3	(2.5)	2.74	0.01*	0.6	96.1	(5.5)	95.8	(7.4)	0.0	1.00	0.0
Complexity														
Utterances	6.8	(2.2)	8.5	(2.7)	1.80	0.07	0.4	6.3	(1.8)	6.0	(2.5)	0.44	0.66	0.1
Utterance length (w)	8.5	(1.6)	9.2	(2.4)	0.37	0.71	0.1	9.3	(1.6)	17.3	(2.8)	3.37	<0.01*	0.8
Utterance length (m)	9.9	(1.9)	10.4	(2.6)	0.19	0.85	<0.1	10.4	(1.7)	19.3	(2.9)	3.46	<0.01*	0.8
Sentence type														
Simple	2.7	(1.5)	2.2	(2.3)	1.24	0.21	0.3	2.3	(1.6)	1.3	(0.9)	1.11	0.27	0.3
Compound	1.3	(1.0)	1.7	(1.1)	0.88	0.38	0.2	1.5	(0.9)	0.3	(0.5)	2.61	0.01*	0.6
Complex	0.3	(0.7)	1.1	(1.4)	1.84	0.07	0.4	0.8	(1.2)	3.6	(2.1)	2.62	0.01*	0.5
Compound-complex	0.2	(0.4)	0.6	(0.8)	1.40	0.16	0.3	0.0	(0.0)	0.3	(0.7)	1.37	0.17	0.2
Simple connectors	4.7	(2.5)	5.8	(2.1)	1.13	0.26	0.2	3.1	(1.9)	4.8	(2.5)	1.36	0.17	0.3
Subordinating connectors	0.2	(0.6)	1.5	(1.5)	2.45	0.01*	0.5	0.5	(1.1)	4.0	(2.5)	2.91	<0.01*	0.7
Clauses per utterance ^a	1.1	(0.1)	1.2	(0.2)	1.15	0.25	0.2	1.2	(0.4)	1.8	(0.4)	2.37	0.02*	0.6
Adverbials														
Of time	0.3	(0.7)	0.3	(0.6)	0.13	0.90	<0.1	0.8	(1.0)	2.1	(1.1)	2.24	0.03*	0.5
Of place	3.9	(1.5)	4.2	(1.4)	0.58	0.56	0.1	3.0	(0.8)	5.8	(1.9)	3.04	<0.01*	0.7
Of manner	0.3	(0.5)	0.6	(1.3)	0.00	1.00	0.0	0.5	(0.8)	1.3	(2.1)	0.34	0.74	0.1
Of degree	0.3	(1.0)	0.5	(1.1)	0.75	0.45	0.2	0.6	(1.1)	0.7	(1.7)	0.54	0.59	0.1
Of reason	0.0	(0.0)	0.3	(0.6)	1.59	0.11	0.3	0.3	(0.5)	0.4	(0.5)	0.81	0.42	0.2
Semantics														
Words	57.1	(18.4)	77.4	(27.0)	1.71	0.09	0.4	57.3	(15.9)	105.6	(49.2)	2.21	0.03*	0.5
Words (type)	36.5	(7.9)	47.4	(13.7)	1.90	0.06	0.4	37.3	(9.1)	61.9	(23.9)	2.56	0.01*	0.6
Verbs	10.7	(2.8)	13.4	(5.3)	1.09	0.27	0.2	9.6	(2.1)	17.6	(7.2)	2.58	0.01*	0.6
Verbs (type)	9.2	(2.6)	11.5	(4.6)	0.97	0.33	0.2	8.5	(2.0)	15.2	(5.8)	2.43	0.02*	0.6
Verb – linguistic	0.6	(0.7)	1.2	(1.2)	1.0	0.32	0.2	1.0	(1.1)	1.90	(1.5)	1.31	0.19	0.3
Verb – cognitive	0.4	(0.7)	1.1	(1.4)	1.46	1.14	0.3	0.4	(0.7)	1.7	(1.7)	1.83	0.07	0.4
Verb – sensory	0.5	(0.7)	0.3	(0.5)	0.60	0.55	0.1	0.5	(0.8)	0.6	(0.7)	0.22	0.83	0.1
Prepositions	7.0	(2.2)	9.8	(4.3)	1.68	0.09	0.4	7.0	(1.7)	14.3	(6.9)	2.34	0.02*	0.6
Prepositions (type)	5.0	(1.7)	7.0	(3.0)	1.69	0.09	0.4	5.1	(1.5)	9.7	(4.0)	2.48	0.01*	0.6
Emotion words	1.1	(1.2)	1.5	(1.3)	0.87	0.39	0.2	0.9	(0.8)	2.6	(2.5)	1.69	0.09	0.4
Adjectives	2.0	(1.5)	2.6	(1.9)	0.67	0.50	0.1	2.3	(2.1)	6.7	(5.5)	1.84	0.07	0.4
Adjectives (type)	1.8	(1.1)	2.3	(1.6)	0.67	0.50	0.1	1.6	(1.3)	5.4	(5.2)	2.01	0.05*	0.4

Note: Mann–Whitney *U* test; LD = language disorder; RR = reference rate; (w) = in words; (m) = in morphemes. ^aSubordination Index; **p* ≤ 0.05.

3.3.1. Cohesion

When compared to the oral narratives, the written narratives had a higher rate of appropriate introduction references.

3.3.2. Complexity

The oral narratives contained a greater number of utterances (and utterances of shorter length) than the written narratives. In contrast, the written narratives contained more complex sentence structures and included a greater number of subordinating connectors, clauses per utterance, and adverbials of time and reason.

3.3.3. Semantics

There was only a difference between modalities for verbs relating to linguistic behaviours (e.g. said, shouted, yelled); the written narratives contained a greater number of linguistic verbs than the oral narratives. For the remaining vocabulary items, there was no evidence of a difference between modalities however the frequency of their use was consistently lower in the oral modality compared to the written.

