

**School of Population Health**

**A Comparison of the Associations between Alexithymia and both Non-suicidal  
Self-Injury and Risky Drinking: The roles of Cognitive-Emotional Variables and  
Biological Sex**

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

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## **Declaration**

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

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research studies received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Numbers #HRE2019-0061-01, #HRE2016-0313, #RDHS-236-15, #HRE-2018-0536.

Signature:

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## List of Papers

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4. \***Greene D.**, Hasking, P., & Boyes, M. (2020). The associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy. *Stress and Health*. Advance online publication. <https://doi.org/10.1002/smi.2991>
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3. **Greene, D.,** Hasking, P., & Boyes, M. (2020, May). *A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of biological sex and cognitive-emotional variables* [Conference Session]. Mark Liveris Seminar, Perth, Australia.
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6. Dawkins, J., Hasking, P., Boyes, M., **Greene, D.,** & Passchier, C. (2018, June). *Applying a cognitive emotional model to non-suicidal self-injury* [Poster Session]. International society for the study of self-injury 2018 conference, Brussels, Belgium.

7. Dawkins, J., Hasking, P., Boyes, M., **Greene, D.**, & Passchier, C. (2017). *Applying a cognitive emotional model to non-suicidal self-injury* [Poster Session]. Mark Liveris Seminar, Perth, Australia

## Table of Contents

<b>Declaration</b> .....	<b>2</b>
<b>Acknowledgements</b> .....	<b>3</b>
<b>List of Papers</b> .....	<b>4</b>
Journal Articles .....	4
Conference Presentations .....	6
<b>Thesis Overview</b> .....	<b>11</b>
<b>Author’s note</b> .....	<b>15</b>
<b>List of Tables</b> .....	<b>16</b>
<b>List of Figures</b> .....	<b>18</b>
<b>List of Appendices</b> .....	<b>20</b>
<b>Chapter 1: Introduction to thesis and overview of main topics</b> .....	<b>21</b>
Non-Suicidal Self-Injury .....	22
Risky Drinking .....	26
Commonalities between NSSI and Risky Drinking.....	28
Alexithymia.....	32
Social Cognitive Theory .....	34
What do Individuals Anticipate from Engaging in NSSI and Risky Drinking ...	36
Conclusion .....	41
Aims and Outlines of Thesis .....	43
<b>Chapter 2: Systematic literature review and meta-analysis: The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis</b> .....	<b>46</b>
Introduction to Chapter 2 .....	46
Abstract .....	48

Introduction .....	49
Methods.....	54
Results .....	59
Discussion .....	84
Conclusion .....	92

**Chapter 3: The associations between alexithymia, non-suicidal self-injury, and risky drinking: The moderating roles of experiential avoidance and biological sex.**

.....	<b>94</b>
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Introduction to Chapter 3 .....	94
Abstract .....	96
Introduction .....	97
Methods.....	102
Results .....	105
Discussion .....	113
Conclusion .....	118

**Chapter 4: Measurement invariance of two measures of alexithymia among students who do and who do not engage in non-suicidal self-injury and risky**

<b>drinking. ....</b>	<b>120</b>
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Introduction to Chapter 4 .....	120
Abstract .....	122
Introduction .....	123
Methods.....	130
Results .....	138
Discussion .....	154
Conclusion .....	159

**Chapter 5: A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy .....**

Introduction to Chapter 5 .....	160
---------------------------------	-----

	10
Abstract .....	162
Introduction .....	163
Methods.....	171
Results .....	176
Discussion .....	186
Conclusion .....	191
<b>Chapter 6: Comparing the roles of behaviour-specific beliefs in the associations between alexithymia and both non-suicidal self-injury and risky drinking: A multi- method assessment of expectancies .....</b>	<b>193</b>
Introduction to Chapter 6 .....	193
Abstract .....	195
Introduction .....	196
Methods.....	200
Results .....	206
Discussion .....	217
Conclusion .....	221
<b>Chapter 7: General Discussion .....</b>	<b>223</b>
Introduction to General Discussion.....	223
Aims of Thesis .....	223
Summary of Findings.....	223
Comparing the Associations and Theoretical Implications .....	225
Implications and Avenues for Future Research .....	235
Limitations .....	243
Final Conclusion .....	246
<b>Reference List .....</b>	<b>247</b>
<b>Appendices .....</b>	<b>293</b>

## Thesis Overview/Summary

Non-Suicidal Self-Injury (NSSI) and risky drinking are two behaviours that share an emotion regulatory function (Aurora & Klanecky, 2016; Klonsky 2007; Kingston et al., 2010). If underlying emotional difficulties are not addressed, there could be a tendency for individuals to shift between NSSI and risky drinking (Symptom shift; Garke et al., 2019; Duggan & Heath, 2014; Sauer-Zavala et al., 2017). However, if a transdiagnostic approach is taken by studying mutual predictors of both behaviours, these predictors could be targeted in intervention and prevention initiatives to decrease the likelihood of symptom shift (Garke et al., 2019). One common predictor of both NSSI and risky drinking is alexithymia (Greene et al., 2020a), a factor encompassing three aspects related to difficulties in the processing of emotions; 1) difficulties identifying one's feelings, 2) difficulties describing one's feelings to others, and 3) a tendency to focus externally (Bagby et al., 1994). Although there has been a significant amount of research on the associations between alexithymia and both self-injury and risky drinking, the two associations are yet to be compared. It is unknown whether the associations between alexithymia and both NSSI and risky drinking are similar and under what conditions they may differ (e.g., biological sex and experiential avoidance). Further, a more nuanced understanding of the associations between alexithymia and both behaviours may be obtained by evaluating the mediating roles of behaviour specific thoughts and beliefs (i.e., outcome expectancies and self-efficacy beliefs; Cox & Klinger, 1988; Hasking et al., 2016). In this thesis, I describe five studies that aimed to explore the associations between alexithymia and both NSSI and risky drinking among university students, a group that is at elevated risk of both self-injury and risky drinking (AIHW, 2016, 2020; Auerbach et al., 2018; Swannell et al., 2014)

The first two studies explored and compared the direct associations between the three facets of alexithymia and both NSSI and risky drinking. Additionally, I

investigated the moderating role of biological sex (Studies 1 and 2) and experiential avoidance (Study 2) in both associations. The first study was a systematic review and meta-analysis reviewing and comparing both associations. The second was, a self-report study ( $n = 778$ ,  $Mean = 22.27$ ,  $SD = 6.71$ ) that compared four groups of students based on their NSSI history and risky drinking status (e.g., students who have engaged in NSSI only, students who have engaged in both behaviours) on the variables of interest. Across these studies I found differences in the associations between the three facets of alexithymia and both behaviours. Specifically, I found stronger associations between difficulties identifying and describing feelings and NSSI compared to risky drinking. Conversely, compared to individuals who engaged in NSSI, individuals who engaged in risky drinking were more likely to have an externally orientated thinking style. There were a few minor sex differences. Meta-analytically, the association between alexithymia and NSSI was slightly stronger for women. Further, men who had more difficulties describing their emotions had an increased likelihood of reporting engaging in risky drinking compared to self-injury (Study 2).

In the third study, I investigated the measurement invariance and psychometric properties of the Toronto Alexithymia Scale (TAS-20) and the newly developed Perth Alexithymia Questionnaire (PAQ) in a sample of students ( $n = 640$ ;  $Mean = 20.39$ ,  $SD = 1.86$ ) who have and students who have not engaged in NSSI and risky drinking. There were two reasons for this study. First, to ensure I chose a reliable measure of alexithymia going forward into Studies 4 and 5. Second, to ensure I had confidence that differences in alexithymia (as measured by self-report scales) between individuals who do and individuals who do not engage in NSSI/risky drinking are true group differences and not artificial differences due to different interpretations of scale items. Although both the TAS-20 and PAQ were invariant among students who do and students who do not self-injure/engage in risky drinking the Perth scale had a more reliable externally

orientated thinking subscale. Considering these results, I decided that the PAQ would be a more reliable measure of alexithymia to use in Studies four and five. Additionally, the PAQ could give us a more nuanced understanding of the associations between alexithymia and both behaviours considering it provides valence specific (i.e., both positive and negative) measurement of difficulties identifying and difficulties describing feelings.

In the final two studies, I investigated the indirect associations between alexithymia and both self-injury and risky drinking via behaviour specific outcome expectancies (i.e., what an individual anticipates from engaging in a behaviour; Bandura, 1977), and refusal self-efficacy using both questionnaire (Study 4;  $n = 627$ ,  $M_{age} = 20.75$ ,  $SD = 1.88$ ) and lab-based (Study 5;  $n = 259$ ,  $M_{age} = 19.98$ ;  $SD = 1.49$ ) data. Across studies, I found that alexithymia exhibited indirect effects on both NSSI and risky drinking via behaviour-specific refusal self-efficacy. Thus, students with emotion processing difficulties may believe they are incapable of resisting engaging in self-injury or consuming alcohol in circumstances where they are required to place attention on and/or appraise their feelings. In Study 4, I found indirect associations between alexithymia and NSSI through weaker expectations of communication and pain, and stronger expectations of affect regulation. Further, I found indirect associations between alexithymia and risky drinking through expectations of negative consequences and increased confidence. Yet, these associations were dependent on whether the emotions that individuals had difficulties appraising were negative or positive. Specifically, among students who have problems appraising negative feelings, NSSI may be engaged in with the expectation of emotional relief and alcohol may be consumed with the expectation that it will increase their confidence in articulating feelings. Whereas among students who have problems appraising positive emotions, both NSSI and risky drinking could be engaged in with the expectation that these

behaviours will draw attention away from internal experiences onto the physical aspects of NSSI/drinking (e.g., physical sensations from NSSI or hangovers from drinking). In Study 5, modelling the same relationships with experimental data, I found similar results for NSSI as I did in Study 4. However, there were no indirect effects between alexithymia and risky drinking via lab-measured expectancies in Study 5.

Overall, the findings of the five studies suggest that there are similarities and differences in the associations between alexithymia and both NSSI and risky drinking. At a surface level, the associations differed across the subcomponents of alexithymia. Difficulties identifying and difficulties describing feelings had stronger associations with self-injury than risky drinking. Conversely, students who engage in risky drinking may be more likely to have a predisposition to focus externally than students who engage in NSSI. Clinically, these results may be important in determining what emotion processing difficulties should be focused on in the treatment of NSSI compared to treating risky drinking. Further, alexithymia may be associated with different anticipated outcomes of NSSI than risky drinking in university students. Nevertheless, outcome expectancies and self-efficacy beliefs play roles in both associations, and an intervention approach where a person's behaviour-specific beliefs are challenged could be beneficial for individuals with elevated levels of alexithymia. Future research could examine the effectiveness of challenging behaviour-specific beliefs in treating NSSI and/or risky drinking among people with elevated levels of alexithymia.

### **Author's note**

The current thesis is presented as a hybrid thesis and includes five papers that have been accepted for publication. Considering that each chapter is presented as a published manuscript, there is inevitable repetition throughout the thesis, particularly when describing the background literature and the methods for each study. Each chapter begins with a short introduction which links together the individual studies to form a unified body of work. Changes to language and presentation have been made to published manuscripts (e.g., I use the term biological sex instead of gender throughout) for consistency purposes. Furthermore, referencing was converted to APA 7<sup>th</sup> across studies, with a combined reference list presented at the end of the general discussion. Due to the many publications by Lyvers included in the meta-analysis (Chapter 2) his studies were referenced Lyvers, second author et al., year. Apart from the systematic review of the literature and meta-analysis presented in Chapter 2, four data sets were used across studies. Study 2 is a combination of two pre-existing data sets. Studies 3 and 4 use the same data set. Differences in participant numbers and descriptive statistics across Studies 3 and 4 are due to the removal of data from participants who did not complete all measures related to that study.

## List of Tables

Table 2.1: Search terms.....	55
Table 2.2: Studies exploring the association between alexithymia and NSSI.....	62
Table 2.3: Studies exploring the association between alexithymia and risky drinking ..	68
Table 2.4: Moderator analysis for the association between alexithymia and NSSI.....	79
Table 2.5: Moderator analysis for the association between alexithymia and risky drinking .....	82
Table 2.6: Summary of pooled effect sizes and sample size.....	84
Table 3.1: Comparison between groups of participants on variables of interest .....	106
Table 3.2: Means, standard deviations, and correlations between predictors.....	107
Table 3.3: Multinomial regression: NSSI and risky drinking compared to neither behaviour.....	107
Table 3.4: Binary logistic regressions: Comparing NSSI, risky drinking, and both behaviours .....	111
Table 4.1: Means and standard deviations of TAS-20 and PAQ subscales across groups .....	140
Table 4.2: Pearson’s correlations between PAQ, TAS-20, K10, and DERS for individuals who do and who do not engage in NSSI .....	141
Table 4.3: Pearson’s correlations between PAQ, TAS-20, K10, and DERS for low-risk and risky drinkers.....	142
Table 4.4: Model fit for competing TAS-20 models across all samples.....	144
Table 4.5: Cronbach alphas and standardised factor loadings for 3-factor + method factor model of the TAS-20 .....	145

Table 4.6: Model fit for competing PAQ models .....	146
Table 4.7: Cronbach alphas and standardised factor loadings for the 5-factor model of the PAQ.....	149
Table 4.8: Measurement invariance assessment of alexithymia measures between university students with and without histories of NSSI.....	150
Table 4.9: Measurement invariance assessment of alexithymia measures between low-risk and risky drinkers.....	152
Table 5.1: Comparison of means across NSSI groups on variables of interest .....	178
Table 5.2: Correlations between all model variables.....	179
Table 6.1: Means, standard deviations, internal consistency, and correlations between NSSI model variables.....	208
Table 6.2: Means, standard deviations, internal consistency, and correlations between risky drinking model variables.....	209
Table 6.3: Comparison between NSSI and no NSSI groups on questionnaire-based and lab-based measures of outcome expectancies and self-efficacy to resist NSSI.....	210
Table 6.4: Logistic regression predicting engagement in NSSI.....	211
Table 6.5: Comparison between low-risk and risky drinkers on questionnaire and lab-based measures of outcome expectancies and drinking refusal self-efficacy .....	212
Table 6.6: Multiple regression predicting risky drinking.....	213

## List of Figures

Figure 1.1: Conceptual model of the association between alexithymia and both NSSI and risky drinking .....	42
Figure 2.1: Study screening procedure.....	56
Figure 2.2: Forest plots for random effects models for history of NSSI.....	77
Figure 2.3: Forest plots for random effects models for recent NSSI.....	78
Figure 2.4: Forrest plots of random effects models for risky drinking .....	81
Figure 3.1: Engagement in both behaviours compared to neither behaviour. Sex moderates the associations between difficulties describing feelings and probability of engaging in both behaviours .....	108
Figure 3.2: NSSI compared to neither behaviour. Sex and experiential avoidance interact to moderate the association between externally orientated thinking and the probability of engaging in NSSI only .....	109
Figure 3.3: NSSI only compared to risky drinking only. Sex and experiential avoidance interact to moderate the association between externally orientated thinking and the probability of engaging in risky drinking only .....	112
Figure 3.4: Drinking compared to both behaviours. Sex moderates the associations between difficulties describing feelings and probability of engaging in both behaviours .....	112
Figure 4.1: The six tested measurement models of the TAS-20.....	135
Figure 4.2: The five tested measurement models of the PAQ.....	136
Figure 5.1: Hypothesised path models for the associations between alexithymia and both NSSI and risky drinking.....	171

Figure 5.2 : Alternative path model of the association between alexithymia and NSSI via behaviour-specific outcome expectancies and self-efficacy beliefs. ....	182
Figure 5.3: Alternative path model of the association between alexithymia and risky drinking via behaviour-specific outcome expectancies and self-efficacy beliefs.....	185
Figure 6.1 : Unconstrained path model of the association between alexithymia and NSSI via behaviour-specific outcome expectancies and self-efficacy beliefs. ....	2017
Figure 6.2 :Unconstrained path model of the association between alexithymia and risky drinking via behaviour-specific outcome expectancies and self-efficacy beliefs.....	216

## List of Appendices

Appendix A: Database searches, example data extraction form, study exclusion details, and risky of bias and quality assessment tables (Study 1).....	293
Appendix B: Ethics approval letters for data used in Study 2. ....	301
Appendix C: Information sheets, consent forms, and questionnaires used in Study 2. ....	304
Appendix D: Ethics approval letters for data used in Study 3,4, and 5. ....	313
Appendix E: Information sheets, consent forms, and questionnaires used in Study 3,4, and 5.....	317
Appendix F: NEQ and DEQ-R items compared to sentence-completion task items..... .....	332
Appendix G: Non-Supervisor authors approval.....	334
Appendix H: Copyright information for published articles. ....	335

## **Chapter 1: : Introduction to Thesis and Overview of Main Topics**

### **Introduction to Chapter 1**

In chapter one, I first provide an overview of non-suicidal self-injury and risky drinking, including the prevalence and reasons for engaging in both behaviours. Second, I outline commonalities between NSSI and risky drinking, including the roles of emotion, alexithymia, and behaviour-specific cognitions in predicting both behaviours. Third, I explain the possible role of behaviour-specific cognitions in the associations between alexithymia and both NSSI and risky drinking with reference to the Cognitive-Emotional Model of NSSI (Hasking et al., 2016) and the Motivational Model of Alcohol Use (Cox & Klinger, 1988). The chapter ends with the aims and an outline of the thesis.

## **Non-Suicidal Self-Injury**

### **What is Non-Suicidal Self-Injury?**

NSSI is intentionally causing harm to the body without lethal intent for reasons not culturally or socially endorsed (International Society for the Study of Self-Injury [ISSS], 2018; Nock, 2009). Skin cutting is the most commonly reported method of NSSI (Bresin & Schoenleber, 2015), but other methods include, but are not limited to, burning, biting carving, pinching, severe scratching, and self-battery. Individuals are likely to report engaging in multiple methods of self-injury rather than one sole method (Bresin & Schoenleber, 2015). However, in the past, definitions of self-inflicted harm have varied across the literature and have often been unclear. For example, terms such as “self-harm” and “deliberate self-harm” are used by some researchers (e.g., Hawton et al., 2012) to describe any self-injurious behaviour that is non-fatal and self-inflicted regardless of suicide intent, whilst others (e.g., Gratz, 2006) use these terms to describe self-injurious behaviours where suicide intent is explicitly absent. In 2006 the ISSS defined NSSI to help differentiate these behaviours.

For an injury to be considered NSSI, it must be self-inflicted, and deliberate with the intent to cause physical harm but not death (ISSS, 2018). NSSI does not include risk-taking behaviours, such as tobacco use, or behaviours that result in unintended harm. Further, only harm from direct injury (e.g., carving or pinching the skin), and not indirect damage which occurs over time, such as damage caused by substance use, is classified as NSSI. Body modifications, for example, piercings or tattoos, that are religiously or culturally endorsed, are not classified as NSSI. Similarly, behaviours such as trichotillomania or excoriation which are symptoms of other disorders are not classified as NSSI (ISSS, 2018).

Differentiating NSSI from suicide attempts/ideation is important. It is sometimes argued that the phrase “non-suicidal” can be misleading due to the strong association between NSSI and future suicide attempts (Griep & MacKinnon, 2020; Whitlock et al., 2013). However, suicide attempts occur at a considerably lower frequency than NSSI (Muehlenkamp & Gutierrez, 2004). The motives behind NSSI and suicide/suicide attempts significantly differ, as NSSI is most often engaged in to regulate emotions, while suicide attempts are associated with hopelessness and intentions of dying or death (Muehlenkamp & Gutierrez, 2004). Yet, the intent of the self-injury can fluctuate over time, with between 4 and 7% of individuals reporting both NSSI and suicidal behaviour (Whitlock et al., 2013). Further, methods of NSSI have a low level of lethality (e.g. cutting and pinching), whereas, methods of suicide attempts have high lethality (Muehlenkamp & Kerr, 2010), with, approximately 99% of deaths by suicide being caused by the following methods: overdose, self-poisoning, jumping, hanging, and self-inflicted gunshots (The Center for Disease Control and Prevention, 2009). If NSSI is not classified separately from behaviours with suicidal intent this can lead to imprecise risk assessments and conceptualisation of cases, and poor treatment choices (Glenn & Klonsky, 2013; Latimer et al. 2009).

Although NSSI is a diagnostic criterion for Borderline Personality Disorder (Selby et al., 2012), NSSI is more generally considered as a transdiagnostic construct. NSSI often co-occurs with several diagnoses including substance use disorders, eating disorders, anxiety disorders, depression, and post-traumatic stress disorder (PTSD; Bentley et al., 2015; Cipriano et al., 2017). Approximately 30% of individuals who have been diagnosed with a substance use disorder report a history of NSSI (Gratz & Tull, 2010; Gupta et al., 2019). Similarly, approximately 27% of individuals with an eating disorder report a lifetime history of NSSI (Cucchi et al., 2016). Regarding emotional disorders, odds of engaging in NSSI are as follows for individuals with the disorder

compared to individuals without the disorder: Anxiety disorders (pooled OR = 1.76), depression disorders (pooled OR = 1.86), and PTSD (pooled OR = 2.06; Bentley et al., 2015). However, individuals without a clinical diagnosis also engage in NSSI (Hasking et al., 2008; Swannell et al., 2014).

Further, non-suicidal self-injury disorder (NSSI-D) was included in the 5th edition of the 'Diagnostic and Statistical Manual of Mental Disorders', as a condition that requires additional research (American Psychiatric Association, 2013). There are six proposed diagnostic criteria for NSSI-D (see APA, 2013), including that the individual must have engaged in self-injury on at least 5 days within the last year, and that an individual has self-injured for one or more of the following reasons: 1) to regulate negative thoughts/feelings, 2) to resolve interpersonal problems, and 3) to induce positive emotions.

### **How Prevalent is NSSI?**

Prevalence rates of NSSI are estimated to be up to 60% in adolescent clinical samples (Glenn & Klonsky, 2013), and 18% for adult clinical samples (Polanco-Roman et al., 2014). Yet, self-injury is also prevalent among non-clinical populations with about 17% of adolescents, 13%, of young adults (18-25) and 5% of adults (26+) reporting having engaged in NSSI (Swannell et al., 2014). The age of onset of NSSI appears to be bimodal. The first peak in the onset of NSSI is typically between the ages of 13 and 16 with individuals who begin to engage in NSSI earlier being at increased risk of engaging in NSSI more frequently and using more severe methods (Ammerman et al., 2017; Gandhi et al., 2018). Gandhi et al. (2018) noted the second peak in onset in early adulthood between the ages of 20 and 24.

Sex differences in prevalence rates have been inconsistent. In a metaanalytic review, Bresin and Schoenleber (2015) found that men are less likely to report ever

having engaged in NSSI than women. Sex differences are stronger in clinical samples, with women 1.50 times more likely to have engaged in NSSI than men. In community samples, sex differences are smaller with women only 1.20 times more likely to have a history of NSSI than men. Although cutting is the most consistently endorsed form of NSSI for both men and women, women are more likely to endorse, scratching, biting, hair-pulling, and wound interference, than men (Bresin & Schoenleber, 2015). Sex differences in prevalence rates might differ by race (Gholamrezaei et al., 2015; Gratz et al., 2012). For example, Gratz et al. (2012) found that white female adolescents reported significantly higher rates of self-injury than white male adolescents. Yet, in the same study, male African American adolescents reported significantly higher rates of self-injury than female African American adolescents. However, a review by Gholamrezaei et al. (2015) found that other than in samples with majority Caucasian participants, sex differences in NSSI were very inconsistent. Thus, the authors suggest that sex differences across ethnicity, culture, and race requires further research.

### **Why do People Self-Injure?**

NSSI can serve various functions for different individuals, and reasons for engaging in NSSI can change across situations (Nock & Prinstein, 2004). Nock and Prinstein (2004) proposed that the functions of NSSI fall into four specific categories. Specifically, the authors characterised NSSI functions across two domains that reflect the source (interpersonal vs. intrapersonal) and valence (positive reinforcement vs. negative reinforcement) of the outcomes of NSSI. First, intrapersonal negative reinforcement functions refer to engaging in NSSI to downregulate an unpleasant emotional state. Second, intrapersonal positive reinforcement functions include engaging in NSSI to induce feelings or sensations (e.g., to not feel numb). Third, interpersonal negative reinforcement functions refer to engaging in NSSI to evade a disagreeable social situation. Last, interpersonal positive reinforcement is engaging in

NSSI to gain a response from other individuals (e.g., care or assistance; Nock & Prinstein, 2004). Through reviewing the literature and expert interviews, Klonsky and Glenn (Klonsky, 2007, 2011; Klonsky & Glenn, 2009) identified 13 functions of NSSI that map onto Nock and Prinstein's initial model: intrapersonal functions (e.g., affect regulation, self-punishment, anti-dissociation, and anti-suicide) and interpersonal functions (e.g., revenge, sensation seeking, autonomy, and peer bonding).

Overall, individuals are more likely to report intrapersonal functions of NSSI (pooled prevalence = 74%, 95% CI [61, 81]) than interpersonal functions (pooled prevalence = 44%, 95% CI [33, 56]; Taylor et al., 2018). Affect regulation is the most endorsed function of NSSI (pooled prevalence = 71%, 95% CI [63, 78]; Taylor et al., 2018), with other interpersonal functions such as mood enhancement (pooled prevalence = 50%, 95% CI [42, 57]) and self-punishment (pooled prevalence = 51%, 95% CI [41, 62]) being less likely to be reported. Communication of distress is the most strongly endorsed interpersonal function (pooled prevalence = 42%, 95% CI [30, 55]), with interpersonal influence (pooled prevalence = 28%, 95% CI [23, 33]) and punishment of others (pooled prevalence = 18%, 95% CI [13, 23]) being endorsed by fewer individuals (Taylor et al., 2018). Further, the functions of NSSI may vary across biological sex. Although emotion regulation is the most consistently reported function for both men and women, men are more likely to endorse social functions of NSSI than women (e.g., toughness and attention; Claes et al., 2007).

## **Risky Drinking**

### **What is Risky Drinking?**

The World Health Organisation (2014) describes “risky” drinking as drinking alcohol in a fashion that heightens an individual's risk of harmful consequences to themselves and other people (i.e., short-term consequences, e.g., dehydration and

hangovers). “Harmful” alcohol use refers to drinking alcohol in a fashion that impacts on the individual’s physical and mental health (i.e., long-term consequences; liver damage; WHO, 2014). Whereas, Alcohol Use Disorders are defined as consuming alcohol in a pattern that is associated with problems controlling drinking, being preoccupied with drinking, and the continued consumption of alcohol after negative outcomes have occurred (APA, 2013; WHO, 2014). Though less severe than Alcohol Use Disorders, consuming alcohol in a risky or harmful pattern can have adverse physical and psychological consequences including increased risk of stroke, some cancers, liver cirrhosis, depression, anxiety, and memory loss (Poznyak & Rekve, 2015). Risky drinking is also associated with mental disorders such as depression (Caldwell et al., 2002), social anxiety (Terlecki et al., 2020), and post-traumatic stress disorder (Johnson et al., 2016).

### **How Prevalent is Risky Drinking?**

Lifetime prevalence rates of alcohol use disorders are estimated at 13.70% - 18.30% in Australian adults (AIHW, 2016, 2020). However, although less severe than alcohol use disorders, risky drinking is also prevalent with approximately 18% of Australian adolescents, 31% of young adults (18-24), and 16-30% of Australian adults reporting to have engaged in risky drinking (AIHW, 2016). Age of first drink is typically between the ages of 14 and 17 (AIHW, 2016, 2020), with earlier consumption associated with consuming alcohol at riskier levels in adulthood (Ohannessian et al., 2015). Overall, in contrast to NSSI, men (approx. 24%) are more likely to consume alcohol at risky levels than women (approx. 9.5%; AIHW, 2016, 2020).

### **Why do People Engage in Risky Drinking?**

Individuals have various motives for consuming alcohol, and reasons for drinking can be different across situations (Cooper et al., 1995; Cox & Klinger, 1988).

Cox and Klinger (1988) characterised drinking motives into four groups based on the source (interpersonal vs. intrapersonal) and the valence (positive reinforcement vs. negative reinforcement) of the outcome an individual hopes to achieve from consuming alcohol. Intrapersonal negative reinforcement motives of drinking include drinking to cope with aversive emotional states, whereas intrapersonal positive reinforcement motives include drinking to enhance positive feelings. Further, interpersonal negative reinforcement motives include consuming alcohol to prevent social censure or rejection, whereas interpersonal positive reinforcement motives of drinking include consuming alcohol to obtain positive social rewards. Kuntsche et al. (2005) reviewed the literature on drinking motives in young adults and found that functions generally map onto Cox and Klinger's (1988) framework: intrapersonal functions (e.g., mood enhancement, sensation seeking, coping/affect regulation) and interpersonal functions (e.g., peer bonding, social pressure, conformity).

Overall, social and conformity motives are the most consistently reported motives for drinking among young adults (Kuntsche et al., 2005). However, young adults who drink alcohol in a risky pattern are more likely to endorse coping motives than young adults who do not drink alcohol in a risky pattern (Kuntsche et al., 2005; White et al., 2016). Further, drinking to cope with negative emotions during young adulthood is particularly associated with alcohol dependence later in life (Kuntsche et al., 2005). Coping motives may also differ across biological sex among university students, with Foster et al., (2014) finding that male students were more likely to report affect regulation motives for drinking than female students.

### **Commonalities between NSSI and Risky Drinking**

#### **NSSI and Risky Drinking Among University Students**

Early adulthood is a transitional time in the life of an individual with physical changes, social changes and increases in independence and personal responsibilities (Arnett, 1997; Bewick et al., 2010). Due to the added financial, academic, and social pressures, the university period can be associated with decreased psychological wellbeing (Arnett, 1997; Bewick et al., 2010). Prevalence rates of NSSI and risky drinking are both higher in young adults who attend university than the broader young adult population. An estimated 20% of university students report a history of NSSI compared to 13% of young adults in the broader population (Swannell et al., 2014). Further, approximately 15% of university students first start to engage in NSSI in their first or second year of university (Gandhi et al., 2018; Kiekens et al., 2018b). Similarly, prevalence rates of risky drinking are estimated at 30% for the broader young adult population but up to 40% for young adults attending university (AIHW, 2016, 2020; Auerbach et al., 2018). Via a meta-analysis Bresin and Mekawi (2020) highlight a significant positive correlation between self-injury and risky drinking in university samples (Pooled OR = 1.48). Recently, Greene et al. (2019) and Hasking (2017) reported that approximately 13% of their samples of Australian university students had engaged in both NSSI and risky drinking. There is an increased risk of adverse psychological (Ansari et al., 2013; Hamza & Willoughby, 2014) and educational consequences (Kiekens et al., 2016; Martens et al., 2008) for students who consistently self-injure or engage in risky drinking throughout tertiary education than students who do not self-injure or drink at risky levels. Thus, highlighting the need for further investigation of NSSI and risky drinking among students.

### **The co-occurrence of NSSI and risky drinking**

Both clinical and non-clinical research has highlighted that NSSI, and risky drinking often co-occur (Hasking et al., 2008, Hasking, 2017, Williams & Hasking; Sinclair & Green, 2005). People regularly report engaging in self-injury and/or drinking

alcohol with the intention of downregulating or escaping from emotional experiences that are intense or undesirable (Aurora & Klanecky, 2016; Kingston et al., 2010; Klonsky, 2007). Considering that individuals typically report engaging in self-injury or drinking in a risky fashion for emotion regulatory purposes, emotion regulation is a significant component in theoretical models of dysregulated behaviours. For example, the Emotional Cascade (Selby & Joiner, 2009) and the Experiential Avoidance (Chapman et al., 2006) models of NSSI, and the Motivational Model of Alcohol Use (Cox & Klinger, 1988) highlight a key role for emotion in predicting dysregulated behaviours. Individuals are more likely to engage in self-injury (Klonsky, 2007) or consume alcohol (Martins et al., 2018) when less harmful emotion regulation strategies (e.g., exercising) cannot be accessed or have been unsuccessful. Individuals who both self-injure and consume alcohol at risky levels are a group at heightened risk of negative outcomes (e.g., poor mental health outcomes, and suicide ideation), potentially trying out multiple methods to regulate their emotions (Andrews et al., 2012).

Among young adults common and differential factors may predict engagement in NSSI and risky drinking and the co-occurrence of both behaviours (Andrews et al., 2012). Internal factors such as poor coping and problem solving, and high levels of psychological distress are more strongly associated with engagement in NSSI, whereas external factors such as poor social support, and coping by turning to others are more strongly associated with risky drinking. Common predictors, or predictors of co-occurrence of NSSI and risky drinking have internal and external characteristics. Factors such as poor resiliency, high levels of psychological distress and non-productive coping (e.g., worrying and concern about the future), poor cognitive reappraisal, and low self-esteem and family/peer support are associated with the co-occurrence of both behaviours. Thus, individuals consuming alcohol in a risky fashion may switch to engaging in NSSI if they are also experiencing intrapersonal problems such as high

levels of psychological distress or low levels of self-esteem. On the contrary, individuals who engage in NSSI may switch to drinking in a risky fashion if they have problems reappraising stressful situations and/or have a preference of coping by tuning to others (Andrews et al., 2012).

A large body of research has focused on understanding individual differences that predict engagement in NSSI and risky drinking, with the intention of informing prevention and intervention programs. While NSSI and risky drinking can serve similar functions, existing interventions typically focus on decreasing an individual's engagement in NSSI or risky drinking with limited focus on other psychological problems (Harvey et al., 2004). If the underlying psychological problems remain untreated, individuals can shift between behaviours, whereby an individual may cease engaging in NSSI only to start engaging in risky drinking (or vice versa; Garke et al., 2019). Symptom shift may also occur as an individual becomes older, with alcohol misuse increasing as an individual enters adulthood (i.e. alcohol becomes more readily available and socially acceptable), and engagement in NSSI begins to decrease (Andrews et al., 2010; Nakar et al., 2016; Ghinea et al., 2019), thus, suggesting that alcohol consumption could replace self-injury as a strategy to regulate one's emotions. However, co-occurrence /symptom shift may occur in the other direction with individuals first engaging in risky drinking before engaging in NSSI. Specifically, many people choose not to engage in NSSI because of the physical pain associated with self-injury, however, alcohol intoxication may facilitate engagement in NSSI by increasing pain tolerance (Horn-Hofmann et al., 2015; Thompson et al., 2017). Thus, alcohol consumption may be vital in the onset of NSSI before reinforcement of positive outcomes of NSSI (i.e., emotion regulation) are formed.

Recently, Garke et al. (2019) studied symptom shifting in the context of eating disorders, specifically individuals who experience eating disorder symptoms switching

between, eating disorder symptoms, alcohol use and self-injury overtime. Compared to individuals who did not shift to self-injury or alcohol use over time, individuals who shifted between symptoms/behaviours had higher levels of emotion regulation difficulties and elevated clinical presentations (e.g., anxiety and depression). Further, Turner et al. (2015) reported that the temporal association between self-injury and disordered eating is stronger for individuals who have difficulties with emotion regulation. Thus, taking a transdiagnostic approach and investigating key emotional variables that are theoretically linked to multiple behaviours (e.g., NSSI and risky drinking) or disorders (Duggan & Heath, 2014; Sauer-Zavala et al., 2017) is warranted. If transdiagnostic factors are identified for NSSI and risky drinking, these factors can be pursued in intervention plans to potentially decrease the odds of a person switching between NSSI and risky drinking for emotional relief. Alexithymia is a transdiagnostic construct that might underlie both NSSI and risky drinking (Cruise & Becerra, 2017; Greene et al., 2020a; Norman & Borrill, 2015).

## **Alexithymia**

### **What is Alexithymia?**

Alexithymia characteristics were first noted by psychiatrists working with individuals who presented with psychosomatic symptoms in the mid-20th century (Nemiah, 1984). It was noted that this group of individuals presented with a set of emotional processing difficulties including having difficulties describing and distinguishing their feelings, having difficulties fantasising, and being preoccupied with the external environment (Nemiah, 1984). However, it was not until the 1970's that the word alexithymia (after the Greek, *a* = lack, *lexis* = word, *thymos* = feeling) was coined to label this group of emotional processing difficulties (Nemiah & Sifneos, 1970; Sifneos, 1973). Currently, researchers typically use the term alexithymia to define a

group of three aspects related to difficulties in the processing of, 1) difficulties identifying one's personal feelings, 2) difficulties describing one's feelings to other people, and 3) a tendency to focus one's attention on the external world as opposed to one's personal thoughts and feelings (Bagby et al., 1994; Preece et al. 2017).

Alexithymia is considered a transdiagnostic factor related to a range of psychopathologies and developmental disorders, including substance use disorders (Thorberg et al., 2009), schizophrenia (O'Driscoll et al., 2014), autism (Berthoz & Hill, 2005), depression (Li et al., 2015), posttraumatic stress disorder (Frewen et al., 2008), obsessive-compulsive disorder (Roh et al., 2011), and anorexia and bulimia nervosa (Westwood et al., 2017). Further, alexithymia is a shared predictor of dysregulated behaviours, including NSSI (Greene et al., 2020a; Norman & Borrill, 2015) and risky drinking (Cruise & Becerra, 2017; Greene et al., 2020a). However, the associations between the three components of alexithymia and both behaviours have been inconsistent. For example, some studies report externally orientated thinking to be associated with NSSI (e.g., Wester & King, 2010), where others do not (e.g., Greene et al., 2019). Similarly, some studies report a medium-large association between difficulties identifying feelings and risky drinking (e.g., Lyvers, Hinton et al., 2014), whilst others report no association (e.g., Wahlstrom et al., 2012). Thus, it is unclear whether the associations between alexithymia (and its subcomponents) and NSSI and risky drinking are similar or different.

Experiential avoidance, the tendency to avoid, emotions, thoughts and other internal experiences, has been linked to alexithymia (Chapman et al., 2006; Hayes et al., 1996; Kingston et al., 2010 ). Individuals who have elevated levels of alexithymia have the tendency to confound physical sensations with feelings and over emphasise somatic complaints (Lumley et al., 1996). Self-injury or consuming alcohol at risky levels may allow an individual to avoid or escape the feelings they are having difficulties

identifying and describing and move their attention towards physical sensations (Lumley et al., 1996). Therefore, an individual's tendency to avoid internal experiences might be crucial in predicting engagement in dysregulated behaviours for individuals with high levels of alexithymia. Specifically, if a person with elevated high levels of alexithymia and the tendency to avoid their thoughts and feelings, they may be more likely to engage in dysregulated behaviours such as self-injury and risky drinking to escape the emotions they have difficulties processing. Conversely, if a person with elevated levels of alexithymia but has the ability to accept their thoughts and feelings, they may be less likely to engage in dysregulated behaviours.

Additionally, a more nuanced insight into associations between alexithymia and both behaviours could be gained through studying the roles of behaviour-specific thoughts and beliefs (Cox & Klinger, 1988; Hasking et al., 2016). Investigating how NSSI and drinking specific thoughts and beliefs are related to alexithymia could provide additional acumen into why students with elevated levels of alexithymia may self-injure or drink in a risky pattern. Social Cognitive Theory covers two key behaviour-specific cognitions; outcome expectancies and self-efficacy beliefs (Bandura, 1986; 1989) which are detailed below.

### **Social Cognitive Theory**

Historically, behavioural theorists argued a role for the environment in behaviour engagement, whereas psychodynamic theorists argued the for importance of internal factors (e.g., personality) when predicting behaviour engagement. Through Social Cognitive Theory, Bandura (1986, 1989) merged ideas from psychodynamic theories and behavioural theories and proposed that internal factors (e.g., thoughts and feelings, emotion), behaviour, and the environment interact together via triadic reciprocal determinism. Both the social and physical environment can alter behaviour,

and an individual's behaviour can influence their environment (Bandura, 1986, 1989). Internal factors, including, emotion, outcome expectancies, and thoughts/beliefs can be altered by an individual's social environment (e.g., social pressures, and modelling). Concurrently, an individual's physical attributes (e.g., appearance, age, and biological sex) can affect how other individuals interact with them, and an individual's societal position and status can have an impact on an individual's behaviour. Subsequently, the outcomes an individual experiences from engaging in a behaviour may alter their beliefs and feelings and their expectations about that behaviour (Bandura, 1986, 1989).

Bandura was influenced by expectancy theories of motivation, which suggest that the likelihood of an individual performing a behaviour is determined by what they anticipate to occur after engaging in a behaviour, and whether they believe the outcome is desirable (Atkinson, 1964; Feather & Newton, 1982). According to Bandura (1986) there are three categories of expectancies: social, physical, and expectancies related to an individual's self-beliefs. Across all three expectancy types, an individual will be more likely to engage in a behaviour when they perceive a positive outcome but will be unlikely to engage in a behaviour if they perceive a negative outcome. For example, a positive social expectancy may be anticipating social encouragement, whereas social ridicule may be a negative expectancy. Concerning physical expectancies, anticipating a pleasant sensory experience may be a positive expectancy, whereas a negative expectancy may be anticipating physical harm or discomfort. Beyond environmental influence, an individual's behaviour may be guided by self-concept and personal standards. Thus, an individual may anticipate consequences to one's self-beliefs. For example, if an individual believes a behaviour will induce feelings of pride and self-worth, they will be more likely to engage in it, whereas, if they anticipate that the behaviour will induce feelings of self-deprecation or self-dislike, they will avoid that behaviour. An individual's expectancies about a specific behaviour are directly affected

by experiencing the outcomes of that behaviour (Bandura, 1986). However, we can also imagine what could occur if we perform specific behaviour, which indicates that we do not have to have previously engaged in a behaviour or witnessed others engaging in a behaviour to hold behaviour-specific expectancies (Bandura, 1997).

In proposing Social Cognitive Theory, Bandura (1997, 1986) considered that even if an individual anticipates positive outcomes from engaging in a behaviour, they are unlikely to engage in that behaviour if they believe they are unable to successfully do so. Perceived self-efficacy, a person's belief in their capacity to effectively engage a behaviour, is a significant determinant of behaviour (Bandura, 1986). It is important to note that an individual's perceived self-efficacy is not defined by their actual abilities but their personal beliefs about their ability to perform a behaviour (Bandura, 1986). If a person is confident that they can effectively engage in a specific behaviour to attain a favourable outcome, there is a higher likelihood they will engage in that behaviour (Bandura, 1986, 1997). A person's capacity to avoid/resist performing a particular behaviour (e.g., self-injury or consuming alcohol) across varying circumstances is known as refusal self-efficacy and is a salient predictor of whether an individual engages in a behaviour (Greene et al., 2020b; Hasking & Rose, 2016; Oei et al., 2007).

### **What do individuals anticipate from engaging in NSSI and risky drinking?**

Hasking and colleagues combined Social Cognitive Theory with emotion regulatory models to highlight a mediating role for behaviour-specific beliefs in the relationships between emotional-related factors (such as alexithymia) and self-injury (Cognitive-Emotional Model of NSSI; Hasking et al., 2016). Existing studies (e.g., Dawkins et al., 2018; Hasking & Rose, 2017), indicate that NSSI-specific outcome expectancies can discriminate between individuals who do and who do not have a history of self-injury. In contrast to individuals who have never self-injured, individuals

who have self-injured tend to believe that engaging in NSSI will have emotion regulatory effects (Dawkins et al., 2018, 2019a, 2019b; Greene et al., 2020b; Hasking & Rose, 2017). Whereas individuals who have never self-injured tend to anticipate negative outcomes from NSSI, such as believing that self-injury will be painful (Dawkins et al., 2018, 2019a, 2019b; Greene et al., 2020b; Hasking & Boyes, 2017). Further, in contrast to individuals who do not have a history of NSSI, individuals who have a history of NSSI are more likely to hold weaker beliefs in their capacity to avoid self-injury in the future (Dawkins et al., 2019a; Hasking & Rose, 2016). In comparison to general self-efficacy, self-efficacy to resist NSSI is superior at distinguishing between individuals who have and individuals who have not self-injured (Hasking & Rose, 2016).

Similarly, Cox and colleagues argue a role for behaviour-specific cognitions in the relationships between emotional-related factors (such as alexithymia) and risky drinking (Motivational Model of Alcohol Use; Cox and Klinger, 1988; Cooper et al., 1995). Decades of research has shown that in community samples, individuals who drink at high-risk levels have stronger positive expectancies of drinking than individuals who consume alcohol at low-risk levels, who in turn have stronger negative expectancies (Hasking et al., 2015; Hasking, 2017; Hasking & Oei, 2002; Lee et al., 2003). Specifically, in community samples, people who drink in a risky fashion are more likely to anticipate that consuming alcohol will reduce tension/negative affect, increase confidence, and result in sexual enhancement than individuals who are low-risk drinkers (Greene et al., 2020b; Hasking, 2017; Hasking & Oei, 2002; Hasking et al., 2015). However, various researchers have found that individuals who report consuming alcohol in a risky pattern also hold strong negative expectancies (Lee et al., 1999; McMahon & Jones, 1993). These results may be due the cross-sectional nature of many of these studies, with individuals who consume alcohol in a risky pattern being more

likely to have experienced these outcomes and hold these expectancies than individuals who drink at low-risk levels (Lee et al., 1999; McMahon & Jones, 1993).

People who do and people who do not drink in a risky fashion are distinguishable by their ability to resist drinking (i.e., drinking refusal self-efficacy; Oei et al., 2007; Young & Oei, 2000). Where general self-efficacy is a prominent predictor of alcohol-related outcomes in clinical samples, drinking refusal self-efficacy is superior at distinguishing individuals who do and do not drink in a risky pattern in the general population (Oei et al., 2007). With individuals who consume alcohol at low-risk levels reporting a greater ability to resist drinking across numerous situations than individuals who drink in a risky fashion (Oei et al., 2007; Young & Oei, 2000).

Contextually, a person who has difficulties identifying and describing their feelings (i.e., elevated alexithymia) could anticipate that engaging in self-injury will help them to regulate the feelings they are having difficulties assessing, thus, increasing their risk of engaging in NSSI. Or possibly, a person with elevated levels of alexithymia may anticipate that drinking alcohol will enhance their confidence in articulating their emotions in social settings, thus, increasing the likelihood of the individual consuming alcohol in a risky pattern. Additionally, these indirect associations may be strengthened by weak beliefs in one's ability to resist engaging in a behaviour. Specifically, a person who anticipates that engaging in self-injury will have emotion regulatory benefits and holds weak beliefs in their capacity to resist NSSI may be at increased risk of self-injury. Likewise, a person who anticipates that drinking alcohol will heighten their confidence in articulating their feelings and holds weak beliefs in their ability to avoid alcohol may be at elevated risk of risky drinking. I test these possibilities in the final two studies of this thesis.

Furthermore, there is indication in the literature that women with elevated alexithymia may be more likely to self-injure than men, whereas men with elevated alexithymia may be more likely to drink in a risky fashion than women (Cruise & Becerra, 2017; Greene et al., 2020a; Greene et al., 2019; Norman & Borrill, 2015). It is conceivable that these sex differences may be related to differences in anticipated outcomes of self-injury and risky drinking across sex. The assessment of NSSI-specific outcome expectancies is a new area of study, and sex differences are seldom investigated. Yet, in the NSSI functions literature, it has been found that although emotion regulation is the most strongly endorsed function of NSSI for both men and women, women are more likely to endorse affect-regulation functions in contrast to men (Claes et al., 2017). Whereas men are more likely to endorse social functions in contrast to women (Claes et al., 2007). Thus, in contrast to men, women experiencing difficulties identifying and describing their emotions, may have higher odds of believing that engaging in self-injury will have emotion regulatory benefits, which could result in the association between alexithymia and NSSI being stronger for women.

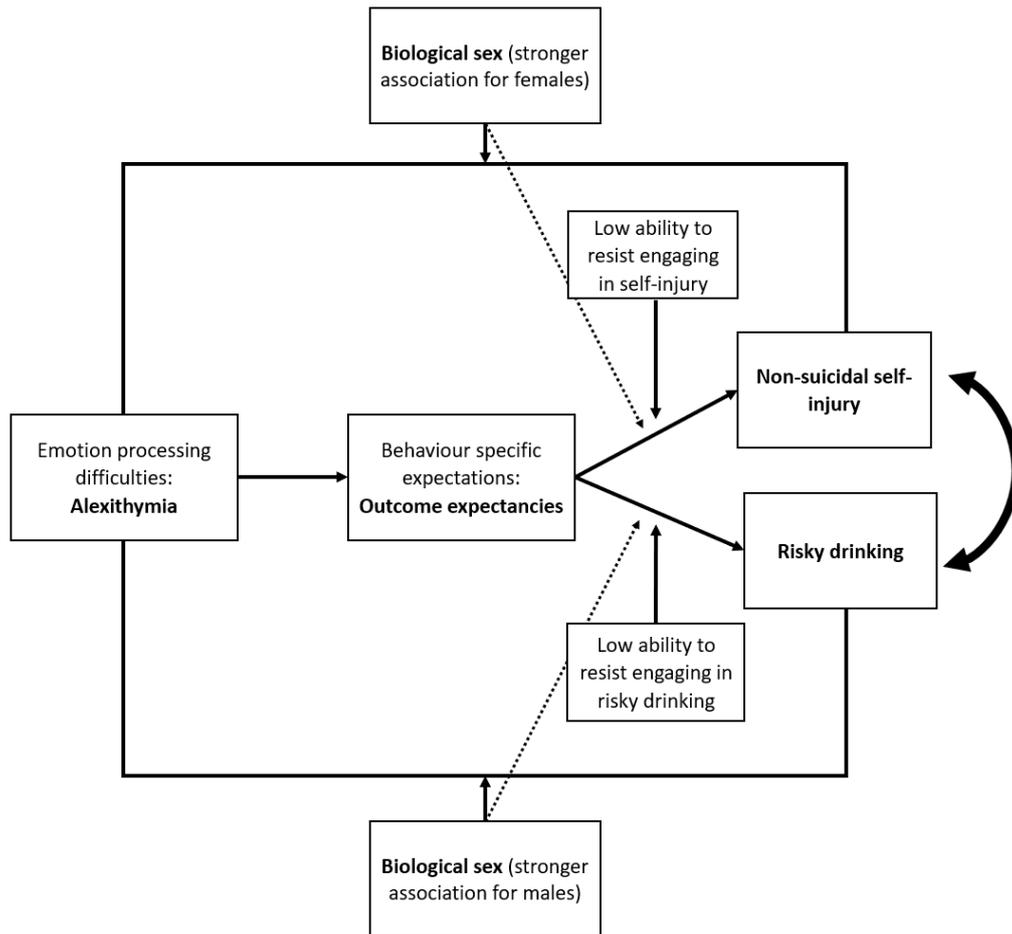
Expectations of alcohol consumption could also differ across biological sex. Men are more likely to endorse positive expectations such as tension reduction and sexual enhancement than women (Kalichman et al., 2007; Kushner et al., 1994). However, compared to men, women are more likely to anticipate negative consequences (Nolen-Hoeksema & Hilt, 2006). Thus, in contrast to women, men who have difficulties identifying and describing emotions are possibly more likely to anticipate that consuming alcohol in a risky fashion will help them to downregulate their emotions, which could result in a stronger association between alexithymia and risky drinking for men.

Gender-based socialisation may also play a role regarding what behaviours men and women might more commonly choose to regulate their emotions. Men are more

likely to be raised in line with traditional ideologies of masculinity, whereby they may be persuaded to restrict emotional expression (Levant, 1992; Levant et al., 2009). Whereas women are more likely to be raised in traditional models of femininity, whereby the expression of emotion is encouraged but behaviours such as excessive drinking are discouraged (Bem, 1979; Spence & Buckner, 2000). While a misconception, self-injury is regularly conceptualised as a feminine behaviour that adolescent girls and young women engage in (Lewis et al., 2014). This misconception might be due online content and entertainment media, 1) implying that mostly women engage in NSSI (Lewis et al., 2014), and 2) more likely to depict female characters visibly engaging in NSSI than male characters (Whitlock et al., 2009). Further, NSSI can leave visible scars, which may be seen as an expression of strong emotions or a reminder of intense emotional experience(s) (Lewis, 2016), and as such could be conceptualised as non-masculine. Thus, compared to women, men with elevated levels of alexithymia may be less likely to engage in NSSI as it is viewed as a feminine behaviour that can leave evidence of high emotionality. Therefore, men with high levels of alexithymia may be more likely to engage in risky drinking than NSSI to regulate their emotions, as drinking is typically considered a masculine behaviour that leaves no visible sign of emotionality (De Visser et al., 2007). Conversely, women with high levels of alexithymia may be more likely to self-injure than drink in a risky fashion to regulate their emotions, considering that traditionally, excessive drinking is considered a more masculine behaviour (De Visser et al., 2007). Throughout this thesis, I explore sex differences in both associations. A visual representation of how alexithymia, behaviour-specific beliefs, and both NSSI and risk drinking might be associated can be viewed in Figure 1.1.

## Conclusion

The associations between alexithymia and both NSSI and risky drinking are seldom compared. It is not known if the relationships between the components of alexithymia and both behaviours are distinguishable between behaviour and sex. Further, more insight into the relationships between alexithymia and both behaviours may be gathered by examining the roles of NSSI and drinking specific expectancies and refusal self-efficacy. By taking a transdiagnostic approach and examining the relationships between alexithymia and both self-injury and risky drinking in the same samples could provide an opportunity to highlight key shared factors/predictors between both behaviours. It could be possible to target shared predictors in intervention plans to decrease the incidence of individuals shifting between NSSI and risky drinking for emotional relief.



**Figure 1.1.** Conceptual model of how alexithymia, behaviour-specific beliefs, and biological might be associated with both NSSI and risky drinking. Dashed lines are included so paths are not confused.

## Aims and outline of Thesis

The overarching aim of this thesis was to compare the associations between alexithymia and both NSSI and risky drinking among university students by exploring the roles of cognitive-emotional variables (i.e., experiential avoidance, behaviour specific outcome expectancies, refusal self-efficacy) and biological sex. In total this thesis has 7 chapters, which are outlined here:

**Chapter 2** reports on Study 1 a systematic literature review and meta-analysis. *The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis.* The primary aim of this chapter was to review, compare, and meta-analyse the associations between alexithymia and both NSSI and risky drinking. The secondary aim was to investigate potential moderators of both associations, including biological sex and sample age (e.g., young adult vs. adult).

**Chapter 3** covers Study 2. *The associations between alexithymia, non-suicidal self-injury, and risky drinking: The moderating roles of experiential avoidance and biological sex.* In this study I examine whether the subcomponents of alexithymia have differential associations with NSSI than risky drinking and whether these associations are moderated by experiential avoidance and biological sex. In this study I merged data from two pre-existing datasets to have sufficient power to compare the following four groups of students on the variables of interest; 1) students who have not engaged in NSSI or risky drinking, 2) students who had engaged in NSSI only, 3) students who had engaged in risky drinking only, and 4) students who had engaged in both behaviours. These groupings allow for direct comparisons between NSSI and risky drinking.

**Chapter 4** details Study 3. *Measurement invariance of two measures of alexithymia among students who do and who do not engage in non-suicidal self-injury and risky drinking.* In order to inform measure choice for Studies 4 and 5, the aim of

this study was to investigate the psychometric properties and measurement invariance of the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) and Perth Alexithymia Questionnaire (PAQ; Preece et al., 2018b); first, in samples of university students with and without a history of self-injury, and second, in samples of university students who do and do not consume alcohol at risky levels. Study 1 and Study 2 used the Toronto Alexithymia Scale (TAS-20) to assess alexithymia, which is considered the ‘gold standard’ measure of alexithymia. However, there are concerns regarding the poor internal consistency of the externally orientated thinking subscale and overall factor structure of the TAS-20. The newly developed Perth Alexithymia Questionnaire (Preece et al., 2018b) appears to be a good alternative with a reliable externally orientated thinking subscale.

**Chapter 5** includes Study 4. *A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy.* In previous studies I explore differences in the direct associations between alexithymia and both NSSI and risky drinking. In this chapter I build on the previous studies by examining indirect effects between alexithymia and both NSSI and risky drinking through behaviour-specific outcome expectancies and self-efficacy beliefs. The aim of this study was to examine if the associations between alexithymia and both NSSI and risky drinking could be explained by similar or different behaviour-specific cognitions. I also examined whether biological sex moderated these indirect associations.

**Chapter 6** contains Study 5. *Comparing the roles of behaviour-specific beliefs in the associations between alexithymia and both non-suicidal self-injury and risky drinking: A multi-method assessment of expectancies.* In this study I aimed to replicate the results of Study 4 by measuring behaviour-specific expectancies using reaction time-based sentence completion tasks in place of self-report questionnaire. A drawback

of self-report questionnaires is that participants have to make a deliberate choice based on the restricted response options. Reaction-time based lab tasks allow for a more objective examination of the strength of an individual's NSSI and drinking expectancies, with faster reaction times indicating stronger expectancy beliefs.

**Chapter 7** is the final chapter of the thesis and comprises of the general discussion. I outline theoretical, methodological, educational, and clinical implications, limitations of the research program and areas for future research, followed by concluding remarks.

**Chapter 2: Systematic review of the literature and meta-analysis: The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis (Study 1)**

**Introduction to Chapter 2**

In the first study I review, compare, and meta-analyse the associations between alexithymia and both NSSI and risky drinking. Specifically, I investigate the strength and direction of the relationships between alexithymia (general alexithymia, difficulties identifying feelings (DIF), difficulties describing feelings (DDF), and externally orientated thinking (EOT)) and both behaviours. Further, I investigated potential moderators of both associations including age, biological sex, and sample type (i.e., clinical compared to non-clinical).

**This chapter is based on the paper** “*The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis*” published online on the 29<sup>th</sup> of August 2019 by Elsevier in *Journal of Affective Disorders*.

**Reference:** Greene, D., Boyes, M., & Hasking, P. (2020). The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis. *Journal of Affective Disorders*, 260, 140-166. <https://doi.org/10.1016/j.jad.2019.08.088>

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Author	Contribution	I acknowledge that these represent my contribution to this chapter Signed:
Danyelle Greene	Development of the research question, data searches, data extraction and analysis, interpretation of the results and manuscript preparation.	
Penelope Hasking	Assisted in the development of the research question, and manuscript preparation.	
Mark Boyes	Assisted in the development of the research question, and manuscript preparation.	

## Abstract

**Background.** Non-suicidal self-injury (NSSI; direct harm to the body without suicidal intent) and risky drinking are two behaviours that serve emotion regulatory functions. When underlying emotional problems are untreated, individuals may shift between NSSI and risky drinking. Both behaviours are associated with alexithymia, difficulties identifying and describing emotions and retaining an externally orientated thinking style. However, it is unknown to what extent the associations are similar and under what circumstances (e.g., sex, age) they may differ. **Method.** To compare both associations we conducted an extensive review using several databases. Overall, 20 NSSI-related articles and 33 risky drinking-related articles met the inclusion criteria. **Results.** A meta-analysis revealed significant positive associations between total alexithymia scores, difficulties identifying feelings, difficulties describing feelings and both NSSI and risky drinking. However, these associations appear stronger for NSSI. Further, externally orientated thinking was associated with risky drinking but not NSSI. Age had opposing moderating effects on the relationships, with the association between alexithymia and NSSI being stronger in younger samples and the association between alexithymia and risky drinking being stronger in older samples. Further, the association between alexithymia and NSSI was stronger for female only samples than male only samples. **Limitations.** The review was limited to English articles. High levels of heterogeneity were observed. The majority of the studies included were cross-sectional. **Conclusion.** These results imply that NSSI and risky drinking may have both shared and distinguishable correlates. Alexithymia can be targeted in treatment to potentially reduce individuals shifting between behaviours to regulate their emotions.

NSSI is the deliberate damage to body tissue without suicidal intent, for reasons not culturally or socially sanctioned (ISSS, 2018). Behaviours include, but are not limited to, cutting and scratching the skin, and self-battery. In non-clinical samples, NSSI is reported by 17% of adolescents, 13% of young adults, and 5% of adults aged over 25 (Swannell et al., 2014). NSSI is linked to psychological morbidity (e.g., anxiety and depression) and can cause permanent scarring (Lewis & Mehrabkhani, 2015). Individuals report a range of functions of self-injury, including self-punishment and anti-dissociation, however, emotion regulatory functions are the most consistently reported (Taylor et al., 2018). Individuals also report engaging in risky drinking, consuming alcohol in a pattern that heightens a person's risk of negative consequences to themselves and others (WHO, 2014), to regulate their emotions (Martins et al., 2018). However, unlike NSSI, motives for engaging in risky drinking are more heterogeneous, with young adults frequently endorsing social enhancement and conformity motives (Kuntsche et al., 2005). Risky drinking has prevalence rates of approximately 18% for adolescents, 35% for young adults, and 30% for adults (AIHW, 2016). Similar to NSSI, risky drinking is associated with psychological morbidity (e.g., anxiety and depression) and negative physical consequences (e.g., liver and nerve damage; Poznyak & Rekve, 2015). Both NSSI and risky drinking can cause significant distress to the individual and people close to them (Klonsky et al., 2014; WHO, 2014). Effective treatments that target the underlying mechanisms of both behaviours can help alleviate the distress and negative outcomes caused by NSSI and risky drinking (Duggan & Heath, 2014; Harvey et al., 2004).

Self-injury and risky drinking share an emotion regulatory function (Aurora & Klanecky, 2016; Kingston et al., 2010; Klonsky, 2007). An individual has increased odds of engaging in NSSI (Klonsky, 2007) or risky drinking (Martins et al., 2018) when other emotion regulation strategies have been ineffective. Individuals may be inclined to

shift from self-injury to risky drinking or vice versa to regulate their emotions when underlying problems are untreated (Duggan & Heath, 2014; Garke et al., 2019; Harvey et al., 2004). Despite this, only a few studies directly compare these behaviours (e.g., Kingston et al., 2010; Hasking, 2017). Yet, by employing a transdiagnostic approach and understanding shared mechanisms between behaviours, we can target these commonalities in interventions and decrease the likelihood of behaviour shift (Duggan & Heath, 2014; Garke et al., 2019; Sauer-Zavala et al., 2017).

One shared mechanism that underlies both NSSI and risky drinking may be alexithymia, difficulties processing and communicating emotions (Cruise & Becerra, 2017; Norman & Borrill, 2015). The Toronto Alexithymia Scale (TAS) is the gold-standard measure of alexithymia and assesses the following core components: 1) difficulties identifying feelings and differentiating feelings from other bodily sensations, 2) difficulties describing and communicating feelings to others, and 3) an externally orientated thinking style (Bagby et al., 1994). Alexithymia is a transdiagnostic construct associated with several affective disorders, including depression (Li et al., 2015), obsessive-compulsive disorder (Roh et al., 2011), schizophrenia (O'Driscoll et al., 2014), posttraumatic stress disorder (Frewen et al. 2008), autism (Berthoz & Hill, 2005), and various eating disorders (Westwood et al., 2017). It is theorised that individuals who have high levels of alexithymia engage in NSSI and/or risky drinking to regulate their emotions and escape adverse emotional experiences (Kingston et al., 2010). If alexithymia has similar associations with both NSSI and risky drinking, therapies tailored to target alexithymia may not only reduce the engagement in a specific behaviour but also reduce the probability of behaviour shift (Duggan & Heath, 2014; Garke et al., 2019). In the current paper, we conducted a systematic review and meta-analysis to compare the associations between alexithymia and both NSSI and risky drinking.

Although, past systematic reviews support positive associations between alexithymia and both NSSI (Norman & Borill, 2015) and risky drinking (Cruise & Becerra, 2017) they are hindered by definitional confusion. Formerly, definitions of self-inflicted injury have been inconsistent and ambiguous. For example, some authors use the term “self-harm” to define any self-inflicted behaviour regardless of suicidal intent (e.g., Hawton et al., 2012), while others (e.g., Gratz, 2006) use “self-harm” interchangeably with NSSI to describe only self-inflicted behaviours that lack suicidal intent. Further, NSSI is sometimes grouped together with suicide attempts, implying that superficial self-injury (e.g., scratching oneself) is equivalent to suicidal thoughts and behaviours (Brausch & Gutierrez, 2009; Jacobson et al., 2008). By not distinguishing between NSSI and suicidal behaviours this can cause inaccuracies in treatment, case conceptualisation, and risk assessments (Glenn & Klonsky, 2013; Latimer et al. 2009).

Like NSSI, definitional confusion has affected research into drinking behaviour. For example, some researchers define risky drinking solely by the quantity of alcohol consumed over a given period and do not take into account behaviours and problems that arise from drinking (Gmel et al., 2010; Lyvers, Hanigan et al., 2018). Further, by assessing quantity only, one is assuming that the same quantity of alcohol affects all individuals equally, which is incorrect and can cause inaccuracies in treatment and risk assessment. To address the issue of definitional confusion, in the current review, we have only included studies that align with the ISSS (2018) and The World Health Organization (2014) definitions of NSSI and risky drinking, respectively. To ensure all the studies met the WHO definition of risky drinking only studies that used the Alcohol Use Disorders Identification Test (AUDIT), a scale developed by the WHO, were included in the current review. Although, we acknowledge that some regularly used problematic drinking questionnaires (i.e., CAGE and the Michigan Alcohol Screening

Test) do overlap with the WHO definition they do not correlate strongly enough with the AUDIT (Hays & Merz, 1995) to suggest they are measuring the same drinking construct.

### **Moderators of the Relationships between Alexithymia, NSSI, and Risky Drinking**

It is also unknown whether the associations between alexithymia and these two functionally similar behaviours are equivalent and under what circumstances they may differ. In the current review, we employ meta-analytic techniques to establish, and directly compare, the strength and direction of the associations between alexithymia and both NSSI and risky drinking. Further, we test moderators (e.g., clinical vs. non-clinical, biological sex) that may highlight similarities and differences in these relationships.

**Clinical vs Non-Clinical Samples.** People dependent on alcohol generally have higher levels of alexithymia than social drinkers do (Thorberg et al., 2009). Alexithymia is a strong predictor of alcohol problem severity in alcohol dependent populations (medium effect size; Thorberg et al., 2009). However, the association between alexithymia and risky drinking in university/community samples appears weaker (Small effect size; Lyvers, Brown et al., 2018; Lyvers, Simons et al., 2013). Due to the variation in clinical samples (e.g., personality disorders, alcohol dependence, NSSI disorder, and psychiatric patients) in the NSSI literature, it is difficult to predict whether the association between alexithymia and NSSI will be stronger in clinical samples than non-clinical samples. In this meta-analysis, we test whether sample type (clinical or non-clinical) moderates the associations between alexithymia and both NSSI and risky drinking.

**Biological Sex.** Although the base rates of NSSI are similar for men and women (Bresin & Schoenleber, 2015), the motives for engaging in self-injury may differ across sex. Women are more likely to report engaging in self-injury for emotional relief,

whereas men are more likely to report social motives for self-injury (e.g., attention; Claes et al., 2007). Norman and Borrill (2015) have therefore suggested the association between alexithymia and NSSI may be stronger for women than men. We aimed to test this prediction. Conversely, young men are more likely to report engaging in excessive alcohol consumption to cope with emotional stress (Kuntsche et al., 2010; Foster et al., 2014), than young women who tend to report social motives, raising the possibility that the association between alexithymia and risky drinking may be stronger for men than women. Given these sex differences in motives for NSSI and risky drinking, the current meta-analysis tested whether associations between alexithymia and both NSSI and risky drinking were moderated by sex.

**Age.** Laws regarding the purchasing of alcoholic beverages vary between countries, but it typically becomes legal between the ages of 16 and 21. Adolescents and young adults may have limited access to alcohol and/or are yet to associate drinking with emotion regulation, which may lead to a weaker association between alexithymia and risky drinking for younger individuals (Kuntsche et al., 2010). On the other hand, engaging in NSSI has fewer legal complications and is more accessible than alcohol for young adults and adolescents (Klonsky & Glenn, 2009). Older individuals with emotional processing difficulties may engage in drinking instead of NSSI because for them it is more socially acceptable (Gilson et al., 2017). Given these possibilities, we also examined age a potential moderator of the associations between alexithymia and both NSSI and risky drinking. Further, due to differences in laws and attitudes regarding NSSI and risky drinking across countries we tested geographical location as a potential moderator.

The aim of this review was to critically evaluate, meta-analyse, and compare the current literature on the associations between alexithymia and both NSSI and risky drinking. Specifically, we examined the strength and direction of the associations

between alexithymia (total score and subscales: difficulties identifying feelings (DIF), difficulties describing feelings (DDF), and externally orientated thinking (EOT)) and both NSSI and risky drinking. Further, we investigated potential moderators (clinical sample, biological sex, age, and geographical location), to explore the conditions under which the associations between alexithymia and both NSSI and risky drinking may differ.

## **Method**

### **Procedure**

We pre-registered the current review with PROSPERO (CRD42018089834) and followed The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). Table 2.1 shows the keywords that were used to search the following databases: Journals@Ovid, PsycARTICLES, Joanna Briggs Institute EBP Database, AGRICOLA, AMED, Embase, Global Health, ICONDA, MEDLINE(R), PsycINFO, and PsycTESTS. We conducted separate searches for NSSI and risky drinking. Inclusion criteria for both reviews were as follows: 1) peer-reviewed articles; 2) English or English translation; 3) human participants; and 4) measures alexithymia using the Toronto Alexithymia Scale. Specifically, for the NSSI review, we excluded articles if the authors did not measure NSSI in accordance with the ISSS (2018) definition (e.g., excluding trichotillomania, autoerotic asphyxiation, self-injury as a cultural/religious practice, self-injury with suicidal intent). Similarly, for the risky drinking review, we excluded studies that did not use the Alcohol Use Disorders Identification Test. We manually scanned the reference lists of articles included in the review to locate any relevant studies not found in the search. Further, we contacted key authors for unpublished data. Figure 2.1 summarises the identification, screening, eligibility, and inclusion procedures. At each step of the PRISMA screening protocol, a

second researcher checked 20% of eligible studies. We had an agreement rate of 97 % (Cohen's Kappa = .92,  $p < .001$ ). The first author and a second researcher extracted data and resolved any discrepancies by discussion.

**Table 2.1** Search Terms

Alexithymia	NSSI	Risky Drinking
Alexithymia OR "alexithymic features" OR alexithymic	NSSI or "non-suicidal self-injury" or "non-suicidal self injury" or "self-injur*" or "self injur*" or "self-harm*" or "self harm*" or "self-mutilat*" or "self mutilat*" or parasuicide	"Alcohol use disorder" or "alcohol dependence" or "alcohol abuse" or "alcohol use" or "alcoholism" or "binge drinking" or "alcohol intoxication" or "alcohol abstinence" or "alcohol problem" or "risky drinking" or "Problematic Drinking" or "risky drinking" or "problematic alcohol use" or "risky alcohol use"

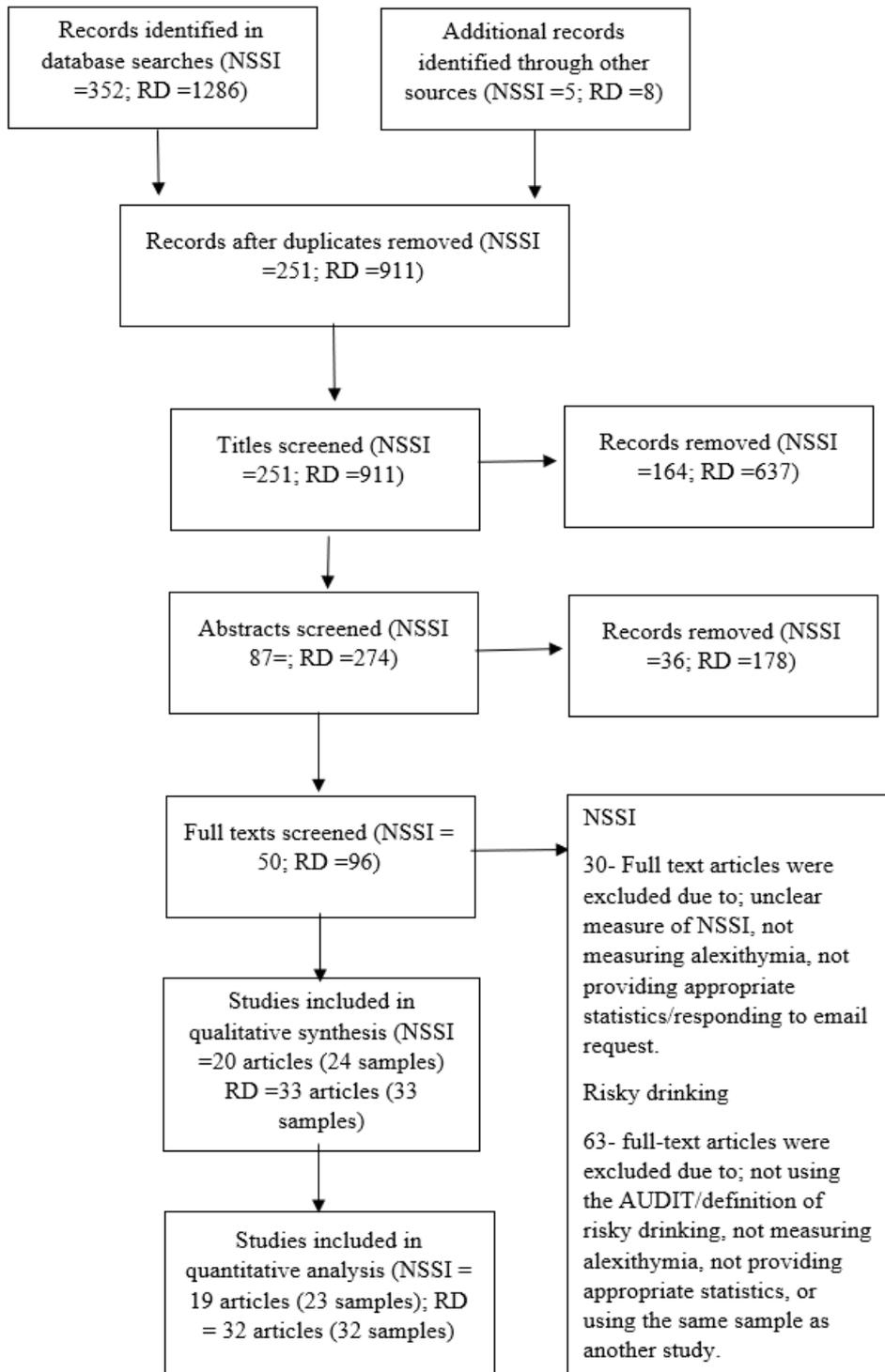
### Study Quality and Risk of Bias

We assessed the study quality and risk of bias using a tool adapted from the Agency for Healthcare Research Quality (Williams et al., 2010) used in past systematic reviews on NSSI (e.g., Taylor et al., 2018). See Appendix A for a summary of whether each study met a series of quality criteria and methodological safeguards against bias. All studies included in the meta-analysis were of reasonable to good quality. However, very few studies reported information on missing values, meaning we could not account for bias caused by missing values if it exists.

### Data-management, extraction, and coding

Correlation coefficients were extracted or calculated from each eligible study. We contacted the corresponding author to provide correlation coefficients when we

were unable to calculate appropriate effect sizes from the data provided. In the NSSI literature, each study measured one or more of the following: history of NSSI (i.e., have engaged in NSSI at least once in their life), recent NSSI (i.e., engaged in NSSI within the last 12 months), the frequency of NSSI, NSSI severity, and method of NSSI.



**Figure 2.1. Study Screening Procedure**

We only had sufficient data to meta-analyse history of NSSI and recent NSSI. However, we reported on all NSSI outcomes in the systematic review.

We coded all studies on sample type, sex, age, and geographical location. Studies were broadly categorised as clinical or non-clinical. If not reported, authors were contacted for sex specific effect sizes. We intended on using sex specific correlations for each eligible study, however, too few authors reported them or replied to our emails. Therefore, sex composition at the study level (i.e., male only, female only, mixed samples) was used as the moderator in the analyses. We coded studies by biological sex as follows: recruiting only male participants, only female participants, or both. Similarly, we were not able to analyse age-specific effects within each study; however, given the generally small standard deviations regarding age, studies were coded into the following categories: adolescent sample (mean age < 18), young adult sample (18-29) and adult sample (30+). These categories were used for the moderation analyses. Additionally, we coded risky drinking studies by legal and illegal age of purchase dependent on the mean age of participants and the laws of the country where the study took place. There was not sufficient data to test age of legal purchase as a moderator, but we reported on it in the systematic review. Last, studies were broadly categorised by geographical location into the following: North American, European, Australasian, and other.

**Meta-analysis**

Before analysis, all effect sizes were converted to Fisher's  $r$  and standard errors calculated (Hedges & Olkin, 1985) using the "Practical Meta-Analysis Effect Size Calculator" online calculator by David Wilson (Wilson, n.d.). For consistency, we

imputed the effect size for the association between alexithymia and the continuous AUDIT score instead of AUDIT cut-off points (e.g., low-risk drinkers compared to risky drinkers). For two studies (i.e., Kopera et al., 2018; Rengade et al., 2009) this was not possible. However, we tested “cut-off vs. continuous” as a covariate in the relevant associations and it did not significantly alter the results ( $p$ 's > .10). Likewise, we did not include Lyvers, Hanigan et al. (2018) in the meta-analysis as they used AUDIT dimensions (i.e., consumption and problematic drinking) instead of a full-scale score.

We calculated all meta-analytic results using Hedges random-effects model in JASP v0.9.1.0 (JASP Team, 2018). We chose a random effects model for two reasons. First, a random-effects model assumes that effect sizes differ between studies. This is evident in the current meta-analysis as the majority of the tests of homogeneity were significant. Second, a random effects model calculates the most precise estimation of the pooled effect size when effect sizes are diverse (Field, 2001). Sample type (clinical or non-clinical), biological sex, the age of the sample, (adolescent, young adults, and adults), and geographical location were tested as moderators of associations that were heterogeneous. We compared confidence intervals (CIs) around the effects to determine any significant differences in the associations between alexithymia and NSSI, and alexithymia and risky drinking. Effect sizes were regarded as significantly different if the pooled effect size of one association falls outside the CI of the other association (Finch & Cumming, 2008). To make fair comparisons between alexithymia and both NSSI and risky drinking, where possible, unadjusted effect sizes were extracted and requested. Publication bias was determined by Egger's test. If Egger's test is  $p > .05$ , publication bias is not considered influential (Egger et al., 1997).

## Results

### Qualitative Reviews

#### *Non-Suicidal Self-Injury*

The samples investigated encompass four main groups: non-clinical adolescents, young adults (mainly university samples, community-based adults, and clinical samples. Included studies are summarised in Table 2.2.

#### **Non-Clinical Adolescent Samples.**

Five research groups published six studies that investigated the association between alexithymia and engaging in NSSI among adolescents. All authors reported alexithymia, or a component of alexithymia, to be positively associated with NSSI. Specifically, Garisch and Wilson (2010, 2015), Howe-Martin et al. (2010), and Gatta et al. (2016) found significant positive associations between total alexithymia score and history of NSSI. Lin et al. (2017) and Garisch and Wilson (2015) tested the association between total alexithymia score and recent NSSI and both found significant positive associations. Further, Garisch and Wilson (2015) found that alexithymia (total score) at baseline significantly predicted engagement in NSSI at follow-up. Howe-Martin et al. (2012) and Gatta et al. (2016) assessed the frequency of NSSI. Both groups of researchers found positive associations between alexithymia and the frequency of NSSI. Only Gatta et al. (2016) and Cerutti et al., (2018) utilised the subscales of the TAS. Both Gatta et al. (2016) and Cerutti et al. (2018) report DIF and DDF to be positively associated with a history of NSSI. However, only Gatta et al. (2016) found EOT to be positively associated with a history of NSSI.

Howe-Martin et al. (2012) analysed sex differences in their study. Female students who engaged in self-injury had significantly higher alexithymia scores than

female students who did not self-injure. Alexithymia levels in male students did not significantly differ between those who did and did not self-injure. Alexithymia was positively associated with the frequency with which an individual engaged in NSSI, however when analysing men and women separately, this association was only significant for women.

### **Young Adults.**

Seven studies drew on university student samples. All seven studies found alexithymia to be positively associated with NSSI. Specifically, Greene et al., (2019), Hasking and Claes (2019), Paivio and McCulloch (2004), and Wester and King (2018), found a positive association between total alexithymia score and history of NSSI. Greene et al. (2019), Hasking and Claes (2019), and Wester and King (2018) measured the association between total alexithymia score and recent NSSI and found significant positive associations. Anderson and Crowther (2012) only assessed DIF and reported that it was significantly correlated with both history of and recent, NSSI. Greene et al. (2019), Hasking & Claes (2019), and Wester and King (2018) provided subcomponent and sex-specific results. In male and female sub-samples both DDF and DIF were positively related to history of, and recent, NSSI. However, associations between EOT and NSSI were mixed. Webster and King (2018) reported significant associations between EOT and recent NSSI for both males and females. Greene et al. (2019) provided significant negative associations between EOT and both recent and history of NSSI for females but no association for males. Hasking and Claes (2019) found no significant associations between EOT and NSSI.

Lastly, Polk and Liss (2009) conducted a discriminant analysis with three groups of participants: university students who had self-injured, university students who had never self-injured, and individuals recruited via the internet who had engaged in NSSI.

Childhood neglect, depression, alexithymia (DIF and DDF) anxiety, insomnia, sexual and emotional abuse distinguished between individuals who had not engaged in NSSI and individuals in the internet sample who had engaged in NSSI. However, the discriminant factor did not distinguish between university students who had and who had not self-injured.

### **Community-Based Adults.**

Verrocchio et al. (2010) and Swannell et al. (2012) both drew samples from adult community populations. Verrocchio et al. (2010) studied Italian male adults recruited from the community and found only DIF and not DDF, EOT, or alexithymia (total score) to be positively associated with a history of NSSI. A large survey study by Swannell et al. (2012) with Australian adults split their sample based on sex. They found a positive association between DDF and recent NSSI among both male and female participants (other aspects of alexithymia were not assessed).

**Table 2.2** Studies exploring the association between alexithymia and NSSI

First Author	Year	Country	Clinical or non-clinical	Population	Sample N	Age Range/ M (SD)	Sex	N NSSI (% of total sample)	Measure of NSSI	Measure of alexithymia
Anderson	2012	USA	Non-clinical	University Students	214	18.86 (1.97)	M = 64 (30%)	50 (23.36%) M = 21 (32.81%) F = 29 (19.33%)	DSHI (History of NSSI and current NSSI)	TAS-20 Only DIF
Cerutti,	2018	Italy	Non-clinical	Adolescents middle-School	709	12.6 (1.06)	M = 357(50.4%)	M = 204 (28%) M = 114 (31.93%) F = 90 (25.57%)	DSHI (History of NSSI)	Children's version of TAS-20
Evren	2005	Turkey	Clinical	Adults, inpatients, males who are substance dependent patients	136	36.42 (8.72)	M = 100%	47 (35%)	Clinical interview (history of NSSI)	TAS-20 Including subscales
Garisch	2010	New Zealand	Non-clinical	Adolescents, high school students	325	16.67 (SD NR)	M = 199(61.23%)	49 (15%) M = 25(12.56%) F = 24 (19.05%)	Self-report NSSI developed by Deleo and Heller (2004; NSSI history)	TAS-20
Garisch	2015	New Zealand	Non-clinical	Adolescents, high school students	1162	16.35 (.62)	M = 662 (57%)	566 (48.71%) M = 319 (48%) F = 247 (19.4%)	DSHI (history of NSSI)	TAS-20
Garisch <sup>a</sup>	2015	New Zealand	Non-clinical	Adolescents, High school students	830	16.49 (.71)	M = 440 (53%)		DSHI (recent NSSI)	TAS-20
Greene <sup>a</sup>	2019	Australia	Non-clinical	University students	778	22.2 (6.71)	M = 178 (22.9%)		ISAS (History and recent NSSI)	
Hasking <sup>a</sup>	2019	Australia	Non-clinical	University students	951	21.86 (6.05)	M = 191 (20%) Other = 6 (0.6%)	255 (28%)	ISAS (history and recent NSSI)	TAS-20 All subscales
Gatta	2016	Italy	Case-control	Adolescents, case =	112	15.0 (1.37)	M = 17 (15.18%)	33 (29.46%) M = 8 (47.06%)	Clinical interview (current NSSI,	TAS-20 All subscales

				individuals attending a neuropsychiatry who presented with NSSI, controls = individuals from local high school				F = 25 (26.32%) Occasional NSSI (13). Habitual NSSI (20)		
Lin	2017	Taiwan	Non-clinical	High school students	2122	16.08	M = 1007 (47.46%) Other = 7 (0.32%) F = 100%	Current NSSI, 434 (20.45%) M = 170 (16.9%) F = 264(23.80%) 42 (63.89%)	NSSI measure developed by You et al. (2012)	TAS-20
Lüdtke,	2016	Germany	Clinical	Inpatients (individuals who met criteria for NSSI-D and clinical controls)	72	16.08 (1.29)			DSM-IV criteria for NSSI-disorder	TAS-26
Mojahed,	2018	Iran	Clinical	Inpatients with borderline personality disorder	94	22.77 (2.83)	M = 100%	94 (100%)	DSHI (frequency of NSSI)	TAS-20 subscales
Bedi	2014	Canada	Clinical	Treatment-seeking women	167	39.95 (11.11)	F = 100%	67 (40%)	Suicide and self-harm interview behaviours treated as separate)	TAS-20
Paivo	2004	Canada	Non-clinical	university students	100	21 (1.66)	F = 100%	41 (41%)	A self-injurious behaviours questionnaire was developed for this study	TAS-20
Polk	2007	USA	Non-clinical	Two groups: university students, and individuals who	University students = 194	Students 18-25(18.79)	Student M = 48(24.74%)	20% of collage group 100% of internet group	Participants were described NSSI by Winchel and Stanley (1991) definition which is	TAS- 20 and subscales

				self-identified as having engaged in NSSI on a self-help webpage.	Internet sample =	Internet 18-47	Internet M =		compatible with the ISSS definition	
Sluwaegen,	2017	Belgium	Clinical	Inpatients with Borderline personality disorder	220	(22.59)	M = 22(10%)			
					185	30.03 (8.62)	M = 25 (13.5%)	153 (82.70) M = 21 (84%) F = 132 (82.5%) 81 (43.75) had self-injured in the last year of which 13 (52% of males) s were male and 68 female (42.5% of females)	self-injury Questionnaire, Treatment Related	TAS-20 subscales
Swannell,	2012	Australia	Non-clinical	Community sample of adults participating in an Australian national household survey	4320	52.11 (16.89)	M =100%	64 (1.48%) had self-injured in the last year	Self-report question developed for the study	TAS-20 DDF- only
Swannell	2012	Australia	Non-clinical	Community sample of adults participating in an Australian national household survey	7103	52.11 (16.89)	F=100%	122 (1.72%) had self-injured in the last year	Self-report question developed for the study	TAS-20 DDF- only
Verrocchio	2010	Italy	Non-clinical	Community sample recruited through work and university environments	77	28.12 (3.84)	M =100%	11 (16.67%)	DSHI	TAS-20 Subscales
Verrocchio	2010	Italy	Clinical	Substance dependent inpatients	77	29.32 (6.42)	M = 100%	35 (45.45%)	See above	See above

Verrocchio	2010	Italy	Clinical	Inpatients with a personality disorder	63	Not stated	M = 100%	34 (59.74%)	See above	See above
Wester <sup>a</sup>	2018	USA	Non-clinical	First year university students	262	18	M = 47(17.9%)	117 (44.7%) 51(19.5%) currently	DSHI	TAS-20
Zlotnick,	1996	USA	Clinical	Inpatients at a women's psychiatric unit who had reported NSSI within the last 3 months.	148	33 (9.23)	F = 100%	103(70%) in the last 3 months	Self-injury inventory developed by authors (definition compatible with ISSS)	TAS-26

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*Note.* <sup>a</sup> = authors provided extra effect sizes, DIF = Difficulties Identifying Feelings, DDF = Difficulties Describing Feelings, and EOT = Externally Orientated Thinking.

### **Clinical Samples.**

Two studies investigating NSSI in clinical samples involved substance dependent patients. The first of these was by Evren and Evren (2005) who recruited Turkish male inpatients and found that men who had a history of self-injury scored significantly higher on alexithymia (total score), DIF and DDF, but not EOT.

Conversely, Verrocchio et al. (2010) found in their sample of substance dependent Italian men that no aspects of alexithymia were associated with a history of NSSI.

Three studies included participants reporting a personality disorder (majority Borderline Personality Disorder); two of which were 100% male (Mojahed et al., 2018; Verrocchio et al. 2010) and the third was majority female (86.5%; Sleuwagen et al. 2017). First, Verrocchio et al. (2010) found DIF and DDF, but not EOT, to be positively associated with a history of NSSI. Second, Mojahed et al. (2018) found in their all-male sample that all aspects of alexithymia (total-score, DIF, DDF, and EOT) were positively associated with frequency of NSSI. Additionally, individuals who had higher personality disorder scores had higher levels of both alexithymia (all aspects) and NSSI frequency. Last, Sleuwagen et al. (2017) found in their sample of individuals with Borderline Personality Disorder that only DDF, and not DIF or EOT, was positively associated with recent engagement in NSSI and frequency of NSSI. The number of NSSI methods endorsed was not significantly associated with any aspect of alexithymia (Sleuwagen et al., 2017).

The three remaining studies with clinical samples do not fit into either the substance dependence or personality disorder categories. First, Zlotnick et al. (1996) found that female inpatients of a psychiatric unit who engaged in NSSI had significantly higher levels of alexithymia than inpatients who did not self-injure. Other risky

behaviours (e.g., excessive alcohol use) and dissociation were also associated with self-injury. Similarly, Bedi et al. (2014) study with treatment seeking women found women who self-injured had significantly higher levels of alexithymia than women who did not. Last, Lüdtke et al. (2016) were interested in comparing adolescents who met criteria for NSSI disorder (NSSI-D) and adolescents with no history of self-injury. Adolescents who meet criteria for NSSI-D reported significantly higher levels of alexithymia (Total, DIF, DDF, but not EOT), even after controlling for parental antipathy, neglect, physical abuse, sexual abuse, dissociation, depression, and OCD.

### ***Risky Drinking***

Studies included in the risky drinking portion of the review fall into the following three categories: young adults (majority university students), non-clinical adult samples, and substance dependent samples. The included studies are summarised in Table 2.3.

#### **Young Adults.**

The work by Lyvers, Thorberg, and Hasking and their teams, recruiting Australian university students, accounts for ten of the sixteen studies with young adults. When examining total scores, seven reported a significant association between alexithymia and risky drinking (Greene et al. 2019; Hasking & Claes, 2019; Lyvers, Brown et al., 2018; Lyvers, Duric, et al., 2014; Lyvers, Hanigan et al., 2018; Lyvers, Jamieson et al., 2013; Lyvers et al., 2017; Lyvers, Lysychka et al., 2014) and two reported a non-significant association (Lyvers, Makin et al., 2014; Lyvers et al., 2016). In one study (Lyvers, Hanigan et al., 2018) the researchers considered two of the AUDIT subscales, ‘problematic drinking’ and ‘alcohol consumption’, and found alexithymia to be related to problematic drinking, but not alcohol consumption.