3.4. How does the production of microstructure elements in oral and written narrative texts compare between those with and without LD?

Table 5 shows comparisons of microstructure element use according to group and modality for the students who completed at least one of two narrative tasks.

3.4.1. Cohesion

Within the oral modality, the LD group used fewer appropriate introduction and tie references than the comparison group. In the written modality, there was no evidence of a difference between groups.

3.4.2. Complexity

Within the oral modality, there was a difference for subordinating connectors only whereby the LD group used less than one overall. Within the written modality, there was also a difference for subordinating connectors as well as for utterance length, clauses per utterance, and adverbials of time and place. The students with LD used a greater number of compound sentence structures while students in the comparison group used a greater number of complex sentence structures.

3.4.3. Semantics

In the oral modality, there was no evidence of a difference between the LD and comparison groups for any vocabulary item however students with LD generally used a smaller number and type of vocabulary items. In the written modality, there was a difference between the groups whereby students with LD used fewer words (total and type), including verbs (total and type), prepositions (total and type) and adjectives (type).

3.5. What percentage of students in youth detention demonstrate errors in the microstructure elements of written conventions (spelling and sentence boundaries) in a narrative text, and how does this compare between students with and without LD?

Of the 17 written narratives, 13 (76%) had one or more spelling errors, 16 (94%) had one or more capitalisation errors, and 14 (82%) had one or more full stop errors. While the percentage of students who made each error type was variable according to group, there was no evidence of a difference between groups (spelling errors: LD = 63%, comparison = 89%, $p = 0.29$, $\phi = 0.3$; capitalisation errors: LD = 100%, comparison = 89%, $p = 1.00$, $\phi = 0.2$; full stop errors: LD = 100%, comparison = 67%, $p = 0.21$, $\phi = 0.4$).

4. Discussion

In this study, we examined the oral and written text-level language skills of students in youth detention (mean age of 17 years), specifically, their skills in narrative macrostructure (story grammar) and microstructure (syntax and semantics). All participants' narratives were characterised by a lack of key detail, and some narratives contained ambiguous referencing to characters and concepts. The written narratives were also characterised by errors in spelling and poor management of sentence boundaries. Weaknesses in oral and written text-level language skills among the group overall may be a result of suboptimal education, premature school disengagement and neurodevelopmental disability (Hamilton et al., 2019, 2020).

Overall, when comparing students' narratives across modalities, the inclusion of macrostructure elements was similar. However, the participants as a group demonstrated stronger skills in cohesion, sentence complexity and semantics in the written modality. Overall, this finding highlights that modality of text production affects narrative performance. The students may have taken more care in the writing task due to both the formality and permanency of written language (DeVito, 1967; Spencer & Petersen, 2018), and they may have benefited from rehearsal in the oral modality as the picture stimulus used in the oral task was the same as that used in the written task. Further, the slower pace of writing reduces immediate cognitive loading, which may have allowed students to capitalise on the language skills they had, thus extending the linguistic complexity they initially demonstrated in the oral modality (Fisher,

Barton-Hulsey, Walters, Sevcik, & Morris, 2019; Haslett, 1983; Loban, 1976; Spencer & Petersen, 2018).

This first finding however does not tell the whole story. As expected, LD also affected narrative performance. Students who had LD were outperformed by those who did not in both the oral and written modalities. They included fewer narrative macrostructure elements, particularly in the oral modality. In line with previous research, this finding indicates that young people in youth justice populations who have LD struggle more than those who do not to efficiently organise and provide adequate information when telling a story orally (Snow & Powell, 2008).

In the written modality, while inclusion of macrostructure elements was variable, there were fewer differences between those with and without LD. For both groups, some factors associated with written tasks, as discussed above, may have provided support. However, the additional language, cognitive and motor demands associated with spelling, sentence boundary management and handwriting may have resulted in the inclusion of fewer elements. In a previous study of 10-year old school students, Koutsoftas and Gray (2012) identified that inclusion of story grammar elements in a written narrative did not differ between those with and without LD. However, syntactic and semantic skills differed between their participant groups. This is in line with our findings that the students with LD demonstrated weaker narrative microstructure skills, particularly in the written modality, including fewer complex sentences and subordinating connectors as well as fewer adverbial phrases and less diverse vocabulary. It could be that microstructure in the written modality in particular was restricted for the students with LD due to both weaker foundational oral language skills and additional language, cognitive and motor demands (Koutsoftas & Gray, 2012; Spencer & Petersen, 2018). In contrast, students who did not have LD (but who also made errors with written conventions) were able to extend the linguistic sophistication of their narratives in the written modality. Our results demonstrate how language ability can affect narrative performance in both the oral and written modalities. This highlights the need to consistently evaluate the functional text-level language and literacy skills of young people in youth justice in addition to standardised assessments of language ability. This is important so that students' needs in everyday language and literacy tasks are better identified, and interventions are better informed.

A key finding of our study is that for both the oral and written modalities, no student with LD included a plan (the macrostructure element related to character intent). Similarly, Snow and Powell (2008) found that among young people involved with youth justice, those who had LD were less likely to include a plan in their oral narratives. Our study extended this finding into the written modality. Moreover, inclusion of the plan was the only difference in macrostructure between the groups in the written modality.

In a narrative, omission of key details that relate to intent or goal directed behaviours can indicate problems with the ability to infer meaning from implicit information, including the motivations of others. In addition, omission of these details can indicate difficulties with the ability to appreciate and produce the level of information required to convey cause and effect to an audience (Applebee, 1978; Snow & Powell, 2005; Westby, 1984). This highlights potential difficulties with skills in social cognition including theory of mind (ToM), which is the ability to appreciate one's own and others' mental and emotional states, as well as social problem solving, which is the ability to realise the relationships between events, characters, and concepts (Noel & Westby, 2014; Wainryb et al., 2010). Compromised language, social and cognitive skills are common to youth justice populations (Winstanley et al., 2019), which can have implications for learning and socioemotional functioning. Wainryb et al. (2010) identified that young people with violent offending behaviour show few instances reflecting ToM in personal narratives about the harm they have caused to others. Snow and Powell (2008) identified that young people who are violent offenders are more likely to have LD compared to those convicted of lesser offences. Such language and cognitive skills are important to consider in forensic contexts including in rehabilitation programs, as young people may have difficulties appreciating the needs and experiences of others, as well as verbally expressing their own needs, feelings, and emotions (Snow et al., 2016; Winstanley et al., 2019).