**Table 2.3.** Studies exploring the association between alexithymia and risky drinking.

First Author	Year	Country	Clinical or non-clinical	Population	Sample N	Age M(SD)	Sex	Percentage Risky drinkers	AUDIT	Measure Alexithymia
Andres,	2014	France	Non-clinical	University students (sports science students)	434	20.24 (2.02)	M = 236 (54.38%)	Not reported	Continuous	TAS-20 DIF DDF
Bujarski,	2010	USA	Non-clinical	University students	237	19.79 (2.73)	M = 73 (30.8%)	Not reported	Continuous	TAS-20
Founta <sup>b</sup>	2018	Ireland	Non-clinical	Individuals receiving treatment for psoriasis	184	46.12 (12.24)	M = 125 (67.93%)	54 (29.5%)	Continuous	TAS-20
Greene <sup>b</sup>	2019	Australia	Non-clinical	University students	778	22.20 (6.71)	M = 178 (22.9%)	286 (26.8%)	Continuous	TAS-20 subscales
Hasking	2019	Australia	Non-clinical	University students	951	21.86 (6.05)	M = 191 (20%) Other = 6	288 (30.5%)	Continuous	TAS-20
Karukivi <sup>b</sup>	2010	Finland	Non-clinical	Late adolescents recruited from a previous study on eating disorders	729	17-21 19	M = 190 (26%)	Not reported	Continuous	TAS-20 subscales
Karukivi, <sup>b</sup>	2014	Finland	Non-clinical	See above (follow-up study)	317	21-24 22	M = 56 (17.8%)	Not reported	Continuous	TAS-20 subscales
Khosravani,	2018	Iran	Clinical	Outpatients with alcohol use disorder currently under treatment.	205	32.36 (10.26)	M = 165 (75.12%)	100% of participants scored 20 or more which indicates dependency	Continuous	TAS-20
Kopera	2018	Poland	Case-control (clinical compared to non-clinical)	The clinical sample were inpatients with alcohol dependence. The control group were hospital staff and medical university students	Clinical sample = 92 Control sample = 86	Clinical sample = 44.10 Control sample = 36.76	M = 100%	100% of clinical sample met criteria for alcohol use disorder  The control sample were low-risk consumers	Cut-offs (compares low-risk drinkers to dependent drinkers)	TAS-20 subscales

Lyvers, Bremner	2017	Australia	Non-clinical	Self-selected Australian Community sample.	106	31.42 (6.3)	M = 45 (42%)	Not stated	Continuous	TAS-20 Subscales
Lyvers, Brown	2018	Australia	Non-clinical	University students	224	27.17 (9.56)	M = 40(17.86%)	Not stated	Continuous	TAS-20
Lyvers, Coundouris	2018	Australia	Non-clinical	Australian Adult community sample	155	21.95 (6.19)	M = 75 (48.39%)	Not stated	Continuous	TAS-20
Lyvers, Duric	2014	Australia	Non-clinical	University students	106	21.21 (3.9)	M =39 (36.79%)	Not stated	Continuous	TAS-20
Lyvers, Hanigan	2018	Australia	Non-clinical	University students	126	20.58 (8.34)	M = 50 (39.68%)	Not stated	Continuous	TAS-20
Lyvers, Hasking	2011	Australia	Non-clinical	Mixture of university students and general adult community members	262	26.83 (8.34)	M = 84(32.06%)	139 (53.05%) scored 8 or higher	Continuous	TAS-20 subscales
Lyvers, Hinton	2014	Australia	Case-control	Clinical sample were substance dependent inpatients and control sample were community social drinkers	Inpatients =100 Control = 107	Inpatients = 18-63(32.47) Control = 18-48(26.65)	Inpatients M =58 (58%) Control M = 43(40.19%)	100% of inpatients met criteria for substance abuse disorder Control group were excluded if indicated likely drug or alcohol use disorders	Continuous	TAS-20 subscales
Lyvers, Jamieson	2013	Australia	Non-clinical	University students who were cannabis users	138	22.56 (5.28)	M =49(35.5%)	66 (47.50) scored 8 or above on the AUDIT 99 (71.74%) were low risk cannabis	Continuous	TAS-20 subscales

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Lyvers, Kohlsdorf,	2017	Australia	Non-clinical	University students	102	22.18	M = 13 (12.75%)	users and 39 (28.26%) were risky cannabis users. Not stated	Continuous	TAS-20 Subscales
Lyvers, Lysychka	2014	Australia	Non-clinical	University students	113	22.11 (.33)	M = 35(31%)	49 (43.77%) of participants scored above 8. 32% of the sample scored between 8 and 15 (risky) and 10% scored above 16 (harmful)	Continuous	TAS-20
Lyvers, Makin	2014	Australia	Non-clinical	University students	153	21.29(3 .11)	M = 66 (43.14)	Not stated	Continuous	TAS-20 Subscales
Lyvers, Mayer	2019	Australia	Non-clinical	Combined university students (30%) and community members (70%)	291	26 (9)	M = 114 (39.9%)	Not reported	Continuous	TAS-20
Lyvers, McCann	2018	Australia	Non-clinical	Combined sample of university students (29%) and community members	161	22.64(7 .15)	M = 72 (44.72)	119 (74%) scored over 8. 47% of sample scored between 8 and 15 (risky) and 27% scored 16 or higher (harmful drinking)	Continuous	TAS-20 Subscales
Lyvers, Narayanan,	2018	Australia	Non-clinical	General community sample	143	26.09 (4.75)	M = 74 (51.75%)	Not stated	Continuous	TAS-20
Lyvers, Simons,	2013	Australia	Non-clinical	General adult community sample	100	21 (2.70)	M = 28%	Not stated	Continuous	TAS-20

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Lyvers, Stafford	2016	Australia	Non-clinical	University students who consumed caffeine	104	20.83 (2.45)	M = 18 (17.32)	Not stated	Continuous	TAS-20
Moretta <sup>b</sup>	2018	Italy	Non-clinical	University students	45	23.04 (3.57)	M = 13 (28.89%)	Risky drinkers = 19(42.20%)	Continuous	TAS-20
Pedersen,	2016	Denmark	Non-clinical	Danish Physicians	1841	NR	M = 875 (47.5%)	Risky drinkers = (346) 18.8% F = 132(13.7%) M = 214 (24.5%)		
Rengade,	2009	France	Clinical	Methadone Patients	152	32.17 (7.9)	M = 115(75.66%)	Risky Drinkers = 42(27.63%)	Low-risk ( $\leq$ 7) High-risk (8 $\geq$ )	TAS-20 Subscales
Thorberg	2011a	Australia	Clinical	AD outpatients	254	36.84 (11.34)	M = 176(69.29)	100%	Continuous	TAS-20 subscales
Thorberg	2011 b	Australia	Clinical	AD outpatients	230	36.82 (11.38)	M = 158(68.7%)	100%	Continuous	TAS-20 DIF DDF
Thornberg	2010	Australia	Clinical	AD Outpatients	210	38.17 (10.82)	M = 144 (68.57%)	100%	Continuous	TAS-20 subscales
Wahlstrom	2012	USA	Non-clinical	University students	120	19.88 (1.83)	M = 100%	Not stated	Continuous	TAS-20 subscales

*Note.* <sup>a</sup> = under legal drinking age, <sup>b</sup> = author contacted for effect sizes, DIF = Difficulties Identifying Feelings, DDF = Difficulties Describing Feelings, and EOT = Externally Orientated Thinking.

When Lyvers, Thorberg, and Hasking utilised the TAS-20 subscales (Greene et al., 2019; Hasking & Claes, 2019; Lyvers, Jamieson et al., 2013; Lyvers, Kohlsdorf et al., 2017; Lyvers, Makin et al., 2014) they reported mixed results. In one study (Lyvers, Makin et al., 2014) Lyvers report no significant association between any aspects of alexithymia and risky drinking. However, in two studies (Lyvers et al. 2013; Lyvers et al., 2017) Lyvers and his team reported positive associations between EOT and risky drinking. In three studies (Greene et al. 2019; Hasking & Claes, 2019; Lyvers, Jamieson et al., 2013) the authors reported a positive correlation between DIF and risky drinking, and in more recent studies reported a significant positive correlation between DDF and risky drinking (Greene et al., 2019; Hasking & Claes, 2019). We had access to the data sets used by Greene et al. (2019) and Hasking and Claes (2019) to conduct sex-specific analyses. There were no sex differences in Greene et al's (2019) data set, however in Hasking and Claes' data (2019) there were significant positive correlations between total score, DDF and risky drinking for female participants but not for male participants.

Of the remaining six studies with young adults, four drew on European samples (French; Andres et al., 2014; Finnish; Karukivi et al., 2010; Karukivi et al., 2014; Italian; Moretta & Buodo, 2018) and two North American (Bujarski et al., 2010; Wahlstrom et al., 2012). The four studies conducted by European researchers with young adults above the legal drinking age reported significant associations between at least one aspect of alexithymia and risky drinking. Conversely, the two North American studies conducted with young adults below the legal drinking age did not report any significant associations between alexithymia and risky drinking. Specifically, Moretta and Buodo (2018) found positive associations between both total alexithymia, and EOT and risky drinking. However, the associations between both DIF, and DDF and risky drinking were non-significant. Upon request, Moretta and Buodo (2018) provided sex-

specific correlations. No aspect of alexithymia was associated with risky drinking for males (n=11). For females (n=34), only EOT was associated with risky drinking. Andres et al. (2014), found DIF, but not DDF, to be positively associated with risky drinking. Andres did not report on general alexithymia score or EOT. Last, Karukivi conducted a baseline study (Karukivi et al., 2010) and a four-year follow-up study (Karukivi et al., 2014). Cross-sectional analysis at both time points revealed positive associations between alexithymia (total, DIF, DDF, and EOT) and risky drinking. However, only EOT scores at baseline positively predicted engagement in risky drinking at follow-up.

### **Non-Clinical Adult Samples.**

Lyvers and colleagues have conducted seven eligible studies with Australian community adult samples. In two studies (Lyvers, Hasking, et al, 2011; Lyvers, Simmons et al., 2013) Lyvers found no association between total alexithymia score (i.e. Lyvers, Simmons et al., 2013) or any aspects of alexithymia (i.e. Lyvers, Hasking et al., 2011) and risky drinking. In four of the five remaining studies, Lyvers and colleagues reported a positive association between total alexithymia score and risky drinking (Lyvers, Bremner et al., 2017; Lyvers, Coundouris et al., 2018; Lyvers, Narayanan et al., 2018; Lyvers, Onuoha et al., 2012). In one study, Lyvers et al. (2011) did not observe this association. Lyvers utilised all subscales of the TAS-20 in three (Lyvers, Bremner et al., 2017; Lyvers Onuoha et al., 2012; Lyvers, McCann et al., 2018) of the seven studies and found mixed results. In one study (Lyvers, McCann et al., 2018) they reported all three aspects of alexithymia (i.e. DIF, DDF, & EOT) to be positively associated with risky drinking. In another (Lyvers, Bremner et al., 2017) they found only EOT to be significantly associated with risky drinking. In the last (Lyvers, Onuoha et al., 2012) only DDF was positively associated with risky drinking.

The remaining study (Pedersen et al., 2016) was not with community adults but, Danish physicians. Total alexithymia score was positively associated with risky drinking. Pedersen compared physicians across quartiles according to their alexithymia scores (lowest, second, third, and highest). Compared to physicians who scored in the lowest quartile for total score and DIF, individuals who scored in the third and highest quartiles had increased odds of engaging in risky drinking. Compared to the lowest quartile, only individuals who scored in the highest quartile for DDF and EOT had increased odds of engaging in risky drinking.

### **Substance Dependent Patients.**

Three groups of researchers (six studies) drew their samples from alcohol dependent populations. Kopera et al. (2018) conducted one study with Polish male adults and Khosravani et al. (2018) conducted another with Iranian adults. Thorberg, Lyvers, and colleagues conducted the remaining four studies (Lyvers, Hinton et al., 2014; Thorberg et al., 2010; Thorberg et al., 2011a; Thorberg et al., 2011b) with Australian adults. Kopera et al. (2018) and Lyvers, Hinton et al. (2014) employed case-control designs; the remaining four studies were cross-sectional. A significant positive association between general alexithymia and risky drinking was found in five samples (Khosravani et al., 2018; Kopera et al., 2018; Thorberg et al., 2010; Thorberg et al., 2011a; Thorberg et al., 2011b). Lyvers, Hinton et al. (2014) did not report this association. Kopera et al. (2018), Lyvers, Hinton et al. (2014), Thorberg et al. (2010), Thorberg et al. (2011a) utilised all three subscales of the TAS-20 and reported a significant positive relationship between DIF and risky drinking. However, results for DDF and EOT were mixed. Kopera et al. (2018), Lyvers, Hinton et al. (2014) and Thorberg et al. (2010), found a significant positive association between DDF and risky drinking, but Thorberg et al. (2011a) did not. Kopera et al. (2011), Thorberg et al.

(2010), and Thorberg et al. (2011a) did not find a significant correlation between EOT and risky drinking. However, Lyvers, Hinton et al., (2014) reported a negative association between EOT and risky drinking.

Rengade et al. (2009) recruited French outpatients dependent on opioids. Individuals who were classified as risky drinkers had significantly higher levels of general alexithymia and DIF. However, there were no group differences on DDF or EOT. The final study conducted by Founta et al. (2018) involved individuals with Psoriasis and did not fit into the three overarching categories. Upon request, coefficients were calculated for all three subscales. Total score, DIF and DDF, but not EOT were significantly associated with risky drinking. Sex-specific results were slightly different. The association between DDF and risky drinking was only significant for women.

## **Quantitative Review: Meta-Analysis**

### ***Non-Suicidal Self-Injury***

Nineteen articles with data from 23 samples were included in the NSSI meta-analysis. Twelve measured the association between total alexithymia score and history of NSSI, nine between DIF and history of NSSI, eight between DDF and history of NSSI, and seven between EOT and history of NSSI. Further, nine studies measured the association between total score and recent NSSI, seven between DIF and recent NSSI, eight between DDF and recent NSSI, and six between EOT and recent NSSI.

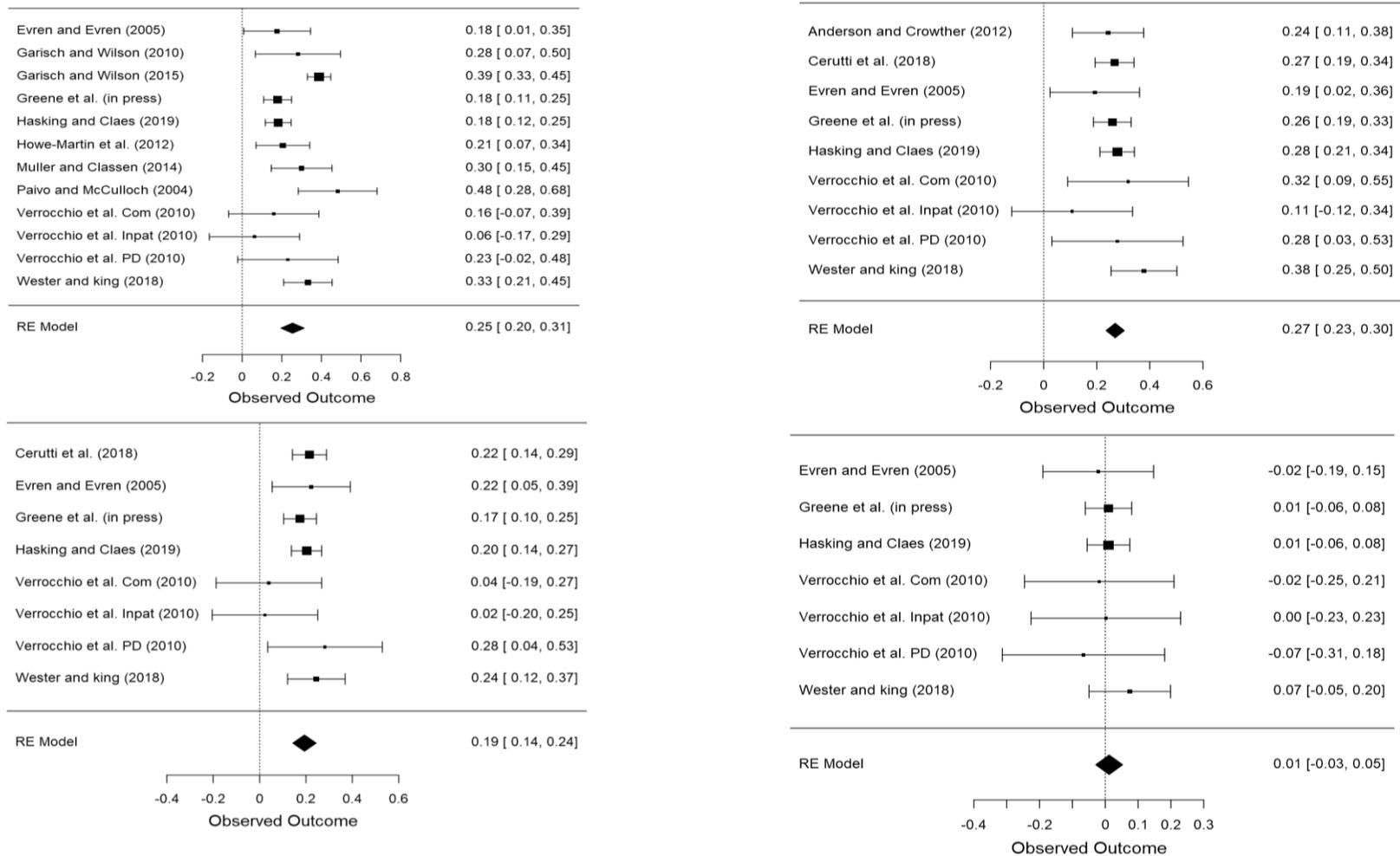
Random effects analysis revealed significant associations between total alexithymia score (Pooled  $r = .25$ , CI = .19-.31,  $p < .001$ ), DIF (Pooled  $r = .27$ , CI = .23-.30,  $p < .001$ ), DDF (Pooled  $r = .19$ , CI = .12-.27,  $p < .001$ ), but not EOT (Pooled  $r = .01$ , CI = -.03-.05,  $p = .57$ ) and history of NSSI. Forest plots for these associations are displayed in Figure 2.2 Edgar's test for publication bias was non-significant for all

associations ( $p = .08-.91$ ). The test of residual heterogeneity was significant for the total score ( $Q (11) = 40.55, p < .001, I^2 = 61.61\%$ ) but not DIF ( $Q (8) = 6.17, p = .63, I^2 = 0\%$ ), DDF ( $Q (7) = 5.83, p = .56, I^2 = 35.29\%$ ), or EOT ( $Q (6) = 1.60, p = .95, I^2 = 0\%$ ).

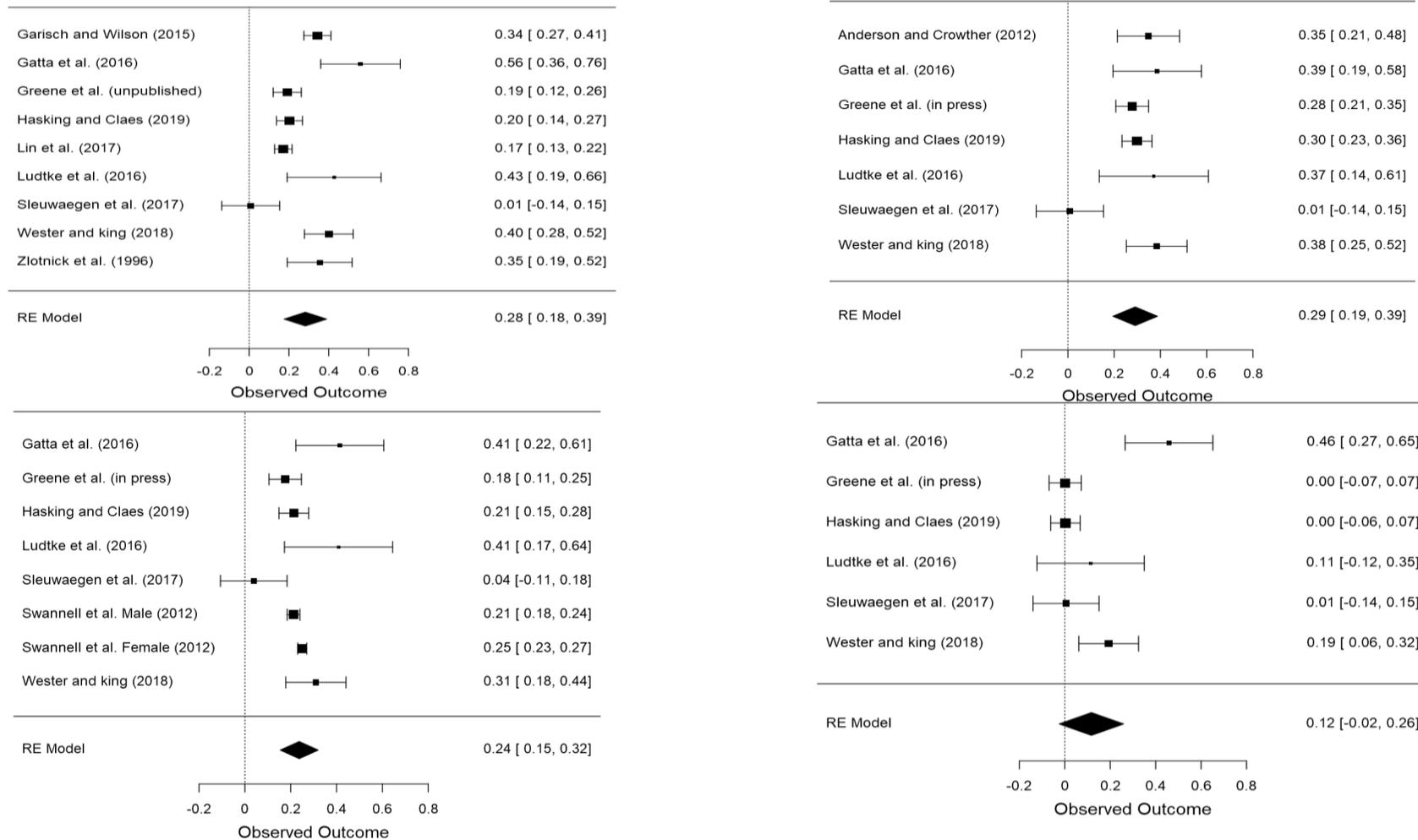
Similarly, a random effect analysis revealed significant associations between total alexithymia score (Pooled  $r = .28, CI = .18-.39, p < .001$ ), DIF (Pooled  $r = .29, CI = .19-.39, p < .001$ ), DDF (Pooled  $r = .24, CI = .15-.32, p < .001$ ) but not EOT (Pooled  $r = .12, CI = -.02-.26, p = .11$ ; see Figure 2.3 for forest plots) and recent NSSI. Edgar's test for publication bias was non-significant for all associations ( $p = .42-.82$ ). The test of residual heterogeneity was significant for all components of alexithymia: full scale ( $Q (8) = 50.93, p < .001, I^2 = 92.00\%$ ), DIF ( $Q (6) = 18.69, p = .005, I^2 = 78.61\%$ ), DDF ( $Q (7) = 21.67, p = .003, I^2 = 93.92\%$ ) and EOT ( $Q (5) = 26.18, p < .001, I^2 = 89.15\%$ ).

### **Moderators.**

Type of sample (clinical vs non-clinical), biological sex, sample age, and geographical location were tested as moderators of the associations with significant heterogeneity (Table 2.4). Sex moderated the association between total alexithymia score and history of NSSI, with female and mixed samples having significantly stronger effect sizes than male only samples. Sample age moderated ( $p < .01$ ) the associations between both DIF and DDF and recent NSSI. The association between DIF and recent NSSI was stronger for adolescent and young adult samples than adult samples. However, the association between DDF and recent NSSI was stronger for adolescent samples than both young adult and adult samples. Geographical location only moderated the association between total alexithymia score and history of NSSI, with European samples having significantly smaller effect sizes than North American and Australasian samples.



**Figure 2.2** Forest plots for random effects models for history of NSSI. Including effect size and CI for each sample and overall weighted effect size and confidence interval. Upper-left panel = total alexithymia score, upper right = difficulties identifying feelings, lower left = difficulties describing feelings, lower right = externally orientated thinking.



**Figure 2.3.** Forest plots for random effects models for recent NSSI. Including effect size and CI for each sample and overall weighted effect size and confidence interval. Upper-left panel = total alexithymia score, upper right = difficulties identifying feelings, lower left = difficulties describing feelings, lower right = externally orientated thinking.

**Table 2.4.** Moderator analysis for the associations between alexithymia and NSSI.

	History of NSSI						Recent NSSI					
	Alexithymia(total)			DIF			DDF					
	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>
Young Adults <sup>a</sup>	-.06(-.20-.07)	-.91	52.24%	-.09(-.34-.15)	-.75	91.25%	-.07(-.23-.08)	-.95	0%	-.19(-.38-.01)*	-2.34	82.49%
Adults (30+) <sup>a</sup>	-.12(-.27-.03)	-1.54	52.24%	-.18(-.46-.11)	-1.20	91.25%	-.37(-.58-.16)***	-3.50	0%	-.22(-.39-.03)*	-2.27	82.49%
Non-clinical <sup>b</sup>	.07(-.07-.20)	.95	60.61%	-.06(-.29-.17)	-.55	85.24%	.09(-.12-.31)	.83	81.91%	-.03(-.23-.17)	-.32	95.39%
Europe <sup>c</sup>	-.15(-.30-.01)*	-2.14	34.04%	-.06(-.41-.28)	-.36	92.67%	-.13(-.41-.14)	-.96	84.15%	-.04(-.37-.27)	-.38	96.48%
Australasia <sup>c</sup>	-0.06 (-.16-.05)	-1.06	34.04%	-.13(-.46-.20)	-.78	92.67%	-.08(-.35-.20)	-.55	84.15%	-.10(-.39-.20)	-.63	96.48%
Female <sup>d</sup>	.21 (.07-.33)**	3.09	20.27%	.08(-.73-.56)	-.25	92.17%	0.02(-.47-.52)	.09	76.75%	-.01(-.32-.29)	-.08	79.49%
Mixed sex <sup>d</sup>	.21(.10-.32)***	3.69	20.27%	0.08 (-.71-.54)	-.26	92.17%	-.06(-.52-.41)	-.24	76.75%	-.04 (-.34-.27)	-.22	79.49%

<sup>a</sup>=compared to adolescent sample; <sup>b</sup>= compared to clinical samples; <sup>c</sup> = compared to North American samples \*\*\*; <sup>d</sup>= compared to male only samples; \*\*\* p<.001, \*\* p<.01, \* p<05.

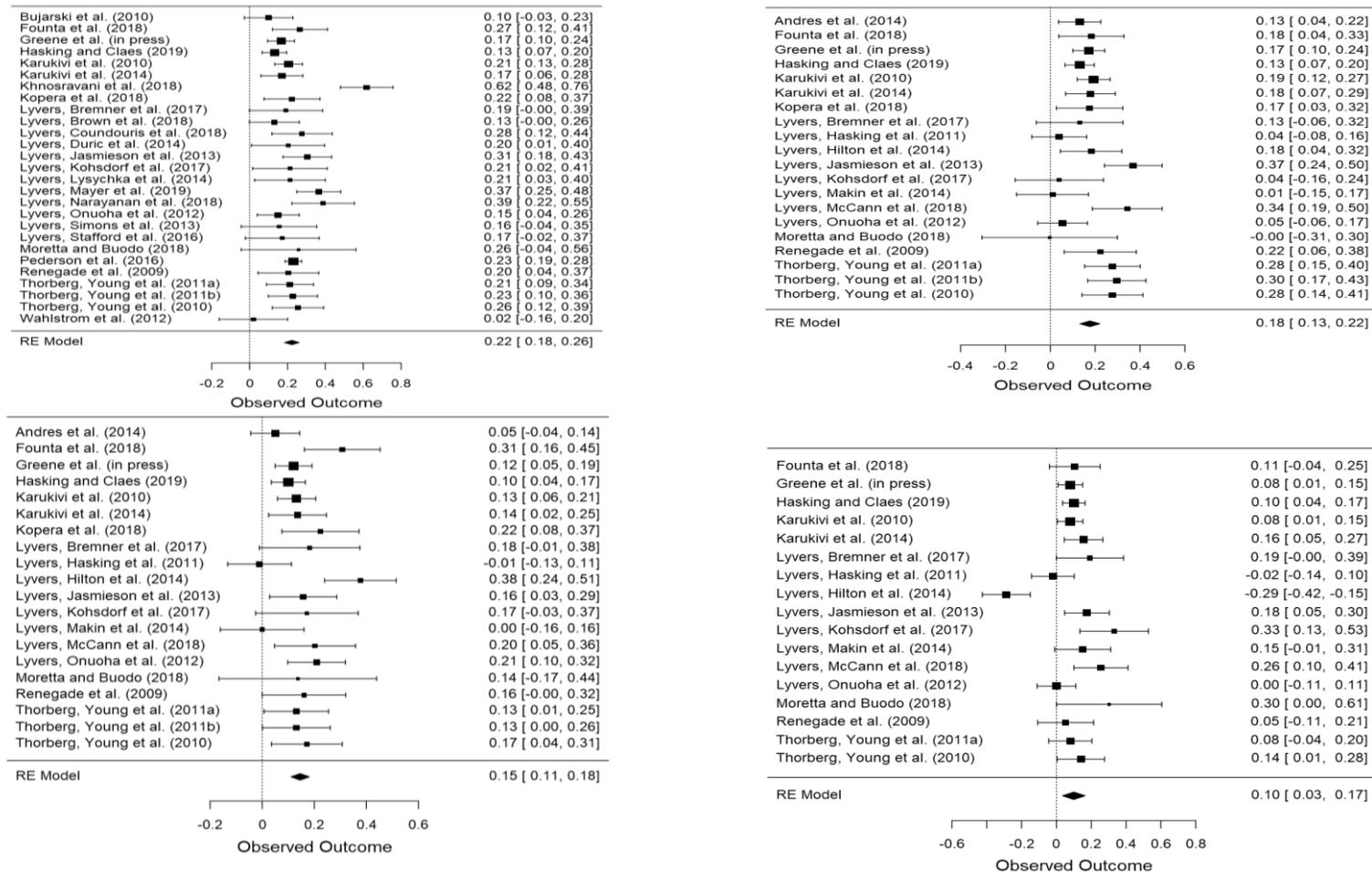
### ***Risky Drinking***

Of the 32 samples included in the risky drinking meta-analysis, 27 measured the associations between total alexithymia score and risky drinking, 20 between DIF and risky drinking, 20 between DDF and risky drinking, and 17 between EOT and risky drinking.

Random-effects analysis revealed significant associations between total alexithymia score (Pooled  $r = .22$ , CI =  $.18$ -. $26$ ,  $p < .001$ ), DIF (Pooled  $r = .18$ , CI =  $.13$ -. $22$ ,  $p < .001$ ), DDF (Pooled  $r = .15$ , CI =  $.11$ -. $18$ ,  $p < .001$ ), and EOT (Pooled  $r = .10$ , CI =  $.03$ -. $17$ ,  $p = .003$ ) and risky drinking. Forest plots for these associations are displayed in Figure 2.4. Egger's test for publication bias was non-significant ( $p = .19$ -. $82$ ) for all associations. The test of residual heterogeneity was significant for all aspects of alexithymia; total score (Q (26) = 65.19,  $p < .001$ ,  $I^2 = 61.89\%$ ), DIF (Q (19) = 41.24,  $p = .002$ ,  $I^2 = 62.71\%$ ), DDF (Q (19) = 34.50,  $p = .02$ ,  $I^2 = 40.24\%$ ), and EOT (Q (16) = 52.52,  $p < .001$ ,  $I^2 = 79.77\%$ ).

### **Moderators.**

Type of sample (clinical, non-clinical), sample age, and geographical location were tested as moderators of the significant associations with inconsistency in their effect sizes (Table 2.5). The association between total alexithymia score and risky drinking was significantly stronger for clinical samples than non-clinical samples. Age moderated the associations between total alexithymia score and risky drinking, with larger effect sizes observed in adult samples than young adult samples. Conversely, the association between EOT and risky drinking was weaker for adult samples than young adult samples. Last, the association between total alexithymia score and risky drinking was significantly weaker for North American samples than Australian, European, and other samples.



**Figure 2.4.** Forest plots for random effects models for risky drinking. Including effect size and CI for each sample and overall weighted effect size and confidence interval. Upper-left panel = total alexithymia score, upper right = difficulties identifying feelings, lower left = difficulties describing feelings, lower right = externally orientated thinking.

**Table 2.5.** Moderator analysis for the association between alexithymia and risky drinking

	Alexithymia			DIF			DDF			EOT		
	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>	B(95% CI)	Z	I <sup>2</sup>
Adults(30+)	.10(.03-.17)*	2.71	51.35%	.05(-.04-.14)	1.04	61.11%	.05(-.01-.13)	1.46	36.61%	-.13(-.25--.02)*	-2.22	71.82%
Clinical	.09(.01-.17)*	1.98	55.00%	.10(-.01-.21)	1.92	55.97%	.02(-.08-.11)	.38	43.98%	-.01(-.19-.22)	.10	81.20%
Europe	-.04(-.09-.01)	-1.61	0	-.03(-.12-.07)	-.55	63.82%	-.02(-.09-.06)	-.12	43.98%	.02(-.12-.16)	.27	80.63%
North American	-.16(-.27-.05)*	-2.86	0	-	-	-	-	-	-	-	-	-
Other	.40(.24-.53)***	5.21	0	-	-	-	-	-	-	-	-	-

Note. <sup>a</sup>= compared to young adult samples; <sup>b</sup> = Compared to clinical samples; <sup>c</sup>= compared to Australian samples

### ***Comparing NSSI and Risky Drinking***

Table 2.6 displays a summary of the pooled correlation coefficients and confidence intervals for all tested associations. The correlation coefficients for the associations between general alexithymia and recent NSSI ( $r = .28$ ) but not history of NSSI ( $r = .25$ ) fall outside the coefficient confidence interval for the association between general alexithymia and risky drinking (CI = .18-.26). This indicates a stronger association between general alexithymia and recent NSSI, compared to general alexithymia and risky drinking. Similarly, the correlation coefficients for the associations between DIF and both recent NSSI ( $r = .29$ ) and history of NSSI ( $r = .27$ ) fall outside the coefficient confidence interval for the association between DIF and risky drinking (CI = .13-.22), indicating associations between DIF and NSSI are stronger than the association between DIF and risky drinking. Again, the correlation coefficients for the associations between DDF and both recent NSSI ( $r = .24$ ) and history of NSSI ( $r = .19$ ) fall outside coefficient confidence interval for the association between DDF and risky drinking (CI = .11-.18). This indicates the association between DDF and NSSI is stronger than the association between DDF and risky drinking. Finally, EOT was only significantly associated with risky drinking and not history of or recent NSSI.

**Table 2.6.** Summary of pooled effect sizes and sample size

	History of NSSI		Recent NSSI		Risky Drinking	
	Pooled <i>r</i> (95% CI)	<i>k</i> (N)	Pooled <i>r</i> (95% CI)	<i>k</i> (N)	Pooled <i>r</i> (95% CI)	<i>k</i> (N)
Alexithymia (Total TAS)	.25 (.20-.31)	12 (4309)	.28 (.18-.39)	9 (5460)	.22 (.18-.26)	27 (8427)
Difficulties Identifying Feelings	.27 (.23-.30)	9 (3267)	.29 (.19-.39)	7(2574)	.18 (.13-.22)	20(6005)
Difficulties Describing Feelings	.19 (.12-.27)	8 (3053)	.24 (.15-.32)	8 (13783)	.15 (.11-.18)	20(6005)
Externally Orientated Thinking	.01 (-.03-.05)	7 (2344)	.12 (-.02-.26)	6 (2360)	.10 (.03-.17)	17(5163)

### Discussion

The current systematic review and meta-analysis provide support for the associations between alexithymia and both NSSI and risky drinking. Consistent with past systematic reviews alexithymia, difficulties identifying feelings, and difficulties describing feelings were positively associated with NSSI (Norman & Borrill, 2015) and risky drinking (Cruise & Becerra, 2017). However, these associations were generally stronger for NSSI compared to risky drinking. Conversely, externally orientated thinking positively correlated with risky drinking but not with NSSI. The association between total alexithymia and NSSI was stronger in female samples than male samples. Further, age had opposing moderating effects; the association between alexithymia (DIF and DDF) and NSSI was stronger for younger samples, whereas the association between alexithymia and risky drinking was stronger for adults aged 30 and above. These results imply that NSSI and risky drinking may have shared and distinguishable correlates.

Clinically, these results may be beneficial in developing intervention programmes to reduce behaviour shift among behaviours used to regulate emotion.

### **Comparing NSSI and Risky Drinking**

The heterogeneity of drinking motives compared to NSSI motives may explain the stronger associations between alexithymia and NSSI in comparison to the association between alexithymia and risky drinking. While motives for engaging in NSSI are often emotion regulatory in nature (Taylor et al., 2018), motives for engaging in risky drinking are more diverse, with many individuals endorsing social motives (Martins et al., 2018). For example, an individual engaging in risky drinking for social or conformity purposes may not score as highly on alexithymia as an individual consuming alcohol to regulate their emotions. Specifically, individuals engaging in risky drinking for social or conformity purposes are generally influenced by external motivations (e.g., avoiding social rejection) rather than internal motivations (e.g., emotional processing difficulties; Cooper, et al., 1995). As the majority of the studies included in this review did not measure drinking motives, it is difficult to determine the breakdown of motives amongst risky drinkers for each study. To test the proposed emotion regulatory function of NSSI and risky drinking in individuals with high levels of alexithymia, future research should measure behaviour-specific expectations, motives and functions. By measuring behaviour specific variables, we can gain further insight into why people who have high levels of alexithymia are engaging in NSSI and risky drinking.

Externally orientated thinking was only associated with risky drinking and not NSSI. The differences in the correlations between externally orientated thinking and both behaviours may be symptomatic of the direct and indirect aspects of self-injury and

risky drinking, respectively. Individuals who have a tendency to focus externally may choose indirect regulatory behaviours (i.e., drinking; indirect damage to the body) and individuals with a tendency to focus internally may choose direct regulatory behaviours (i.e., self-injury; direct damage to the body). However, the association between externally orientated thinking and alcohol use may be explained by strong social motives for drinking, typically not reported as motives for engaging in NSSI (Kuntsche et al., 2010; Taylor et al., 2018). Theoretically, individuals who focus externally may be more likely to have external motives (e.g., social; to fit in) for consuming alcohol rather than intrapersonal motives (e.g., emotion regulation; Kuntsche et al., 2010). This proposition may be particularly relevant for adolescents and young adults and explain the stronger association between externally orientated thinking and risky drinking in these age groups in the current meta-analysis. Additionally, the ability of the TAS-20 to reliably measure externally orientated thinking could explain this lack of association between externally orientated thinking and NSSI. Many studies report low reliability for the externally orientated thinking scale (Preece et al., 2018a; Thorberg et al., 2010), and fail to reproduce the three-factor structure of the TAS-20 (Haviland, 1996; Tullio et al., 2019).

Whether the sample was clinical or non-clinical did not moderate the association between alexithymia and NSSI. As mentioned, this may be due to the variation in clinical samples (e.g., personality disorders, alcohol dependent, NSSI disorder, and psychiatric patients) in the NSSI literature. As anticipated, the association between alexithymia and risky drinking was stronger for clinical samples compared to non-clinical samples. This implies that individuals with high levels of alexithymia may be at greater risk of developing an alcohol use disorder than individuals with lower levels of alexithymia (Thorberg et al., 2009). To test this proposition, researchers could conduct

a study of longitudinal design tracking alexithymia and risky drinking over time to investigate whether high levels of alexithymia can predict the development of an alcohol use disorder.

As predicted, the association between alexithymia (total score) and NSSI was stronger for female samples compared to male samples. However, we observed no sex differences in the associations between the subcomponents of alexithymia and NSSI. Only three authors provided sex-specific data for the associations between alexithymia and risky drinking. Further, of these studies one study had a very low number of males and another was with a very specific population (i.e., patients with psoriasis) making it not feasible to draw any generalisations from these results. To eliminate confounding variables between studies and to make direct comparisons, future research should investigate sex differences in the association between alexithymia and both NSSI and risky drinking in the same sample.

Age had contrasting moderating effects on the associations between alexithymia and both NSSI and risky drinking. As predicted, the associations between difficulties identifying feelings, difficulties describing feelings and NSSI were stronger for younger participants. However, only the association between total alexithymia score and risky drinking was stronger for older samples. These opposing age effects may be consistent with the concept of 'behaviour shift' (Duggan & Heath, 2014; Garke et al., 2019). Young adults and adolescents with high levels of alexithymia may engage in self-injury to regulate their emotions but shift to drinking as alcohol becomes more readily available to them. To test this proposal, future research could conduct a study of longitudinal design tracking alexithymia, risky drinking, and self-injury from adolescence into adulthood.

## **Theoretical Implications**

The results of the current review show support for emotion regulatory models of NSSI and risky drinking (Chapman et al., 2006; Cox & Klinger, 1988; Nock, 2009). Individuals who have difficulties identifying and describing emotions are more likely using NSSI or risky drinking to regulate their emotions than individuals who do not possess these emotional difficulties. The positive associations found between difficulties describing feelings and both NSSI and risky drinking, support interpersonal models of emotion regulatory behaviours (e.g. Prinstein et al., 2009). Theoretically, individuals could be using NSSI as an avenue to describe their feelings or using alcohol as a method to enhance their ability to describe their feelings to others. However, due to the aforementioned heterogeneous nature of risky drinking it is inaccurate to conceptualise the behaviour as purely emotion regulatory. Therefore, we urge researchers to assess drinking motives and motives for self-injury when exploring emotion regulatory models of either behaviour.

Future research could utilise the sub-components of alexithymia to investigate how each aspect of alexithymia may have a differential relationship with NSSI and risky drinking. For example, researchers could investigate behaviour-specific factors through which different aspects of alexithymia lead to engaging in NSSI compared to risky drinking. Factors may include the outcomes an individual expects from the given behaviour (i.e., outcome expectancies) and self-efficacy to resist the behaviour (Dawkins et al., 2018), or possibly diverse motives/functions the behaviour could serve. For example, emotion regulatory motives for individuals who have difficulties identifying feelings and enhancement or communicative motives for individuals who have difficulties describing feelings.

## **Clinical Implications**

By studying NSSI and risky drinking simultaneously, we can compare and contrast the correlates of both behaviours. While we acknowledge the majority of the studies included in the analysis are cross-sectional, one NSSI study (Garisch & Wilson, 2015) and one risky drinking study (Karukivi et al., 2014) had longitudinal data. Both studies found at least one aspect of alexithymia to predict future engagement in NSSI or risky drinking. Nevertheless, further prospective research is warranted to determine temporal relationships between the variables. Thus, the following clinical implications should be considered with the nature of the data in mind.

Although we did observe some differences in the relationships between alexithymia and both NSSI and risky drinking, findings highlight the possible importance of improving an individual's ability to identify and describe their emotions to reduce engagement in both behaviours and potentially 'behaviour shift'. Several researchers (e.g., Swannell et al., 2012) suggest adapting dialectical behaviour therapy (DBT; Linehan, 2014) to help individuals with high levels of alexithymia develop emotion processing skills. DBT helps an individual to learn to identify and describe their emotions and then develop alternative ways to process their emotions instead of engaging in dysregulated behaviours (Linehan, 2014). The emotional intensity of a situation can be reduced by identifying the emotional experience, which may, in turn, decrease the urge to engage in dysregulated behaviours. Targeting emotional processing, rather than specific behaviours, may also reduce the need to shift from one dysregulated behaviour to another.

High levels of alexithymia may hinder an individual's ability to engage successfully in psychological treatments, particularly emotion-focused therapies that

require emotional insight (Allemand et al., 2013). Further, low levels of change in alexithymia is correlated with a prolonged treatment period and poor treatment outcomes (e.g. continuing to engage in or switching between risky drinking and self-injury; Ogrodniczuk et al., 2013). Due to the relative stability of alexithymia, it may be difficult to treat. There is some evidence that behavioural-based therapies have more clinical-utility for individuals with high levels of alexithymia than other psychological therapies (Lumley, 2009). Behaviour-based treatments such as Cognitive Behavioural Therapy (CBT) may be more effective for individuals with high levels of alexithymia because they do not solely focus on understanding emotional experiences. Rufer et al. (2010) report that by initially taking the focus away from emotional experience this can increase therapeutic engagement for individuals with externally orientated thinking styles. Once the individual engages in the treatment, the therapist can address the underlying emotional issues.

### **Limitations and Directions for Future Research**

Although the current review contributes important information about similarities and differences between NSSI and risky drinking, and their links with alexithymia, it is not without limitations. First, there were high levels of heterogeneity in the majority of the tested associations. We attempted to explain discrepancies by exploring moderators (e.g., age and biological sex) which may account for some of the heterogeneity. Second, only English articles were included in the current review, meaning relevant non-English articles may have been excluded. Further, only one study included a non-western population; due to cultural differences, regarding NSSI (Gholamrezaei et al., 2015) and alcohol use (Kuntsche et al., 2015), this may bias the results. Third, few studies reported on age and sex differences in the associations between alexithymia and both self-injury and risky drinking within their own samples. Due to limited replies to data requests, we

had to test age and sex as moderators across studies rather than within. Although this method is a good starting point (Leaper & Robnett, 2011) it is limited by confounding variables (e.g., sample type) between studies. The quality of the research on these associations can be improved by providing accurate information regarding sex and age specific effect sizes within individual studies.

Fourth, studies that provided no effect sizes for a particular aspect of alexithymia could not be included in the meta-analysis for that subscale. Given, publication bias against null results, it is possible that authors chose not to publish these results because they were non-significant. Hence, the pooled coefficients may be over-estimates. Fifth, information regarding the handling of missing data was often absent or incomplete. If missing data is not handled effectively (i.e., missing at random or missing not at random), it can lead to bias in parameter estimates (Kang, 2013). We encourage authors to report on 1) all alexithymia subscales even when non-significant, and 2) the extent, type and handling of missing data.

Sixth, we could not make any causal inferences because the majority of the included studies were cross-sectional. Specifically, for risky drinking, it is possible that prolonged excessive alcohol consumption could impair an individual's ability to describe and identify their emotions (Thorberg et al., 2009). Upon request, Karukivi et al. (2014) provided us with the correlations between baseline alexithymia and alcohol use at four-year follow-up. Whilst all aspects of alexithymia were related to risky drinking in the cross-sectional analyses, only externally orientated thinking at baseline predicted risky drinking at follow-up. This indicates that different aspects of alexithymia may be playing different roles in emotion regulatory behaviours and have different temporal relationships. Future research could investigate whether and which aspects of alexithymia can predict and differentiate future engagement in NSSI and

risky drinking. Further, the impact of alexithymia on NSSI and risky drinking treatment can be clarified by incorporating alexithymia in future clinical trials aimed at reducing engagement in both behaviours. Age and sex differences could further be explored when studying the effects of alexithymia in the treatment of both NSSI and risky drinking.

Seventh, the measurement of NSSI varied between studies. The majority of the studies looked at lifetime history of NSSI regardless of current engagement or frequency. An individual who has engaged in NSSI once or who no longer engages in NSSI is likely different in terms of alexithymia from an individual who currently engages in NSSI. Future research could investigate whether people who engage in NSSI currently and those who no longer engage in NSSI differ on levels of alexithymia. Last, we only included studies that used the AUDIT in the review due to inconsistencies in drinking constructs and how they are measured in the literature. Future research could investigate similarities and differences in the associations between alexithymia and various alcohol related constructs (e.g., binge drinking, alcohol consumption, obsessive compulsive drinking etc.).

### **Conclusion**

With limitations considered, the present systematic review and meta-analysis provides support for the relationships between alexithymia and both NSSI and risky drinking. Further, the review offers evidence that NSSI and risky drinking may have both shared and distinguishable correlates. Clinically, with future prospective support, these findings suggest that intervention initiatives that focus on treating commonalities (i.e., alexithymia) across behaviours may be key in reducing behaviour shift. However, due to the relative stability of alexithymia it may be difficult to treat. Thus, behaviour-

based therapies that initially take the focus away from understanding emotional experience may be more successful at reducing NSSI and risky drinking in individuals with high levels of alexithymia. To further the understanding of the similarities and differences in these associations, future research should measure behaviour-specific motives and expectancies. By measuring behaviour specific variables, we can gain further insight into why people who have high levels of alexithymia are engaging in NSSI and risky drinking.

### **Chapter 3: The associations between alexithymia, non-suicidal self-injury, and risky drinking: The moderating roles of experiential avoidance and biological sex**

#### **Introduction to Chapter 3 (Study 2)**

In the previous chapter I found that the relationships between the subcomponents of alexithymia and both self-injury and risky drinking vary. There were significant positive associations between general alexithymia, difficulties identifying feelings, and difficulties describing feelings and both behaviours. However, these associations could be stronger when predicting NSSI than risky drinking. The third component, externally orientated thinking was not significantly related to NSSI but was related to risky drinking.

The aim of this study was to further explore the association between alexithymia and both behaviours, and how biological sex and experiential avoidance might moderate these associations. A meta-analysis can provide pooled effect sizes and highlight differences across studies in the associations between alexithymia and both self-injury and risky drinking, however, in a meta-analysis we cannot make direct comparisons between both associations in the same sample. Due to the large amount of existing data, I was able to directly compare individuals who have engaged in 1) neither behaviour, 2) NSSI only, 3) risky drinking only, and 4) both behaviours on the three facets of alexithymia. Also, in this study I gain more insight into the sex differences in the associations without the influence of between study effects (e.g., sample type: clinical vs. non-clinical). Although not a key focus of this thesis but due to the connection between alexithymia and experiential avoidance (see introduction), I took the opportunity to utilise the existing data by exploring the moderating role of experiential avoidance.

**This chapter is based on the published paper** “*The associations between alexithymia, non-suicidal self-injury, and risky drinking: The moderating roles of experiential avoidance and biological sex*” published on the 7<sup>th</sup> of June 2019 by John Wiley & Sons Ltd in *Stress and Health*.

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Author	Contribution	I acknowledge that these represent my contribution to the above research output Signed:
Danyelle Greene	Development of the research question, data analysis, interpretation of the results and manuscript preparation.	
Penelope Hasking	Assisted in the development of the research question, and manuscript preparation.	
Mark Boyes	Assisted in the development of the research question, and manuscript preparation.	

## Abstract

Alexithymia and experiential avoidance are personality traits regularly identified as correlates of behaviours that can serve an emotion regulatory function, including, non-suicidal self-injury (NSSI) and risky drinking. In the current study, we examined whether the relationships between alexithymia, NSSI, and risky drinking are moderated by experiential avoidance and sex. A sample of 778 university students (77.1% female,  $M_{age} = 22.27$ ,  $SD = 6.71$ ) completed online questionnaires. For men, a combination of high levels of externally orientated thinking and experiential avoidance was associated with NSSI. Conversely, for women, a combination of high levels of externally orientated thinking but low levels of experiential avoidance was associated with risky drinking. Findings suggest that associations between alexithymia and experiential avoidance with NSSI and risky drinking may differ between men and women and across behaviour.

Non-suicidal self-injury (NSSI) is the intentional damage to one's body tissue, without suicidal ideation, for reasons not socially or culturally endorsed (International Society for the Study of Self-Injury, 2018). NSSI can involve many methods, but common behaviours include cutting and burning the skin. Approximately 13% of young adults, and up to 20% of university students have engaged in NSSI, implying that young adults attending university are more likely to self-injure than the general population (Swannell et al., 2014). Individuals who persistently engage in self-injury throughout university are at heightened risk of experiencing psychological distress (e.g., anxiety and depression) and adverse educational outcomes compared to students who do not self-injure, emphasising the importance of additional study in this population (Hamza & Willoughby, 2014; Kiekens et al., 2016). Despite engaging in self-injury without suicidal intent, NSSI is associated with suicidal thoughts and behaviours (Kiekens et al., 2018c), and is challenging to treat (Glenn et al., 2015). Subsequently, the last decade has seen growth in research aiming to explore factors that predict and maintain NSSI (Fox et al., 2015).

Risky drinking, consuming alcohol in a pattern that increases an individual's risk of adverse consequences to themselves and/or others (World Health Organisation, 2014), like NSSI, is a prevalent behaviour amongst students. Similar to individuals who engage in NSSI, individuals who engage in risky drinking are at increased risk of suicidal thoughts and behaviours (Darvishi et al., 2015), and negative physical (e.g., liver damage), and psychological (e.g., anxiety and depression; Poznyak & Rekve, 2015) health outcomes. Approximately 30% of community-based young adults and up to 40% of university students engage in risky drinking (Auerbach et al., 2018; Australian Institute of Health and Welfare, 2016). These rates again imply that young adults attending university are more likely to engage in risky drinking than the general

population. University students may be at a higher risk of engaging in NSSI and risky drinking due to additional academic pressure and stress (e.g., test anxiety; Kiekens et al., 2016; Norberg et al., 2010) not experienced by the general population.

### **Commonalities between NSSI and Risky Drinking**

Emotion regulation refers to the strategies or behaviours an individual may use to initiate, maintain, and modify emotional experiences (Gross, 1998). NSSI and risky drinking are two behaviours commonly reported to serve an emotion regulatory function (Kingston et al., 2010). Individuals are more likely to engage in NSSI (Klonsky, 2007) or risky drinking (Martins et al., 2018) when other emotion regulation strategies are inaccessible or unsuccessful. Individuals often report engaging in NSSI and/or risky drinking with the goal of reducing intense or unwanted emotional experiences (Aurora & Klanecky, 2016; Klonsky 2007). Individuals who engage in both behaviours are a group at particularly high risk of adverse outcomes (e.g., diminished psychological well-being and suicide attempts), possibly trialling several methods to alter their emotions (Andrews et al., 2012).

Although NSSI and risky drinking share a common function and predict numerous psychological disorders, current interventions tend to focus on reducing the occurrence of the specific behaviour independently of other mental health problems (Harvey et al., 2004). If the underlying mechanisms remain untreated, individuals tend to shift to alternative behaviours (e.g., Individuals shifting from using NSSI to risky drinking to regulate their emotions; Duggan & Heath, 2014; Garke et al., 2019). However, there is a move in the mental health field to explore transdiagnostic processes, which entails studying variables that are thought to underlie a number of behaviours (i.e., NSSI and risky drinking) or disorders (Sauer-Zavala et al., 2017). By taking a transdiagnostic approach and studying comparable behaviours simultaneously, we can

gain insight into cognitive and behavioural processes that may underlie a broad range of mental health conditions. If NSSI and risky drinking share similar underlying processes, then interventions can target these common processes, rather than applying behaviour-specific therapies. Targeting the underlying processes could decrease the urge to shift to alternative behaviours that serve a similar function (Duggan & Heath, 2014; Harvey et al., 2004).

Alexithymia appears to be a commonality between NSSI and risky drinking (Cruise & Becerra, 2017; Norman & Borrill, 2015). Alexithymia is a personality trait encompassing three core facets of emotional processing: 1) difficulties identifying feelings and differentiating these feelings from arousal sensations 2) difficulties describing feelings to other people and 3) focusing on external events rather than internal thoughts and feelings (Bagby et al., 1994). Alexithymia is a predictor of many psychological disorders such as depression, anxiety, and borderline personality disorder (Berardis et al., 2008). Given the transdiagnostic nature of alexithymia, additional understanding of the role of alexithymia in NSSI and risky drinking may have utility for both prevention and intervention.

Recent systematic reviews report positive associations between alexithymia and both NSSI (Norman & Borrill, 2015) and risky drinking (Cruise & Becerra, 2017). Further, both NSSI and risky drinking are most strongly associated with the facet difficulties identifying feelings, followed by the facet difficulties describing feelings. Additionally, externally orientated thinking is consistently associated with drinking but not NSSI (Cruise & Becerra, 2017; Norman & Borrill, 2015). Due to differential associations between the facets of alexithymia and both NSSI and risky drinking it is important to investigate these different aspects of alexithymia and not rely on the total score.

Norman and Borrill (2015) and Cruise and Becerra (2017) postulate an inter-relationship between alexithymia and experiential avoidance, the predisposition to escape, or control the frequency of thoughts, feelings, and other internal experiences (Hayes et al., 1996) in predicting engagement in NSSI and/or risky drinking. It is stipulated that individuals with emotional processing difficulties (i.e., alexithymia), and a tendency towards experiential avoidance may engage in NSSI (Norman & Borrill, 2015) or risky drinking (Cruise & Becerra, 2017) to escape or control intense or unwanted emotions (c.f., experiential avoidance model; Chapman et al., 2006).

Theoretically, whether an individual who has high levels of alexithymia engages in NSSI and/or risky drinking may be determined by their tendency towards experiential avoidance (Chapman et al., 2006). Specifically, individuals who have high levels of alexithymia and a predisposition toward experiential avoidance may be likely to engage in self-injury or risky drinking to escape adverse emotions. Conversely, low levels of experiential avoidance may be a protective factor against engaging in NSSI or risky drinking for individuals with high levels of alexithymia. Thus, a combination of individual differences in alexithymia and experiential avoidance may be key in the onset and maintenance of both NSSI and risky drinking.

Additionally, Norman and Borrill (2015) proposed that the relationship between alexithymia and NSSI may be stronger for women, and the association between alexithymia and risky drinking may be stronger for men. Although the base rates of both NSSI and risky drinking may be similar for young women and men (AIHW, 2016; Bresin & Schoenleber, 2015), the underlying mechanisms of these behaviours may be different across biological sex. Sex differences could be indicative of differential motives for engaging in NSSI and risky drinking for women compared to men. Women who self-injure are significantly more likely to report engaging in NSSI for affect-

regulation in comparison to men who are more likely to report social motives for self-injury (e.g., attention; Claes et al., 2007; Rodham et al., 2004). In contrast, young men who drink typically report stronger coping motives (e.g., coping with emotional distress) for alcohol consumption (Foster et al., 2014; Kuntsche et al., 2005) compared to young women who place more emphasis on social motives. Given these findings, it is plausible that women who have high levels of alexithymia may be inclined to engage in NSSI rather than risky drinking to escape unwanted emotional experiences and stressors, therefore, resulting in a stronger relationship between alexithymia and NSSI for women. Conversely, men who have high levels of alexithymia may engage in risky drinking, rather than NSSI, to escape intense emotions, therefore, resulting in a stronger positive relationship between alexithymia and risky drinking for men. However, the moderating role of biological sex in these associations is speculative and is yet to be empirically tested.

### **The Current Study**

In this study, we aimed to explore the roles of biological sex, as well as individual differences in alexithymia, and experiential avoidance in predicting NSSI and risky drinking. Specifically, we investigated the way the facets of alexithymia interact with experiential avoidance and sex to predict engagement in NSSI and/or risky drinking. First, we expected positive associations between alexithymia, experiential avoidance, and both NSSI and risky drinking. Second, we predicted that associations between alexithymia and both behaviours would be stronger for participants reporting a greater tendency toward experiential avoidance. Third, we hypothesised that the associations between alexithymia and NSSI will be stronger for women, and associations between alexithymia and risky drinking will be stronger for men. We also

explored three-way interactions between alexithymia, experiential avoidance, and biological sex.

## Method

### Participants

As part of a larger study on health-risk behaviours, students from an Australian university completed an online questionnaire. The sample comprised 778 students (77.1% female,  $M_{age} = 22.27$ ,  $SD = 6.71$ ). Seven participants (0.9%) identified as Aboriginal or Torres Strait Islander, 73% were born in Australia, and the majority lived with family (67.1%) or housemates (11.9%). Consistent with other Australian university samples, participants were most likely studying full-time (85.6%) and in their first or second year at university (71.2%).

### Measures

In addition to collecting data on biological sex, age, and history of mental illness diagnoses, students were administered the following measures.

**The Inventory of Statements about Self-Injury** (ISAS; Klonsky & Glenn, 2008) is a questionnaire that asks about a participant's history of NSSI. First, participants read the following description of NSSI "Non-suicidal self-injury is defined as the deliberate physical self-damage or self-harm that is not accompanied by suicidal intent or ideation. Although cutting is one of the most well-known non-suicidal self-injury behaviours, it can take many forms including but not limited to biting, burning, scratching, self-bruising or swallowing dangerous substances if undertaken with intent to injure oneself". Second, participants report whether they have ever engaged in NSSI. We used this question to create our binary outcome variable (Lifetime history of NSSI – 0: No; 1: Yes). Additional questions assess descriptive and contextual factors of NSSI

(e.g., age of onset). The ISAS has excellent test-retest reliability in young adults ( $r = .85$ ; Klonsky & Olino, 2008).

**The Alcohol Use Disorders Identification Test (AUDIT;** Degenhardt et al., 2001) is a 10-item questionnaire that assesses current typical alcohol intake (e.g., “how often do you have a drink containing alcohol?”), and alcohol-related problems (e.g., “how often during the last year have you found that you were not able to stop drinking once you had started?”). Participants rate questions on a 5-point Likert scale ranging from 0-4; larger scores indicate higher levels of risky drinking. The Majority of the items have options ranging from never (0) to daily or almost daily (4). For this study, we used cut-off points ( $8 \leq$  risky drinking) validated by Roche and Watt (1999) in an Australian student sample to create a binary variable of low-risk and risky drinkers. The internal consistency in the current sample was good,  $a = .85$ .

**The Toronto Alexithymia Scale (TAS-20;** Bagby et al., 1994) is a 20-item self-report scale measuring three core aspects of alexithymia. Seven items (e.g., “I have feelings that I can't quite identify”) measure difficulties identifying feelings (DIF), five items (e.g., It is difficult for me to find the right words for my feelings) measure difficulties describing feelings (DDF), and eight items (e.g., I don't know what's going on inside me) measure externally orientated thinking (EOT). Participants rate each item on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Scores per subscale range as follows: DIF (7-35), DDF (5-25), and EOT (8-40). The scale has good test-retest reliability ( $r = .77$ ) and satisfactory internal consistency (DIF,  $a = .79$ , DDF,  $a = .75$ ; EOT,  $a = .66$ ; Bagby et al., 1994). Cronbach alphas in the current sample were DIF  $a = .87$ ; DDF  $a = .80$ ; EOT  $a = .58$ . Due to the relatively low internal consistency of the EOT all results related to this subscale should be interpreted with caution.

**The Brief Experiential Avoidance Questionnaire** (BEAQ; Gámez et al., 2014) is a 15-item unidimensional short-form of the Multidimensional Experiential Avoidance Questionnaire (MEAQ; Gámez et al., 2011). Participants rate each item (e.g., “When unpleasant memories come to me, I try to put them out of my mind”) on a six-point Likert scale ranging from strongly disagree (1) to strongly agree (6). Scores range from 15 to 90 with larger scores indicating higher levels of experiential avoidance. The scale has shown excellent internal reliability in past studies ( $\alpha = .84$ ; Gámez et al., 2014) and in the current,  $\alpha = .87$ , sample.

### **Procedure**

Upon gaining approval from the university’s human research ethics committee, participants were recruited through an online undergraduate participant pool. Interested students could complete the online questionnaire to gain course credit. Upon reading the information sheet and providing consent, participants completed the questionnaire, taking between 45 and 60 minutes. At the beginning and end of the survey, participants had access to resources including NSSI and alcohol information sheets, on-campus counselling numbers, and mental health websites.

### **Data Analysis**

Individuals were classified into one of four groups based on their NSSI history (no/yes) and their scores on the AUDIT (low risk (7 or less) risky (8 or more; Roche & Watt, 1999)). The four groups were; individuals with no history of either behaviour, individuals who have self-injured but did not engage in risky drinking, people who engage in risky drinking but had never self-injured, and individuals who reported both behaviours. To test the direct and moderating effects of the variables of interest in differentiating these four groups we ran a multinomial logistic regression with neither

behaviour as the reference category. We conducted post-hoc binary logistic regressions to detect which variables distinguished between each specific pair of groups, allowing a more nuanced understanding of how facets of alexithymia, experiential avoidance, and biological sex may differentially relate to NSSI and risky drinking. All regressions included age and history of mental health as covariates. Predictors were standardised for all analyses and we used simple slopes analysis at  $\pm$  one standard deviation from the mean (Aiken & West, 1991) to explore all significant interactions.

## Results

### Preliminary Results

There was less than 5% missing data on all variables of interest, and data was missing completely at random,  $\chi^2(1699) = 1706.08, p = .45$ . Missing data was imputed using Expectation Maximisation (Tabachnick & Fidell, 2013). Of the sample, 186 (23.9%) participants reported a history of mental illness, most commonly depression (29.03%), anxiety (18.89%) or comorbid depression and anxiety (30.11%). Two-hundred and twenty-nine (29.5%) participants reported a lifetime history of NSSI, of whom 105 (45.85%) reported engaging in NSSI in the past year. We used lifetime history of NSSI in all regression analyses. Age of onset ranged between 3 and 40 years ( $M = 15.31, SD = 3.83$ ). The most prevalent form of NSSI was cutting (79.47%) followed by self-battery (55.46%). 286 (36.8%) individuals reported engagement in risky drinking. NSSI and risky drinking were positively associated,  $\chi^2(1) = 9.73$ , Cramer's  $V = .112, p = .002$ . One-hundred and four participants (13.37%) reported engaging in both behaviours. The remaining 367 individuals (47.12%) reported engaging in neither behaviour. History of mental illness was related to both NSSI,  $\chi^2(1) = 74.99, p < .001$ , and risky drinking  $\chi^2(1) = 15.21, p < .001$ .

Male participants (32%) were more likely to consume alcohol in a risky pattern than female participants (21%),  $\chi^2(3) = 15.86, p < .001$ , but no other significant sex or age,  $F(3,777) = 2.19, p = .09$ , differences were apparent across groups. Table 3.1 shows means and standard deviations on variables of interest for each group, and Table 3.2 displays correlations between the variables of interest.

***Multinomial Regression: With Neither Behaviour as the Contrast Group***

Having a history of mental illness was associated with increased odds of engaging in both NSSI and risky drinking (Table 3.3). Being younger and having difficulties identifying feelings were associated with increased odds of NSSI, in both the absence and presence of risky drinking.

**Table 3.1.** Comparison between groups of participants on variables of interest.

	Neither behaviour ( <i>n</i> = 365)		NSSI Only ( <i>n</i> = 126)		Risky Drinking Only ( <i>n</i> = 183)		Risky Drinking + NSSI ( <i>n</i> = 104)		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age	22.88	7.78	21.52	4.91	22.07	6.22	21.39	5.00	2.20
Difficulties Identifying Feelings	16.02	5.75	19.19	6.01	17.58	5.25	20.96	5.95	24.61**
Difficulties Describing Feelings	13.31	4.24	14.86	4.24	14.12	4.06	15.55	4.91	9.37**
Externally Orientated Thinking	19.18	4.03	18.81	4.12	19.88	3.69	19.04	4.14	2.17
Experiential Avoidance	47.40	11.90	52.12	12.04	50.26	10.79	53.62	11.88	10.60**

*Note.* \* $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ .

**Table 3.3** Multinomial regression: NSSI and risky drink compared to neither behaviour.

	NSSI only Exp(95% CI)	Drinking only Exp (95% CI)	NSSI +drinking Exp (95% CI)
Step one			
Mental illness	5.93(3.67- 9.58)***	2.43(1.52- 3.89)***	6.77(4.09-11.21)***
Age	.69(.53-.50)**	.84(.70-1.02)	.65(.49-.87)**
Step two			
Difficulties identifying feelings	1.65(1.22-2.24)**	1.23(.94-1.60)	2.33(1.68-3.24)***
Difficulties describing feelings	1.14(.85-1.53)	1.03(.79-1.33)	1.06(.77-1.46)
Externally orientated thinking	.80(.63-1.00)	1.14(.93-1.39)	.80(.62-1.03)
Step three			
Experiential avoidance	1.16(.88-1.52)	1.11(.88-1.40)	1.09(.80-1.47)
Biological sex	1.63(.92-2.90)	.66(.44-.99)*	1.40(.75-2.60)
Step four			
DIF*EA	.73(.52-1.02)	.81(.61-1.07)	.75(.52-1.07)
DIF*sex	.76(.28-2.09)	1.21(.63- 2.35)	.40(.13-1.27)
DDF*EA	1.18(.6-1.61)	1.11(.84-1.46)	1.26(.89-1.78)
DDF*sex	1.72(.70-4.14)	.76(.43-1.36)	3.22(1.17-8.87)*
EOT*EA	1.25(.99-1.58)	1.03(.84-1.26)	1.24(.96-1.59)
EOT*sex	.57(.31-1.05)	.84(.55-1.28)	.63(.33-1.21)
EA*sex	.97(.45-2.10)	1.24(.72-2.14)	.92(.40-2.13)
Step five			
DIF*EA*sex	1.13(.37-3.42)	1.13(.59-2.16)	2.34(.75-7.26)
DDF*EA *sex	1.71(.77-3.79)	1.25(.70-2.23)	.85(.36-2.00)
EOT*EA *sex	.43(.22-.85)*	1.06(.66-1.71)	.64(.30-1.34)

Note. \*\*\*p<.001, \*\* p<.01, \*p<.05; DIF = Difficulties identifying feelings, DDF = Difficulties describing Feelings, EOT = Externally Orientated Thinking, EA = Experiential Avoidance.

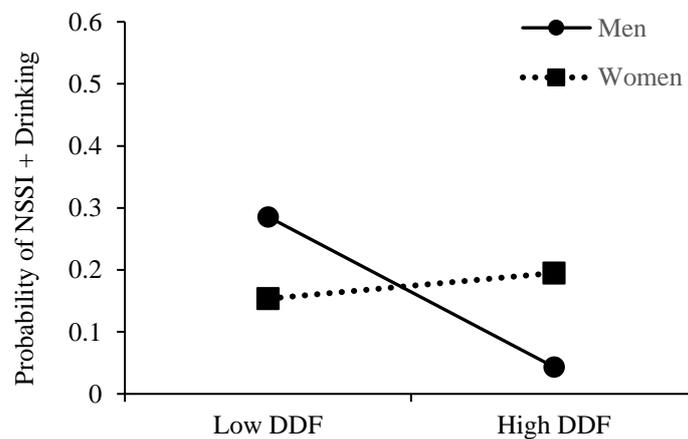
**Table 3.2.** Means, standard deviations, and correlations between predictors

Variable	M (SD)	2	3	4	5	6	7
History of Mental Illness <sup>a</sup>	-	5.35 <sup>b*</sup>	.12**	.16***	.04	-.11**	.12**
Biological Sex <sup>a</sup>	-		.02	.06	.01	-.03	.03
Age	22.29(6.71)			-.19***	-.24***	-.13***	-.17***
Difficulties Identifying feelings	17.55 (5.97)				.31***	.69***	.59***
Difficulties Describing Feelings	14.94(4.37)					.33***	.54***
Externally orientated thinking	19.26(3.98)						.31***
Experiential Avoidance	49.67(11.88)						

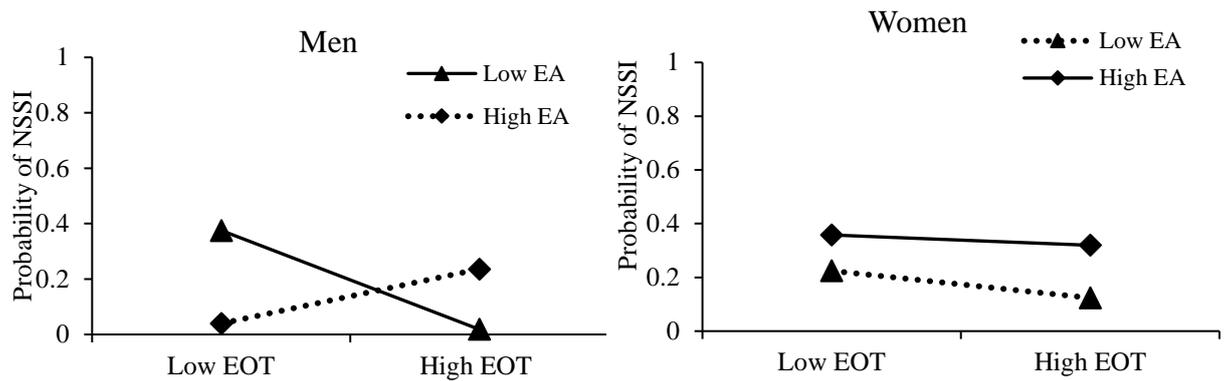
Note. <sup>a</sup> Point-Biserial correlations; <sup>b</sup> Chi-square test of Contingency\* $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ .

Being male was associated with an increased probability of engaging in risky drinking in the absence of NSSI. There was a significant two-way interaction between difficulties describing feelings and biological sex to predict engagement in both behaviours. As seen in Figure 3.1, there was no association between difficulties describing feelings and engaging in both behaviours for women ( $b = .14, z = .67, p = .50$ ) but there was a negative association for men ( $b = -1.06, z = -2.06, p = .04$ ).

There was a significant three-way interaction between externally orientated thinking, sex, and experiential avoidance to predict engagement in self-injury (Figure 3.2). Specifically, for men, there was a significant positive association between externally orientated thinking and NSSI at high levels of experiential avoidance ( $b = .99, z = 2.45, p = .01$ ), and a negative relationship between externally orientated thinking and NSSI at low levels of experiential avoidance ( $b = -1.71, z = -2.52, p = .01$ ).



**Figure 3.1.** Engagement in both behaviours compared to neither. Sex moderates the association between difficulties describing feelings and probability of engaging in both behaviours.



**Figure 3.2.** NSSI compared to neither behaviour. Sex and experiential avoidance interact to moderate the association between externally orientated thinking and probability of engaging in NSSI only.

For women, there was no association between externally orientated thinking and NSSI at high ( $b = -.44, z = -1.91, p = .06$ ) or low ( $b = -.31, z = -1.61, p = .11$ ) levels of experiential avoidance. The model with all variables and interactions significantly predicted group membership,  $\chi^2(45) = 194.95, p < .001$ , explaining between 10% (McFadden  $R^2$ ) and 24% (Nagelkerke  $R^2$ ) of variance.

### Binary Logistic Regressions

#### *Differentiating engagement in NSSI and Risky Drinking*

Compared to individuals who self-injured, people who engaged in risky drinking were more likely to be male and have higher levels of externally orientated thinking, but less likely to have a history of mental illness (Table 3.4). There was a significant three-way interaction between externally orientated thinking, sex, and experiential avoidance (see Figure 3.3). Specifically, for women, there was a significant positive association between externally orientated thinking and drinking at low levels of experiential avoidance ( $b = .47, z = 2.01, p = .04$ ). At high levels of experiential avoidance for women, ( $b = .41, z = 1.87, p = .06$ ) and low levels of experiential avoidance for men ( $b = 1.03, z = 1.95, p = .051$ ) the association was in the same direction (positive) and

approaching significance. There was no significant association for men at high levels of experiential avoidance ( $b = -.69, z = -1.40, p = .16$ ). The final model significantly differentiated individuals who had a history of NSSI only and individuals who engaged in risky drinking only,  $\chi^2 (16) = 48.10, p < .001$ , explaining between 14% (Cox & Snell  $R^2$ ) and 19.4% (Nagelkerke  $R^2$ ) of the variance.

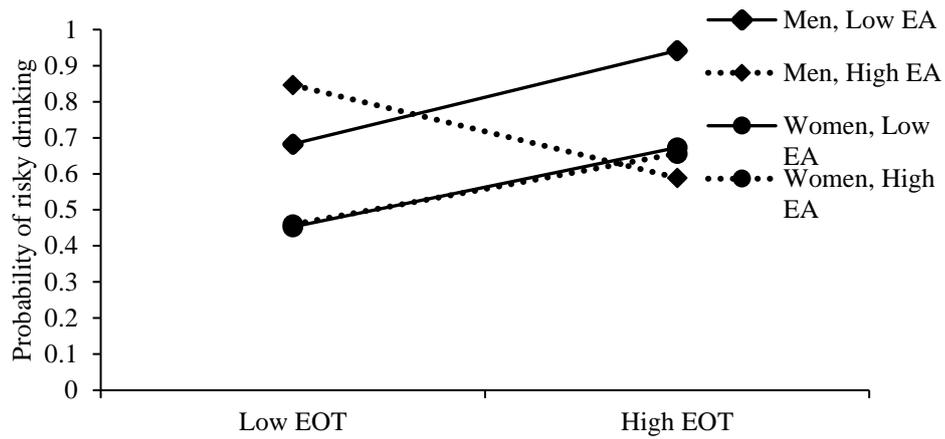
***Differentiating Engagement in Both Behaviours and Risky Drinking.***

Individuals who engaged in both behaviours were more likely to have a history of mental illness, be female, have greater difficulties identifying feelings, and lower levels of externally orientated thinking than individuals who only engaged in risky drinking (Table 3.4). There was one significant two-way interaction between difficulties describing feelings and sex. As seen in Figure 3.4, for men there was a significant negative association between difficulties describing feelings and engaging in both behaviours, ( $b = -1.27, z = -2.21, p = .03$ ), but there was no association for women, ( $b = .19, z = .95, p = .34$ ). The model significantly differentiated individuals who engaged in risky drinking only and individuals who had engaged in both behaviours [ $\chi^2 (16) = 60.62, p < .001$ ], explaining between 19% (Cox & Snell  $R^2$ ) and 26% (Nagelkerke  $R^2$ ) of the variance.

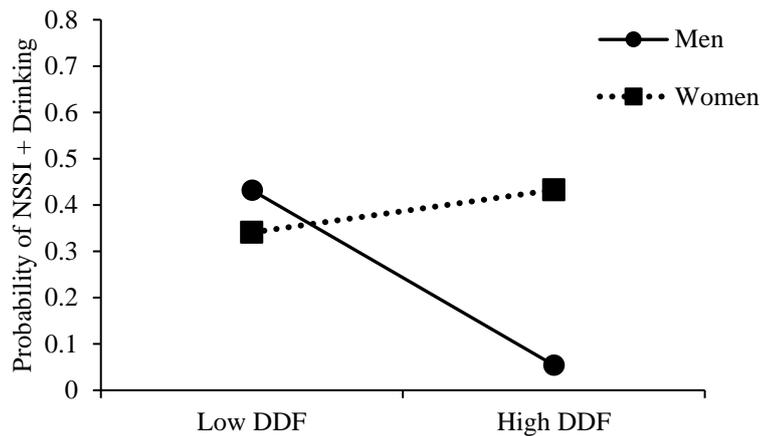
**Table 3.4.** Binary logistic regressions: Comparing NSSI, risky drinking, and both behaviours.

	Drinking only <sup>a</sup>	NSSI +drinking <sup>a</sup>	NSSI + drinking <sup>b</sup>
	Exp (95% CI)	Exp (95% CI)	Exp (95% CI)
<b>Step one</b>			
Mental illness	.41(.25-.70)***	1.14(.68-1.93)	2.76 (1.67-4.67)***
Age	1.21(.89-1.63)	.96(.67-1.37)	.75(.54-1.06)
<b>Step two</b>			
Difficulties identifying feelings	.75(.55-1.04)	1.45(.99-2.12)	2.05(1.39-3.00)***
Difficulties describing feelings	.88(.64-1.21)	.90(.62-1.30)	1.00(.71-1.40)
Externally orientated thinking	1.39(1.08-1.80)*	.99(.75-1.31)	.68(.51-.90)**
<b>Step three</b>			
Experiential avoidance	.90(.65-1.26)	.96(.68-1.35)	1.00(.70-1.44)
Biological sex	.41(.22-.75)**	.91(.43-1.91)	1.96(1.02-3.76)*
<b>Step four</b>			
DIF*EA	1.05(.73-1.50)	.99(.66-1.47)	.92(.59-1.42)
DIF*sex	1.54(.54-4.45)	.54(.14-2.14)	.33(.09-1.27)
DDF*EA	.96(.67-1.37)	1.12(.74-1.70)	1.29(.87-1.91)
DDF*sex	.47(.18-1.24)	1.71(.57-5.16)	4.43(1.36-14.45)*
EOT*EA	.81(.61-1.08)	.96(.72-1.28)	1.10(.78-1.54)
EOT*sex	1.37(.68-2.73)	1.08(.49-2.36)	.87(.40-1.90)
EA*sex	1.48(.62-3.52)	.90(.33-2.41)	.56(.20-1.56)
<b>Step five</b>			
DIF*EA*sex	.76(.22-2.62)	6.67(.85-52.61)	2.09(.56-7.76)
DDF*EA*sex	1.00(.44-2.30)	.16(.03-1.02)	.44(.16-1.17)
EOT*EA*sex	2.40(1.04-5.53)*	1.47(.58-.372)	.73(.25-2.16)

*Note.* References group; <sup>a</sup> = NSSI; <sup>b</sup> = Risky drinking; \*\*\*p<.001, \*\* p<.01, \*p<.05; DIF = Difficulties identifying feelings, DDF = Difficulties describing Feelings, EOT = Externally Orientated Thinking, EA = Experiential Avoidance.



**Figure 3.3.** NSSI only compared to risky drinking only. Sex and experiential avoidance interact to moderate the association between externally orientated thinking and probability of risky drinking.



**Figure 3.4.** Drinking compared to both behaviours. Sex moderates the association between difficulties describing feelings and probability of engaging in both behaviours.

*Differentiating Engagement in Both Behaviours and NSSI*

The model did not significantly distinguish between individuals who engage in both behaviours and individuals who only engage in NSSI,  $\chi^2(16) = 12.77, p = .70$ , and no individual predictors added unique variance to the model (Table 3.4).

**Discussion**

NSSI and risky drinking are two prevalent behaviours among university students that can have adverse physical and psychological outcomes. Identifying individual differences that could elevate the risk of these behaviours is important in developing prevention and intervention initiatives. The current study aimed to expand on work exploring the associations between alexithymia and both NSSI and risky drinking by testing the moderating roles of experiential avoidance and biological sex. Experiential avoidance did not uniquely predict NSSI or risky drinking; however, it did interact with externally orientated thinking and sex to differentiate engagement in these behaviours. Men who reported a combination of high levels of both externally orientated thinking and experiential avoidance were at increased odds of having engaged in NSSI. Whereas women who reported a combination of high levels of externally orientated thinking, but low levels of experiential avoidance were more likely to have engaged in risky drinking. However, consistent with previous research (e.g., Preece et al., 2017), the reliability of the externally orientated thinking subscale was poor in the current sample and results should be interpreted with caution.

### **Alexithymia**

As expected, we found support for the positive associations between alexithymia and both NSSI and risky drinking, however, there were some important differences. Consistent with previous research, individuals who had difficulties identifying feelings were more likely to engage in NSSI (Norman & Borrill, 2015) regardless of drinking behaviour. Conversely, individuals who had a tendency towards an externally orientated thinking style were more likely to engage in risky drinking than NSSI. Strong social motives for alcohol use among students may explain the association between externally orientated thinking and risky drinking (Kuntschek et al., 2005). Students who have an externally orientated thinking style may be more likely to have external motives (e.g.,

social; to fit in with others) for engaging in drinking rather than internal motives (e.g., emotion regulation; Kuntschek et al., 2005). Future research could examine this proposition.

Contrary to previous research (Mattila et al., 2006), age was negatively associated with alexithymia (Table 3.2). This may be an artefact of age range of our sample with the vast majority of participants aged between 17 and 25. It is possible rather than a linear association, alexithymia has a quadratic association with age (Cabello et al., 2016; Parker et al., 2001). Levels of alexithymia may decrease until roughly middle age and then begin to increase thereafter. However, this suggestion is only theoretical and warrants further exploration.

### **Sex Differences**

For men only, individual differences in difficulties describing feelings distinguished risky drinking from engaging in both behaviours. Specifically, men who reported difficulties describing feelings were at increased probability of engaging in risky drinking but decreased probability of engaging in both behaviours. As we observed no differences between NSSI and engaging in both behaviours, any associations between alexithymia and engaging in both behaviours is likely driven by NSSI. The interaction between difficulties describing feelings and sex to predict risky drinking may be as hypothesised, and men are using drinking to alleviate emotional difficulties. However, the negative association between difficulties describing feelings and NSSI for men is less clear. Considering that alexithymia is a traditionally masculine trait (Levant, 1992; Levant et al., 2009), men who report difficulties describing their feelings might hold high levels of traditional masculine ideologies and thus be less likely to report engaging in NSSI, a behaviour traditionally associated with women (Lewis, 2016). In contrast,

men who have less difficulty describing feelings might hold fewer masculine ideologies and could be more open to reveal engagement in NSSI or use self-injury as a way to describe their feelings (Klonsky & Muehlenkamp, 2007). Alternatively, due to the retrospective reporting of NSSI, it is conceivable that men who currently have less difficulty describing feelings have, in the past, received treatment for psychological distress and may have learned these skills.

Biological sex and a combination of individual differences in both externally orientated thinking and experiential avoidance distinguished between NSSI and risky drinking. Specifically, men who reported an externally orientated thinking style and a predisposition towards experiential avoidance had an increased likelihood of NSSI. Conversely, women who reported an externally orientated thinking style but a tendency to accept emotion (low levels of experiential avoidance) were more likely to engage in risky drinking than NSSI. However, it appears that the non-significant association between externally orientated thinking and risky drinking, at high levels of experiential avoidance for men is what is driving the second three-way-interaction (Figure 3.3). Upon examining the simple slopes, we can tentatively propose that the associations between externally orientated thinking and risky drinking are also positive, at high levels of experiential avoidance for women and at low levels of experiential avoidance for men. Conceivably, other than men with a tendency to avoid emotion, individuals who report an externally orientated thinking style are more likely to engage in risky drinking than NSSI. Theoretically, these results imply that men with high levels of externally orientated thinking may be using NSSI to escape or avoid emotional experience (Chapman et al., 2006), but underlying motives for drinking for both men and women in this population may be different.

At a theoretical level, the findings suggest that individual differences and the underlying processes associated with engaging in NSSI compared to risky drinking may be diverse for men and women. This opens up potential avenues to investigate the behaviour-specific factors through which alexithymia leads to engagement in NSSI compared to risky drinking. Factors may include the outcomes an individual expects from a specific behaviour (i.e., outcome expectancies) or perhaps alternative motives/functions the behaviour could serve for the person (e.g., social functions versus emotion regulatory functions). Additionally, exploring how these behaviour-specific factors differ across biological sex could provide further insight into possible functional and motivational differences of these behaviours for men and women.

### **Clinical Implications**

By investigating NSSI and risky drinking concurrently, we can compare similarities and differences in the underlying processes of both behaviours. Although alexithymia plays somewhat different roles in NSSI and risky drinking, one can stipulate the importance of improving an individual's emotional processing (i.e., emotional awareness, clarity and acceptance) skills to reduce engagement in both behaviours and overall psychological distress. Dialectical Behaviour Therapy (DBT; Linehan, 2014) is one therapeutic intervention that can modify emotional processing skills. In DBT, an individual first learns to identify and accept their emotions, thoughts, and bodily sensations. For some individuals, identifying the adverse emotional experience can decrease the urge to engage in dysregulated behaviours to control or manipulate their emotions (Linehan, 2014). Implementing these types of therapies for individuals with high levels of alexithymia could help prevent the onset or re-occurrence of NSSI and risky drinking.

Additionally, the results highlight the clinical utility of building emotional acceptance (i.e., decreasing experiential avoidance) specifically for men in the treatment of NSSI. Although experiential avoidance can be targeted through DBT or Mindfulness-Based Cognitive Therapy, Acceptance Commitment Therapy (ACT; Hayes et al., 2016) may be the most effective as it covers two aspects of experiential avoidance. First, individuals learn to accept adverse emotional experience, thus decreasing the desire to engage in NSSI to escape from these emotions. Second, individuals devise behaviour-related goals and alternative emotion regulation strategies for when the urge to avoid adverse experiences arises (Hayes et al., 2016). Combined, these two phases of ACT may give individuals the essential skills to accept emotional adversity and subsequently decrease the urge to engage in dysregulated behaviours.

### **Limitations**

Naturally, the present study is not without limitation. First, students self-selected to participate in our study, which elevates the possibility of self-selection bias. However, our sample characteristics and rates of NSSI and risky drinking were comparable to other similar studies (e.g., Hasking, 2017). Supplementary studies with a more representative sample of university students would enhance the external validity of the results. Further, we acknowledge that although many students report engagement in NSSI and risky drinking, few would meet the diagnostic criteria for NSSI disorder (Kiekens et al., 2018c) or alcohol use disorders (WHO, 2014). Subsequently, replication with clinical samples is warranted.

Our finding that experiential avoidance was not directly associated with NSSI or risky drinking may be an artefact of our measurement rather than an indication that experiential avoidance is not directly involved in either behaviour. Specifically, we

tested experiential avoidance as a unidimensional trait; however, experiential avoidance may have multiple facets (MEAQ; Gámez et al., 2011). Similar to alexithymia, self-injury and risky drinking may have differential associations with diverse aspects of experiential avoidance (e.g., behaviour avoidance and stress aversion) that the BEAQ does not account for. Future research would benefit from exploring the subscales of the MEAQ separately, as it could provide further insight into the associations between experiential avoidance, alexithymia and both NSSI and risky drinking.

Causal interpretation is not possible due to the cross-sectional nature of the research and retrospective reporting of self-injury (history) compared to risky drinking (recent). Specifically, an individual who has a history of NSSI but no longer engages in self-injury may have learned to process their emotions or shifted to consuming alcohol in a risky pattern. Further, we measured NSSI as a binary variable, meaning the subsample consists of individuals who frequently engage in NSSI and those who may have only self-injured a few times. This may attenuate the true relationships between alexithymia and experiential avoidance in predicting NSSI. If power permits, future research may benefit from focusing on individuals who have engaged in self-injury within a narrower period or NSSI frequency. Alternatively, prospective research may be beneficial, to predict whether scores on variables at time one predicts engagement in self-injury at time two.

Finally, the current study relies on self-report measures, which do not account for a person's distorted, or lack of, self-knowledge (McDonald, 2008). This is particularly relevant in alexithymia research (Bagby et al., 1994). Nevertheless, the TAS-20 is the "gold standard" when measuring alexithymia. The development of experimental or implicit measures could be useful to gain a more objective assessment of alexithymia.

## Conclusion

With limitations noted, our findings provide support for the importance of biological sex and individual differences in alexithymia and experiential avoidance in predicting and differentiating NSSI and risky drinking. These results highlight that engagement in both NSSI, and risky drinking may be the product of an intricate interplay between various cognitions and emotions. Importantly, these findings suggest intervention initiatives that focus on developing emotional processing skills may reduce the likelihood of engaging in NSSI and/or risky drinking.

## **Chapter 4: Measurement invariance of two measures of Alexithymia Among students who do and who do not engage in non-suicidal self-injury and risky drinking**

### **Introduction to Chapter 4 (Study 3)**

In Study 3, I investigate the measurement invariance and psychometric properties of two alexithymia questionnaires across individuals who do and individuals who do not engage in NSSI/risky drinking. There were two purposes for this study. First, it was evident through searching the literature in Study 1 and our own analyses in Study 2 that the Toronto-Alexithymia Scale (TAS-20) has some internal consistency issues, specifically in regard to the externally orientated thinking subscale. Further, many studies (e.g., Preece et al., 2018a; Thorberg et al., 2010) fail to replicate the three-factor structure of the TAS-20. The recently developed Perth Alexithymia Questionnaire (PAQ) appears to be a good alternative with a reliable externally orientated thinking subscale and valence specific subscales for difficulties identifying and difficulties describing feelings. Valence specific subscales may provide us with a more complete understanding of the associations between alexithymia and both behaviours. Second, it is assumed that measurement of alexithymia using self-report questionnaires is equivalent for people who do and who do not have a history of NSSI, and people who do and who do not drink in a risky fashion. It is conceivable that the very difficulties in identifying and describing emotions thought to underlie both NSSI and risky drinking may limit the validity of alexithymia questionnaires. The results of this study influenced which alexithymia scale I decided to use going forward into the final two studies.

**This chapter is based on the paper** “*Measurement invariance of two measures of Alexithymia in students who do and who do not engage in non-suicidal self-injury and risky drinking*” published on the 24<sup>th</sup> of May 2020 by Springer Science+Business Media, LLC, part of Springer Nature in *Journal of Psychopathology and Behavioral Assessment*.

**Reference:** Greene, D., Hasking, P., Boyes, M., & Preece, D. (2020). Measurement invariance of two measures of Alexithymia in students who do and who do not engage in non-suicidal self-injury and risky drinking. *Journal of Psychopathology and Behavioral Assessment*. <https://doi.org/10.1007/s10862-020-09806-7>

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Author	Contribution	I acknowledge that these represent my contribution to the above research output  Signed:
Danyelle Greene	Development of the research question, data analysis, interpretation of the results and manuscript preparation.	
Penelope Hasking	Assisted in the development of the research question, and manuscript preparation.	
Mark Boyes	Assisted in the development of the research question, and manuscript preparation.	
David Preece	Assisted with data interpretation and manuscript preparation.	

## Abstract

Non-Suicidal Self-Injury (NSSI) and risky drinking have a shared emotion regulatory function. Alexithymia is an important risk factor for both behaviors. However, it is conceivable that the emotional processing difficulties thought to underlie both behaviors may contribute to differences between people who self-injure or drink in a risky fashion, and those who do not, when interpreting alexithymia items on self-report questionnaires. Therefore, measurement invariance should be established before attributing scale score differences between groups to true differences in alexithymia. We examined the validity, factor structure, and measurement invariance of the Toronto Alexithymia Scale (TAS-20) and the Perth Alexithymia Questionnaire (PAQ) among 640 university students ( $M_{age} = 20.39$ ,  $SD = 1.86$ ) with and without histories of NSSI and risky drinking. The original factor structure of the TAS-20 was not supported; however, the addition of a reverse-scored item method factor improved fit. The intended five-factor model of the PAQ was supported. We found configural, full metric, and full scalar invariance for the PAQ and a revised-TAS-20. Both the PAQ and TAS-20 demonstrated good concurrent, convergent, and discriminate validity. Our results suggest that all subscales of the PAQ and the difficulties identifying feelings and difficulties describing feelings subscales of the TAS-20 can be used confidently to discern differences in alexithymia in the context of NSSI and risky drinking. However, the externally orientated thinking subscale of the TAS-20 had poor internal consistency and several inadequate factor loadings. We discuss the utility of the externally orientated thinking subscale of the TAS-20.