Complex language is regarded as important for facilitating development of skills in social cognition (Farrant, Fletcher, & Maybery, 2006). Preliminary research with a small group of males involved with youth justice has shown that speech-language pathology intervention that targets text-level language, ToM and social problem solving can improve language skills related to narrative production and possibly, aspects of social cognition (Noel & Westby, 2014). This highlights the potential benefit of involving speech-language pathology services in assessment and therapeutic interventions for young people who are involved with youth justice.

Cohesion was weaker in the oral modality compared to the written overall and in the oral modality for the students who had LD. Failure to appropriately introduce characters and concepts results in poor orientation to the 'who' and 'what' of a story with subsequent effect on audience comprehension. While correct references, including pronouns, may be used later in a story to refer to characters and concepts, a poor initial orientation places an increased burden on the audience to infer information. The weaker cohesion in the oral narratives of the students with LD could suggest more difficulties taking account of the audience's needs when sharing a story. However, there was no evidence of a difference for cohesion between groups in the written modality. This might be attributed to the small sample size or to other factors associated with written tasks, which offer opportunities for text revisions.

The finding that students with LD (compared to those without) produced less complex sentences and had weaker semantic skills, particularly in the written stories, is unsurprising given that weak syntax and vocabulary are characteristic of individuals with LD (Rice & Hoffman, 2015; Starling et al., 2011). Development of both syntactic and semantic skills is important for the acquisition and ongoing development of language skills. A strong foundation in these language skills underpins language transition to a more formal and academic style of oral language as well as to a more literary style of written language which is important for meeting the requirements of the school curriculum (ACARA, 2010a, 2010b; Spencer & Petersen, 2018). Our findings highlight that for this population, assessment of, and intervention for, text-level syntactic and semantic skills are required to support this transition. Fewer group

differences for microstructure in the oral modality also demonstrate that LD is not always obvious, and that functional effects of LD can present differently depending on the demands of a task (Starling et al., 2011; Wetherell et al., 2007). This finding may also call into question the classification of students' abilities based on standardised assessment scores. Our results emphasise the importance of comprehensive assessment, including functional assessment, to better identify specific areas of difficulty that are likely to restrict effective participation and success in educational and forensic contexts.

4.1. Strengths & limitations

The students in this study were from a larger study whose participant group reflected a representative sample of young people in the youth detention (Bower et al., 2018). Given the language diversity of youth justice populations (Kippin et al., 2018) and our inclusion criteria to include speakers of SAE only, it is not known whether the findings of this study apply to first language speakers of other languages. This is an important area for future research, as all young people involved with Australian youth justice systems are exposed to practices and processes which are typically administered with SAE.

While the current study's sample was small, our findings for macrostructure inclusion in the oral modality being both variable among all students and weaker among those with LD are in line with previous research with youth justice populations (Snow & Powell, 2005, 2008). We have extended the evidence base by also including examination of narrative microstructure elements, and comparing both macrostructure and microstructure elements across oral and written modalities as well as between students with and without LD. Further, our examination of microstructure skills in narrative texts adds to what is known about the microstructure skills in expository texts of young people involved with youth justice compared to non-offending peers (Hopkins et al., 2017).

Our comprehensive profiling of narratives of students in youth detention has highlighted specific and functional language and literacy needs of this population group, which are important to consider when planning and delivering services. Standardised assessment is important to ascertain capacity and classify health conditions however assessment which examines functional abilities of an individual is necessary to identify specific limitations that affect participation in meaningful tasks (Westby & Washington, 2017). In an educational setting, it is common practice for students to be given predetermined prompts from which to generate texts (Hall-Mills & Apel, 2015). Therefore, the elicitation of narratives using a picture stimulus has enabled us to identify specific areas of oral and written text-level language that are likely to restrict students' participation and success. In justice settings, this is particularly important, as teachers need practical information and resources to better respond to students' longstanding academic difficulties. Further, as forensic contexts require two-way communication, information related to how a young person can communicate is important to inform equitable justice processes and practices.

It is important to note that the picture sequence used in this study was in view of both the students and the SLP for both the oral and written tasks. Such a joint focus has the potential to alter the level of detail required by an audience, and as a result, the amount of detail provided by a narrator. However, a picture sequence can reduce a narrator's cognitive load by placing less demand on executive functions such as working memory and information organisation (Westby & Washington, 2017). Therefore, use of the picture stimulus in our study likely provided an opportunity for the students to showcase their narrative skills as best they could in both the oral and written modalities. A previous study in a youth justice setting identified that a picture stimulus can result in improved text-level writing compared to no prompt, a verbal prompt, and a written prompt (Sinatra, 1984). A strength of our study was the finding that some students were able to extend their language skills when provided with the same task in the written modality. This highlights that language and literacy needs do differ among this population group which further emphasises the importance of comprehensive language assessment.

The use of a prompt may limit the ability to generalise our results to how a student performs with functional narrative text production without visual supports. Future research with larger samples should examine the oral and written text-level language skills of young people undertaking tasks specific to forensic contexts, such as giving an account in a legal interview as well as participating in psychological programs which draw on the recall and discussion of events and experiences.