Non-suicidal self-injury (NSSI) is the deliberate damage of one's body tissue, without suicidal intent, for reasons not socially or culturally endorsed (ISSS, 2018). Methods of NSSI include but are not limited to, cutting, severe scratching, and self-battery. It is estimated via meta-analytic techniques that, internationally, 13.4% of community-based young adults and 20% of young adults attending university have engaged in NSSI in their lifetime (Swannell et al., 2014). Although individuals report engaging in NSSI for various reasons (e.g., anti-dissociation, self-punishment), affect regulation functions are the most consistently endorsed (Taylor et al., 2018). People also commonly report engaging in risky drinking (i.e., consuming alcohol in a pattern that increases an individual's risk of adverse consequences to themselves or others; WHO, 2014), to cope with emotional difficulties (Martins et al., 2018). Like NSSI, the prevalence of risky drinking is higher among young adults attending university (40%) compared to young adults (30%) in the general population (Auerbach et al., 2018; AIHW, 2016).

Given that NSSI and risky drinking often serve emotion regulatory functions, emotion regulation has become a key factor in theoretical models of both behaviors, such as the Experiential Avoidance (Chapman et al., 2006) and the Emotional Cascade (Selby & Joiner, 2009) models of NSSI, and the Motivational Model of Alcohol Use (Cox & Klinger, 1988). This has led to a considerable body of research with the aim of understanding emotional processing difficulties and cognitive-emotional variables thought to underlie NSSI and risky drinking. Alexithymia is one such cognitive-emotional variable (Greene et al., 2020a). Alexithymia is a multidimensional personality trait encompassing deficits in three<sup>1</sup> core facets of emotional processing:

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<sup>1</sup> Early theoretical models included a fourth component of alexithymia, difficulty fantasising, whereby the individual has limited imagination and a lack of ability to fantasise (Sifneos, 1973). However, there is continuing debate about the inclusion of this component in the construct (Watters, et al., 2016), and most measures of alexithymia do not measure it.

difficulties identifying one's own feelings, difficulties describing feelings, and an externally orientated thinking style whereby one has a tendency to concentrate on the external environment as opposed to one's own emotional states (Bagby et al., 1994; Preece et al., 2017). Conceptually, many authors consider alexithymia to be an important rate-limiting factor for effective emotion regulation (Gross, 2015; Preece et al., 2017; Taylor, 1994). Support for this link between alexithymia and emotion dysregulation has been found across a number of studies (Pandey et al., 2011; Swart et al., 2009; Taylor, 2000). Specifically, in his review, Taylor (2000) suggests that alexithymia is a deficit in our emotional response system, which impacts our abilities to regulate emotions. Namely, because alexithymia precludes people from identifying their emotions, it prevents them from reflecting on and regulating these same emotions.

### **Measurement Invariance**

Although alexithymia, as measured by self-report questionnaires, is positively associated with both NSSI and risky drinking (Greene et al., 2020a), there has been limited research on the psychometric properties (i.e., factor structure) of self-report alexithymia questionnaires among people engaging in NSSI or risky drinking. Moreover, no researchers have examined whether the measurement of alexithymia is equivalent for individuals who do and who do not self-injure, and individuals who do and who do not consume alcohol in a risky pattern. It is conceivable that the emotional processing difficulties thought to underlie both NSSI and risky drinking may hinder the validity of the supposed differences on self-report alexithymia scales. Specifically, the emotion processing difficulties that underpin dysregulated behaviors (i.e. behavioral strategies that allow an individual to shift their attention away from diverse emotional states towards body sensations; Jungmann et al., 2016) may obstruct an individual's ability to identify and describe specific feelings during times of heightened distress,

which in turn may hamper their capacity to accurately report on their levels of alexithymia. Furthermore, the very inability to clearly identify emotions may obstruct an individual's ability to accurately answer questions about their emotions. This could result in artificial group differences in alexithymia based on self-report measures due to differential interpretation of scale items, rather than true group differences in alexithymia.

In similar work, Kiekens et al. (2018a) found some items on the widely used Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) to function differently for individuals who have a history of self-injury compared to individuals who do not have a history of self-injury. Ignoring the differential functioning of these items may incorrectly lead to the conclusion that individuals with a history of NSSI have lower levels of cognitive reappraisal compared to individuals without a history of NSSI when assessed with the ERQ (Kiekens et al., 2018a). Therefore, past research using the ERQ (for a review see Wolff et al., 2019) concluding that individuals with a history of self-injury compared to those without a history of NSSI are less likely to reappraise stressful situations may be inaccurate. Thus, it is important to establish measurement invariance of other emotion-based self-report (e.g., alexithymia) scales across individuals who do and individuals who do not engage in dysregulated behaviors in order to make accurate statistical comparisons (Sass, 2011). In the current study, we investigate whether self-report alexithymia questionnaires are invariant across individuals who do and individuals who do not engage in dysregulated behaviors (i.e., NSSI and risky drinking).

### **Psychometric Properties of Self-Report Alexithymia Questionnaires**

The 20-item Toronto Alexithymia Scale (TAS-20), considered the ‘gold standard’ measure of alexithymia is commonly used in both NSSI and risky drinking research (Greene et al., 2020a). The TAS-20 has twenty items designed to load onto separate, difficulties identifying feelings (DIF), difficulties describing feelings (DDF), and externally orientated thinking style (EOT) factors, and all items are intended to be summated to give an overall index of alexithymia (Bagby et al. 1994). Generally, the total score and the DIF and DDF subscales of the TAS-20 have good psychometric properties but EOT subscale has regularly demonstrated poor internal consistency (e.g., Preece et al., 2018a; Thorberg et al., 2010; Tullio et al., 2019). Relatedly, several of the EOT items have inadequate factor loadings, which authors have attributed to the poor content validity and the reverse-scored format of some EOT items (Gignac et al., 2007; Meganck et al., 2008; Tullio et al., 2019; Preece et al., 2017). Reverse-scored items frequently cause unanticipated factor structures, as they tend to load onto a separate method factor (Netemeyer et al., 2003). The methods factor accounts for variance which is not accounted for by the latent factors thought to measure the trait (i.e., DIF-DDF-EOT) but is variance that is shared by items that have a common method (i.e., negatively keyed items). Thus, many researchers fail to replicate the original three-factor (i.e., DIF, DDF, and EOT) structure of the TAS-20 (e.g., Haviland & Reise, 1996; Tullio et al., 2019; Preece et al., 2017; Thorberg et al., 2010). Several alternative models are suggested (e.g., two-factor model consisting of ‘difficulties appraising feelings’ (DIF and DIF) and EOT subscales; Meganck et al., 2008; Zhu et al. 2007), but the TAS-20 generally conforms well to the intended three-factor structure with an additional reverse-scored item method factor (Preece et al., 2017; Tullio et al., 2019; Watters et al., 2016). Although, the TAS-20 is regularly used in NSSI and risky drinking research (Greene et al., 2020a), its factor structure and measurement invariance

are yet to be assessed across individuals who do and who do not engage in these behaviors.

More recently, Preece et al., (2018b) developed the Perth Alexithymia Questionnaire (PAQ). The PAQ contains items designed to measure the three facets of alexithymia (DIF, DDF, EOT) with valence specific DIF and DDF subscales; difficulties identifying negative feelings, difficulties identifying positive feelings, difficulties describing negative feelings, difficulties describing positive feelings, and general externally orientated thinking. Valence-specific measurement is now common for new measures of emotion-related constructs, such as emotion regulation (e.g., Weiss et al., 2015) and emotion reactivity (e.g., Becerra et al., 2017; Ripper et al., 2018). Existing work has also highlighted the importance of valence-specific measurement in alexithymia research. For example, using meta-analytic techniques, van der Velede et al. (2013) found that alexithymia had unique neural correlates depending on whether the valence of the emotion being processed was positive or negative. Specifically, the processing of negative stimuli was related to a decreased activation of the amygdala and motor/premotor areas suggesting decreased attention to stimuli and poor empathic and emotion regulatory abilities related to alexithymia. Conversely, processing of positive stimuli was associated with decreased activation of the right insula and precuneus which indicates poor emotional awareness (van der Velede et al., 2013).

The intended five-factor model of the PAQ appears to be a good fit in general community samples (Preece et al., 2018b; Preece et al., 2020) but is yet to be assessed in NSSI and risky drinking populations. In the current study, we examine a series of PAQ models beginning with general models that do not distinguish between positive and negative valence and ending with valence-specific models (Preece et al., 2018b). This progression from the most general model through to valence-specific models

allows us to examine whether valence is important in the context of NSSI and risky drinking.

### *Concurrent and Construct Validity*

It is important for scores on self-report questionnaires to be able to predict theoretically related outcomes (i.e., have good concurrent validity; Groth-Marnat, 2009). As alexithymia is considered a rate-limiting factor for successful emotion regulation, concurrent validity of the TAS-20 (e.g., Swart et al., 2009) and PAQ (Preece et al., 2018b) has been examined and supported by correlating alexithymia with measures of emotion regulation. One would anticipate that high PAQ and TAS-20 scores would be related to more difficulties in emotion regulation (e.g., difficulties accessing emotion regulation skills) and higher levels of psychological distress (Preece et al., 2018b). In the current study, we examine concurrent validity of the TAS-20 and the PAQ in the context of NSSI and risky drinking.

For a measure to show good construct validity a measure needs to have good convergent validity (i.e., two scales designed to measure the same construct are strongly related) and discriminate validity (i.e. a scale is not too highly correlated with tests designed to measure theoretically different constructs). The TAS-20 has been found to show good convergent validity with other measures of alexithymia, specifically, the Bermond-Vorst Alexithymia Questionnaire (Vorst & Bermond, 2001). Although, the PAQ has been found to correlate strongly with measures of emotion regulation (i.e., ERQ; Preece et al., 2018b), its convergence with other measures of alexithymia is yet to be tested. Further, there is concern that some measures of alexithymia may not be divergent from measures of psychological distress and broad emotion regulation constructs (Helmes et al., 2008; Leising et al., 2009). Given that many researchers (e.g.,

Gross, 2015, Preece et al., 2017; Taylor, 2000) consider an individual's level of alexithymia to be, theoretically, separable from their level of psychological distress, it is important to establish discriminant validity between measures of alexithymia and related but theoretically separate constructs. In the current study, we test the construct validity of the TAS-20 and the PAQ in the context of NSSI and risky drinking.

### **The Current Study**

The aim of the current study was to investigate whether the PAQ and the TAS-20 are valid, reliable, and invariant measures of alexithymia across individuals who do and individuals who do not engage in dysregulated behaviors (i.e., NSSI and risky drinking). We first tested a series of factor structures of the TAS-20 and the PAQ to see which factor structure fit best across our four groups: 1) students who have never engaged in NSSI; 2) students who have engaged in NSSI; 3) students who are low-risk drinkers; and 4) students who are risky drinkers. Second, we conducted a multi-group confirmatory factor analysis (MGCFA) to examine measurement invariance of the TAS-20 and PAQ across these groups. We did this by first comparing students who had and students who had not engaged in NSSI, and second by comparing students who do and students who do not consume alcohol in a risky pattern. We assessed configural (i.e., infers same concepts are defined), metric (i.e., infers mean-corrected scores can be compared), scalar (i.e., infers total scores can be compared), and residual error (i.e., infers that manifest scores can be compared) invariance. Lastly, we tested concurrent and construct validity of both the PAQ and TAS-20.

## Methods

### Participants and Procedure

We merged two data sets from studies on NSSI, risky drinking, and cognitive-emotional variables. After exclusion of duplicate cases and invalid responses, data from 640 participants remained. Participants were Australian university students aged between 17 and 25 years ( $M = 20.39$ ,  $SD = 1.86$ ) who self-selected into the studies via an undergraduate participant pool, poster advertisements, or social media posts (Facebook, Reddit). Of the 640 participants, 487 (76.09%) identified as female and nine (1.41%) as 'other'. The majority of the participants were born in Australia (75.80%) and studying an undergraduate course (96.40%). In both studies, students were directed to an online survey hosted by Qualtrics. Students could receive course credits or enter a prize draw to win an iPad or one of several \$50 gift cards. The University's Human Research Ethics Committee approved both studies. We gave students access to mental health resources and provided counselling service information at the beginning and the end of each study.

### Measures

**The Inventory of Statements about Self-Injury** (ISAS; Klonsky & Glenn, 2009). Students were given the following definition of NSSI "the deliberate physical self-damage or self-harm that is not accompanied by suicidal intent or ideation" and asked if they had ever engaged in the behavior. Students who reported a history of self-injury were asked to estimate using an open response format how frequently they engaged in 12 forms of self-injury (e.g., cutting, burning, and severe scratching), the age at which they first engaged in NSSI, and frequency of NSSI in the past year. In samples

of young adults, the ISAS has excellent test-retest reliability ( $r = .85$ ; Klonsky & Olino, 2008).

**The Alcohol Use Disorders Identification Test (AUDIT;** Degenhardt et al., 2001) is a 10-item scale that assesses typical alcohol intake (e.g. “How many drinks containing alcohol do you have on a typical day when you are drinking?”) and alcohol-related complications (e.g. “Have you or someone else been injured as a result of your drinking?”). Participants answer most questions on a 5-point Likert scale ranging from 0-4. Higher scores infer higher levels of risky drinking. For the current study, we used cut-off points (seven < risky drinking) validated by Roche and Watt (1999) in Australian student samples to create a binary variable of low-risk and risky drinkers. The AUDIT had excellent internal consistency in the current sample ( $\alpha = .85$ ).

**The Toronto Alexithymia Scale (TAS-20;** Bagby et al. 1994) is a 20 item self-report scale that measures Difficulties Identifying Feelings (DIF; “I have feelings that I can't quite identify”), Difficulties Describing Feelings (DDF; “I find it hard to describe how I feel to people”), and Externally Orientated Thinking (EOT; “I find the examination of my feelings useful in solving personal problems” (R)). Participants use a five-point Likert scale ranging from one (strongly disagree) to five (strongly agree) to indicate their level of agreement with each statement. The three subscales have the following ranges: DIF (7-35), DDF (5-25), and EOT (8-40). Past research indicates good internal consistency for DIF,  $\alpha = .79$ , DDF,  $\alpha = .75$  and total score,  $\alpha = .80$ , but poor internal consistency for EOT,  $\alpha = .66$  (Bagby et al., 1994). Cronbach alphas in the current sample were, DIF,  $\alpha = .89$ , DDF,  $\alpha = .82$ , EOT,  $\alpha = .62$ , and total,  $\alpha = .89$ .

**The Perth Alexithymia Questionnaire (PAQ;** Preece et al., 2018b) is a 24-item self-report scale designed to measure DIF, DDF, and EOT. The following subscales

have four items each; Negative -Difficulties Identifying Feelings (N-DIF; e.g. “When I feel bad I can’t make sense of these feelings”), Positive-Difficulties Identifying Feelings (P-DIF; e.g. “When I am feeling good, I’m puzzled about those feelings”), Negative-Difficulties Describing Feelings (N-DDF; e.g. “when something bad happens, it is hard to put into words how I am feeling”), and Positive-Difficulties Describing Feelings (P-DDF; e.g. “When I am feeling good I can’t talk about those feelings in much depth or detail”). The final subscale General-Externally Orientated Thinking (G-EOT) has eight items (e.g., “I don’t pay attention to my emotions”). Participants rate each item on a 7-point Likert scale ranging from one (strongly disagree) to seven (strongly agree). Scores range between 4 and 28 for the N-DIF, P-DIF, N-DDF, and P-DDF subscales and between 8 and 56 for the G-EOT subscale. All subscales had good to excellent internal consistency in the original study (N-DIF; .89), (P-DIF; .89), (N-DDF; .91) (P-DDF; .90) (G-EOT; .90) (Total; .95) and in the current sample (N-DIF; .91) (P-DIF; .90), (N-DDF; .92) (P-DDF; .89) (G-EOT; .92) (Total; .96).

**The Kessler Psychological Distress Scale (K10;** Kessler et al., 2002) is a 10-item measuring of psychological distress within the last month. Individuals rate each item (e.g., about how often did you feel nervous?) on a 5-point likert scale ranging from 1 (none of the time) to 5 (all of the time). Scores range from 5-50 with higher scores indicating greater psychological distress. The K10 had excellent internal consistency in past studies (Cronbach's  $\alpha = .93$ ; Kessler et al., 2002) and in the current sample,  $\alpha = .92$ .

**The Difficulties in Emotion Regulation Questionnaire (DERS;** Gratz & Roemer, 2004) is a 36-item scale that assesses emotion regulation difficulties across six domains. Participants answer each item on a five-point Likert scale ranging from 1 (almost never (0-10%)) to 5 (almost always (91-100%)). Higher scores are indicative of greater difficulties with emotion regulation. The DERS provides a total score and the

following subscale scores: clarity (difficulties distinguishing between emotions), awareness (difficulties in placing attention on emotion), non-acceptance (difficulties accepting emotions), goal directed behaviour (problems with goal-directed behaviors when distressed), impulse-control (problems with behavior control when distressed) and strategies (difficulties accessing emotion regulation skills). The content of the clarity subscale conforms closely to DIF, and the content of the awareness subscale conforms closely to EOT. The DERS has excellent internal consistency ( $\alpha = .80-.93$ ), construct validity, test-retest reliability, and is invariant across individuals who do and who do not engage in NSSI (Gratz & Roemer, 2004; Kiekens et al., 2018a). In the current study, all subscales had excellent internal consistency ( $\alpha$ : Total = .94, awareness = .86, clarity = .84, non-acceptance = .93, goals = .87, impulse = .89, strategies = .92).

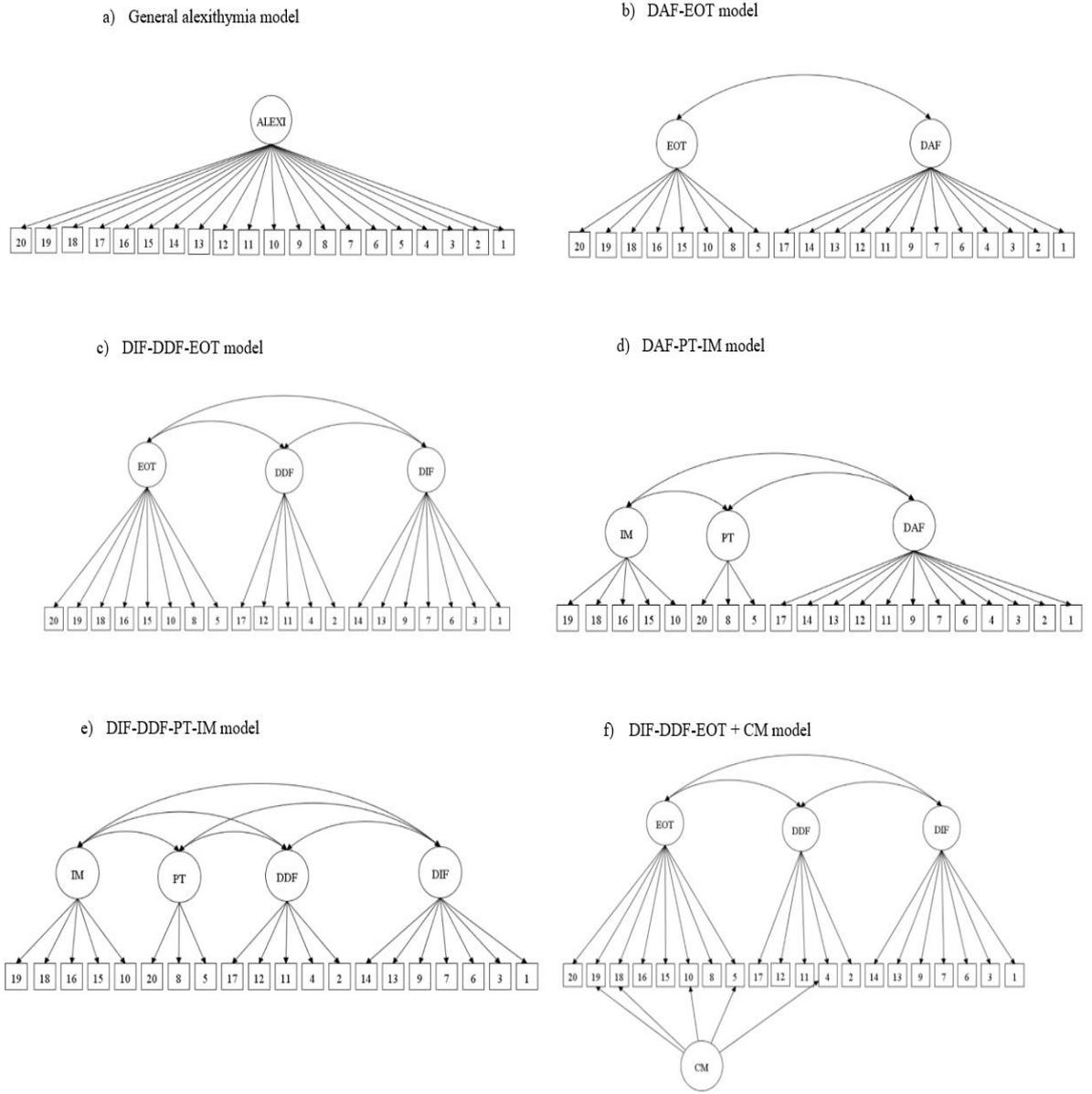
### **Data Analysis**

**Model Selection.** Using a sequence of Confirmatory Factor Analyses with Maximum Likelihood Estimation with Robust Standard Errors (MLR), we examined the factor structure of both the TAS-20 and the PAQ in the following groups: individuals with no history of NSSI ( $n = 373$ ), individuals with a history of NSSI ( $n = 267$ ), individuals classified as low-risk drinkers ( $n = 370$ ), and individuals classified as risky drinkers ( $n = 270$ ). It should be noted that the participants are from the same sample (i.e. NSSI vs no NSSI and low-risk drinkers vs risky drinkers), therefore, there is overlap between groups. MLR can account for possible deviations from multivariate normality and missing data on TAS-20, and PAQ items (< 1.0%). We considered a model to have acceptable fit if it met the following criteria: Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) between 0.90 and 0.95 or higher, and a Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) close to or below 0.08 (Brown, 2015). We examined

standardized factor loadings across all four groups for the best fitting model. Factor loadings of .40 or larger were considered adequate (Stevens, 1992).

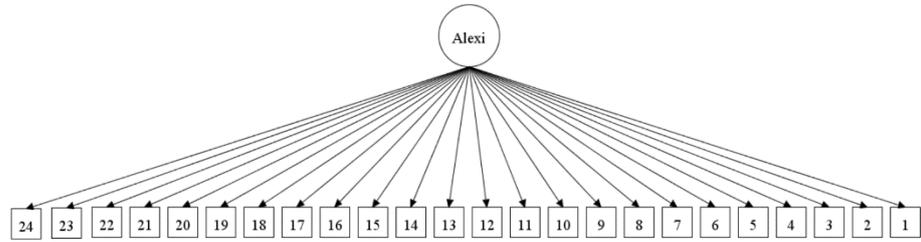
For the TAS-20, we tested a series of six models starting from the most basic general alexithymia model through to the reverse-scored method factor model (see Figure 4.1). Specifically, a 1-factor model where all items load onto one general alexithymia factor; a 2-factor model that has an EOT factor and a combined DIF/DDF factor known as ‘Difficulties Appraising Feelings’ (DAF); the original 3-factor model with DIF, DDF, and EOT factors; a 3-factor model with a DAF factor, and an EOT subscale split into two separate factors ‘Pragmatic Thinking’ and ‘Importance of Emotions’; a 4-factor model with DIF, DDF, Pragmatic Thinking, and ‘Importance of Emotions’ factors (Preece et al., 2018b; Meganck et al., 2008; Watters et al., 2016). Last, we assessed the original three-factor model with the addition of a reversed scored item method factor, which had been supported in a number of previous nonclinical and clinical studies (e.g., Preece et al., 2018b; Meganck et al., 2008; Watters et al., 2016).

Similarly, for the PAQ we tested a series of five models starting from general models through to valence-specific models (see Figure 4.2). Specifically, we tested a 1-factor general alexithymia model, a 2-factor model with a general DAF factor and a general EOT factor, a 3-factor model with general DIF, DDF, and EOT factors, and a 3-factor model with valence-specific DAF factors and a general EOT factor. Last, we assessed, a 5-factor model with valence specific N-DIF, P-DIF, N-DDF, and P-DDF factors and a general EOT factor, which reflected the intended subscale structure of the PAQ (Preece et al., 2018b).

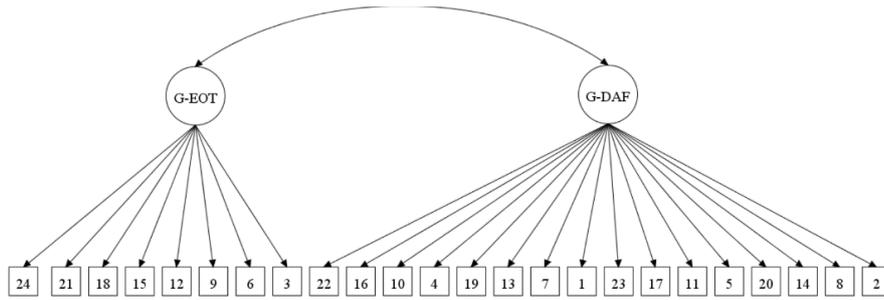


**Figure 4.1.** Six tested measurement models of the TAS-20.

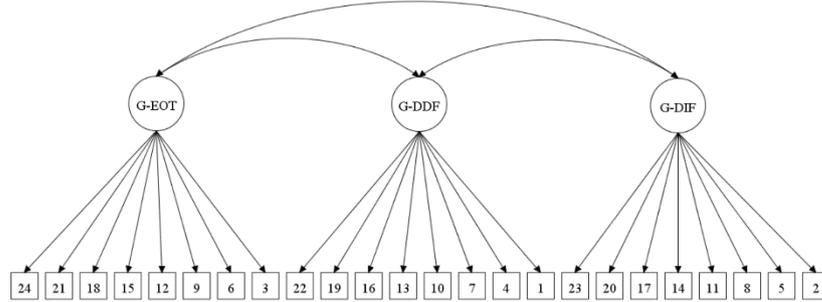
a) General alexithymia model



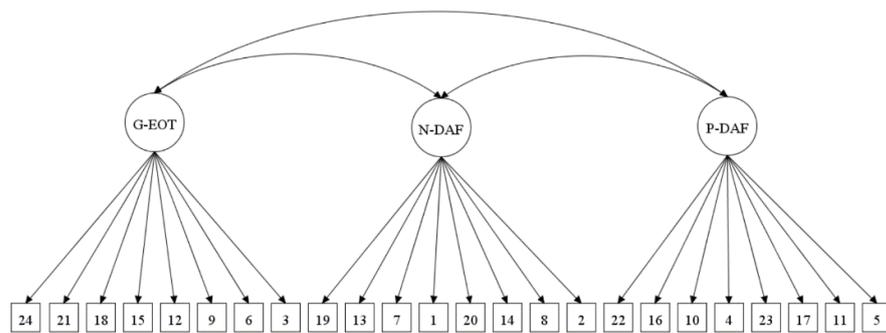
b) G-DAF-G-EOT model



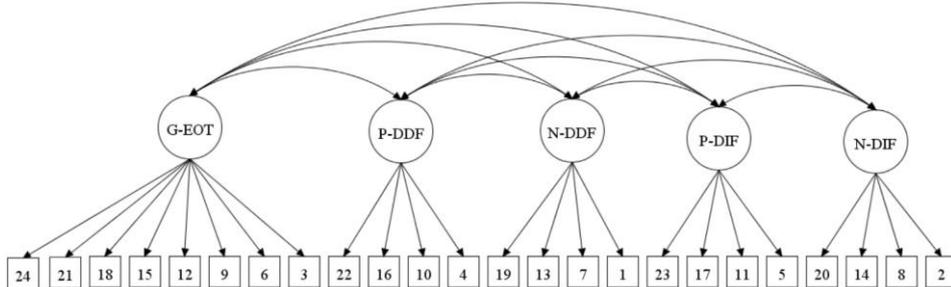
c) G-DIF-G-DDF-G-EOT model



d) P-DAF-N-DAF-G-EOT model



e) P-DIF-N-DIF-P-DDF-N-DDF-G-EOT model



**Figure 4.2.** The five tested measurement Models of the PAQ.

**Measurement Invariance.** We used the best fitting TAS-20 and the best fitting PAQ models to test measurement invariance across our four groups. We tested configural (i.e. infers same concepts are defined), metric (i.e. infers mean-corrected scores can be compared), scalar (i.e. infers total scores can be compared), and residual error (i.e., infers that manifest scores can be compared) invariance and model fit using Multi-Group Confirmatory Factor Analysis with Maximum Likelihood Estimation with Robust Standard Errors (MLR). We accepted configural, full metric, full scalar, and residual error invariance if the configural model had adequate fit, and a change in CFI of  $< .01$  and in RMSEA of  $< .015$  and SRMR of  $< .030$  (for metric invariance) or  $< .015$  (for scalar or residual invariance; Chen, 2007) from the previous model (e.g., metric compared to configural model). Data were analyzed using Mplus version 8 (Muth en & Muth en, 2017).

**Concurrent Validity and Construct Validity.** Concurrent, convergent, and discriminate validity were examined by calculating Pearson correlations between PAQ scores, TAS-20 scores, DERS scores, and K10 scores. We accepted concurrent validity if the PAQ/TAS-20 were significantly positively correlated with the DERS scores and K10 scores (Groth-Marnat, 2009). First, to demonstrate good convergent validity PAQ scores and TAS-20 scores should be significantly positively correlated. We considered convergent validity as moderate when the correlation coefficient was between .30 and .49 and high if the correlation coefficient was above .50 (Cohen, 1977). Second, to demonstrate good discriminate validity, PAQ subscale scores and equivalent TAS-20 subscale scores should be more strongly correlated with each other than with psychological distress. To further support construct validity, DIF scores (TAS-20 and PAQ) should correlate more strongly with the clarity subscale of the DERS than the

other subscales. Similarly, EOT scores should correlate most strongly with the awareness subscale of the DERS compared to the other five subscales.

## Results

### Preliminary Analysis

Of the 640 participants, 41.70% of students reported a history of NSSI. Of students who had ever self-injured, 63.30% reported engaging in NSSI in the last 12 months. The primary form of self-injury was cutting (44.60%), followed by banging/hitting oneself (13.48%) and severe scratching (11.98%). Of the sample, 270 (42.20%) scored above the cut-off on the AUDIT and could be classified as risky drinkers. Eighty-four (31.11%) of the risky drinkers reported consuming alcohol in a harmful/high-risk pattern (AUDIT score > 15). One-hundred and twenty-one (18.90%) students reported engaging in both NSSI and risky drinking.

Women (46%) were more likely to have engaged in NSSI than men (24.30%),  $\chi^2(1) = 21.61, p < .001$ . In contrast, men (51.40%) were more likely to have consumed alcohol in a risky pattern than women (39.20%),  $\chi^2(1) = 6.76, p = .009$ . Older participants were more likely to have engaged in NSSI,  $F(1, 638) = 8.02, p = .023$ , NSSI ( $M_{age} = 20.60, SD = 1.98$ ) vs. No-NSSI ( $M_{age} = 20.25, SD = 1.75$ ). However, there were no age differences between low-risk drinkers and risky drinkers,  $F(1, 638) = .53, p = .47$ . Table 4.1 displays the means and standard deviations of each of the PAQ and TAS-20 subscales for each of the four groups. Correlations (Pearson's  $r$ ) between all subscales of the TAS-20, PAQ, DERS, and K10 for each group can be found in Table 4.2 and Table 4.3. All subscales of the PAQ and the TAS-20 were significantly positively correlated in all groups. All TAS-20 and PAQ items were reasonably

normally distributed across all four groups (maximum skewness = .98, maximum kurtosis = -1.26; George & Mallery, 2010).

**Table 4.1.** Means and standard deviations of TAS-20 and PAQ subscales across all groups.

	NO NSSI <i>n</i> = 373	NSSI <i>n</i> = 267	Low-risk drinkers <i>n</i> = 370	Risky drinkers <i>n</i> = 270
	M(SD)	M(SD)	M(SD)	M(SD)
<b>General Alexithymia (TAS-20)<sup>a</sup></b>	47.99(12.82)	54.41(13.46)	49.15(13.29)	52.68(13.46)
Difficulties Identifying Feelings <sup>b</sup>	15.63(6.19)	20.05(6.81)	16.64(6.69)	18.60(6.84)
Difficulties Describing Feelings <sup>c</sup>	13.49(4.70)	15.39(4.97)	13.81(4.91)	14.92(4.83)
Externally Orientated Thinking <sup>d</sup>	18.92(4.98)	18.89(4.41)	18.67(4.57)	19.23(4.54)
<b>General Alexithymia (PAQ)<sup>e</sup></b>	71.93(29.02)	83.25(29.99)	73.56(29.82)	80.77(29.61)
Difficulties Identifying Negative Feelings <sup>f</sup>	12.47(5.87)	15.05(6.52)	13.06(6.27)	14.20(6.23)
Difficulties Identifying Positive Feelings <sup>f</sup>	10.59(4.98)	12.11(5.84)	10.99(5.44)	11.55(5.34)
Difficulties Describing Negative Feelings <sup>f</sup>	14.10(6.36)	16.32(6.87)	14.54(6.63)	15.67(6.66)
Difficulties Describing Positive Feelings <sup>f</sup>	11.52(5.27)	13.52(5.97)	12.09(5.64)	12.70(5.65)
General Externally Orientated Thinking <sup>g</sup>	23.87(10.66)	25.52(11.00)	23.21(10.53)	26.37(10.95)

*Notes.* <sup>a</sup> 20-100 <sup>b</sup>7-35 range, <sup>c</sup>5-25 range, <sup>d</sup>8-40 range, <sup>e</sup> 24-168, <sup>f</sup>4-28 range, <sup>g</sup>8-56 range, NSSI = Non-Suicidal Self-Injury, M = Mean, SD = standard deviation.

**Table 4.2.** Pearson's correlations between the PAQ, TAS-20, K10, and DERS for Individuals who do and who do not engage in NSSI

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<b>1. General Alexithymia (TAS-20)</b>	<b>1</b>	.88	.84	.70	.81	.76	.68	.73	.66	.66	.54	.70	.50	.72	.46	.31	.53	.57
2. Difficulties Identifying Feelings	.88	<b>1</b>	.68	.40	.71	.78	.67	.63	.59	.49	.58	.71	.30	.72	.49	.38	.59	.60
3. Difficulties Describing Feelings	.89	.72	<b>1</b>	.39	.78	.69	.55	.83	.64	.63	.43	.57	.48	.63	.37	.26	.34	.44
4. Externally Orientated Thinking	.66	.30	.44	<b>1</b>	.47	.34	.41	.32	.37	.51	.23	.40	.47	.37	.21	.08 <sup>a</sup>	.33	.31
<b>5. General Alexithymia (PAQ)</b>	.83	.75	.76	.50	<b>1</b>	.86	.82	.88	.85	.86	.45	.62	.52	.66	.41	.28	.38	.47
6. Negative-Difficulties Identifying Feelings	.79	.81	.71	.35	.85	<b>1</b>	.69	.84	.66	.57	.47	.62	.32	.67	.44	.36	.45	.51
7. Positive-Difficulties Identifying Feelings	.53	.52	.42	.34	.75	.54	<b>1</b>	.57	.85	.58	.41	.56	.33	.59	.36	.26	.46	.46
8. Negative-Difficulties Describing Feelings	.81	.73	.82	.40	.86	.83	.45	<b>1</b>	.68	.66	.34	.54	.41	.61	.36	.33	.30	.41
9. Positive- Difficulties Describing Feelings	.56	.54	.50	.32	.78	.53	.86	.55	<b>1</b>	.61	.37	.51	.35	.53	.32	.24	.38	.43
10. General-Externally Orientated Thinking	.68	.51	.62	.55	.83	.61	.43	.67	.45	<b>1</b>	.32	.46	.64	.49	.31	.12	.18	.30
<b>11. Psychological Distress (K10)</b>	.46	.54	.35	.17	.43	.38	.41	.37	.39	.27	<b>1</b>	.70	.20	.53	.51	.50	.57	.69
<b>12. Difficulties in Regulating Emotions</b>	.64	.65	.53	.33	.59	.61	.43	.55	.42	.44	.62	<b>1</b>	.35	.72	.78	.68	.82	.91
13. Awareness	.51	.33	.49	.47	.48	.35	.19	.42	.22	.60	.08 <sup>a</sup>	.32	<b>1</b>	.40	.09 <sup>a</sup>	.04 <sup>a</sup>	.06 <sup>a</sup>	.14
14. Clarity	.76	.69	.72	.41	.70	.71	.43	.70	.47	.55	.37	.63	.51	<b>1</b>	.06 <sup>a</sup>	.36	.50	.56
15. Non-Acceptance	.37	.40	.32	.14	.38	.39	.28	.34	.25	.29	.47	.72	.09 <sup>a</sup>	.30	<b>1</b>	.42	.58	.67
16. Goals	.27	.35	.21	.04 <sup>a</sup>	.21	.24	.17	.25	.18	.06	.39	.67	-.12 <sup>a</sup>	.22	.37	<b>1</b>	.56	.65
17. Impulse	.34	.41	.22	.15	.30	.39	.29	.25	.23	.15	.45	.76	-.04 <sup>a</sup>	.31	.50	.48	<b>1</b>	.78
18. Strategies	.42	.49	.29	.17	.39	.43	.38	.35	.35	.20	.63	.85	.02	.35	.58	.61	.67	<b>1</b>

Note. Upper portion of matrix = correlation coefficients for No-NSSI group; Lower portion of matrix (shaded) = correlation coefficients for NSSI group; <sup>a</sup>non-significant correlation.

**Table 4.3.** Pearson's correlations between the PAQ, TAS-20, K10, and DERS for low-risk and risky drinkers

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.	16.	17.	18
<b>1. General Alexithymia (TAS-20)</b>	<b>1</b>	.88	.87	.68	.83	.77	.64	.78	.65	.69	.49	.66	.48	.75	.42	.31	.44	.51
2. Difficulties Identifying Feelings	.89	<b>1</b>	.69	.33	.74	.80	.63	.68	.59	.52	.59	.70	.30	.70	.49	.41	.54	.60
3. Difficulties Describing Feelings	.86	.72	<b>1</b>	.42	.76	.69	.50	.82	.60	.62	.37	.51	.45	.66	.32	.24	.25	.37
4. Externally Orientated Thinking	.66	.36	.38	<b>1</b>	.49	.33	.39	.37	.37	.55	.16	.33	.46	.42	.17	.04 <sup>a</sup>	.22	.20
<b>5. General Alexithymia (PAQ)</b>	.81	.71	.79	.46	<b>1</b>	.86	.81	.87	.85	.86	.42	.57	.46	.68	.38	.27	.34	.43
6. Negative-Difficulties Identifying Feelings	.80	.79	.74	.35	.86	<b>1</b>	.62	.84	.62	.61	.41	.58	.32	.66	.42	.31	.42	.45
7. Positive-Difficulties Identifying Feelings	.60	.58	.49	.35	.77	.64	<b>1</b>	.55	.86	.57	.43	.52	.28	.55	.32	.27	.39	.45
8. Negative- Difficulties Describing Feelings	.75	.66	.83	.32	.87	.84	.50	<b>1</b>	.68	.67	.34	.48	.38	.64	.32	.27	.24	.34
9. Positive- Difficulties Describing Feelings	.60	.56	.56	.31	.79	.59	.85	.56	<b>1</b>	.59	.38	.47	.29	.54	.29	.26	.30	.40
10. General-Externally Orientated Thinking	.62	.44	.62	.49	.82	.55	.44	.65	.47	<b>1</b>	.28	.42	.56	.52	.28	.11	.19	.26
<b>11. Psychological Distress (K10)</b>	.61	.64	.49	.28	.51	.54	.42	.49	.43	.30	<b>1</b>	.70	.14	.68	.55	.48	.53	.71
<b>12. Difficulties in Regulating Emotions</b>	.73	.73	.63	.36	.65	.68	.50	.62	.51	.43	.76	<b>1</b>	.33	.65	.78	.70	.81	.92
13. Awareness	.54	.36	.54	.46	.57	.37	.26	.46	.33	.70	.23	.37	<b>1</b>	.44	.06 <sup>a</sup>	-.03 <sup>a</sup>	.03 <sup>a</sup>	.14
14. Clarity	.75	.75	.70	.32	.70	.75	.50	.67	.48	.55	.56	.76	.48	<b>1</b>	.36	.31	.39	.48
15. Non-acceptance	.50	.52	.46	.20	.47	.47	.38	.44	.37	.33	.56	.78	.19	.50	<b>1</b>	.46	.56	.70
16. Goals	.38	.45	.32	.09 <sup>a</sup>	.30	.40	.23	.38	.24	.09	.59	.73	-.04 <sup>a</sup>	.41	.46	<b>1</b>	.58	.65
17. Impulse	.52	.56	.39	.26	.39	.49	.41	.37	.39	.13	.64	.82	.06 <sup>a</sup>	.53	.53	.64	<b>1</b>	.76
18. Strategies	.57	.62	.45	.27	.49	.56	.42	.48	.44	.23	.74	.90	.12	.56	.64	.73	.77	<b>1</b>

Note. Upper portion of matrix = correlation coefficients for low-risk drinkers; Lower portion of matrix (shaded) = correlation coefficients for risky drinkers; <sup>a</sup>non-significant correlation  $p > .05$ .

## Model Selection

**TAS-20.** The original DIF-DDF-EOT model of the TAS-20 had inadequate fit across all groups (see Table 4.4 for fit indices). Of the tested models, the DIF-DDF-EOT model with the common method factor had the best fit for all groups (Table 4.4). However, the fit of the common method factor model was borderline in the total sample and across all four groups. The DIF and DDF had good item loadings but various items loaded poorly onto the EOT factor across the groups (Table 4.5). Specifically items 5 “I prefer to analyze problems rather than just describe them”, 8 “I prefer to just let things happen rather than to understand why they turned out that way”, 16 “I prefer to watch “light” entertainment shows rather than psychological dramas” and 18 “I can feel close to someone even in moments of silence” loaded poorly onto EOT. DIF and DDF subscales had excellent internal consistency across all four groups; however, the EOT factor had poor internal consistency across all groups (see Table 4.5 for group-specific Cronbach alphas).

**PAQ.** Model fit was significantly better across all samples in the valence-specific models compared to the models where valence was not specified (see Table 4.6 for fit indices). Distinguishing between positive and negative valence had a more significant impact on model fit than distinguishing between DIF and DDF (see Table 4.6 for fit indices). The five-factor NDIF-PDIF-NDDF-PDDF-GEOT model, corresponding to the five intended subscales of the PAQ, had the best fit across all four groups. The fit was satisfactory-good for the total sample and across all four groups (Table 4.6). All items adequately loaded onto their respective factors across all groups (Table 4.7). Across all groups, all subscales have excellent internal consistency (see Table 4.7 for group-specific Cronbach alphas).

**Table 4.4.** Model fit for competing TAS-20 models across all samples.

	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA[90%CI]	SRMR
<b>General alexithymia model</b>	<b>1114.479</b>	<b>170</b>	<b>.775</b>	<b>.749</b>	<b>.093[.088-.098]</b>	<b>.079</b>
NO NSSI	773.328	170	.753	.723	.098[.091-.105]	.086
NSSI	524.837	170	.783	.757	.089[.080-.097]	.080
Low-risk	722.960	170	.775	.748	.092[.085-.099]	.083
Risky	609.171	170	.754	.725	.100[.092-.109]	.085
<b>DAF-EOT model</b>	<b>927.077</b>	<b>169</b>	<b>.819</b>	<b>.797</b>	<b>.084[.079-.089]</b>	<b>.088</b>
NO NSSI	645.505	169	.805	.780	.087[.080-.094]	.095
NSSI	496.037	169	.800	.775	.085[.077-.094]	.089
Low-risk	593.385	169	.827	.806	.081[.074-.088]	.091
Risky	559.666	169	.781	.754	.095[.086-.104]	.094
<b>DAF-PT-IM model</b>	<b>906.667</b>	<b>167</b>	<b>.824</b>	<b>.800</b>	<b>.083[.078-.089]</b>	<b>.082</b>
NO NSSI	625.850	167	.812	.786	.086[.079-.093]	.086
NSSI	475.466	167	.811	.785	.083[.075-.092]	.088
Low-risk	575.918	167	.834	.811	.080[.073-.087]	.083
Risky <sup>b</sup>	NO CONVERGENCE					
<b>DIF-DDF-EOT model</b>	<b>823.100</b>	<b>167</b>	<b>.844</b>	<b>.822</b>	<b>.078[.073-.084]</b>	<b>.085</b>
NO NSSI	574.898	167	.833	.810	.081[.074-.088]	.093
NSSI	456.085	167	.823	.799	.081[.072-.090]	.087
Low-risk	540.643	167	.848	.827	.077[.069-.084]	.087
Risky	500.653	167	.813	.787	.088[.079-.097]	.093
<b>DIF-DDF-PT-IM model</b>	<b>795.367</b>	<b>164</b>	<b>.850</b>	<b>.826</b>	<b>.078[.072-.083]</b>	<b>.078</b>
NO NSSI	547.846	164	.843	.818	.079[.072-.087]	.083
NSSI	439.588	164	.833	.807	.079[.070-.088]	.084
Low-risk	521.462	164	.855	.831	.076[.068-.083]	.080
Risky <sup>b</sup>	NO CONVERGENCE					
<b>DIF-DDF-EOT With CM model</b>	<b>564.015</b>	<b>159</b>	<b>.904</b>	<b>.885</b>	<b>.063[.058-.069]</b>	<b>.047</b>
NO NSSI	391.511	159	.905	.886	.063[.055-.070]	.051
NSSI	349.285	159	.884	.861	.067[.058-.077]	.057
Low-risk	377.511	159	.911	.894	.060[.052-.068]	.049
Risky	387.620	159	.872	.847	.075[.065-.084]	.059

*Note.*<sup>a</sup> = total sample fit; <sup>b</sup>No convergence, number of iterations exceeded. Issue comes from negative residual estimate in item 8; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual;

**Table 4.5.** Cronbach alphas and Standardised factor loadings for the 3-factor + method factor model of the TAS-20.

ITEM	DIF	No NSSI group			NSSI group			Low risk drinking group				Risky drinking group				
		DDF	EOT	CM	DIF	DDF	EOT	CM	DIF	DDF	EOT	CM	DIF	DDF	EOT	CM
<i>a</i>	.89	.81	.65	-	.87	.82	.58	-	.88	.81	.63	-	.90	.83	.62	-
01	.777				.791				.785				.787			
03	.509				.485				.504				.561			
06	.803				.726				.764				.795			
07	.628				.639				.616				.719			
09	.781				.791				.835				.761			
13	.843				.788				.801				.862			
14	.706				.659				.710				.702			
02		.793				.794				.794				.815		
04		.927		.632		.751		<b>.342</b>		.999		.697		.783		<b>.349</b>
11		.717				.715				.737				.697		
12		.640				.701				.683				.643		
17		.638				.568				.608				.631		
05			.488	.573			<b>.186</b>	.422			.540	.583			<b>.199*</b>	.403
08			.500				<b>.372</b>				.474				.422	
10			.880	.820			.560	.620			.882	.755			.648	.767
15			.514				.661				.531				.587	
16			<b>.328</b>				<b>.215</b>				<b>.238</b>				<b>.344</b>	
18			.699	.637			<b>.327</b>	.433			.686	.652			.426	.418
19			.937	.924			.499	.745			.998	.962			.492	.723
20			.489				.444				.414				.564	

*Note.* Factor loadings below .40 are boldface, \*Non-significant factor loading  $p > .05$ . DIF = difficulties identifying feelings, DDF = difficulties describing feelings, EOT = externally orientated thinking, CM = common method factor.

**Table 4.6.** Model fit of competing PAQ models.

	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA[90% CI]	SRMR
<b>General alexithymia model<sup>a</sup></b>	<b>3170.262</b>	<b>252</b>	<b>.676</b>	<b>.645</b>	<b>.135[.130-.139]</b>	<b>.098</b>
NO NSSI	1801.201	252	.708	.681	.128[.123-.134]	.088
NSSI	1799.583	252	.615	.579	.152[.145-.158]	.123
Low-risk	1935.977	252	.689	.660	.132[.127-.138]	.094
Risky	1635.193	252	.642	.608	.146[.139-.153]	.112
<b>G-DAF-G-EOT model<sup>a</sup></b>	<b>2304.560</b>	<b>251</b>	<b>.772</b>	<b>.749</b>	<b>.113[.109-.117]</b>	<b>.079</b>
NO NSSI	1289.092	251	.805	.785	.105[.100-.111]	.069
NSSI	1444.875	251	.703	.674	.133[.127-.140]	.106
Low-risk	1455.376	251	.778	.756	.112[.106-.118]	.077
Risky	1230.950	251	.747	.721	.123[.116-.130]	.092
<b>G-DIF-G-DDF-G-EOT model<sup>a</sup></b>	<b>2255.057</b>	<b>249</b>	<b>.777</b>	<b>.753</b>	<b>.112[.108-.116]</b>	<b>.080</b>
NO NSSI	1248.894	249	.812	.791	.104[.098-.110]	.069
NSSI	1414.304	249	.710	.679	.132[.126-.139]	.110
Low-risk	1421.239	249	.784	.760	.111[.105-.117]	.078
Risky	1209.572	249	.752	.725	.123[.116-.129]	.091
<b>N-DAF-PDAF-G-EOT model<sup>a</sup></b>	<b>1506.887</b>	<b>249</b>	<b>.906</b>	<b>.896</b>	<b>.089[.085-.093]</b>	<b>.047</b>
NO NSSI	1217.668	249	.880	.867	.102[.096-.108]	.053
NSSI	739.619	249	.910	.900	.086[.079-.093]	.049
Low-risk	1032.966	249	.901	.890	.091[.085-.096]	.049
Risky	879.574	249	.889	.876	.099[.092-.106]	.061
<b>NDIF-PDIF-NDDF-PDDF-GEOT model<sup>a</sup></b>	<b>833.504</b>	<b>242</b>	<b>.934</b>	<b>.925</b>	<b>.062[.057-.066]</b>	<b>.043</b>
NO NSSI	732.558	242	.908	.895	.074[.068-.080]	.050
NSSI	455.320	242	.947	.940	.057[.049-.066]	.044
Low-risk	618.077	242	.931	.921	.064[.058-.070]	.045
Risky	536.673	242	.924	.913	.069[.061-.077]	.056

*Note* .<sup>a</sup> = total sample fit; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; G-DAF = General Difficulties Appraising Feelings; G-EOT = General Externally Orientated Thinking; G-DIF = General Difficulties Identifying Feelings; G-DDF = General Difficulties Describing Feelings; N-DAF = Difficulties Appraising Negative Feelings; P-DAF = Difficulties Appraising Positive Feelings; N-DIF = Difficulties Identifying Negative Feelings; P-DIF = Difficulties Identifying Positive Feelings; N-DDF = Difficulties Describing Negative Feelings; P-DDF = Difficulties Describing Positive Feelings.

## Measurement Invariance

### *Non-Suicidal Self-Injury*

**TAS-20.** Configural, full metric, and full scalar invariance, but only partial residual invariance, were supported for the three-factor model with the additional method factor (see

Table 4.8 for specific fit indices). The residual error variances were larger in the group reporting NSSI compared to the group not reporting NSSI for items 3 “I have physical sensations even the doctors do not understand” (Residual Variance<sub>(no NSSI)</sub> = 0.79 vs. Residual Variance<sub>(NSSI)</sub> = 1.43), 6 “When I am upset, I don’t know if I am frightened or angry” (Residual Variance<sub>(no NSSI)</sub> = 0.49 vs. Residual Variance<sub>(NSSI)</sub> = 0.72), 13 “I don’t know what’s going on inside me” (Residual Variance<sub>(no NSSI)</sub> = 0.74 vs. Residual Variance<sub>(NSSI)</sub> = 1.01), 17 “It is difficult for me to reveal my innermost feelings, even to my close friends’ (Residual Variance<sub>(no NSSI)</sub> = 1.03 vs. Residual Variance<sub>(NSSI)</sub> = 1.32), and 18 “I can feel close to someone even in moments of silence” (Residual Variance<sub>(no NSSI)</sub> = 0.74 vs. Residual Variance<sub>(NSSI)</sub> = 1.07). The original 3-factor model (without the method factor) follows a similar pattern of results but has poor fit at each level of invariance testing (see Table 4.8 for fit indices).

Examination of unstandardized latent mean differences indicated that students who have engaged in NSSI score higher on DIF ( $M_{(NSSI)} = 0.62, Z = 7.00, p < .001$ ), and DDF ( $M_{(NSSI)} = 0.42, Z = 4.65, p < .001$ ), but not EOT ( $M_{(NSSI)} = 0.02, Z = 0.45, p = .655$ ) compared to students who have never engaged in NSSI. When the three original alexithymia factors were added as predictors, and sex, age, and the common method factor entered as covariates, DIF uniquely positively predicted ( $\beta = .85, Z = 6.01, p < .001$ ) and EOT uniquely negatively predicted ( $\beta = -.46, Z = -3.15, p = .002$ ) lifetime history of NSSI.

**PAQ.** For the five-factor model, we found support for configural, full metric, full scalar, and full residual error invariance (see Table 4.8 for fit indices). Examination of unstandardized latent mean differences indicated that students who have engaged in NSSI score higher on N-DIF ( $M_{(NSSI)} = 0.60, Z = 5.02, p < .001$ ), P-DIF ( $M_{(NSSI)} = 0.38, Z = 3.62, p < .001$ ), N-DDF ( $M_{(NSSI)} = 0.54, Z = 4.31, p < .001$ ), P-DDF ( $M_{(NSSI)} = 0.44,$

$Z = 4.32, p < .001$ ), but not G-EOT ( $M_{(NSSI)} = 0.23, Z = 1.78, p = .075$ ) compared to students who have

**Table 4.7.** Cronbach alphas and Standardised factor loadings for the 5-factor mode of the PAQ

ITEM	No NSSI sample					NSSI sample					Low-risk drinking sample					Risky drinking sample				
	NDIF	PDIF	NDDF	PDDF	GEOT	NDIF	PDIF	NDDF	PDDF	GEOT	NDIF	PDIF	NDDF	PDDF	GEOT	NDIF	PDIF	NDDF	PDDF	GEOT
<i>a</i>	.91	.88	.91	.88	.93	.91	.92	.91	.90	.91	.91	.90	.91	.89	.91	.91	.91	.93	.90	.93
02	.778					.818					.803					.800				
08	.850					.879					.847					.898				
14	.906					.901					.922					.886				
20	.873					.793					.856					.812				
05		.739					.754					.773					.710			
11		.812					.877					.838					.863			
17		.870					.919					.894					.899			
23		.813					.876					.827					.869			
01			.824					.818					.826					.821		
07			.832					.811					.808					.849		
13			.888					.916					.894					.909		
19			.877					.900					.895					.886		
04				.727					.735					.752					.707	
10				.813					.809					.804					.827	
16				.847					.912					.865					.806	
22				.857					.848					.854					.870	
03					.825					.831					.842					.802
06					.805					.824					.786					.859
09					.890					.864					.860					.890
12					.841					.821					.820					.835
15					.741					.718					.757					.688
18					.795					.774					.782					.793
21					.617					.463					.520					.590
24					.764					.713					.712					.770

*Note.* NDIF = Difficulties Identifying Negative Feelings; PDIF = Difficulties Identifying Positive Feelings; NDDF = Difficulties Describing Negative Feelings; PDDF = Difficulties Describing Positive Feelings; GEOT = General Externally Orientated Thinking. All factor loadings were significant at  $p < .001$ .

**Table 4.8.** Measurement invariance assessment of alexithymia measures between university students with and without histories of NSSI

	$\chi^2$	<i>df</i>	SRMR	RMSEA	CFI	Model comparison	$\Delta$ SRMR	$\Delta$ RMSEA	$\Delta$ CFI
<b>PAQ</b>									
M1: Configural invariance	1203.974	484	0.048	0.068	0.923	-	-	-	-
M2: Full Metric invariance	1233.118	503	0.050	0.067	0.922	M1-M2	-.002	.001	.001
M3: Full Scalar invariance	1271.315	522	0.050	0.067	0.920	M2-M3	.000	.000	.002
M4: Full Residual error invariance	1314.127	546	0.056	0.066	0.918	M3-M4	-.006	.001	.002
<b>TAS-20 with method factor</b>									
M1: Configural invariance	741.399	318	0.054	0.065	0.896	-	-	-	-
M2: Full Metric invariance	756.337	339	0.057	0.062	0.898	M1-M2	-.003	.003	-.002
M3: Full Scalar invariance	800.349	355	0.059	0.063	0.891	M2-M3	-.002	-.001	.007
M4: Full Residual invariance	874.824	380	0.067	0.065	0.877	M3-M4	-.008	-.002	.014 <sup>a</sup>
M4.1: Partial Residual invariance <sup>a</sup>	807.705	369	0.061	0.061	0.892	M3-M4.1	-.002	.002	-.001
<b>TAS-20</b>									
M1: Configural invariance	1033.280	334	0.090	0.081	0.828	-	-	-	-
M2: Full Metric invariance	1028.594	351	0.092	0.078	0.834	M1-M2	-.002	.003	-.006
M3: Full Scalar invariance	1071.893	368	0.093	0.077	0.827	M2-M3	-.001	.001	.007
M4: Full Residual invariance	1144.802	388	0.097	0.078	0.814	M3-M4	-.004	-.001	.013 <sup>a</sup>
M4.1: Partial Residual invariance <sup>a</sup>	1077.476	382	0.094	0.075	0.829	M3-M4.1	-.001	-.002	-.002

*Note.* <sup>a</sup>residual variance of items 3, 6, 13, 14, 17, and 18 was significantly higher in individuals who engaged in NSSI, SRMR = standardized root mean squared residual, RSMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index (CFI).

never engaged in NSSI. When entering all factors and controlling for age and sex in a logistic regression, only N-DIF uniquely predicted lifetime history of NSSI ( $\beta = .44$ ,  $Z = 4.11$ ,  $p = .029$ ).

### ***Risky Drinking***

**TAS-20.** Configural, full metric, full scalar, and residual invariance were supported for the method factor model (see Table 4.9 for fit indices). The original three-factor model followed a similar pattern of results but had unacceptable fit at each level of testing (Table 4.9). Examination of unstandardized latent mean differences, accounting for the method factor, indicated that students who engage in risky drinking score higher on DIF ( $M_{(NSSI)} = 0.27$ ,  $Z = 3.43$ ,  $p = .001$ ), DDF ( $M_{(NSSI)} = 0.24$ ,  $Z = 2.65$ ,  $p = .008$ ) but not EOT ( $M_{(NSSI)} = 0.06$ ,  $Z = 1.15$ ,  $p = .252$ ). However, not accounting for the method factor would result in a small observed difference in latent means on EOT ( $M_{(NSSI)} = 0.09$ ,  $Z = 2.48$ ,  $p = .013$ ). When entering all factors and controlling for age, sex, and the method factor in a logistic regression, only DIF uniquely differentiated drinking groups ( $\beta = .31$ ,  $Z = 2.49$ ,  $p = .013$ ).

**PAQ.** We found support for configural, full metric, full scalar, and full residual error invariance (see Table 4.9 for fit indices). Examination of unstandardized latent mean differences indicated that students who engage in risky drinking score higher on N-DIF ( $M_{(NSSI)} = 0.27$ ,  $Z = 2.22$ ,  $p = .026$ ), N-DDF ( $M_{(NSSI)} = 0.30$ ,  $Z = 2.36$ ,  $p = .018$ ), and G-EOT ( $M_{(NSSI)} = 0.48$ ,  $Z = 3.79$ ,  $p < .001$ ), but not P-DIF ( $M_{(NSSI)} = 0.15$ ,  $Z = 1.43$ ,  $p = .152$ ), or P-DDF ( $M_{(NSSI)} = 0.12$ ,  $Z = 1.17$ ,  $p = .242$ ). When entering all factors and controlling for age and sex in a logistic regression, only G-EOT uniquely differentiated drinking groups ( $\beta = .32$ ,  $Z = 2.53$ ,  $p = .011$ ).

**Table 4.9.** Measurement invariance assessment of alexithymia measures between low-risk and risky drinkers

	$\chi^2$	<i>df</i>	SRMR	RSMSEA	CFI	Model comparison	$\Delta$ SRMR	$\Delta$ RSMSEA	$\Delta$ CFI
<b>PAQ</b>									
M1: Configural invariance	1154.398	484	0.050	0.066	0.928	-	-	-	-
M2: Full metric invariance	1186.138	503	0.053	0.065	0.926	M2-M1	.003	-.001	-.002
M3: Full Scalar invariance	1211.928	522	0.052	0.064	0.926	M3-M2	-.001	-.001	.000
M4: Full Residual error invariance	1227.645	546	0.054	0.062	0.927	M4-M3	.002	-.002	.001
<b>TAS-20 with method factor</b>									
M1: Configural invariance	765.079	318	0.053	0.066	0.895	-	-	-	-
M2: Full metric invariance	796.735	339	0.059	0.065	0.892	M2-M1	.006	-.001	.003
M3: Full Scalar invariance	831.407	335	0.060	0.065	0.888	M3-M2	.001	.000	.004
M4: Full Residual error invariance	855.255	375	0.061	0.063	0.887	M4-M3	.001	-.002	.001
<b>TAS-20</b>									
M1: Configural invariance	1041.659	334	0.090	0.081	0.833	-	-	-	-
M2: Full metric invariance	1051.434	351	0.092	0.079	0.835	M2-M1	.002	-.002	.002
M3: Full scalar invariance	1086.581	368	0.093	0.078	0.831	M3-M2	.001	-.001	-.004
M4: Full Residual error invariance	1113.774	388	0.094	0.077	0.829	M4-M3	.001	-.001	-.002

*Note.* SRMR = standardized root mean squared residual, RSMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index (CFI).

### ***Concurrent and Construct Validity***

Supporting the concurrent validity of the TAS-20, across all groups, students who reported higher levels of alexithymia on the TAS-20 (all subscales) also tended to report more difficulties with emotion regulation ( $r = .33-.73$ ; see Tables 4.3 and 4.4) and higher levels of psychological distress ( $r = .16-.64$ ). Similarly, supporting the concurrent validity of the PAQ, across all groups, students who reported higher levels of alexithymia on the PAQ (all subscales) also tended to report more difficulties with emotion regulation ( $r = .42-.68$ ; see Tables 4.2 and 4.3) and higher levels of psychological distress ( $r = .27-.54$ ).

Supporting construct validity, the total TAS-20 and PAQ scores were more strongly correlated ( $r = .81-.83$ ; see Tables 4.2 and 4.3) with each other than with psychological distress ( $r = .42-.61$ ) across all groups. The TAS-DIF and PAQ-NDIF demonstrated high convergent validity ( $r = .78-.81$ ) and were discriminate from psychological distress ( $r = .38-.64$ ; see Tables 2 and 3). Similarly, the TAS-20-DDF and the PAQ-NDIF demonstrated high convergent validity ( $r = .82-.83$ ) and were discriminate from psychological distress ( $r = .34-.55$ ). Concerning positive valence, convergent validity was moderate-high between TAS-DIF and PAQ-PDIF ( $r = .52-.67$ ), and between the TAS-DDF and PAQ-PDDF ( $r = .50-.64$ ). Both P-DIF ( $r = .39-.43$ ) and P-DDF ( $r = .37-.43$ ) were discriminate from psychological distress. The convergent validity between TAS-EOT and PAQ-GEOT was moderate ( $r = .49-.55$ ) and both subscales were discriminate from psychological distress ( $r = .16-.32$ ).

As anticipated, difficulties in emotional clarity had high convergence with TAS-DIF ( $r = .69-.72$ ) and PAQ-NDIF ( $r = .66-.75$ ) and moderate convergence with PAQ-PDIF ( $r = .43-.59$ ). Demonstrating good discriminate validity, across all groups, TAS-

DIF, PAQ-NDIF, and PAQ-PDIF were most strongly correlated with the emotional clarity subscale of the DERS compared to the other subscales (see Tables 4.2 and 4.3). Difficulties in emotional awareness was moderately convergent with the TAS-EOT ( $r = .46-.47$ ) and highly convergent with the PAQ-GEOT ( $r = .56-.70$ ). Demonstrating good discriminate validity, across all four groups, both EOT subscales were most strongly correlated with the emotional awareness subscale of the DERS compared to the other five subscales (see Tables 4.2 and 4.3).

### **Discussion**

The aim of this study was to examine whether self-report measures of alexithymia are invariant across individuals who do and who do not engage in dysregulated behaviors (i.e., NSSI and risky drinking). Further, we examined the concurrent and construct validity of the TAS-20 and PAQ across each group. Practically, our results suggest that all subscales of the PAQ, and the DIF and DDF subscales of the TAS-20, can be used to confidently discern differences in alexithymia between individuals who do and who do not self-injure, and individuals who do and who do not engage in risky drinking. However, in this sample, the EOT subscale of the TAS-20 observed poor internal consistency and inadequate factor loadings across all groups. We observed moderate-high convergent validity between the subscales of the TAS-20 and PAQ. Both scales were positively related to but divergent from measures of emotion regulation difficulties and psychological distress indicating good concurrent and discriminate validity, respectively.

In line with past research with clinical and non-clinical samples (Meganck et al., 2008; Preece et al., 2018b; Tuliao et al., 2019; Watters et al., 2016), we found the DIF-DDF-EOT model with the additional method factor to be the best fitting factor solution

for the TAS-20 across all four groups (No NSSI, NSSI, low-risk drinkers, and risky drinkers). Additionally, full scalar invariance of the method factor model across groups suggests that the method factor similarly affects individuals who do and who do not engage in NSSI, and individuals who do and who do not engage in risky drinking. However, due to the poor reliability of the EOT subscale of the TAS-20, and several inadequate item factor loadings across all groups, researchers need to consider the utility of the TAS for questions that require an isolated EOT score. The current scoring of the EOT includes the error variance of the reverse-scored items which lowers the internal consistency of the EOT (Watters et al., 2016). Even if the four reverse-scored items of the EOT subscale are removed, the internal consistency of the EOT does not improve (see. Preece et al., 2018a). This may be due to potential content validity issues that some authors have noted with three of the remaining EOT items that do not directly ask about emotions (e.g., Gignac et al., 2007; Preece et al., 2018a).

Given the PAQ has an EOT subscale with excellent internal consistency and strong item factor loadings, it appears to be a good alternative. However, we note that the PAQ is a newly developed scale with only two other validation papers (Preece et al., 2018b; Preece et al., 2020), therefore additional independent psychometric assessments will be essential to further verify its utility. Future research could focus on testing the psychometric properties of the PAQ across populations that vary on ethnicity, age, and mental health.

Although the TAS-20 did not achieve full residual invariance across individuals who have or have not self-injured, any non-invariance across item residuals is irrelevant to the interpretation of latent mean differences (Vandenberg & Lance, 2000). Nevertheless, residual error non-invariance can be an issue if a researcher wants to compare manifest (observed) scores (e.g., comparing scores on a specific item).

Therefore, we advise caution when attempting to compare specific TAS-20 item scores across individuals who have and individuals who have not engaged in NSSI.

Consistent with a recent meta-analysis by Greene et al. (2020a), NSSI and risky drinking had differential associations with alexithymia. Regardless of the self-report scale (i.e., TAS-20 or PAQ), NSSI was most strongly related to DIF and unrelated to EOT (Greene et al., 2020a). However, the association between alexithymia and risky drinking was scale dependent. When using the TAS-20, DIF was most strongly related to risky drinking. Conversely, when using the PAQ, EOT was most strongly related to risky drinking. Although both EOT subscales are moderately correlated, the current results highlight the possibility that EOT subscales of the TAS-20 and PAQ may be measuring different constructs (Hays & Merz, 1995).

Our series of CFA's of the PAQ suggest that, when measuring DIF and DDF across all four groups (no NSSI, NSSI, low-risk drinkers, and risky drinkers), differentiating between negative and positive valence is more important than differentiating between DIF and DDF (Preece et al., 2018a). In fact, in both sets of analyses, individuals who engaged in NSSI or risky drinking compared to individuals who did not engage in these behaviors, reported significantly more difficulties identifying and describing negative emotions than positive emotions. Thus, theoretically, our data suggest that the PAQ may be a useful option for research questions about valence specific aspects of alexithymia.

### **Clinical Implications**

The current results suggest that both the TAS-20 and PAQ are valid and reliable measures of general alexithymia for individuals who engage in NSSI or risky drinking. Reliable and valid measures of alexithymia may be required in clinical settings to

decide what intervention/treatments may be most beneficial for specific individuals who seek treatment for NSSI or risky drinking. Emotion-focused therapies are regularly used to treat both behaviours. However, high levels of alexithymia may hamper a person's ability to engage in emotion-focused therapies because they require emotional insight (Allemand et al., 2013). Individuals with high levels of alexithymia are more likely to engage in treatment that initially takes the focus away from emotion (Rufer et al., 2010). Therefore, behaviour-based interventions (e.g., Cognitive Behavioural Therapy (CBT)) may be more beneficial for people with high levels of alexithymia because less emphasis is placed on the understanding of emotional experiences (Lumley et al., 2007). The therapist may choose to address the underlying emotional problems once the individual has engaged in treatment. However, we note that the current results only indicate the reliability of the PAQ and TAS-20 in students who engage in NSSI or risky drinking, future psychometric research is warranted to confirm the clinical utility of both scales.

### **Limitations and Future Directions**

The current findings suggest that both the TAS-20 (DIF and DDF) and PAQ can be used to make reliable statistical comparisons between students who do and students who do not engage in NSSI or risky drinking. However, we do note that the majority of students were female and self-selected to participate in our study, which heightens the possibility of biological sex and self-selection biases. Thus, replication in larger community samples that are not self-selected is warranted. Additionally, we recognise that while many students engage in NSSI and risky drinking, few would meet the diagnostic criteria for the proposed NSSI disorder (Kiekens et al., 2018b) or alcohol use disorders (WHO, 2014). Individuals who meet proposed diagnostic criteria for NSSI disorder or an alcohol use disorder would likely have significantly higher emotional

regulation difficulties than non-clinical samples of individuals who self-injure or drink alcohol. Greater emotional regulation difficulties may influence an individual's ability to identify and describe emotions during times of heightened distress, and subsequently affect their capacity to report on their levels of alexithymia. Consequently, investigation of measurement invariance of the TAS-20 and PAQ in clinical samples is justified.

In the present study, we focused on investigating measurement invariance in self-report alexithymia questionnaires across individuals who do and do not engage in NSSI and risky drinking. However, observer-rated measures such as the Observer Alexithymia Scale (Haviland et al., 2000) and the Toronto Structured Interview for Alexithymia (Bagby et al., 2006) are regularly used to capture alexithymia. Future research could investigate the measurement invariance of observer-rated measures of alexithymia across groups of individuals who do and who do not engage in NSSI and risky drinking. If measurement invariance is established across groups for observer-rated measures of alexithymia, it could help to inform multi-modal assessments of alexithymia in individuals who engage in NSSI and risky drinking.

While the PAQ contains valence specific DIF and DDF subscales it only has a general EOT factor. As the current study highlights the importance of valence when investigating differences in DIF and DDF across individuals who do and individuals who do not engage in emotion regulatory behaviors, it is plausible that valence may also be an important consideration for EOT. An individual's tendency to focus on external events over internal thoughts and feelings may be valence dependent. For example, an individual may take their focus away from negative internal emotions but not positive internal emotions. Future research could investigate whether EOT is better represented as a general or a valence-specific factor across individuals who do and who do not engage in dysregulated behaviors.

## Conclusion

Both the PAQ and the TAS-20 may be used to assess NSSI and drinking-related differences in alexithymia. However, the EOT subscale of the TAS-20 should be used with caution. The PAQ may provide a good alternative for research requiring a specific EOT score, or where a more nuanced valence-specific profile is desired. Further, we urge authors investigating emotional differences (e.g., emotion regulation, alexithymia, emotional processing difficulties) to check for measurement invariance before making comparisons between individuals who do and who do not engage in dysregulated behaviors.

**Chapter 5: A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy (Study 4)**

**Introduction to Chapter 5**

In the first three studies I examined the direct associations between alexithymia and both NSSI and risky drinking, and the moderating roles of biological sex (Studies 1 and 2) and experiential avoidance (Study 2). Yet, it has been theorised that a more comprehensive understanding of the associations between emotional-related variables (alexithymia) and emotion regulatory behaviours (risky drinking and self-injury) may be inferred by studying the roles of key cognitions such as behaviour specific thoughts and beliefs (Cox & Klinger, 1988; Hasking et al., 2016). Studying the roles of behaviour-specific thoughts and beliefs in the relationships between alexithymia and both behaviours could offer insight into what individuals with elevated levels of alexithymia anticipate from self-injury and/or consuming alcohol. In Study 2, I utilised existing datasets, and although it seems that experiential avoidance may interact with biological sex and externally orientated thinking to distinguish between NSSI and risky drinking, experiential avoidance was not the main focus of the current research program. Thus, it was removed from the final two studies to bring the focus onto behaviour-specific cognitions. In the remaining two studies I examine potential indirect effects between alexithymia and both behaviours through behaviour-specific outcome expectancies and refusal self-efficacy. Further, given the results of Study 3, I measure alexithymia using the Perth Alexithymia Questionnaire (PAQ). Measuring alexithymia with the PAQ gives me more confidence in results regarding externally orientated thinking and allows me to further explore the role of valence-specific alexithymia.

**This chapter is based on the published paper. In this chapter I provide the submitted version of the article “A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy” published on the 29<sup>th</sup> of September 2020 by John Wiley & Sons Ltd in *Stress and Health*.**

**Reference:** Greene, D., Hasking, P., & Boyes, M. (2020). A comparison of the associations between alexithymia and both non-suicidal self-injury and risky drinking: The roles of explicit outcome expectancies and refusal self-efficacy. Advance online publication. *Stress and Health*. <https://doi.org/10.1002/smi.2991>

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Author	Contribution	I acknowledge that these represent my contribution to the above research output  Signed:
Danyelle Greene	Development of the research question, data analysis, interpretation of the results and manuscript preparation.	
Penelope Hasking	Assisted in the development of the research question, and manuscript preparation.	
Mark Boyes	Assisted in the development of the research question, and manuscript preparation.	

### Abstract

Both non-suicidal self-injury (NSSI) and risky drinking are positively associated with alexithymia, a personality trait characterised by difficulties appraising feelings and an externally orientated thinking style. Although researchers have studied the associations between alexithymia and both NSSI and risky drinking, the underlying factors of both associations are rarely compared. We compared the mediating effects of behaviour-specific outcome expectancies and self-efficacy beliefs on the associations between alexithymia and both NSSI and risky drinking. A sample of 627 university students (76.10% female,  $M_{age} = 20.75$ ,  $SD = 1.88$ ) completed a battery of questionnaires. Alexithymia exhibited indirect effects on NSSI via affect regulation expectancies, pain expectancies, communication expectancies, and low self-efficacy to resist NSSI. Alexithymia exhibited indirect effects on risky drinking via expectations of increased confidence and negative consequences. However, the indirect effects differed depending on the valence of the emotion the individual had difficulties appraising. Our findings indicate that the underlying factors in the associations between alexithymia and both NSSI and risky drinking could differ. Where individuals who have difficulties appraising negative emotions may engage in NSSI to help regulate negative feelings, they may consume alcohol to gain more confidence in expressing their feelings. Clinical implications are discussed.

Non-suicidal self-injury (NSSI) is the direct and deliberate damage of one's body tissue with lack of suicidal intent, for purposes not socially or culturally sanctioned (International Society for the Study of Self-Injury, 2018). Methods of NSSI include, but are not limited to, cutting and burning the skin, and self-battery. Lifetime prevalence rates of NSSI are estimated to be 13.4% for community-based young adults and 20% for young adults attending university (Swannell et al., 2014). People report various motives (e.g., self-punishment, communication) for engaging in self-injury, but emotion regulatory motives are the most consistently endorsed (Taylor et al., 2018). Individuals also frequently endorse emotion regulatory motives of risky drinking (Martins et al., 2018), consuming alcohol in a pattern that heightens a person's risk of negative consequences to themselves and others (World Health Organization, 2014). Like NSSI, the prevalence rates of risky drinking are higher among university students (40%) compared to community-based young adults (30%; Auerbach et al., 2018; Australian Institute of Health and Welfare, 2016). Students who persistently engage in NSSI or risky drinking during university are at increased risk of negative psychological outcomes (e.g., anxiety and depression) and adverse educational consequences compared to students who do not engage in these behaviours (Ansari et al., 2013; Hamza & Willoughby, 2014; Kiekens et al., 2016; Martens et al., 2008), highlighting the need for additional study in this population.

NSSI and risky drinking have a common emotion regulatory function (Aurora & Klanecky, 2016; Kingston et al., 2010; Klonsky, 2007). A person is more likely to engage in NSSI or risky drinking when other emotion regulatory strategies (e.g., going for a walk) are unavailable or unsuccessful (Klonsky, 2007; Martins et al., 2018). Further, people may be prone to shifting from NSSI to risky drinking (or vice versa) to regulate their emotions when underlying emotional difficulties are untreated (Duggan &

Heath, 2014; Garke et al., 2019; Harvey et al., 2004). Regardless of the shared emotion regulatory function, limited research has directly compared NSSI and risky drinking (e.g., Greene et al., 2019; Hasking, 2017; Kingston et al., 2010). Yet, by taking a transdiagnostic approach to identify and understand shared factors between NSSI and risky drinking, we can target these shared factors in intervention initiatives and possibly reduce the odds of an individual shifting between dysregulated behaviours (Duggan & Heath, 2014).

Alexithymia is one cognitive-emotional variable that is associated with both NSSI and risky drinking (Greene et al., 2020a). Alexithymia is a continuous and multifaceted construct encompassing three fundamental aspects of emotional processing: 1) difficulties identifying feelings within the self, 2) difficulties describing feelings to others, and 3) an externally orientated thinking style, a predisposition to place attention on the external environment instead of one's personal emotional states (Bagby et al., 1994). Individuals with high levels of alexithymia tend to confuse bodily sensations with emotions and over report somatic sensations (Lumley et al, 1996). Engaging in NSSI and risky drinking may help draw one's attention away from the emotions they are having difficulties processing, towards bodily sensations (e.g., pain from self-injury or feeling drunk) that the individual can process and understand (Lumley et al., 1996)

Existing work has highlighted the importance of valence-specific alexithymia domains. For example, van der Velde et al. (2013) found that neural correlates of alexithymia were contingent on whether the emotion being appraised was positive or negative. Specifically, during the processing of negative emotional content, alexithymia was related to a decreased response of the amygdala, indicating reduced attention towards the emotional content. Whereas, during the processing of positive emotional

content, there was decreased activation of the right insula and precuneus, indicating a reduction in emotional awareness. Further, Preece et al. (2018b) found that individuals generally have more difficulties identifying and describing negative emotions than positive emotions. Given these results, measuring valence-specific alexithymia will give us a more detailed understanding of the role of alexithymia in both self-injury and risky drinking.

The associations between alexithymia and both NSSI and risky drinking are well established (Greene et al., 2020a). However, it has been argued that a more complete understanding of the associations between cognitive-emotional variables (e.g., alexithymia) and dysregulated behaviours (NSSI and risky drinking) may be gathered by exploring the roles of core cognitions such as behaviour specific thoughts and beliefs (Cox & Klinger, 1988; Hasking et al., 2016). Exploring the roles of behaviour-specific cognitions in the associations between alexithymia and both NSSI and risky drinking could give us further insight into why people with high levels of alexithymia may engage in these behaviours.

### **Outcome Expectancies and Self-Efficacy Beliefs**

Bandura (1986) proposed through Social Cognitive Theory that behaviours such as NSSI and risky drinking are established and maintained by two key thought processes: outcome expectancies and self-efficacy beliefs. Outcome expectancies are the anticipated consequences of a behaviour; behaviours that are expected to achieve a favourable outcome are engaged in, whilst behaviours expected to result in negative outcomes are avoided (Bandura, 1997). Perceived self-efficacy, an individual's belief in their ability to engage in behaviours successfully, is a strong predictor of behaviour engagement (Bandura, 1986). If a person believes they can successfully perform a

specific behaviour to achieve a desired outcome, they are more likely to engage in that behaviour (Bandura, 1986, 1997). An individual's ability to resist engaging in a specific behaviour (e.g., NSSI or risky drinking) in various situations is deemed refusal self-efficacy and is a strong predictor of behaviour engagement (Greenfield et al., 2000; Hasking, 2017).

Behaviour-specific outcome expectancies and self-efficacy beliefs are thought to play significant roles in determining whether an individual engages in NSSI and/or risky drinking (Dawkins et al., 2018; Hasking, 2017; Young et al., 2005). Individuals who expect favourable outcomes from NSSI or risky drinking (e.g., decreased tension) and believe they cannot resist engaging in the behaviour in a specific situation (e.g., in times of high distress) are more likely to engage in the behaviour than individuals who do not hold these beliefs. Conversely, individuals who expect negative outcomes from NSSI and/or risky drinking (e.g., adverse physical or social outcomes) and believe they can resist engaging in self-injury or drinking across various settings (e.g., at a social gathering or when distressed) will be less likely to engage in these behaviours (Hasking, 2017; Young et al., 2005).

The Cognitive Emotional Model (Hasking et al., 2016) of NSSI combines Social Cognitive Theory with emotion regulation theories, to argue the mediating role of cognitions in the associations between predisposing factors (e.g., alexithymia) and NSSI. Recent research has found that NSSI-specific outcome expectancies and self-efficacy beliefs can distinguish between individuals who have and who have not engaged in NSSI (Dawkins et al., 2019a; Dawkins et al., 2018; Hasking & Boyes, 2017). Specifically, individuals with a history of NSSI are more likely to believe that engaging in self-injury will result in emotional relief, whereas individuals who have never engaged in NSSI are more likely to believe that self-injury will result in pain

(Dawkins et al., 2019a). Further, individuals without a history of NSSI are more confident in their ability to resist engaging in NSSI in the future compared to individuals with a history of NSSI (Dawkins et al., 2019a; Hasking & Rose, 2016).

Similarly, through the Motivational Model of Alcohol Use (Cox & Klinger, 1988), researchers (e.g., Cooper et al., 1995) have argued the mediating role of drinking-specific cognitions (e.g., outcome expectancies) in the associations between emotion regulatory factors (e.g., alexithymia) and risky drinking. Decades of research have shown that alcohol-specific outcome expectancies can reliably distinguish between low-risk and risky drinkers (for a review see Monk & Heim, 2013). Specifically, individuals who engage in risky drinking are more likely to believe that drinking will result in increased confidence and emotional relief, whereas, individuals who do not consume alcohol in a risky pattern are more likely to believe that drinking will result in negative consequences (e.g. aggression; Hasking & Oei, 2002; Hasking et al., 2015). Further, low-risk drinkers are more confident in their ability to resist drinking across various contexts (e.g., social gatherings and when distressed) compared to risky drinkers (Oei & Morawska, 2004; Young & Oei, 2000).

To date, no study has explored the roles of outcome expectancies and self-efficacy beliefs in the association between alexithymia and NSSI. However, Thorberg et al., (2011b) examined the mediating roles of alcohol outcome expectancies related to emotional functioning (e.g., affect regulation, assertion) in the association between alexithymia and alcohol dependence. Thorberg et al. (2011b) found that the association between alexithymia and alcohol dependence was, in part, explained by drinking expectancies of affective change and assertion. Therefore, individuals with alcohol dependence and high levels of alexithymia may drink in order to experience/regulate emotions and to help them to communicate their emotions in social contexts. However,

past research suggests that young adults tend to engage in risky drinking for social reasons (drinking to increase confidence/social facilitation) rather than internal reasons such as emotion regulation (Casswell et al., 2002; Read et al., 2003). Thus, it is plausible that expectations of drinking among risky drinking students with high levels of alexithymia may differ from the expectations of individuals with alcohol dependence. In the current study, we explore the mediating role of behaviour-specific cognitions in the association between alexithymia and both NSSI and risky drinking in the same sample of university students. By studying associations between alexithymia and both NSSI and risky drinking in the same sample it allows us to explore similarities and differences in these behaviours in the context of alexithymia.

Contextually, given that individuals with alexithymia struggle to identify their emotions and have difficulties describing their feelings, an individual with high levels of alexithymia may anticipate that NSSI will help them to regulate their emotions and are, thus, more likely to engage in NSSI. Or perhaps, an individual with high levels of alexithymia may believe that consuming alcohol will help them to be more confident in describing their feelings in social situations, thus, making them more likely to engage in risky drinking. Further, behaviour-specific refusal self-efficacy may strengthen these indirect associations. For example, an individual who believes that engaging in NSSI will result in emotional relief and believes they cannot resist engaging in self-injury might be at higher risk of engaging in NSSI. Similarly, an individual who believes that consuming alcohol will increase their confidence in expressing and describing emotions and believes they cannot resist drinking may be at particularly high risk of engaging in risky drinking.

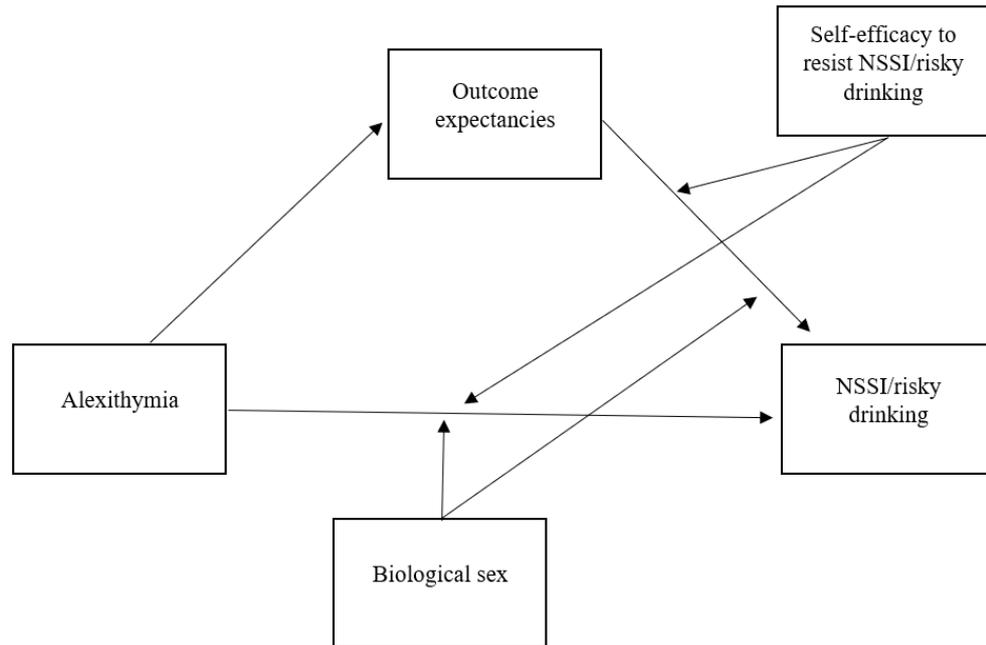
## Sex Differences

A recent systematic review and meta-analysis found that the association between alexithymia and NSSI may be stronger for women (Greene et al., 2020a) and another study (Greene et al., 2019) found that men who had difficulties describing feelings were more likely to engage in risky drinking than NSSI. It is possible that these sex differences may be explained by different anticipated outcomes of NSSI and risky drinking for men and women. The assessment of outcome expectancies associated with NSSI is a relatively new research area, and sex differences are yet to be explored. However, in the emotion regulation literature, it is noted that the relationship between affect-regulation and NSSI is stronger for women (Claes et al., 2007; Rodham et al., 2004). This is likely due to the expectation that engaging in NSSI will reduce intense emotions (Claes et al., 2007; Rodham et al., 2004). Theoretically, women who experience difficulties with emotion may be more likely than men to believe engaging in NSSI will help regulate these emotions, thus, resulting in a stronger positive relationship between alexithymia and NSSI for women.

Outcome expectancies of drinking also differ across sex with a strong correlation between drinking and positive outcome expectancies (e.g., tension reduction and sexual enhancement) for men, but weaker correlations for women (Kalichman et al., 2007; Kushner et al., 1994). Additionally, women tend to have stronger negative expectancies of alcohol use than men (Nolen-Hoeksema & Hilt, 2006). Combining these findings, men who experience difficulties with emotion may be more likely than women to believe that drinking will help regulate these emotions, thus resulting in a stronger positive relationship between alexithymia and risky drinking for men. In the current study, we explore whether sex moderates the indirect associations between alexithymia and NSSI/risky drinking, via outcome expectancies.

## **The Current Study**

The aim of this study was to explore whether behaviour-specific outcome expectancies mediate the associations between alexithymia and both NSSI and risky drinking. Further, we examined the moderating roles of behaviour-specific self-efficacy and biological sex (see Figure 5.1). First, we hypothesise that alexithymia will be indirectly associated with NSSI via NSSI outcome expectancies (e.g., affect regulation, pain expectancies). Second, we anticipate that alexithymia will be indirectly associated with risky drinking via alcohol outcome expectancies (e.g., tension reduction, increased confidence). Third, the direct and indirect associations between alexithymia and both NSSI and risky drinking will be moderated by behaviour-specific refusal self-efficacy and biological sex. Specifically, we expect the direct and indirect associations from alexithymia to NSSI/risky drinking, via outcome expectancies to be stronger for individuals with lower behaviour-specific refusal self-efficacy. Further, we anticipate the direct and indirect associations between alexithymia and NSSI will be stronger for women, and the direct and indirect associations between alexithymia and risky drinking will be stronger for men.



**Figure 5.1.** Hypothesised path models for the associations between alexithymia and both NSSI and risky drinking.

## Method

### Participants

Participants were 627 Australian university students aged between 17 and 25 years ( $M = 20.75$ ,  $SD = 1.88$ ). The majority of the students identified as female (76.10%), were born in Australia (74.50%), attended universities in Western Australia (83.40%), and were studying a bachelor's degree (96%). Nine participants (1.44%) identified as Aboriginal or Torres Strait Islander. The majority of the participants (78.01%) identified as heterosexual.

## Measures

**Inventory of Statements about Self-Injury (ISAS; Klonsky & Glenn, 2009)** was used to measure NSSI. Participants were provided with a definition of self-injury (“the deliberate physical self-damage or self-harm that is not accompanied by suicidal intent or ideation”) and asked if they had ever engaged in NSSI. Individuals who answered ‘yes’ to having ever engaged in NSSI were asked if they had engaged in NSSI within the last year. We used these questions to create a three-category ordinal variable (0 = No NSSI; 1 = past NSSI (have engaged in NSSI but not within the last year); 2 = engagement in NSSI within the last year). Further questions assess descriptive and contextual factors of self-injury (e.g., age of onset). Klonsky and Olino (2008) report the ISAS to have excellent test-retest reliability ( $r = .85$ ).

**The Alcohol Use Disorders Identification Test (AUDIT; Degenhardt et al., 2001)** is a 10-item scale that measures typical alcohol consumption (e.g., ‘How often do you have a drink containing alcohol?’) and alcohol-related impediments (e.g. ‘How often during the last year have you had a feeling of guilt or remorse after drinking?’). Participants answer most questions on a 5-point Likert scale ranging from 0-4. Scores range between 0 and 40, with scores indicating higher levels of risky/hazardous drinking. In the current study, we measure risky drinking as a continuous variable. The internal consistency of the AUDIT in the current sample is excellent ( $\alpha = .84$ ).

**The Perth Alexithymia Questionnaire (PAQ; Preece et al., 2018b)** is a 24-item self-report scale designed to measure valence-specific difficulties identifying feelings and difficulties describing feelings, and general externally orientated thinking. Given, power restraints, we chose to use the valence-specific combined subscales for DIF and DDF; Difficulties Appraising Negative Feelings (e.g., ‘When I feel bad I can’t make

sense of these feelings’), and Difficulties Appraising Positive Feelings (e.g. ‘When I am feeling good I can’t talk about those feelings in much depth or detail’) and the General Externally Orientated Thinking (e.g. ‘I don’t pay attention to my emotions’) subscale. Each item is rated on a 7-point Likert scale ranging from one (strongly disagree) to seven (strongly agree). Scores on all three subscales range between 8 and 56, and larger scores indicate higher levels of alexithymia. All three subscales have excellent internal consistency in the original (N-DAF = .93, P-DAF = .93, G-EOT = .90) and current sample (N-DAF = .95, P-DAF = .94, G-EOT = .92). The PAQ has good concurrent validity with measures of emotion regulation (i.e., expressive suppression;  $r = .52$ ; Preece et al., 2018b).