4.2. Implications

The reporting of insufficient and inconsistent details in a narrative has important implications for both forensic and education contexts. In a police interview, for example, such communicative behaviour could be perceived as rudeness and non-compliance (Snow & Powell, 2008), and may impede investigation into all the events that occurred. In a psychological intervention, problems with narrative language could affect how adequately and explicitly a young person can share, reflect on, and clarify their experiences and feelings (Noel & Westby, 2014). This could impede a young person gaining benefit from the justice process, and could also be detrimental for victims of crime. For example, despite letters of apology playing an important role in restorative justice processes and the closure of incidents for victims, some letters do not make their way to victims due to the quality of written language being poor (Soppitt & Irving, 2014). It will be important that young people involved with youth justice, who have weak language skills, are better identified so that two-way communication, in both oral and written modalities, can be better facilitated.

In a school context, a confusing or overly simple story shared by a student could be perceived negatively by peers, which could affect the establishment of friendships. Individuals with LD are less likely than those who do not to have close friends (Clegg et al.,

2005). Further, a teacher may give a poorly produced text a low score, and potentially, may link academic failure to behaviour problems, rather than to weak language skills (Humber & Snow, 2001). Some students might demonstrate relative strengths in some areas of macrostructure and microstructure however poor management of sentence boundaries and errors in spelling can reduce the overall quality of a text, making its reading laborious and affecting academic achievement (ACARA, 2010a, 2010b). A student who produces text-level language at a lesser developmental level, especially in the secondary school years, requires targeted oral and written language intervention. This is important so that they can better meet the requirements of the school curriculum, attain an education, and broaden their occupational opportunities.

Previous work demonstrates that speech-language pathology intervention can result in language and literacy gains among secondary school students (Ebbels et al., 2016; Spencer, Clegg, Lowe, & Stackhouse, 2017). It is also possible and beneficial for youth justice services to invest in speech-language pathology interventions to improve language and literacy outcomes of young people (Gregory & Bryan, 2011; Noel & Westby, 2014; Snow, 2019). In the youth detention centre where this study took place, education staff have reported the value of SLP and occupational therapist (OT) input, as part of our broader research project, and have called for SLPs, OTs and educational psychologists to be employed to support educational and rehabilitation programs (Hamilton et al., 2019). An Australian economic evaluation of the impact of speech-language pathology services on criminal justice outcomes revealed a cost saving of \$1716 to \$4843 per young person as well as potential reductions in antisocial behaviour and recidivism when speech-language pathology services are provided to a young person upon their initial contact with youth justice services (Dowse, Cronin, Reeve, & Addo, 2020). The results from our current and previous study (Kippin et al., 2018) provide justification for oral and written language interventions and speech-language pathology services to be introduced to youth justice services in WA and more broadly to other services that are accessed by young people who are in, or at risk of, contact with youth justice. This is important for improving the response to young peoples' unmet language and literacy needs.

5. Conclusion

In this study, we have identified and described text-level language difficulties in macrostructure and microstructure for both oral and written narrative texts produced by a sample of students in youth detention. Students with LD demonstrated weaker text-level language skills in both modalities however both students with and without LD exhibited difficulties with narrative macrostructure and microstructure elements. The extent of text-level language difficulties revealed in our study, particularly among those with LD, as well as the implications of these difficulties, demonstrate that investment in the language and literacy skills of this population is required. Targeted language interventions need to be developed, implemented, and evaluated with this population, and the potential benefit for involving speech-language pathology services in this work should be examined.

Funding

National Health and Medical Research Council (NHMRC) (#1072072); NHMRC-funded FASD Research Australia Centre of Research Excellence (#1110341); Australian Government Research Training Program PhD Scholarship. The funding sources were not involved with the study design; the collection, analysis and interpretation of the data; the writing of the manuscript; or the decision to submit the article for publication.

Declaration of Competing Interest

None.

CRediT authorship contribution statement

Natalie R. Kippin: Conceptualization, Methodology, Data curation, Formal analysis, Writing - original draft, Writing - review & editing. Suze Leitao: Supervision, Formal analysis, Writing - review & editing. Amy Finlay-Jones: Supervision, Writing - review & editing. Jennifer Baker: Writing - review & editing. Rochelle Watkins: Supervision, Formal analysis, Writing - review & editing.

Acknowledgements

We thank: the BHDC students and their circles of care for participating in this project; Department of Justice custodial and non-custodial staff; research assistants, Lauren Willis and Christine Astell; and the Banksia Hill project team, in particular, Professor Carol Bower, Clinical Associate Professor Raewyn Mutch, and Professor Rhonda Marriott. Any material published or made publicly available by the authors cannot be considered as either endorsed by the Department of Justice or an expression of the policies or view of the Department. Any errors of omission or commission are the responsibility of the researchers.

Appendix A

Tables A1 and A2

Table A1
Coding protocol for narrative macrostructure elements.