**The NSSI Expectancies Questionnaire** (NEQ; Hasking & Boyes, 2017) is a 25-item questionnaire developed to measure expectations regarding five possible outcomes of engaging in self-injury. The five outcome expectancies measured are: affect regulation expectancies (e.g. ‘I would feel relieved’  $\alpha = .86$ ), anticipated negative social outcomes (e.g. ‘My parents would be angry’  $\alpha = .78$ ), expected communicative function of self-injury (e.g. ‘I would feel that it would be easier to open up and express my feelings’  $\alpha = .71$ ), anticipated pain (e.g. ‘the pain would be intense’  $\alpha = .80$ ) and negative self-beliefs (e.g. ‘I would feel a failure’  $\alpha = .78$ ; Hasking & Boyes, 2017). Participants rate each outcome on a 4-point Likert scale ranging from 1 (not likely at all) to 4 (extremely likely). Cronbach alphas in the current student sample were, affect regulation  $\alpha = .86$ , negative social expectancies,  $\alpha = .84$ , communication,  $\alpha = .75$ , pain,  $\alpha = .76$ , and negative self-beliefs,  $\alpha = .71$ . Initial validation of the scale supported convergent, and discriminate validity (Hasking & Boyes, 2017). The NEQ can distinguish between individuals who do and individuals who do not engage in NSSI, indicating good criterion validity (Dawkins et al., 2019a; Hasking & Boyes, 2017).

**The Self-Efficacy to resist NSSI** (Czyz et al. 2014; Hasking & Rose, 2016) scale was adapted from Czyz et al.'s. (2014) six-item 'ability to resist suicidal action scale' to measure an individual's belief in their ability to resist engaging in NSSI (e.g. 'If at some point in the future you had self-injurious thoughts, how certain are you that you could resist self-injury?'). Individuals respond on a 6-point Likert scale ranging from 1 (very uncertain) to 6 (very certain). The NSSI version had excellent internal consistency in past research ( $\alpha = .92$ ; Hasking & Rose, 2016) and the current study,  $\alpha = .93$ .

**The Drinking Expectancy Questionnaire-Revised** (DEQ-R; Lee et al., 2003) is a 37-item scale developed to measure five possible outcome expectancies of alcohol consumption. Participants respond to each item on a 5-point Likert scale ranging from one (strongly disagree) to five (strongly agree), with higher scores indicating stronger outcome expectancies. The five outcome expectancies measured are cognitive enhancement (e.g. 'I am more aware of what I say and do if I'm drinking'), tension reduction (e.g. 'When I am anxious or tense I do not feel the need for alcohol'; reversed scored), increased confidence (e.g. 'If I'm drinking, it's easier to express my feelings'), sexual enhancement (e.g. 'I tend to avoid sex if I've been drinking'; reverse scored) and negative consequences for drinking (e.g. 'Drinking makes me bad-tempered'). The DEQ-R has good psychometric properties and has been widely used in student, community, and clinical samples (Lee et al., 2003). In the current sample, Cronbach alphas are as follows: cognitive enhancement  $\alpha = .61$ , tension reduction  $\alpha = .60$ , increased confidence  $\alpha = .92$ , sexual enhancement  $\alpha = .80$ , and negative consequences of drinking  $\alpha = .90$ . The DEQ can distinguish between low-risk social drinkers and individuals who consume alcohol at risky levels (Oei & Morawska, 2004).

**The Drinking Refusal Self-Efficacy Questionnaire-Revised** (DRSEQ-R; Oei et al. 2005) is a 19-item measure of an individual's belief in their ability to resist consuming alcohol. Participants respond to each item on a 6-point Likert scale ranging from one (I am very sure I would drink) to 5 (I am very sure I would not drink), with higher scores representing a stronger belief in one's ability to resist drinking. The DRSEQ has good psychometric properties in various samples including student, community and clinical (Oei et al., 2005). In the current sample, the internal consistency of the DRSEQ-R was excellent,  $\alpha = .95$ . Initial validation of the DRSEQ-R supported concurrent, convergent, and discriminate validity (Oei et al., 2005).

### **Procedure**

Upon gaining approval from the University's ethics committee, participants were recruited through an online undergraduate participant pool, posters, and various online platforms (e.g. Reddit, Facebook). Students could complete the questionnaire for course credits or be placed in a draw to win an iPad or 1 of 10 \$50 gift cards. After giving informed consent, participants completed a series of questionnaires, taking between 45 minutes and an hour. Students were given access to NSSI and alcohol-related information sheets, counselling numbers, and mental health websites at the beginning and end of the questionnaire.

### **Data Analysis**

Data were analysed using Mplus 8 (Muthen & Muthen, 2017). We ran two models; one with NSSI as the primary outcome and one with risky drinking as the primary outcome. For both models, difficulties appraising negative feelings, difficulties appraising positive feelings, and general externally orientated thinking were entered as correlated independent variables. The NSSI model had the following outcome

expectancies as mediators: affect regulation, negative social expectancies, communication, pain, and negative self-beliefs, and self-efficacy to resist NSSI and biological sex as moderators along the mediator-outcome path (Figure 5.1). Risky drinking was entered as a covariate variable in the model predicting NSSI. Similarly, the risky drinking model had the following outcome expectancies as mediators: cognitive enhancement, tension reduction, increased confidence, sexual enhancement, negative consequences of drinking, and drinking-refusal self-efficacy and biological sex as moderators along the mediator-outcome path (Figure 5.1). NSSI was included as a covariate in the model predicting risky drinking.

Given the categorical nature of our NSSI variable, we tested direct, indirect, and moderation effects using Weighted Least-Squares Mean and variance adjusted estimation with 5000 bootstrap resamples. Given we measured risky drinking using a continuous scale we tested direct, indirect, and moderation effects using Maximum Likelihood estimation with 5000 bootstrap resamples. We accepted a model to have a good fit if it's Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were equal to or above .90 and had a root mean square error of approximation (RMSEA) value below .06 (Hu & Bentler, 1999).

## **Results**

### **Preliminary Results**

Across all variables of interest, less than 5% of data was missing, thus, we used expectation maximisation to impute missing data (Tabachnick & Fidell, 2013). Two-hundred and fifty-four (40.50%) participants reported having engaged in NSSI in their lifetime, of whom 145 (57.08%) reported engaging in NSSI within the last 12 months. Individuals reported having started engaging in NSSI between the ages of 4 and 23 ( $M =$

13.79,  $SD = 2.98$ ). The most frequently endorsed form of self-injury was cutting (75.20%) followed by self-battery (64.17%) and severe scratching (53.94%). Two-hundred and fifty-six (40.83%) participants reported engaging in risky drinking (AUDIT score  $> 7$ ; Roche and Watt, 1999), of whom 77 (30.08%) could be classified as hazardous drinkers (AUDIT score  $> 15$ ).

Women were more likely to have engaged in NSSI (41.39%) than men (21.27%),  $\chi^2 (2) = 21.81, p < .001$ . Biological sex was not associated with risky drinking, spearman's rho =  $-.08, p = .06$ . Table 5.1 shows means and standard deviations across the alexithymia and NSSI specific variables for the three NSSI groups (no history, past NSSI, recent NSSI). Correlations between risky drinking (continuous) and alcohol-specific variables and correlations between all variables of interest can be found in Table 5.2.

**Table 5.1.** Comparison of means across NSSI groups on variables of interest.

	No history of NSSI (n = 392)		Past NSSI (n = 90)		Recent NSSI (n = 145)		<i>F</i>	<i>Partial</i> $\eta^2$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Difficulties appraising negative feelings	26.64	11.74	27.41	12.00	33.68	13.33	18.09***	.05
Difficulties appraising positive feelings	22.28	9.85	23.17	10.33	27.59	11.97	13.79***	.04
Externally orientated thinking	23.94	10.58	23.55	9.11	27.32	11.62	5.93**	.02
Affect regulation	8.22	3.16	11.14	3.12	12.81	3.23	121.76***	.30
Negative social expectancies	12.78	4.00	13.77	3.67	13.46	4.08	3.16*	.01
Communication expectancies	10.33	3.07	9.11	3.06	8.49	3.06	21.25***	.06
Pain expectancies	17.10	2.86	15.11	2.86	14.99	2.80	38.90***	.11
Negative self-beliefs	14.49	3.13	14.09	3.20	14.14	3.36	.98	.00
Self-efficacy to resist NSSI	30.40	7.10	27.41	5.94	18.04	7.34	155.81***	.33

*Note.* \* $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$ .

**Table 5.2.** Correlation between all model variables

	2	3	4 <sup>a</sup>	5	6	7	8	9	10	11	12	13	14	15	16	17
1. DANF	.68**	.68**	.22**	.10*	.25**	.23**	-.11*	-.19**	.15**	-.29**	.16**	.09*	.14**	-.19**	.25**	-.11*
2. DAPF	1	.62**	.20**	.04	.23**	.16**	-.07	-.22**	.06	-.23**	.21**	.12*	.05	-.19*	.29**	-.09*
3. EOT		1	.12*	.14**	.19**	.19**	-.04	-.19**	.10*	-.16**	.15**	.11*	.10*	-.19**	.21**	-.14**
4. NSSI <sup>a</sup>			1	.07	.53**	.08*	-.25**	-.32**	-.05	-.56**	.10**	.08*	.12**	-.08*	.18**	-.12**
5. Risky Drinking				1	.07	.09*	-.03	-.08*	.09*	-.14**	.10*	.32**	.51**	.03	.24**	-.50**
6. Affect regulation					1	.18**	.10**	-.39**	.03	-.44**	.16**	.16**	.12**	-.06	.19**	-.17**
7. Negative Social						1	.08	.09*	.43**	-.14**	.06	.08*	.14**	-.04	.13**	-.10*
8. Communication							1	.06	.13**	.11**	.12**	-.00	.01	-.02	.06	-.07
9. Pain								1	.23**	.22**	-.17**	-.15**	.01	.05	-.21**	.11**
10. Negative self-beliefs									1	-.01	-.03	-.05	.18**	-.02	.05	-.05
11. NSSI self-efficacy										1	-.14**	-.11**	-.17**	.15**	-.27**	.19**
12. Cognitive enhancement											1	.04	.16**	-.38**	.47**	-.19**
13. Tension Reduction												1	.11**	.12**	.07	-.44**
14. Increased confidence													1	-.05	.17**	-.32**
15. Sexual enhancement														1	-.38**	.04
16. Negative consequences															1	-.17**
17. Drinking self-efficacy																1

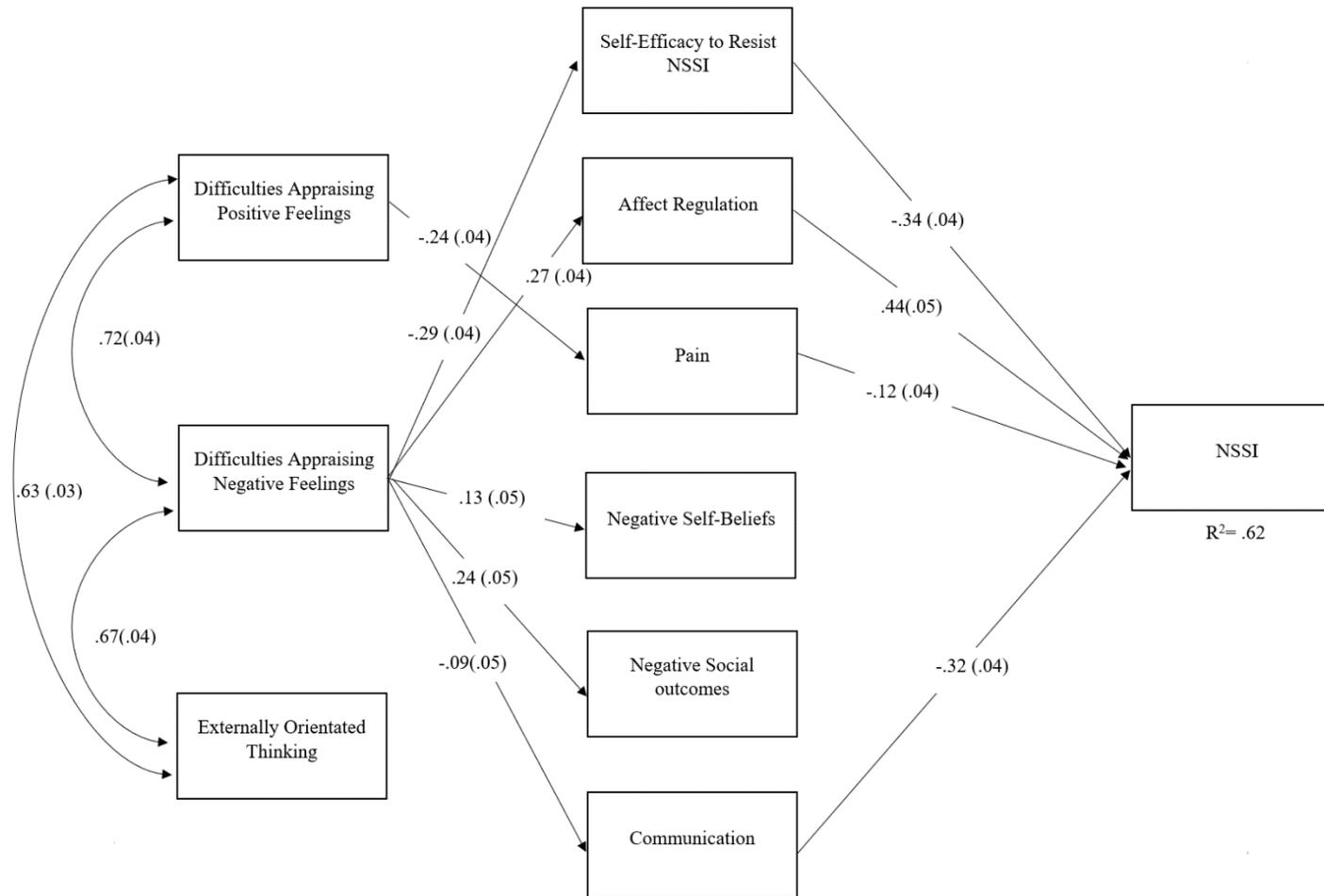
*Note.* DANF = Difficulties Appraising Negative Feelings; DAPF = Difficulties Appraising Positive Feelings; <sup>a</sup> Point-Biserial correlations; correlations \*  $p < .05$ ; \*\* $p < .01$ .

## NSSI Model

The hypothesised model had poor fit, CFI = .87, TFI = .75, RMSEA = .06. Modification indices suggested that self-efficacy to resist NSSI may be better suited as a mediator than a moderator. Also, as sex did not moderate any associations it was entered as a covariate in the alternative model. Entering sex as a covariate and including self-efficacy to resist NSSI as a mediator instead of a moderator created a fully saturated model. In the unconstrained model, direct effects between all three aspects of alexithymia and NSSI were non-significant: difficulties appraising positive feelings ( $\beta = 0.04$ , 95% CI [-0.05, 0.12], SE = .05,  $p = .511$ ), difficulties appraising negative feelings ( $\beta = 0.01$ , 95% CI [-0.09, 0.11], SE = .06,  $p = .933$ ), and externally orientated thinking ( $\beta = -0.06$ , 95% CI [-0.05, 0.03], SE = .05,  $p = .264$ ). Constraining these effects and other non-significant paths resulted in a model (Figure 5.2) that fit the data well, CFI = 0.99, TFI = 0.98, RMSEA = .02.

Difficulties appraising positive feelings was related to stronger expectancies of pain. Difficulties appraising negative feelings was related to stronger expectations of affect regulation, negative self-beliefs, and negative social outcomes, and weaker expectations of communication and self-efficacy to resist-NSSI (Figure 5.2). Stronger expectations of affect regulation and weaker expectations of pain, communication, and self-efficacy to resist NSSI were directly related to engagement in NSSI. Indirect effects differed across the three facets of alexithymia. Difficulties appraising positive feelings had an indirect effect on NSSI via the expectation that engaging in NSSI would cause pain ( $\beta = 0.03$ , 95% CI [0.01, 0.05], SE = .01,  $p = .012$ ). Difficulties appraising negative feelings had indirect effects on NSSI via affect regulation expectancies ( $\beta = 0.12$ , 95% CI [0.08, 0.16], SE = .02,  $p < .001$ ), communication expectancies ( $\beta = 0.03$ , 95% CI [0.01, 0.06], SE = .01,  $p = .045$ ), and self-efficacy to resist NSSI ( $\beta = 0.10$ , 95%

CI [0.07, 0.13], SE =.02,  $p < .001$ ). There were no significant indirect effects between externally orientated thinking and NSSI. Overall, the model explained 62% of the variability in NSSI.



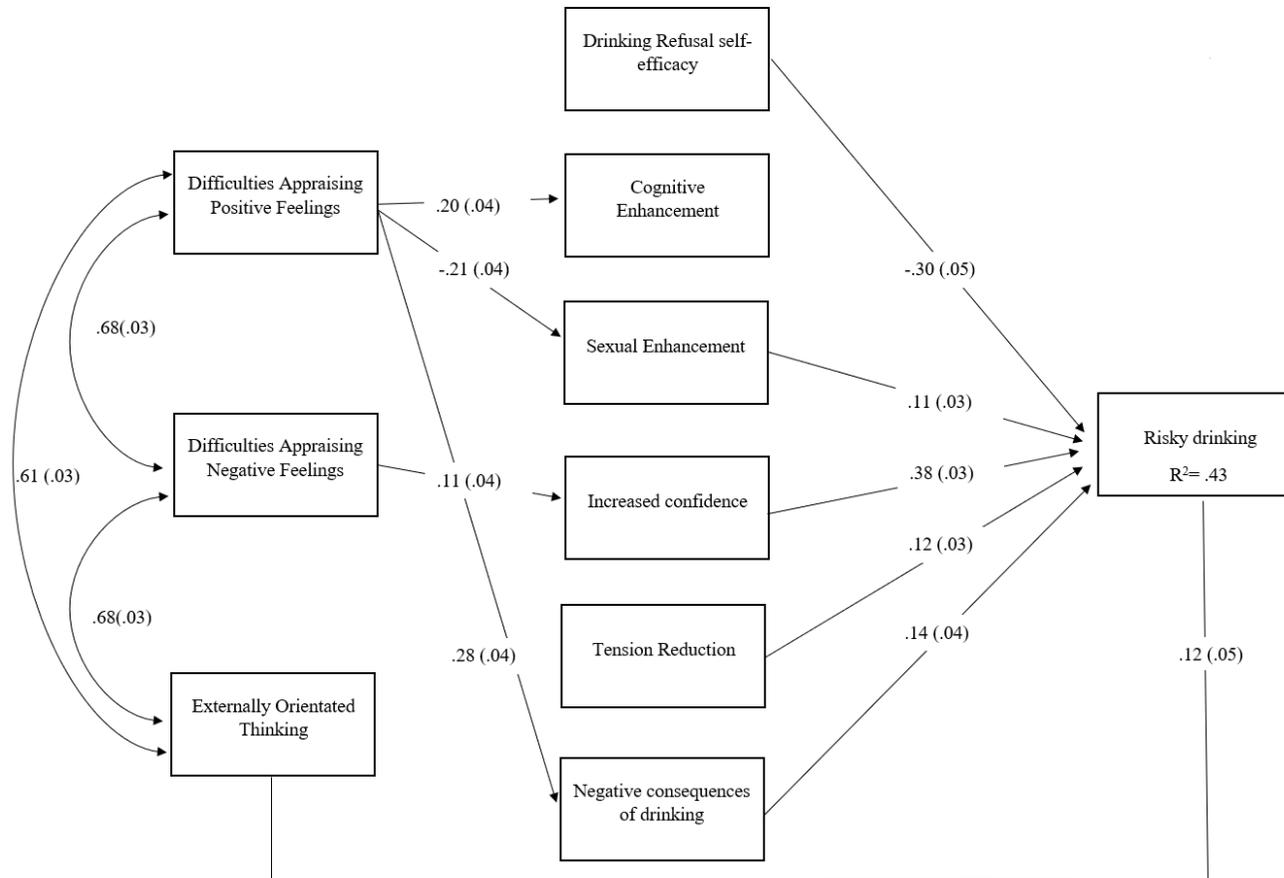
**Figure 5.2.** Alternative path model of the association between alexithymia and NSSI via behaviour-specific outcome expectancies and self-efficacy beliefs. Path values represent standardised path regression weights with standard errors in parenthesis. Non-significant paths removed.

### Risky Drinking Model

The hypothesised model had poor fit, CFI = .82, TFI = .64, RMSEA = .11. Again, modification indices suggested that drinking-refusal self-efficacy may be better suited as a mediator than a moderator. Also, as sex did not moderate any associations it was entered as a covariate in the alternative model. In the unconstrained alternative model, the direct associations between both difficulties appraising positive feelings ( $\beta = -0.07$ , 95% [-0.14, 0.02], SE = .04,  $p = .120$ ) and difficulties appraising negative feelings ( $\beta = -0.06$ , 95% CI [-0.13, 0.02], SE = .04,  $p = .200$ ) and risky drinking were non-significant. However, there was a significant direct positive association between externally orientated thinking and risky drinking ( $\beta = 0.12$ , SE = .05, 95% CI [0.05, 0.19],  $p = .008$ ). Constraining non-significant paths resulted in a model (Figure 5.3) that fit the data well, CFI = .98, TFI = .93, RMSEA = .03. Figure 5.3 illustrates the standardised path regression coefficients of the alternative model, with non-significant pathways removed.

Difficulties appraising positive feelings was related to stronger expectations of cognitive enhancement and negative consequences of drinking, and weaker expectations of sexual enhancement (Figure 5.3). Difficulties appraising negative feelings was related to stronger expectations of confidence. Stronger expectations of sexual enhancement, increased confidence, tension reduction, and negative consequences of drinking, were directly associated with risky drinking. Weaker beliefs about one's ability to resist drinking were negatively associated with risky drinking (Figure 5.3). The indirect associations between alexithymia and risky drinking via alcohol outcome expectancies were subscale dependent. Difficulties appraising positive feelings had an indirect effect on risky drinking via the expectation of negative consequences from

drinking ( $\beta = 0.04$ , 95% CI [0.02, 0.06], SE = .01,  $p < .001$ ) and sexual enhancement expectancies ( $\beta = -0.02$ , 95% CI [-0.04, -0.01], SE = .01,  $p = .010$ ).



**Figure 5.3.** Alternative path model of the association between alexithymia and risky drinking via behaviour-specific outcome expectancies and self-efficacy beliefs. Path values represent standardised path regression weights with standard errors in parenthesis. Non-significant paths removed.

Difficulties appraising negative feelings only had an indirect effect on risky drinking via the expectation that consuming alcohol will increase confidence ( $\beta = 0.04$ , 95% CI [0.02, 0.07], SE = .01,  $p = .010$ ). There were no significant indirect effects between externally orientated thinking and risky drinking. Overall, the model explained 42% of the variability in alcohol consumption.

## Discussion

University students are a group characterised by elevated levels of both NSSI (Swannell et al., 2014) and risky drinking (AIHW, 2016). Engagement in both behaviours is associated with adverse psychological, physical, and educational outcomes, emphasising the need to identify potential underlying mechanisms of both behaviours (Ansari et al., 2013; Hamza & Willoughby, 2014; Kiekens et al., 2016; Martens et al., 2008). In the present study, we aimed to expand on work testing the relationships between alexithymia and both NSSI and risky drinking by exploring the roles of behaviour-specific outcome expectancies and self-efficacy beliefs, and biological sex. Alexithymia exhibited indirect effects on NSSI via affect regulation expectancies, pain expectancies, communication expectancies, and low self-efficacy to resist NSSI. Alexithymia exhibited indirect effects on risky drinking via expectations of increased confidence, and negative consequences. However, in both cases, the indirect effects differed depending on the valence of the emotion the individual had difficulties appraising. Biological sex did not significantly moderate any association. Clinically, these results may be beneficial in developing intervention initiatives that focus on challenging behaviour-specific outcome expectancies and self-efficacy beliefs for individuals with high levels of alexithymia.

Valence played an important role in the indirect associations between alexithymia and both NSSI and risky drinking. As anticipated, the association between difficulties appraising negative feelings and NSSI was explained by the expectation that engaging in NSSI will help to relieve adverse feelings. Yet, students who had difficulties appraising negative feelings tended to believe that consuming alcohol would help them to be more confident in communicating/expressing their feelings, which in turn predicted engagement in risky drinking. In contrast, individuals who had

difficulties appraising negative feelings believed that engaging in NSSI would not help them to communicate their distress to others. Thus, students who have difficulties appraising negative emotions may be using the disinhibiting effects of alcohol to compensate for difficulties related to limited emotional awareness and communication of emotions but may be engaging in NSSI to help relieve or escape from negative feelings.

Further, the association between difficulties appraising negative feelings and NSSI was not moderated, but mediated, by weaker beliefs in one's ability to resist NSSI. It is probable that individuals with high levels of alexithymia may feel they are unable to resist engaging in NSSI in situations that require them to pay attention to and appraise their emotions (e.g., when experiencing high levels of emotional adversity or in social situations where they are expected to describe their feelings to others). However, due to the cross-sectional nature of the current study, the temporal sequences between behaviour-specific self-efficacy and NSSI requires prospective testing. Low self-efficacy to resist NSSI may be an outcome of not being able to resist engaging in self-injury in the past and play little role in predicting future engagement in self-injury.

Individuals who had difficulties appraising positive feelings tended to believe that engaging in NSSI would not be painful, which in turn predicted an increased likelihood of engaging in NSSI. It is possible that individuals who struggle with positive emotions may not perceive the bodily sensation associated with self-injury as painful but as a distraction from emotions they find difficult to appraise. When engaging in NSSI an individual's focus may be turned from internal thoughts and feelings onto physical sensations that individuals with high levels of alexithymia tend to find easier to identify and describe (Lumley et al., 1996).

Focusing on drinking behaviour, we found that individuals who had difficulties appraising positive feelings believed drinking would lead to negative consequences, which in turn predicted higher levels of risky drinking. Again, it is possible that individuals who have difficulties appraising positive feelings could engage in risky drinking because they perceive the negative consequences associated with alcohol (i.e., becoming violent/aggressive/bad-tempered, hangovers) as a distraction away from the positive emotions they find difficult to appraise. When engaging in risky drinking an individual's focus may be turned from internal thoughts and feeling onto physical behaviours (violence, aggression) and sensations (hangovers) that individuals with high levels of alexithymia may find easier to appraise (Lumley et al., 1996). Alternatively, this association could be explained by the cross-sectional nature of the data. Specifically, individuals who drink in a risky pattern have likely experienced negative outcomes of drinking, thus, they are more likely to report expecting negative outcomes (Hasking & Oei, 2007). In summary, it is possible students who have difficulties appraising positive feelings could be using the consequences of NSSI/risky drinking as a distraction away from the feelings they are having difficulties processing on to physical sensations. However, the cross-sectional data means this explanation is speculative and longitudinal research is warranted.

Consistent with a recent meta-analysis (Greene et al., 2020a) externally orientated thinking was related to risky drinking but not NSSI. However, the association between externally orientated thinking and risky drinking was not explained by alcohol expectancies or self-efficacy beliefs. Due to their tendency to focus on the external world, individuals with externally orientated thinking styles tend to lack insight into their intrapersonal thoughts and feelings (Preece et al., 2017). The current study relies on self-report measures of explicit outcome expectancies, which tap into an individual's

direct and controlled thoughts about NSSI/risky drinking. Self-report measures require a certain degree of insight, and particularly among individuals with externally orientated thinking styles, this form of measurement may be biased by a lack of insight (Marissen et al., 2005). Future research could replicate the current study using more objective measures of outcome expectancies, such as an implicate associations test (Greenwald et al., 1998) or a response-timed sentence completion task (Dawkins et al., 2020; Wardell et al., 2011).

### **Implications**

The current findings suggest that behaviour-specific outcome expectancies and self-efficacy beliefs could play an important role in predicting engagement in NSSI and/or risky drinking for individuals with high levels of alexithymia. Alongside other therapies such as Dialectical Behaviour Therapy (DBT; Linehan, 2014) that are often implemented to help individuals with high levels of alexithymia to process their emotions, clinicians may also want to challenge outcome expectancies (Labbe & Maisto, 2011). A clinician could challenge expectancies by devaluing short-term positive expectancies of the specific behaviour whilst highlighting long and short-term negative outcomes. Specifically, for NSSI, a clinician could challenge affect regulation expectancies by acknowledging the short-term emotional relief but emphasising the long term increases in negative affect. Similarly, for alcohol use, a clinician could challenge increased confidence expectancies, by acknowledging the short-term increase in confidence and ability to express emotions but emphasising the negative short-term outcomes (e.g., hangovers) and long term increases in negative affect and negative physical outcomes (e.g., liver damage). Further, the results indicate a salient role for behaviour-refusal self-efficacy in the associations between alexithymia and NSSI. Strengthening an individual's belief in their ability to resist engaging in NSSI could

effectively reduce future engagement in self-injury. The clinician could implement this by emphasising past situations where the individual has resisted the urge to self-injure, so they can recognise that they are capable of resisting engagement in NSSI.

The current results suggest that students with high levels of alexithymia who also engage in risky drinking may be doing so to heighten their confidence in social settings (i.e., feel more outgoing and have more confidence in expressing their feelings). Thus, interventions that focus on helping individuals regulate unwanted feelings, may not be as effective for this specific group of students. Instead, it may be beneficial to not only focus on awareness of emotions but also build skills in confidence and assertiveness.

### **Limitations**

The results of the current study should be interpreted with some limitations in mind. Specifically, the data is cross-sectional which means we cannot determine how alexithymia, and beliefs about NSSI and risky drinking could change over time, and therefore we can make no claims regarding causality and temporal ordering. Whilst behaviour-specific expectancies and self-efficacy beliefs are related to engagement in NSSI and risky drinking, we cannot be certain that these beliefs are predictive of future behaviour engagement. A longitudinal study that measures alexithymia and NSSI/alcohol expectancies and self-efficacy beliefs (and changes in these) from onset to cessation of these behaviours would give us a better understanding of how changes in these beliefs are associated with behaviour over time. Furthermore, a study using Ecological Momentary Assessment (EMA) with a range of individuals who score across the alexithymia spectrum could provide insight into specific thoughts and beliefs held in mind prior to engagement in and urges to self-injure/consume alcohol. This could

provide insight into differences in thoughts and feelings about self-injury/risky drinking across individuals with varying levels of alexithymia when they experience the urge to self-injure or consume alcohol.

### **Conclusion**

Our findings indicate that the underlying factors in the relationships between alexithymia and both NSSI and risky drinking may differ across behaviour and valence in university students. Where individuals who have difficulties appraising negative emotions appear to engage in NSSI to help relieve negative feelings, they may be consuming alcohol to help them to express their feelings and gain more confidence in social situations. While students who have difficulties appraising positive emotions may engage in NSSI and/or risky drinking to draw their attention away from feelings they are having difficulties processing onto the physical consequences of these behaviours. These differences highlight the importance of valence-specific alexithymia domains in research investigating NSSI and risky drinking. Further, these findings support interventions for individuals with high levels of alexithymia that focus on developing confidence and challenging behaviour specific outcome expectancies and self-efficacy beliefs.

**Chapter 6: Comparing the roles of behaviour-specific beliefs in the associations between alexithymia and both non-suicidal self-injury and risky drinking: A multi-method assessment of expectancies (Study 5)**

**Introduction to Chapter 6**

In this final study I sought to replicate the findings of the previous chapter (Study 4) by measuring outcome expectancies with reaction time-based sentence completion tasks instead of expectancy questionnaires. A disadvantage of self-report questionnaires is that individuals are asked to give a deliberate response based on the limited response choices (e.g., a 5-point Likert scale ranging from strongly disagree to strongly disagree; McDonald, 2008). Reaction-time based computer tasks allow for a less direct assessment of the strength of an individual's behaviour-specific expectancies, with faster response times signifying stronger expectancy beliefs. The secondary aim of this study was to equate and compare the ability of sentence-completion tasks and expectancy questionnaires in distinguishing between individuals who do and who do not report self-injury/risky drinking.

**This chapter based on the following paper** “*Comparing the roles of behaviour-specific beliefs in the associations between alexithymia and both non-suicidal self-injury and risky drinking: A multi-method assessment of expectancies*” published on the 10<sup>th</sup> of February 2021 by Elsevier in *Journal of Affective Disorders Reports*.

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Author	Contribution	I acknowledge that these represent my contribution to the above research output Signed:
Danyelle Greene	Development of the research question, data analysis, interpretation of the results and manuscript preparation.	
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## Abstract

**Introduction.** Alexithymia, a trait encompassing difficulties identifying and describing one's feelings, and a tendency to focus externally, is positively associated with both non-suicidal self-injury (NSSI) and risky drinking. The relationships between alexithymia and both behaviours are well researched, however, it is unclear whether both associations are explained by similar behaviour-specific expectancies. The primary aim of the present research was to investigate and compare the indirect relationships between alexithymia and both behaviours through NSSI and drinking specific expectancies and refusal self-efficacy. The secondary aim was to compare lab-based and questionnaire-based measures of expectancies. **Methods.** A sample of 259 students (80.31% female,  $M_{age} = 19.98$ ;  $SD = 1.49$ ) answered a series of questionnaires and completed lab-based expectancy tasks to measure the variables of interest. **Results.** Alexithymia was indirectly associated with both NSSI and risky drinking through behaviour-specific refusal self-efficacy. Thus, students with high levels of alexithymia may believe they are incapable of resisting engaging in self-injury or consuming alcohol in circumstances that warrant them to place attention on and/or appraise their feelings. Further, alexithymia was indirectly associated with NSSI through stronger affect regulation and weaker communication expectancies. However, alexithymia was not indirectly associated with risky drinking through drinking-specific expectancies. **Limitations.** Cross-sectional methods preclude conclusions regarding temporal ordering. **Conclusion.** Theoretically, these findings suggest that anticipated outcomes of NSSI and risky drinking may be different for university students. Clinically, the current results support interventions that challenge behaviour specific thoughts and beliefs for students who have difficulties identifying and describing feelings.

Non-suicidal self-injury (NSSI) is the intentional harm to the body without lethal intent, for purposes not endorsed by society (ISSS, 2018). Common methods include cutting and scratching the skin. Prevalence rates of NSSI are higher among university students (20%) than the broader young adult population (13.4%; Swannell et al., 2014). Although there are numerous motives for engaging in NSSI (e.g., anti-suicide), individuals consistently endorse emotion regulatory motives (Taylor et al., 2018). Similarly, emotion regulation is a commonly reported reason for engaging in risky drinking (Aurora & Klanecky, 2016). Again, university students have a higher prevalence of risky drinking (40%) than the broader young adult population (30%; Auerbach et al., 2018; AIHW, 2016). Self-injury and risky drinking are linked with significant psychological difficulties (e.g., depression/anxiety; Hamza & Willoughby, 2014; Poznyak & Rekve, 2015) and adverse educational outcomes (Kiekens et al., 2016; Martens et al., 2008), emphasising the need for further investigation.

Emotion regulation is a shared function of self-injury and risky drinking (Aurora & Klanecky, 2016; McKenzie & Gross, 2014). People tend to engage in behaviour such as NSSI and risky drinking when alternative emotion regulatory behaviours are unavailable or perceived as futile (Klonsky, 2007; Martins et al., 2018). Additionally, individuals may switch between engaging in self-injury and risky drinking to alter their emotions if psychological difficulties are untreated (Garke et al., 2019). Irrespective of the common emotion regulatory function, few studies have compared both behaviours (e.g., Greene et al., 2019). However, by adopting a transdiagnostic perspective to discern mutual predictors of both behaviours, therapists can focus on these mutual predictors in intervention plans and potentially lower the probability of behaviour shift.

Alexithymia is a shared predictor of both NSSI and risky drinking (Greene et al., 2020a). Alexithymia is a trait defined by difficulties identifying and describing one's

feelings and a predisposition to focus on the external environment (Bagby et al., 1994). However, a more comprehensive understanding of the relationships between alexithymia and both behaviours might be obtained through investigating the roles of behaviour-specific cognitions such as outcome expectancies and refusal self-efficacy (Cox & Klinger, 1988; Hasking et al., 2016). Examining the indirect effects from alexithymia to both behaviour through behaviour-specific thoughts and beliefs could provide additional understanding of why students with elevated alexithymia might drink alcohol or self-injure.

According to Social Cognitive Theory (Bandura, 1986), outcome expectancies and self-efficacy beliefs are two thought processes that initiate and perpetuate volitional behaviours such as risky drinking and NSSI. Outcome expectancies are the self-predicted consequences of behaviour; individuals will engage in behaviours that they anticipate having positive outcomes, whilst avoiding behaviours they anticipate having negative consequences. Refusal self-efficacy is defined as an individual's belief in their ability to avoid performing a behaviour and is negatively associated with behaviour engagement (Bandura, 1986, Hasking, 2017).

In their Cognitive-Emotional Model of NSSI (Hasking et al., 2016), Hasking and colleagues integrated Social Cognitive Theory with emotion-oriented models of self-injury (e.g., Selby & Joiner) to highlight a role of NSSI-specific beliefs in the relationships between emotional difficulties (e.g., alexithymia) and self-injury. Several studies support a role for NSSI-specific expectancies and refusal self-efficacy in differentiating between people with and without histories of NSSI (Greene et al., 2020b; Hasking & Boyes, 2017). People with no history of self-injury are more likely to anticipate physical pain, while people who have self-injured are more likely to anticipate that self-injury will help them to regulate their emotions (Dawkins et al.,

2018). People who report NSSI are more likely to report low self-efficacy to resist future self-injury in contrast to individuals who have not self-injured (Dawkins et al., 2019).

Likewise, in their Motivational Model of Alcohol Use, Cox and Klinger (1988) argue a mediating role for alcohol-specific cognitions in the relationships between emotional difficulties (e.g., alexithymia) and drinking. Drinking-specific expectancies can reliably differentiate between students who do and do not drink alcohol in a risky fashion (Monk & Him, 2013). People who report risky drinking tend to believe that drinking will regulate their emotions and increase their confidence, while people who do not engage in risky drinking anticipate that drinking will have adverse outcomes (e.g., hangover; Hasking, 2017). However, the Ambivalence Model of Alcohol Use (Breiner et al., 1999) suggests that both positive and negative consequences can occur in one drinking session, thus, many individuals may be ambivalent about drinking alcohol. For example, an individual may anticipate that drinking alcohol will make them less inhibited, but when they consume too much, they may experience negative consequences (e.g., becoming anti-social; Breiner et al., 1999). Additionally, individuals who drink at risky levels are less confident in their capacity to resist drinking across situations (e.g., socially/when upset) in contrast to individuals who drink at low-risk levels (Oei & Morawska, 2004).

While there is evidence for links between behaviour-specific expectancies and both behaviours (e.g., Hasking, 2017; Young et al., 2005), much of the research uses self-report questionnaires. Although expectancy questionnaires are valuable to tap into an individual's beliefs about behaviour, they do have several drawbacks. Self-report may be biased due to a participant's lack of insight or answering in a way that is socially desirable (McDonald, 2008). Likert-scale responses tend to be inexact and

subjective to the person, with many individuals giving middling or extreme responses to all items (McDonald, 2008). Yet, expectancies can be measured more objectively through reaction-time based laboratory tasks. Sentence-completion tasks derived from self-report questionnaires have been used in both the alcohol (Wardell et al., 2012) and the NSSI (Dawkins et al., 2020) literature as an alternative measure of expectancies. In sentence-completion tasks, participants indicate whether the sentence is accurate or inaccurate for them and their reaction time is a measure of the strength of their belief. Thus, subjective or extreme responding is less of a concern. Consequently, Dawkins (2020) found that affect regulation expectancies measured through sentence-completion tasks are more sensitive than equivalent self-report expectancies in differentiating between students who have recently engaged in NSSI, and students who have a history of NSSI.

Recently (Greene et al., 2020b) investigated the role of expectancies and self-efficacy in the relationships between alexithymia and both behaviours using self-report methods. There were indirect relationships between alexithymia and NSSI through strong affect regulation expectancies and weak communication and pain expectancies. Similarly, there were indirect relationships between alexithymia and risky drinking through strong expectations of increased confidence and adverse outcomes. These findings imply that students who have emotional processing difficulties may self-injure to help regulate the feelings they are struggling to appraise but drink alcohol to increase their confidence in conveying their feelings. Further, there was an indirect effect from alexithymia to NSSI through low self-efficacy to resist NSSI. Thus, individuals with alexithymia may think they cannot resist engaging in NSSI across contexts that involve them focusing on and appraising their feelings, and weak self-efficacy to resist NSSI, in

turn, increases the likelihood of them engaging in NSSI. In the current study, we aim to replicate these results using lab-based measures of expectancies.

### **Aim**

The primary aim of the research was to replicate Greene et al. (2020b)'s study by examining whether there are indirect relationships between alexithymia and both NSSI and risky drinking through behaviour-specific expectancies and refusal self-efficacy. We predict indirect relationships between alexithymia and both NSSI and risky drinking through behaviour-specific expectancies. Further, we expect indirect relationships between alexithymia and both self-injury and risky drinking through refusal self-efficacy. The secondary aim was to examine and compare the utility of questionnaire and lab-based measures of behaviour-specific expectancies in differentiating between people who do and do not engage in NSSI/risky drinking.

### **Methods**

#### **Participants**

Participants were 259 undergraduate Australian university students under 25 ( $M = 19.98$ ;  $SD = 1.49$ ). Most students were born in Australia (72.20%), identified as female (80.31%) and as heterosexual (82.63%). Three participants (1.16%) identified as Aboriginal or Torres Strait Islander.

#### **Measures**

**Inventory of Statements about Self-Injury (ISAS; Klonsky & Glenn, 2009)** is a measure of NSSI. Individuals were presented with a definition of NSSI “non-suicidal self-injury is defined as the deliberate physical self-damage or self-harm that is not accompanied by suicidal intent or ideation” and asked if they had ever self-injured.

This question was coded to create a binary variable (0 = no NSSI; 1 = NSSI (history)). Klonsky and Olino (2008) reported that the ISAS demonstrates excellent test-retest reliability ( $r = .85$ ). Students also answered questions on NSSI recency and methods.

**Alcohol Use Disorders Identification Test (AUDIT; Degenhardt et al., 2001)** is a 10-item measure of typical alcohol intake and alcohol-related consequences (“Have you or someone else been injured because of your drinking?”). Most of the questions are measured on a 5-point Likert scale ranging for 0 to 4. Scores can range from 0 to 40 with higher scores indicating more hazardous drinking. The AUDIT is widely used and well-validated and demonstrated excellent internal consistency in the current sample ( $\alpha = .83$ ).

**Perth Alexithymia Questionnaire (PAQ; Preece et al., 2018)** is a 24-item questionnaire constructed to assess difficulties identifying feelings, difficulties describing feelings, and externally orientated thinking. The 24-items can be summed to give general alexithymia score (Preece et al., 2018). Due to power constraints, we used the total score. Participants answer items on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Larger scores represent higher levels of alexithymia. The PAQ has demonstrated good psychometric properties (Preece et al., 2019) and is invariant among students who do and who do not self-injure and drink in a risky pattern (Greene et al., 2020c). In the initial study, the internal consistency of the PAQ was excellent ( $\alpha = .96$ ; Preece et al., 2018).

**NSSI Expectancies Questionnaire (NEQ; Hasking & Boyes, 2017)** is a 25-item questionnaire designed to measure anticipated outcomes of NSSI. Individuals respond to each item on a 4-point Likert scale extending from 1 (not at all likely) to 4 (extremely likely). The NEQ measures five expectancies: affect regulation (“I would

feel relieved”), pain (“It would hurt”), communication (“I would feel that it would be easier to open up and express my feelings”), negative social outcomes (“My friends would not approve of me”), and negative self-beliefs (“I would feel like a failure”). In the initial sample, all expectancies had good-excellent internal consistency ( $\alpha = .71-.86$ ; Hasking & Boyes, 2017).

**Self-efficacy to resist NSSI (Czyz et al., 2014; Hasking & Rose, 2016)** was measured using an adapted version of the ‘Self-Efficacy to Avoid Suicidal Action measure’. The adapted version is a 6-item measure of a person’s belief in their capacity to avoid NSSI across various situations (“How certain are you that you could control future self-injurious thoughts if you lost an important relationship?”). Individuals respond to each item on a 6-point Likert scale starting at 1(very uncertain) and ending at 6(very certain) with higher scores signifying a stronger belief in one’s capacity to avoid NSSI. In the initial sample the internal consistency of the questionnaire was excellent ( $\alpha = .92$ ; Hasking & Rose, 2016).

**Drinking Expectancy Questionnaire-Revised (DEQ-R; Lee et al., 2003)** is a 37-item questionnaire that measures anticipated outcomes of drinking. Individuals answer each item on a 5-point Likert scale ranging from 1(strongly disagree) to 5(strongly agree). The DEQ measures five expectancies: Negative consequences (“Drinking makes me feel like a failure”), increased confidence (“If I’m drinking, it’s easier to express my feelings”), sexual enhancement (“I tend to avoid sex when drinking”), cognitive enhancement (“Drinking alcohol sharpens my mind”) and tension reduction (“Drinking does not help to relieve any tension I feel about recent concerns and interests”). In past studies, internal consistency ranged from .57 (tension reduction) to .87 (increased confidence; Hasking et al., 2011).

**Drinking Refusal Self-Efficacy Questionnaire-Revised (DRSEQ-R; Oei et al. 2005)<sup>2</sup>** is a 19-item questionnaire designed to measure a person's belief in their ability to resist drinking across a variety of situations ("when I feel worried"). Individuals respond on a six-point Likert scale starting at 1(I am very sure I would drink) and ending at 5(I am very sure I would not drink). Higher scores indicate a stronger belief in one's capacity to not drink. In the initial sample, the internal consistency of the DRSEQ-R was excellent ( $\alpha = .95$ ).