Story grammar	Code	Explanation
Orientation	[OC]	Orientation to the main character (i.e. the man). e.g., C A man [OC] was walking
	[OL]	Orientation to the location (e.g. down the street, to his friend's house). e.g. C A man was walking down the street [OL]
	[OT]	Orientation to time (e.g. morning, afternoon, one day). e.g., C One day [OT] a man was walking
	[OO]	Orientation to the other character (i.e. dog). e.g., C A man was walking his dog [OO]
Initiating events	[IE1]	The initiating event (i.e. causal event; the cause of the events that follow).
	[IE2]	First element (directionality of the pot plant – falls/drops). Second element (where it falls – reference to the man's head). e.g., The pot falls [IE1] and hits him on the head [IE2] If the narrative refers to one element only, then only use the relevant code. e.g., The pot hit his head [IE2] (no reference to directionality) If there are no initiating events, then the plan, events, direct consequences and resolutions cannot be coded for the purpose of this protocol.
Responses	[RU]	The internal and physical responses to the initiating event.
	[RP]	Internal element (The man's internal response/emotion, e.g. angry, mad) Physical element (The man's observable response, e.g. he yelled; he waved his stick in the air). e.g., The man was angry [RU] and he yelled up at the person [RP] If the narrative refers to one element only, then only use the relevant code. e.g., The man waved his stick in the air [RP]
Plan	[P]	The main character's plan about what he intends to do next/goal directed behaviour. Links the action with reasoning. e.g., He decides to go up the stairs to sort it out [P] e.g., He goes upstairs to confront [P] whoever done it If the intention is not given, but there is an action, do not use [P]. e.g., He walks upstairs (no intent given)
Actions	[A1]	Physical actions taken by the main character to solve the problem.
	[A2]	First element (related to the man going upstairs/into the building). Second element (related to the main banging on the door). e.g., He goes upstairs [A1] and bangs on the door [A2] If the narrative refers to one element only, then only use the relevant code. e.g., He bangs her door [A2]
Direct consequences	[DC1]	The direct consequences related to the actions of the main character.
	[DC2]	First element (Related to the lady answering the door/engaging with the man in some way). Second element (Related to the lady giving the dog a bone/engaging with the dog in some way). e.g., A lovely lady comes out [DC1] and gives the dog a bone [DC2] If the narrative refers to one element only, then only use the relevant code. e.g., the lady says hello to the man [DC1] e.g., the lady pats the dog [DC2] If the utterance does not reflect awareness that the person who opens the door is the same person who knocked over the plant from the balcony, then do not use these codes. e.g., The man kept on walking home and his wife opened the door
Resolutions	[ResI]	A statement that demonstrates a change in the man's demeanour/feelings.
	[ResP]	Internal element (change in the man's emotions e.g. from sad to happy). Physical element (action of the man to demonstrate his change in feeling). e.g., The man was happy [ResI] and kissed her hand [ResP] If the narrative refers to one element only, then only use the relevant code. e.g., The man liked her [ResI] e.g., The man took off his hat and kissed her hand [ResP]

Note: Coding protocol adapted from Snow and Powell (2005) and Whitworth et al. (2015, 2016).

Table A2
Coding protocol for narrative microstructure elements.

C-unit segmentation		
1. Segment the oral and written narratives into c-units (a main clause with all its dependent clauses) according to the SALT Clinician's Guide (Miller et al., 2016, Chapter 8 and Appendix O).		
2. For utterances that contain ellipted subjects, segment these according to the Curtin University Discourse Protocol (Whitworth et al., 2016, Section 3). If there is an ellipted subject, the utterance is one C-unit.		
Coding		
Linguistic element	Code	Explanation
Standard SALT conventions Source: Miller et al. (2016), Appendix N)		See SALT Clinician's Guide
Introduction and the references		Appropriate Introduction references
	[indefintro]	Introduction of an indefinite character or concept e.g., C a man[indefintro] was walking e.g., C someone[indefintro] dropped a pot[indefintro]
	[defintro]	Introduction of a definite character or concept where there is supporting context e.g., C He walks to the entrance[defintro] (The apartment has been introduced prior to this utterance, so the entrance has appropriate supporting context) e.g., C he kisses her on the hand[defintro] (The lady has been introduced prior to this utterance, so the hand has appropriate supporting context)
	[possintro]	Possessive introduction of a character or concept e.g., C A man was walking down the street with his dog[possintro] e.g., C He waved his walking stick[possintro] in the air.
		Inappropriate Introduction references
	[ambigintro]	Introduction of a character or concept, such as the use of a definite form not supported by context on first mention. e.g., C the man[ambigintro] is walking (as the first utterance) e.g., C the lady[ambigintro] came out with a bone (where the lady has not been introduced earlier in the story)
Source: Thorne and Coggins (2016)	[pnintro]	Pronominal introduction of a character or concept on first mention. e.g. C he[pnintro] was walking his dog e.g., C he got angry and yelled at her[pnintro] (The lady has not been introduced prior to this utterance)
		Appropriate the references
	[ntie]	Reference to a character or concept on subsequent referral and using a nominal form e.g., C As the man[ntie] passed a balcony... (the man has already been introduced) E.g. She gave his dog[ntie] a bone (the dog has been introduced previously).
	[pntie]	Reference to a character or concept on subsequent referral and using a pronominal form. e.g., C He[pntie] screamed (the man has already been introduced) e.g., C She[pntie] gave the dog a bone (the lady has already been introduced)
		Inappropriate the reference
	[ambigntie]	Reference to a character or concept on subsequent referral and using a nominal form e.g., C she gave a dog[ambigntie] a bone (should be 'the' dog, or 'his' dog, as the dog was introduced earlier).
	[ambigpntie]	Reference to a character or concept on subsequent referral and using a pronominal form. e.g., C the lady gave him[ambigpntie] a bone (it isn't clear if the bone was given to the man or the dog)
Sentence type	[Simp]	Simple sentence: Utterance of a single clause Compound sentence: At least two independent clauses joined with a connector.
	[Comp]	Note: Compound sentences will go over two or more C-units due to segmentation rules. C a man was walking to his friend's house. C and[CC:and] a flower_pot dropped on his head [Comp]. Complex sentence: One or more subordinate clauses. E.g., C he walked upstairs to confront the lady [Complex] (where 'to' reflects the subordinator, 'in order to')
Sources: Australian Curriculum, Assessment and Reporting Authority (2010c); Miller et al. (2016); codes created for this study.	[Complex]	Complex sentence can have a non-finite clause e.g., C he banged on the door demanding them to come out [Complex]. Where there is omission of the subordinate 'that' where 'that' can be inferred, it is scored as a complex sentence. If the omitted subordinator is obligatory

(continued on next page)

Table A2 (continued)

Coding		
Linguistic element	Code	Explanation
		for cohesion in dialogue, then don't score it as a complex (SALT Clinician's Guide, page 218). Utterances with dialogue/direct speech may reflect complex sentences e.g., he seen this old lady and thought, "I'm not going to go off at her" [Complex]. Compound-complex sentence. Two clauses and a subordinate clause. Note: Sentences may go over two or more C-units due to segmentation rules. e.g., C the lady came out with a bone for the dog. C and[CC:and] then he showed his respect by[SC:by] taking his hat off and kissing her hand [CPCX]. Simple connector. e.g., and, and then, then, but, or, yet, so (where so is not used for subordination, e.g. 'so that'). e.g., C the plant fell and[CC] hit him on the head e.g., C he yelled but[CC] nobody answered
Connectors	[CPCX]	
	[CC]	For sentences with multiple verb phrases connected with 'and', code these with [CC]. If the 'and' is at the start of a new sentence and the sentence is not considered a compound or complex (i.e. the 'and' is used as a filler), do not consider it as a connector. If the 'and' is used to join two nouns e.g. The man and his dog..., do not code the 'and' as a connector, as it does not reflect a phrasal connector. Subordinating connector, e.g., if, because, while, so (that), as, like, to (in order to), when e.g., C he kissed her hand while[SC] the dog ran off happily e.g., C the man kissed the lady on the hand because[SC] he liked her See SALT Clinician's Guide for explanation of each code.
Sources: Miller et al. (2016), p.210), Australian Curriculum, Assessment and Reporting Authority (2010c); codes created for this study.		
	[SC]	
Subordination Index	[SI-X] [SI-0] [SI-1] [SI-2] [SI-3]	Some examples: e.g., C and then (yeah) [SI-X]. e.g., C an old lady ah shake hands I think [SI-X] e.g. C (and yeah) the end [SI-0]. e.g., C starts banging on the door [SI-0] (noun is missing) e.g., C the dog was very happy [SI-1]. e.g. C she opens the door and gives the puppy a bone [SI-1]. e.g., C he knocked on the door to go off at the lady [SI-2]. e.g., C when the old lady answered the door she apologised for what had happened and gave the man's dog who was also with him a bone [SI-3]. e.g., C when the door opened he saw it was a lady [SI-3]. ('that' is inferred, i.e. he saw that it was a lady)
Source: Miller et al. (2016), Appendix P)		
	etc...	
Adverbials	[AT] [AP] [AM] [AD] [AR]	Of time e.g., C as he was walking [AT] a pot dropped on his head e.g., C when he got upstairs [AT] he banged on the door Of place at the phrase level (use [PP] for word level prepositions). e.g., C a man was walking up[PP] the road [AP] e.g., C he knocked on[PP] the door [AP] Note: 'inside' and 'upstairs' are coded as [PP] Of manner (the manner of an action) e.g., C he knocked on the door loudly[AM] e.g., C the dog ran off happily[AM] Of degree (the degree of an action) e.g., C he was so[AD] scared e.g., C she was really[AD] nice Of reason e.g., C he changed his mind because he liked her [AR] e.g., C he banged on the door to go off at the person [AR]
Codes created for this study		
		Total and type of verbs are automatically calculated as a standard SALT measures Note: A gerund (-ing form when it is a subject, complement or object, is not coded as a verb) e.g., he start/ed yelling (where start is the verb and yelling is a gerund).
Source: Miller et al. (2011, p.17); Codes created for this study.		
		Specific verb types
	[VL]	Verb: linguistic e.g., said, shouted, yelled, barked
	[VC]	Verb: cognitive e.g., think, believe, like, decided, love
	[VS]	Verb: sensory e.g., look, see, saw
Emotion	[Emot]	Vocabulary that is specific to a feeling or emotion, e.g., angry, happy, mad, liked e.g., C he was angry[Emot] and yelled
Code created for this study		
Prepositions	[PP]	Vocabulary which relates to:

(continued on next page)

Table A2 (continued)

Coding		
Linguistic element	Code	Explanation
Source: Australian Curriculum, Assessment and Reporting Authority (2010c); Miller et al. (2011, p.17); code created for this study.		a) time or space (e.g., in, on, down, at, to, inside, upstairs), b) a modifier, c) something belonging to, relating to, connected with, a reason for, a purpose for. A preposition can be used in an adverbial clause structure. e.g., C a man walked down[PP] the street e.g., C a pot fell from[PP] a balcony e.g., C he was walking with[PP] his dog Vocabulary that describes, identifies, quantifies a noun or pronoun, e.g., old, little, several, and vocabulary relating to emotions/feelings
Adjectives	[Adj]	e.g., C a little[Adj] lady opened the door e.g., C he was angry[Emot][Adj]
Source: ACARA (2010), Miller et al. (2016), p.222; code created for this study.		See SALT Clinician's Guide page 77 for descriptions and codes for errors for spelling, capitalisation, and full stops.
Standard SALT written conventions		

Note: ACARA: Australian Curriculum, Assessment and Reporting Authority.

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Implications and recommendations from the Telethon Kids Banksia Hill Project



SUMMARY OF THE PROJECT

The Banksia Hill Project is the first study in Australia to assess and diagnose young people in a youth custodial setting for Fetal Alcohol Spectrum Disorder (FASD).

The study, carried out by a multi-disciplinary team of researchers and clinicians from the Telethon Kids Institute, involved comprehensive neurodevelopmental assessments of 99 young people aged 10-17 years who were detained at the Banksia Hill Detention Centre between 2015 and 2016; 74% were Aboriginal.

Training resources for detention centre staff were developed and implemented as part of the study, to build capacity for managing young people with neurodevelopmental impairments.

A qualitative study to understand the experiences of the young people who participated in assessments, their families, Banksia and community service staff was also undertaken.

KEY FINDINGS

- 36 (36%) of the young people involved in the study were identified as having FASD.
- Only two of those with FASD had been previously diagnosed – and their diagnosis had been through research funding, not routine public services.
- 88 (89%) had at least one severe neurodevelopmental impairment – meaning problems with memory, language, motor skills, cognition, attention, social and other skills.
- 65% had at least three severely impaired domains (out of nine neurodevelopmental domains assessed by the team); while 23% had five or more severely impaired domains.
- 24 young people were assessed to have an IQ score less than or equal to 70: 15 with FASD and 9 without.
- Those diagnosed with FASD had higher rates of severe impairment than those not diagnosed with FASD.
- Most young people who participated thought being involved in the study was beneficial for them, particularly as they and their families gained a better understanding of their strengths and difficulties, which had previously not been identified.

IMPLICATIONS

- The Banksia Hill Project identified the highest known prevalence of FASD in a custodial/corrective setting worldwide, and provides evidence of an extraordinary and unprecedented level of neurodevelopmental impairment amongst sentenced youth in Western Australia.
- The impairments discovered are likely to be representative of the experience in juvenile justice centres across Australia, and also to be reflected in the adult prison population.
- Whilst there was a high rate of impairment found in Aboriginal young people, non-Aboriginal young people also demonstrated severe impairment.
- The findings highlight the vulnerability of young people within the justice system and their significant need for improved diagnosis to identify their strengths and difficulties, and to guide and improve their rehabilitation.
- For many of the young people assessed, this was the first time they had had a comprehensive assessment to examine their strengths and difficulties, despite attending school, prior engagement with the justice system and, in many cases, prior engagement with child protection services
- The types of impairments identified suggest many of these young people do not have critical executive functioning abilities that allow them to discern right from wrong and to learn from experience
- Current custodial processes are not reducing recidivism or increasing the chances of these young people becoming productive and law-abiding
- Targeted interventions based on a young person's appropriately diagnosed developmental difficulties and relative strengths are more likely to be effective than current practices
- Research funding has allowed the high rates of neurodevelopmental impairment to be measured and training resources to be developed for corrections staff. Government resources are now needed to institute diagnostic assessments and appropriately targeted interventions into routine management.
- It costs over \$200,000 a year to keep one young person in detention in Western Australia. A relatively small investment in multidisciplinary assessments, evidence-based interventions and different ways of working to keep young people out of youth detention

will result in rapid savings. Long-term social benefits are likely to flow to the young people, their families and the community, and economic benefits including from reduced recidivism and associated enforcement costs

- The study findings also underscore the need to provide early referrals along with adequate assessments and services for young people pre-detention, as soon as behavioural, academic or other issues are identified
- Earlier diagnosis and intervention may have prevented or mitigated the involvement of these young people with justice services, resulting in better outcomes both for the young people concerned, and the broader community
- The findings also highlight the need for more public education around FASD prevention and other causes of neurodevelopmental impairment
- They highlight the importance of improved training for people working in the youth justice system, to help them better understand the nature of impairments and how best to work with affected young people: this process has already begun, with our team developing and delivering training materials to more than 100 staff at Banksia Hill
- The release of this evidence represents a pivot point for our nation, and provides an opportunity to reassess and significantly improve the assessment, diagnosis, management and support of young people in contact with the justice system
- There has been widespread interest in our findings and the training we have developed, and some jurisdictions are already acting on them (e.g. ACT, Queensland).

RECOMMENDATIONS

At Banksia Hill

- **ESSENTIAL: Comprehensive multidisciplinary assessment of all young people on entry to Banksia Hill to identify their strengths and difficulties. At a minimum, the team undertaking this assessment should include a paediatrician, a neuropsychologist and a speech pathologist; ideally also an occupational therapist.**
- Ensure the findings of assessments are available to relevant staff at Banksia Hill and in the community, so that impairments can be addressed and strengths built upon. This could be done through easy availability of the reports on TOMS or other electronic system accessible to all relevant staff
- All relevant staff to receive training and regular updates on management of young people with neurodevelopmental impairments, taking advantage of the training resources developed through the Banksia Hill Project

- Intervention programs at Banksia Hill to be appropriate for young people with neurodevelopmental impairments, as well as culturally- and trauma-informed

Earlier intervention before juvenile detention

- Neurodevelopmental assessment of children and young people in contact with the justice system and/or the child protection system as early as possible, and findings shared appropriately to ensure impairments are addressed
- Given almost half the young people involved in our study had siblings also involved in juvenile justice, a young person's involvement with justice services should trigger assessment of all siblings
- Early referral for neurodevelopmental assessment of children and young people failing at school
- Provision of sufficient multi-disciplinary diagnostic facilities to ensure timely assessment
- Best practice intervention services for all children and young people identified with impairments
- Intervention programs, community-based orders and board conditions for young people engaged with the justice system to be appropriate for young people with neurodevelopmental impairments, and communicated in a way that is appropriate for their level of understanding
- Regular training on neurodevelopmental impairments for all professionals engaged with young people involved in the justice system (including education, child protection, justice and health).

Primary prevention

- State-wide primary prevention programs – universal and targeted – to reduce/prevent pre-natal alcohol exposure and other causes of neurodevelopmental impairment, antenatally and in the early years.

This document represents a summary only. Telethon Kids Institute is keen to engage with government to see the information from this study used to improve the circumstances for young people in contact with the justice system. Institute researchers also intend to undertake further research in this area, which has a high likelihood of attracting Commonwealth funds.

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BANKSIA HILL PROJECT'S RIPPLE EFFECT

Eighteen months on from the publication of its findings in *BMJ Open*, the game-changing Banksia Hill Project is continuing to reshape the way authorities manage and support vulnerable young people within the justice system.



The two-year study, which was the first in Australia to assess and diagnose young people in a youth custodial setting for Fetal Alcohol Spectrum Disorder (FASD), revealed that more than one third of young people assessed by the team had FASD – the highest known prevalence in a justice setting worldwide.

The team, led by Professor Carol Bower, also found 89 per cent of the young people examined had at least one form of severe neurodevelopmental impairment – providing evidence that youth with neurodisability are grossly over-represented in youth detention in WA.

The results are still rippling through government departments, police, custodial authorities, and the Children's Court, and have led not only to changes in policy and practice, but increased community understanding of FASD and widespread interest in Australia and overseas

"The delivery of training resources, pioneered by Hayley Passmore, to more than 100 Banksia Hill custodial staff means they are now better equipped to be able to recognise and work effectively with young people with neurodevelopmental impairment," Professor Bower said.

"Here in WA the findings, and the continuing advocacy and analysis by team members, have changed the way the justice workforce engages with these young people."

- Professor Carol Bower

"We're also seeing moves to improve the way police and the Children's Court interact with young people with a communication disorder or a different language who come into the justice system – another important finding."

The training resources developed, delivered and evaluated by Ms Passmore were a key outcome of the Banksia Hill Project, and are now in hot demand.

The Department of Justice has commissioned further paid training sessions for staff including newly recruited youth custodial officers and community youth justice officers, and other sectors, including police, child protection and education, are also keen to receive the training. In addition, Ms Passmore has received requests to access the resources from researchers, service providers and agencies worldwide.

"These requests are increasing rapidly given the global interest in FASD and justice-involved youth. I'm now seeking funding to evaluate the effectiveness of the training with other workforces, and to develop a 'train the trainer' model to ensure the training remains sustainable."

- Hayley Passmore

The Children's Court is also changing the way it responds to young people coming before it, thanks to the study's findings. Judicial officers have relied on assessment reports prepared by the team to better understand mitigating factors for sentencing; and there's growing recognition of the language and other barriers faced by many young people as they try to navigate the justice system.

Follow-on research led by Banksia Hill Project team member and speech pathologist Natalie Kippin revealed significant levels of language difficulty among young detainees, with almost half meeting the criteria for language disorder. Much of that language disorder was associated with FASD.

The research also found considerable language diversity, with less than a third of the young people assessed speaking Standard Australian English as a first language.

Ms Kippin said these communication barriers meant many young people were going through highly verbal legal and rehabilitation processes at a significant disadvantage.

The findings have led to interest in the provision of intermediaries to help respond to language and communication needs when young people are engaging with police and the courts.



Hayley Passmore and Natalie Kippin

WHAT'S NEXT

- Professor Bower and team are now advocating for **further collaborations with government, community and service providers to better respond to the needs of young people in the justice system.** This includes strengthening health and neurodevelopmental assessments, evaluating rehabilitation programs, training the justice workforce, and reducing the over-representation of Aboriginal people in custody.
- **Ms Passmore and members from the Telethon Kids leadership team are meeting with the heads of seven WA State Government departments,** to discuss a cross-government approach to upskilling frontline professionals in the justice, police, health, education and child protection sectors, to better manage neurodevelopmental impairments.
- The team will host a **WA Youth Justice and Health Forum** in November, to discuss the intersection between the justice, health and education sectors and collate priorities from community, service providers, researchers and government.

Excerpt from: Telethon Kids Institute. (2020). *Impact report 2019*. (pp. 30-31). <https://www.telethonkids.org.au/about-us/annual-reports> Permission to reproduce this material was obtained from Tamara Hunter, Senior Communications Officer (16th March 2021).

Appendix 11: Impact story – Communication skills, FASD and youth justice

IMPACT STORY

NATALIE KIPPIN
Communication skills, FASD and youth justice

Many young people who come into contact with the youth justice system face problems with effective two-way communication. To better understand the communication profiles of young people in the Western Australian youth justice context, Natalie Kippin, a certified practising speech pathologist, undertook a PhD with FASD Research Australia looking at 'Communication, FASD and Youth Justice'.

Natalie's research highlights the need for the WA youth justice system to consider the communication skills of young people as well as the language and communication demands of forensic contexts, such as police interviews and rehabilitation programs. Natalie explained that, "to answer questions, follow orders, and to learn, two-way communication skills are required". However, the results of Natalie's research revealed that two-way communication may be difficult for many of the young people in youth detention. Firstly, eight different first-languages were spoken by the young people in youth detention, and secondly, nearly half of the young people had developmental problems with their communication skills. Natalie's findings emphasise the importance of taking account of a young person's first (or 'home') language, as well as understanding a young person's skills in comprehension, verbal expression, as well as reading and writing.

Natalie's research is the first in Australia to identify the co-occurrence of FASD and language disorder in a youth justice sample (69%). Her work points to the importance of prevention and early identification of prenatal alcohol exposure and FASD, as well as speech pathology assessment for young people involved with youth justice.

Being awarded a PhD scholarship with FASD Research Australia meant that funding was available to help Natalie complete her PhD and disseminate her research findings. "I've been able to share this research at local forums, interstate conferences, and through publications", explained Natalie. She is excited to see change happening at the Banksia Hill Detention Centre school. "The principal and teachers are so proactive; they have implemented evidence-based reading and spelling approaches with the young people, and they're seeing improvements," Natalie reported.

Natalie has contributed to the Speech Pathology Australia: Justice Clinical Guideline, an important resource to inform speech pathology service provision in justice settings. Along with Aboriginal Interpreting WA, Natalie was also invited to help inform a potential intermediary service for WA; this would see allied health professionals working in specialty communication assistant roles in police and court settings to help facilitate two-way communication. With her clinical background, Natalie has also been involved in advisory groups, providing input to FASD-related research and educational resources.



Dr Hayley Passmore and Natalie Kippin visiting colleagues at a Victorian youth justice centre and learning about the education and speech pathology programs they provide to young people.

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Excerpt from: Bower, C., & Elliott, E. on behalf of the FASD Research Australia Centre of Research Excellence Investigators. (2020). *FASD Research Australia Impact Report 2016-2020: Results that change lives* (p. 30). <https://www.fasdhub.org.au/research-and-publications/fasd-research-australia/>
Permission to reproduce this material was obtained from Professor Carol Bower (2nd March 2021).