### *Sentence Completion Tasks*

Expectancies were also measured by two behaviour-specific sentence completion tasks. Sentences were created using items from the NEQ and the DEQ-R<sup>3</sup>. In the sentence completion tasks, the first half of a sentence (e.g., If I self-injured it would ...) is displayed for one second before the remaining half (... hurt). Students respond, using the computer shift keys, to indicate whether the statement is true or false for them. The answer the individual gives (true[+]/ false[-]) and their response time in milliseconds is recorded. Participants are given 5000ms to respond to each item, with a faster response indicating a stronger association. Students were asked to respond to each sentence as quickly as possible. Reaction times were recoded to create a continuous variable whereby faster reaction times indicate stronger endorsement (Wardell et al.,

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<sup>2</sup> All questionnaires used in the current study have been psychometrically assessed in previous research and generally are reliable and valid. For specific information regarding the psychometric properties of the questionnaires see the following: ISAS (Klonsky & Glenn, 2009), AUDIT (Degenhardt et al., 2001), PAQ (Preece et al., 2018), Self-efficacy to resist NSSI (Czyz et al., 2014; Hasking & Rose, 2016), DEQ-R (Lee et al., 2003) and DRSEQ-R (Oei et al. 2005). For internal consistency of the measures in the current sample see Tables 6.1 and 6.2.

<sup>3</sup>For consistency with the NSSI task, items on the DEQ-R were reduced to 25. Specifically, negative consequences and increased confidence expectancies had large numbers of items and were both reduced to 8 items each. Items with weaker factor loadings were removed. The remaining three expectancies (sexual enhancement, cognitive enhancement, and tension reduction) were only measured by three items each, and thus all items from these subscales were retained for the sentence completion task. The sentence completion tasks, and the questionnaires measure the same expectancies. For full list of items see appendix F.

2012). Thus, scores could range from 0-10000. Average responses for each specific expectancy (e.g., affect regulation) were calculated (Wardell et al., 2012). All NSSI and drinking expectancies had adequate-excellent internal consistency apart from negative self-beliefs (NSSI) and cognitive enhancement (drinking; Tables 6.1 and 6.2).

There were 100 trials per task. Each sentence was presented once in its original form (25 trials; "Drinking alcohol would make me feel.....more confident") and once in its reverse form (25 trials; Drinking alcohol would NOT make me feel.... more confident"). Reverse items were included for reliability purposes (i.e., random answering). Further, 25 items from Goldberg's Adjective Scale were randomly intermingled among the behaviour-specific items to control for individual differences in reaction times (i.e., average reaction-time across these items was calculated). The personality items were presented once in their original format (25 trials, e.g. I am.... practical) and once in their reverse-format (25 trials; I am NOT.... practical). Criterion-related validity of the NSSI task is supported by past research (Dawkins et al., 2020), with lab-measured expectancies distinguishing between individuals with and without histories of NSSI.

### **Procedure**

After the ethics application was approved by University's ethics committee, undergraduate students were recruited via a participant pool. Students were asked to book a laboratory session to complete the survey and the sentence-completion tasks. All students completed the survey before the sentence-completion tasks. The order in which the students completed the sentence-completion tasks, and the items within each task, were randomised. Participation took an average of 60 minutes to complete the study,

after which they received course credits. Counselling numbers, behaviour-specific information sheets, and mental health websites were offered at the end of the session.

### **Analysis**

First, we checked whether the behaviour-specific expectancies (lab-measures and questionnaires) and refusal self-efficacy could distinguish between individuals who do and individuals who do not engage in NSSI/risky drinking. Next, to check the convergent validity of the sentence-completion task, we examined correlations between the lab-based and questionnaire-based measures of expectancies. Given that lab-based expectancies were measured as reaction times (i.e., a faster reaction time indicates stronger endorsement of that expectancy) correlations between a lab-based expectancy (e.g., emotion regulation) and the equivalent questionnaire expectancy should be negative. Last, we ran two hierarchical regressions to explore whether lab-based measures of expectancies can account for variance in NSSI/risky drinking beyond that of expectancy questionnaires. The first, a logistic regression with NSSI as the outcome variable and the second, a linear regression with risky drinking (continuous) as the outcome variable. For both regressions, at the first step biological sex and average reaction time were statistically controlled. Second, the questionnaire measured expectancies were entered. Third, lab-measured expectancies were entered. These analyses were conducted in JASP (JASP Team, 2018).

Next, to test the hypothesised indirect effects we ran two-path analysis models using Mplus 8 (Muthen & Muthen, 2017). One model had NSSI entered as the outcome variable and the other had risky drinking as the outcome variable. For both models, alexithymia was entered as the independent variable and behaviour-specific expectancies (lab-based measures) and refusal self-efficacy as mediators. For the NSSI

model, sex, risky drinking and average reaction time were entered as covariates. Likewise, sex, NSSI, and average reaction time were entered as covariates in the drinking model.

Considering we measured NSSI as a binary construct<sup>4</sup> we tested direct and indirect effects using Weighted Least-Squares Mean-Variance adjusted-estimation with 5000 resampling draws. However, as we measured risky drinking as a continuous construct Maximum Likelihood estimation was more appropriate for the risky drinking model. A model was considered good fit if the Root Mean Square Error of Approximation (RMSEA) was below .06 and the Tucker-Lewis Index and Comparative fit index (CFI) were equal to or above .90 (Hu & Bentler, 1999).

## Results

### Preliminary

Less than 5% of data was missing across all variables of interest, thus, missing data was imputed using expectation maximisation (Tabachnick & Fidell, 2013). Of the 259 students, 87 (33.60%) had engaged in NSSI of which 46 (52.87%) had self-injured in the last year. Forty (46%) indicated that cutting was their main form of NSSI. One-hundred and thirty-six (52.50%) students had engaged in risky drinking (AUDIT > 7; Roche & Watt, 1999). Thirty-nine (15.07%) students reported having engaged in both behaviours. There were no significant sex differences in NSSI  $\chi^2(2) = 2.19, p = .139$  or risky drinking, spearman's  $\rho = -.11, p = .079$ . NSSI and risky drinking were not associated with reaction time, however, alexithymia was associated with slower reaction times (Tables 6.1 and 6.2).

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## Psychometrics of Sentence-Completion Tasks

Group differences were observed in self-efficacy to resist NSSI, four questionnaire-measured expectancies, and three lab-measured expectancies (Table 6.3). Individuals who had engaged in NSSI had weaker beliefs in their ability to resist self-injury compared to individuals who had never self-injured. Students who had a history of self-injury reported stronger affect regulation expectancies and weaker communication and pain expectancies on both measures. However, individuals with a history of NSSI reported weaker expectations of negative self-beliefs on the questionnaire but not on the sentence-completion task. No group differences were observed on expectations of negative social outcomes. All lab-based expectancies were moderately-strongly correlated with their equivalent questionnaire-based expectancy ( $r = -.49, -.66$ ; Table 6.1). The logistic regression found that lab measured affect regulation expectancies contributed variance in NSSI beyond that of questionnaire-based expectancies (Table 6.4).

We observed group differences in drinking refusal self-efficacy, all five questionnaire-measured expectancies and three lab-based expectancies. Specifically, compared to students who did not drink in a risky fashion, students who reported risky drinking held weaker beliefs in their ability to resist drinking. Across both measures, students who reported risky drinking had stronger expectations of sexual enhancement, increased confidence and tension reduction compared to students who do not drink in a risky pattern. Compared to individuals who drink at low-risk levels, students who drink at risky levels reported weaker expectations of cognitive enhancement and stronger expectations of negative consequences on the questionnaire but not on the sentence-completion task.

**Table 6.1.** Means, standard deviations, internal consistency, and correlations between NSSI model variables.

	M (SD)	$\alpha$	$\omega$	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. NSSI <sup>a</sup>	-	-	-	.22*	.51**	-	-.25**	-.42**	-.15*	-.59**	-.03	.26**	.23**	.09	-.42**	.16*	.03
2. Risky drinking	7.74(5.87)	.83	.86	1	.17**	-.02	-.08	-.10	-.05	-.15*	.03	-.00	.17**	.11	-.17**	.02	.09
3. Affect regulation SR	9.35(3.57)	.82	.81		1	.06	.10	-.55**	-.07	-.66**	.04	.08	.37**	.25**	-.48**	.21**	.06
4. Negative Social expectancies SR	13.18(3.84)	.84	.84			1	.14*	.09	.44**	-.02	-.58**	.09	-.05	-.18**	-.06	.02	-.02
5. Communication expectancies SR	10.05(3.14)	.77	.76				1	-.00	.10	.07	.07	-.56**	-.01	.11	-.02	-.13*	.03
6. Pain expectancies SR	16.69(2.94)	.79	.77					1	.18**	.47**	-.04	-.15*	-.53**	-.23**	.27**	-.18**	-.08
7. Negative Self-Beliefs SR	14.81(3.08)	.76	.72						1	.14*	-.23**	.01	-.12	-.49**	.02	.06	-.03
8. Affect regulation SC	6789.85 (2165.86)	.78	.78							1	.04	-.12	-.38**	-.23**	.42**	-.16*	-.03
9. Negative Social expectancies SC	3943.83(2323.4 8)	.73	.73								1	-.18**	.02	.25**	.04	-.14*	.13*
10. Communication expectancies SC	5165.21(2083.9 1)	.70	.70									1	.13*	.03	-.12*	.17**	.03
11. Pain expectancies SC	2211.20(1692.0 5)	.76	.76										1	.35**	-.20**	.13*	.12*
12. Negative Self-Beliefs SC	3719.58(1951.2 4)	.63	.57 <sup>b</sup>											1	-.10	-.07	.16*
13. Self-efficacy to resist NSSI	27.26(7.67)	.92	.92												1	-.16*	.06
14. Alexithymia	75.39(24.82)	.95	.95													1	.13*
15. Reaction Time (Control)	1453.54(272.76 )	.80	.79														1

Note. <sup>a</sup>= Point-Biserial correlations; <sup>b</sup> = poor internal consistency; \*\*  $p < .01$ ; \* $p < .05$  SR = self-report questionnaire; SC = Sentence completion task. Correlations between an SC subscale and an equivalent SR subscale are negative given that a faster reaction time indicates stronger endorsement of a SC expectancy and SR expectancy items are measured on a Likert scale ranging from not at all likely to extremely likely.

**Table 6.2.** Means, standard deviations, internal consistency and correlations between risky drinking model variables

	M (SD)	$\alpha$	$\omega$	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Risky drinking	7.75(5.87)	.83	.86	.22**	.15*	.53**	.18**	.39**	-.12	-.03	-.42**	-.17**	-.37**	-.09	-.49**	.02	.00
2. NSSI <sup>a</sup>		-	-	1	.04	.12*	.02	.21**	.01	-.06	-.07	-.04	-.07	.02	-.23**	.16*	.00
3. Negative Consequences SR	31.55(8.64)	.86	.88		1	.10	-.31**	.14**	.34**	-.61**	.06	.20**	.04	-.08	-.14**	.29**	.16*
4. Increased Confidence SR	39.65(8.11)	.85	.88			1	.11	.29**	.07	.07	-.69**	-.10	-.54**	-.17**	-.34**	.06	.05
5. Sexual Enhancement SR	11.05(2.40)	.80	.81				1	.06	-.34**	.14*	-.12**	-.52**	-.08	.03	-.09	-	-.09
6. Tension Reduction SR	7.52(2.50)	.54	.51 <sup>b</sup>					1	.05	.06	-.21**	-.01	-.29**	-.02	-.42**	.20**	-.02
7. Cognitive Enhancement SR	5.78(2.09)	.69	.73						1	-.05	.08	.18*	.01	-.26**	-.07	.13*	.09
8. Negative Consequences SC	6993.51(1837.63)	.79	.79							1	-.07	-.14**	-.12	.03	-.08	-.18*	-.12
9. Increased Confidence SC	3248.63(1014.96)	.80	.81								1	.12**	.66**	.15*	.30**	.07	.09
10. Sexual Enhancement SC	2503.59(1886.24)	.71	.72									1	.09	.05	.08	.14*	.13*
11. Tension Reduction SC	3222.81(2454.83)	.73	.74										1	.12	.35**	-.05	.02
12. Cognitive Enhancement SC	7104.8(1991.19)	.54	.61 <sup>b</sup>											1	.09	.06	.04
13. Drinking refusal self-efficacy	87.18(18.72)	.94	.95												1	-	.00
14. Alexithymia	75.38(24.82)	.95	.95													1	.17**
15. Reaction Time (Control)	1368.57(252.58)	.83	.83														1

Note. <sup>a</sup>= Point-Biserial correlations; <sup>b</sup> = poor internal consistency \*\*  $p < .01$ ; \* $p < .05$ ; SR = self-report questionnaire; SC = Sentence completion task.

Correlations between an SC subscale and an equivalent SR subscale are negative given that a faster reaction time indicates stronger endorsement of a SC expectancy and SR expectancy items are measured on a Likert scale ranging from strongly disagree to strongly agree.

**Table 6.3.** Comparison between NSSI and No NSSI groups on questionnaire-based and lab-based measures of outcome expectancies and self-efficacy to resist NSSI.

	NO NSSI M(SD) <i>n</i> = 172	NSSI M(SD) <i>n</i> = 87	<i>t</i>	Cohen's d
Affect regulation - SC	7698.74 (1501.92)	4992.94(2160.79)	-11.75***	-1.55
Negative social outcomes -SC	4000.52(2361.38)	3831.76(2255.91)	-.55	-0.07
Communication - SC	4788.69(2006.52)	5909.61(2044.16)	4.22***	0.56
Pain expectancies – SC	1935.93(1483.13)	2755.41(1940.16)	3.46**	0.50
Negative self-beliefs - SC	3592.67(1702.69)	3970.48(2358.30)	1.34	0.19
Affect regulation - SR	8.06(3.06)	11.89(3.13)	9.44***	1.24
Negative social outcomes -SR	13.24(3.79)	13.05(3.96)	-.36	-0.05
Communication - SR	10.61(3.07)	8.94(3.01)	-4.16***	-0.55
Pain expectancies – SR	17.57(2.61)	14.97(2.79)	-7.38***	-0.97
Negative self-beliefs - SR	15.14(2.84)	14.17(3.43)	-2.26*	-0.32
Self-efficacy to resist NSSI	29.54(6.69)	22.74(7.51)	-7.42***	-0.97

*Note.* \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; SR= Self-report questionnaire; SC = Sentence completion task.

**Table 6.4.** Logistic regression predicting engagement in NSSI

	B(SE)	OR (95% CI)
Step one – Covariates		
Biological sex	.54(.36)	1.72(.85-3.51)
Reaction Time	.07(.13)	1.07(.82-1.38)
Cox & Snell $R^2 = 0.01$ , Nagelkerke $R^2 = 0.01$		
Step Significance: $\chi^2 (2) = 2.52, p = .283$		
Step two- Questionnaire expectancies		
Affect regulation- SR	1.34(.22)	3.80(2.46-5.89)***
Negative social expectancies -SR	.17(.21)	1.19(.78-1.80)
Communication - SR	-.96(.20)	.38(.26-.56)***
Pain -SR	-.58(.20)	.56(.38-.83)**
Negative self-beliefs -SR	-.33(.20)	.72(.48-1.07)
Cox & Snell $R^2 = 0.37$ , Nagelkerke $R^2 = 0.51$ ***		
Step Significance: $\chi^2 (5) = 115.84, p < .001$		
Step two – Lab-based expectancies		
Affect regulation- SC	-1.03(.24)	.36(.22-.57)***
Negative social expectancies -SC	.04(.24)	1.04(.65-1.68)
Communication - SC	.27(.25)	1.31(.81-2.13)
Pain -SC	-.23(.23)	.80(.51-1.24)
Negative self-beliefs -SC	-.39(.24)	.68(.42-1.09)
Cox & Snell $R^2 = 0.42$ , Nagelkerke $R^2 = 0.59$ ***		
Step Significance: $\chi^2 (5) = 23.41, p < .001$		

Note. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; SR = Self-report questionnaire; SC = sentence Completion task.

The lab-based expectancies of increased confidence, negative consequences, and sexual enhancement were strongly correlated with their equivalent questionnaire measured expectancy ( $r = -.52, -.69$ ; Table 6.5). However, there were only moderate-weak correlations between lab and questionnaire measures of tension reduction ( $r = -.29$ ) and cognitive enhancement ( $r = -.26$ ). The multiple regression found that sexual enhancement lab-based expectancies predicted risky drinking, but questionnaire-based sexual enhancement expectancies did not (Table 6.6). However, the change in  $R^2$  between steps 2 and 3 was non-significant ( $\Delta R^2 = .02, p = .10$ ).

**Table 6.5.** Comparison between Low-risk and risky drinkers on questionnaire and lab-based measures of outcome expectancies and drinking refusal self-efficacy

	Low-risk drinkers M(SD) <i>n</i> = 140	Risky drinkers M(SD) <i>n</i> = 119	<i>t</i>	Cohen's d
Tension reduction - SC	3860.19 (2620.98)	2472.94(2007.87)	-4.82***	-0.59
Negative consequences -SC	7055.86(1969.24)	6920.16 (1674.89)	-.59	-0.07
Increased confidence - SC	3876.32(2201.68)	2510.18(1135.97)	-6.41***	-0.76
Cognitive enhancement – SC	7119.64(2056.82)	7086.42(1919.62)	-.13	-.02
Sexual enhancement - SC	2757.23(2054.91)	2205.18(1624.45)	-2.41*	-0.30
Tension reduction - SR	6.74(2.34)	8.44(2.37)	5.78***	0.72
Negative consequences -SR	30.54(8.97)	32.73(8.12)	2.05*	0.25
Increased confidence - SR	36.03(8.28)	43.91(5.40)	9.19***	1.11
Cognitive enhancement – SR	6.05(2.29)	5.47(1.80)	-2.29*	-0.28
Sexual enhancement - SR	10.72(2.44)	11.46(2.32)	2.55*	0.31
Drinking refusal self- efficacy	93.74(17.88)	79.43(16.69)	-6.62***	-0.83

*Note.* \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . SR= Self-report questionnaire; SC = Sentence completion task.

**Table 6.6.** Multiple regression predicting risky drinking

	B(95% CI)	$\beta$	<i>t</i>
Step one - Covariates			
Biological Sex	-1.71 (-3.53, 0.13)	-.12	-1.83
Reaction Time	-.05 (-0.77, 0.70)	-.01	-.14
$R^2 = 0.01, F(2, 253) = 1.68, p = .188$			
Step Two – Questionnaire-based outcome expectancies			
Tension reduction- SR	1.38 (0.79, 1.98)	.24	4.57***
Negative consequences -SR	1.10 (0.46, 1.73)	.19	3.39**
Increased confidence - SR	2.53 (1.93, 3.13)	.43	8.28***
Cognitive enhancement -SR	-1.22 (-1.85, 0.58)	-.21	-3.78***
Sexual enhancement -SR	.56 (-0.06, 1.19)	.10	1.77
$R^2 = 0.40, \Delta R^2 = .39, F(5, 248) = 31.84, p < .001$			
Step Three- lab-based outcome expectancies			
Tension reduction- SC	-.23 (-1.01, 0.54)	-.04	-.59
Negative consequences -SC	-.05 (-.81, .71)	-.01	-.13
Increased confidence - SC	-.61 (-1.53, 0.31)	.11	-1.31
Cognitive enhancement -SC	-.26 (-.86, .34)	-.05	-.86
Sexual enhancement - SC	-.70 (-1.37, -0.03)	.12	-2.07*
$R^2 = 0.42, \Delta R^2 = .02, F(5, 243) = 1.87, p = .101$			

*Note.* \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; SR = Self-report questionnaire; SC = sentence completion task.

### NSSI Model

The hypothesised model was fully saturated, CFI & TLI = 1.00, RMSEA = .00.

The direct effect between general alexithymia and NSSI was non-significant ( $\beta = 0.04$ ,

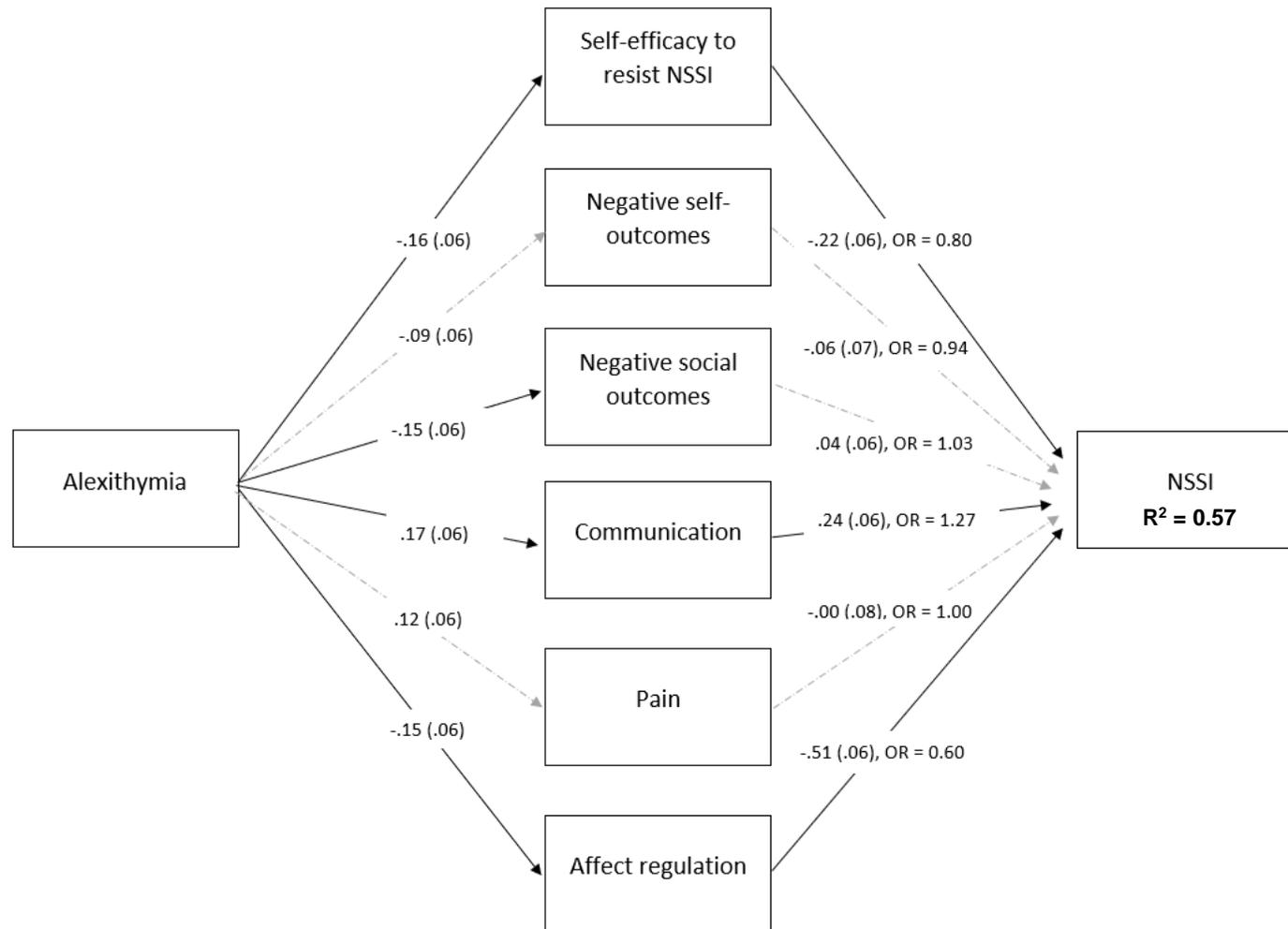
95% CI [-.07,.16], SE =.07,  $p = .520$ ). The model remained a good fit to the data after constraining this direct and all other non-significant paths, CFI = .968, TFI = .911, RMSEA = .043. Alexithymia was associated with weaker communication expectancies and self-efficacy to resist self-injury, and stronger expectations of negative social outcomes and self-beliefs and affect regulation (Figure 6.1)<sup>5</sup>. Stronger affect regulation expectancies, weaker communication expectancies, and low self-efficacy to resist self-injury were directly associated with self-injury. Alexithymia had indirect effects on NSSI through expectations of affect regulation ( $\beta = 0.08$ , 95% CI [.03,.13], SE =.03,  $p = .017$ ), communication ( $\beta = 0.04$ , 95% CI [.02,.08], SE =.02,  $p = .038$ ), and low-self-efficacy to resist NSSI ( $\beta = 0.03$ , 95% CI [.01,.07], SE =.02,  $p = .031$ ).

### **Drinking Model**

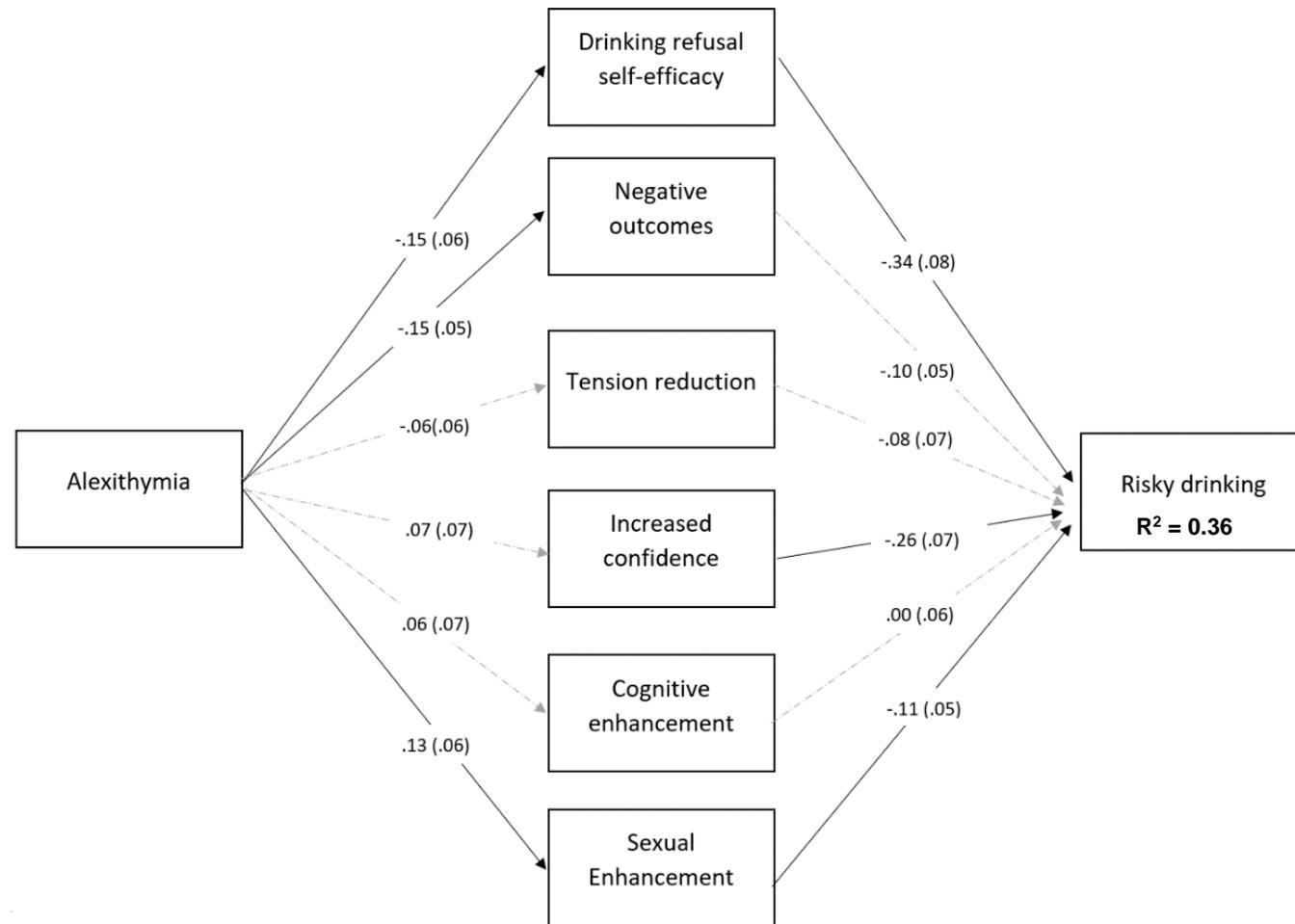
The hypothesised model was fully saturated, CFI & TLI= 1.00, RMSEA= .00. The direct effect between general alexithymia and risky drinking was non-significant ( $\beta = -0.04$ , 95% CI [-.13,.04], SE =.05,  $p = .410$ ). The model remained a good fit to the data after constraining this direct and all other non-significant paths, CFI = .959, TFI = .927, RMSEA = .036. Alexithymia was associated with stronger expectations of negative outcomes, and weaker expectations of sexual enhancement and drinking refusal self-efficacy (Figure 6.2)<sup>1</sup>. Stronger sexual enhancement and increased confidence expectancies, and weaker drinking refusal self-efficacy were directly associated with risky drinking. Alexithymia had one indirect effect on risky drinking via low drinking refusal self-efficacy ( $\beta = 0.05$ , 95% CI [.02,.10], SE =.02,  $p = .043$ ).

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<sup>5</sup> Note that expectancies are measured as reaction times. Thus, stronger expectancies are represented by faster reaction times. i.e., a negative association between an expectancy and NSSI/risky drinking indicates a stronger endorsement of that expectancy for individuals who have engaged in self-injury/risky drinking.



**Figure 6.1.** Unconstrained path model of the association between alexithymia and NSSI via behaviour-specific outcome expectancies and self-efficacy beliefs. Path values represent standardized path regression weights with standard errors in parenthesis. Non-significant paths are represented by dotted lines. *Note.* Expectancies are measured via reaction times and thus a negative association between an expectancy and NSSI/alexithymia indicates stronger endorsement of that expectancy, OR = odds ratio



**Figure 6.2.** Unconstrained path model of the association between alexithymia and risky drinking via behaviour-specific outcome expectancies and self-efficacy beliefs. Path values represent standardized path regression weights with standard errors in parenthesis. Non-significant paths are represented by dotted lines. Expectancies are measured via reaction times and thus a negative association between an expectancy and risky drinking/alexithymia indicates stronger endorsement of that expectancy. *Note*, alexithymia did not exhibit an indirect effect on risky drinking via sexual enhancement expectancies ( $\beta = -.02$ , 95% CI  $[-.04, .00]$ , SE = .01,  $p = .152$ ).

## Discussion

Young adults attending university are at heightened risk of engaging in both self-injury (Swannell et al., 2014) and risky drinking (AIHW, 2016), which can have negative impacts on their mental and physical health, highlighting the need to identify predictors of both behaviours. In the current study, we aimed to examine the indirect effects of alexithymia on both NSSI and risky drinking through lab-measured expectancies and refusal self-efficacy. Consistent with previous research (Dawkins et al., 2019; Greene et al., 2020a) we found group differences between students who do and do not engage in self-injury/risky drinking on both questionnaire and lab measures of expectancies. Further, alexithymia was indirectly related to both self-injury and risky drinking via low refusal self-efficacy. Alexithymia was indirectly related to NSSI via expectations of affect regulation and communication. Inconsistent with research measuring expectancies via questionnaires (Greene et al., 2020b), alexithymia was not indirectly related to risky drinking through behaviour-specific expectancies.

Inconsistent with previous research using the PAQ (Greene et al., 2020c) there was only a weak correlation between alexithymia and NSSI, and none between alexithymia and risky drinking. Greene et al. (2020c) utilise cut-offs (risky/low-risk drinkers) which could indicate that alexithymia is better at distinguishing between low-risk and risky drinking rather than variability in drinking, in student samples. However, the average level of alexithymia was lower in our study (75.39) compared to other nonclinical samples (81.97;  $t = 3.44$ ,  $p < .001$ ; Preece et al., 2018). The description of the study may have deterred individuals with alexithymia from participating. Specifically, people with elevated levels of alexithymia tend to avoid situations (e.g., answering questions about their emotions) where they must attend to their emotions

(Lumley, 1996), and the description informed individuals that the researchers were interested in how people express and understand their emotions.

Consistent with previous research (Greene et al., 2020b), alexithymia had an indirect effect on both behaviours through low refusal self-efficacy. Students with high levels of alexithymia may believe they are incapable of resisting engaging in self-injury or drinking in circumstances that necessitate assessing their feelings (e.g., when distressed or in social circumstances where it is necessary to communicate their emotions). However, one could argue due to the cross-sectional nature of the data that low self-efficacy may be the result of being unable to resist engaging in NSSI or risky drinking in the past and subsequently has no role in predicting future behaviour. Yet, a recent study using Ecological Sampling Methodology (ESM; Kiekens et al., 2019) found that self-efficacy to resist NSSI was a predictor of future self-injury. Similarly, a longitudinal study found low-drinking refusal self-efficacy to be a predictor of future risky drinking among youth (Connor et al., 2011). Thus, a reciprocal temporal association could exist between behaviour and refusal self-efficacy, whereby, individuals who have weak beliefs in their ability to resist NSSI/drinking are more likely to engage in NSSI/drinking in the future, which can in turn result in weaker self-efficacy beliefs.

In line with the Cognitive-Emotional Model of NSSI (Hasking et al., 2016) and previous research (Greene et al., 2020b), there was an indirect effect between alexithymia and NSSI through affect regulation expectancies. Therefore, students who have high levels of alexithymia may be engaging in NSSI to downregulate the emotions they are trying to appraise. Further, students with high levels of alexithymia anticipated that engaging in NSSI would not assist them in communicating their feelings to others. In contrast, although we did not observe an indirect effect from alexithymia to risky

drinking through increased confidence, increased confidence was the most strongly endorsed expectancy for drinking. Thus, students may be more likely to engage in NSSI to regulate emotions but consume alcohol to feel more confident.

More broadly, we found that lab-measured affect regulation expectancies are a stronger predictor of NSSI than questionnaire-measured expectancies. This result is consistent with Dawkins (2020)'s finding that lab-measured affect regulation expectancies are more sensitive than questionnaires at distinguishing between individuals with and without past/recent histories of NSSI. Similarly, lab-measured sexual enhancement expectancies predicted risky drinking in a regression, whereas expectancy questionnaires did not. Thus, it is possible that some expectancies are best assessed by questionnaire measurement (e.g., pain) and other expectancies (e.g. emotion regulation) are best assessed by objective lab measures. Specifically, expectations of physical outcomes such as pain from engaging in NSSI may be fully captured by questionnaire measurement as physical outcomes tend to be less ambiguous to describe (Lumley et al., 1996). However, psychological outcomes such as affect regulation may be better captured by less-direct lab-based measurement, as the experience of emotion may be more ambiguous and difficult to describe (Lumley et al., 1996). These expectancies are still held by the individual but cannot be as easily articulated when asked directly compared to when they are required to answer quickly in a lab-based task. Similarly, expectations that some individuals might feel uncomfortable sharing when directly asked (e.g., sexual enhancement) might be captured more effectively on lab-based measures where they have less time to process their response.

## **Implications**

Dialectical Behaviour Therapy (DBT; Linehan, 2014) is often applied by clinicians to assist people with emotion processing difficulties in appraising their feelings. Given that in the current study behaviour-specific expectancies played a salient role in the relationships between alexithymia and self-injury it may be useful for clinicians to challenge expectancies through Motivational Interviewing in conjunction with DBT. Motivational interviewing is a suggested treatment for NSSI (Kamen et al., 2009) and drinking (Miller, 1993). Through Motivational Interviewing a therapist could aim to enhance behaviour change by promoting changes in beliefs concerning what an individual anticipates from NSSI (Miller, 2013). For example, a therapist could motivate an individual to think about the long/short term negative outcomes of NSSI (e.g., feelings of shame) rather than focus on short-term positive outcomes such as emotional relief.

Behaviour-specific refusal self-efficacy played a significant role in the relationships between alexithymia and both behaviours. If a person's belief in their capacity to resist consuming alcohol or NSSI is strengthened, they may be less likely to drink or self-injure in the future (Kadden & Litt, 2011). A clinician may help achieve this through Motivational Interviewing (Miller, 2013) by first exploring the reasons why their client wants to reduce their engagement in NSSI/risky drinking and plan goals (i.e., outline situations where they may be able to resist engaging in the behaviour and how this could be achieved).

## **Limitations**

A few limitations should be considered when interpreting the findings. First, given that past research has found significant differences in the associations between the

three aspects of alexithymia and both behaviours (Greene et al., 2020a) analysing the subscales may provide more nuanced information. Future research could examine how expectancies and self-efficacy beliefs could be differentially related to the different aspects of alexithymia. Second, we measure self-injury as a dichotomous variable, thus, the subsample contains students who frequently, and students who have infrequently engaged in NSSI. Dichotomous measurement could reduce or increase the associations between alexithymia, expectancies, and self-injury. Nevertheless, the dichotomous measurement of NSSI provides important information on the differences in thoughts and beliefs between individuals who have and have not self-injured. Third, although there are some clear overlaps in expectancies between the NEQ and DEQ (e.g., tension reduction/affect regulation) there are some notable differences between measures (e.g., pain expectancies/sexual enhancement). These differences can limit the comparisons made across behaviours, and future research could assess the same expectancy sets across NSSI and risky drinking.

### **Conclusion**

Our findings highlight an important role for refusal self-efficacy in the relationships between alexithymia and both NSSI and risky drinking. Thus, students with alexithymia may believe they cannot avoid engaging in NSSI or risky drinking at times where they are required to focus attention on and/or identify/describe their emotions. Further, students with high levels of alexithymia could self-injure to help regulate the emotions they are having difficulties processing. Whereas students may drink with the expectation that it will increase their confidence. Theoretically, these findings suggest that the anticipated outcomes of NSSI and drinking may be diverse among students. Further, the results highlight the importance of considering a

multimethod measurement of outcome expectancies. Notably, the current results support interventions that challenge behaviour-specific beliefs.

## **Chapter 7**

### **Introduction to General Discussion**

In this final chapter, I restate the aims of the thesis, provide a summary of the findings, and synthesise the key results across studies. Further, I discuss the theoretical, methodological, clinical, and educational implications of the study program. I outline the limitations of the research program and avenues for future research before providing a concluding statement.

#### **Aims of the Thesis**

The primary aim of this thesis was to examine and compare the associations between alexithymia and both NSSI and risky drinking among university students by exploring the roles of cognitive-emotional variables, including behaviour-specific thoughts and beliefs, and biological sex. First, does alexithymia and its subcomponents have similar or different relationships with both NSSI and risky drinking? Second, do biological sex and experiential avoidance moderate both associations? Third, are the associations between alexithymia and both NSSI and risky drinking explained by similar behaviour-specific beliefs (i.e., outcome expectancies and self-efficacy)? The aims of this thesis were addressed using several designs including meta-analysis, psychometric analysis of self-report measures, and tests of associations using both survey and lab-based assessments. By converging the evidence across the five studies contained in this thesis I address these aims.

#### **Summary of Findings**

In Study 1 through a meta-analysis, I found that general alexithymia, difficulties identifying feelings, and difficulties describing feelings were related to both self-injury and risky drinking. But all three associations appeared weaker for risky drinking than

NSSI. Conversely, a propensity to focus on the external environment as opposed to internal thoughts and feelings was associated with drinking in a risky fashion but not self-injury. There was also some indication that the relationship between general alexithymia and self-injury was stronger for women than men. The findings of Study 2 were consistent with Study 1, with students who had difficulties identifying their feelings being more likely to have self-injured than consumed alcohol in a risky pattern and students who reported a tendency to focus externally being more likely to have reported risky drinking than self-injury. Men but not women who had difficulties describing their feelings had a higher probability of consuming alcohol in a risky fashion than engaging in self-injury. Although there was some evidence that an individual's level of experiential avoidance may have utility in distinguishing between NSSI and risky drinking, experiential avoidance only interacted with the unreliable externally orientated thinking subscale of the Toronto Alexithymia Scale (TAS-20) to predict NSSI and risky drinking (Study 2).

The results of Study 3 highlighted that the TAS-20 and the Perth Alexithymia Questionnaire (PAQ) can be used to accurately determine differences in alexithymia between students who do and who do not engage in emotional regulatory behaviours (i.e., NSSI and risky drinking). However, the Perth questionnaire had a more reliable externally orientated thinking subscale than the Toronto questionnaire. Further, utilising the PAQ's valence-specific measurement of alexithymia allowed for a more nuanced understanding of the associations between alexithymia and both behaviours. Specifically, individuals who engaged in NSSI and/or risky drinking had considerably more issues identifying and describing negative feelings than positive feelings. The value of considering valence-specific alexithymia was further highlighted in Study 4, with the indirect associations between alexithymia and both behaviours via behaviour-

specific thoughts and beliefs differing across valence. Specifically, students who had problems identifying and describing negative feelings anticipated affect regulation from self-injury, and anticipated increased confidence from drinking, both of which are associated with an increased likelihood of engaging in self-injury and risky drinking, respectively. Whereas students who had problems identifying and describing positive emotions, anticipated that self-injury would not be painful, and anticipated that engaging in risky drinking would have negative consequences, both of which were associated with an increased likelihood of engaging in NSSI and risky drinking, respectively. Biological sex did not moderate any of the direct or indirect relationships. Similar results were found for the association between alexithymia and NSSI in Study 5, however, there were no indirect effects from alexithymia through drinking expectancies (as measured by lab-based tasks) to risky drinking. Yet, significant indirect effects were found from alexithymia to both NSSI and risky drinking through weak behaviour-specific refusal self-efficacy (Studies 4 and 5).

### **Comparing the Associations and Theoretical Implications**

Converging evidence across all studies suggests that although alexithymia is associated with both NSSI and risky drinking there are some key differences. At a basic level, the direct relationships between the subcomponents of alexithymia and both NSSI and risky drinking differ among university students. Specifically, there were positive relationships between general alexithymia, and difficulties identifying and describing feelings and both self-injury and risky drinking (Studies 1-4). Yet, these associations appeared stronger for NSSI, with students who had greater difficulties identifying and describing their feelings being more likely to engage in self-injury than risky drinking. Conversely, individuals who consumed alcohol in a risky pattern were more likely to think and focus externally than individuals who engaged in NSSI. Differences in

endorsements of drinking motives (Martins et al., 2018) compared to self-injury functions (Taylor et al., 2018), among university students, might explain the stronger relationships between difficulties identifying and describing feelings and NSSI than risky drinking. Whilst reasons for self-injury are often internally motivated (i.e., emotion regulatory; Taylor et al., 2018), reasons for drinking are typically socially motivated (e.g., fitting in with others) among students (Kuntsche, et al., 2005). An individual consuming alcohol for social reasons may not have as high levels of alexithymia as someone consuming alcohol to regulate their emotions. Specifically, Cooper et al. (1995) has suggested that internal motivations to drink (e.g., escaping or avoiding feelings one has difficulties appraising; alexithymia) are crucial for coping but these internal influences are not as important for socially or conformity motivated alcohol consumption. External motivations for drinking such as avoiding social rejection or to enjoy a party (prominent motives for drinking among students; Kuntsche et al., 2005) are key for socially or conformity motivated alcohol consumption (Cooper et al., 1995).

A similar explanation could be argued for the association that exists between externally orientated thinking and risky drinking but not history of NSSI (Studies 1-3; Greene et al., 2020). Theoretically, students who focus on the external world may hold more external motivations for drinking such as gaining social rewards or to fit in with a group of other university students (Cooper et al., 1995). Further, students who focus externally are unlikely to focus on internal motivations of drinking such as drinking to cope with negative emotions (Cooper et al., 1995). The notion that overall students typically anticipate different outcomes/functions from NSSI than risky drinking is supported in later studies of this thesis (Studies 4 and 5) which are discussed below.

### ***The Role of Outcome Expectancies***

In the NSSI field models used to explain engagement in NSSI have tended to focus on the regulation of emotional experiences and have overlooked behaviour-specific thoughts and beliefs/cognitions (e.g., Emotional Cascade Theory; Selby et al., 2008; Experiential Avoidance Model; Chapman et al., 2006). Bandura (1986, 1997) proposed through Social Cognitive Theory that anticipated outcomes of a behaviour (outcome expectancies) and behaviour-specific self-efficacy beliefs (refusal self-efficacy) are two factors that determine whether or not an individual engages in a specific behaviour. Previous research has highlighted a role for behaviour-specific cognitions in predicting both risky drinking (e.g., Hasking & Oei, 2007) and NSSI (e.g., Dawkins et al., 2018). However, as noted previously, the Cognitive-Emotional Model of NSSI (Hasking et al., 2016) and the Motivational Model of Alcohol Use (Cox & Klinger, 1988) combine emotion focussed theories and theories about behaviour-specific thoughts and beliefs to predict/explain engagement in NSSI and risky drinking, respectively. My thesis builds on past research investigating the role of behaviour specific beliefs in predicting both behaviours (e.g., Hasking, 2017) by investigating the role of behaviour-specific beliefs in the associations between emotional difficulties (alexithymia) and both NSSI and risky drinking. I found support for the roles of behaviour-specific beliefs in the associations between alexithymia and both behaviours in Studies 4 and 5. Further, I found that the indirect effects from alexithymia through outcome expectancies to NSSI and risky drinking were different between behaviours and across the valence of emotion students had difficulties processing (Study 4).

Specifically, when considering difficulties identifying and describing positive feelings there may be some similarities between NSSI and risky drinking. Students who have problems processing positive feelings may drink alcohol or self-injure to entice their focus away from emotions they find difficult to appraise onto the physical

consequences of NSSI/risky drinking (Lumley et al., 1996). For example, physical sensations from engaging in NSSI or intoxication/physical sensations associated with increased anger/aggression from drinking. Thus, it is possible that students who have difficulties appraising positive emotions are engaging in NSSI/risky drinking for anti-dissociation purposes (i.e., to not feel numb; Cooper et al., 1994; Cox & Klinger, 1998; Klonsky & Glenn, 2008). Yet, there were some key differences when considering difficulties identifying and describing negative feelings. While students who have difficulties identifying and describing negative feelings may engage in NSSI because they believe self-injury will help them to regulate negative feelings, they might drink alcohol in a risky fashion because they believe it will give them more confidence expressing negative feelings. Therefore, the results of my PhD work indicate that there might be some anticipated differences in the motives/functions of NSSI and risky drinking, particularly for students who have difficulties appraising negative feelings. While students may anticipate emotional-related functions from both behaviours, students may engage in self-injury to initiate, maintain, or modify emotional experiences (in other words to regulate their negative emotions), but individuals may be using the disinhibiting properties of alcohol to help to express their emotions to others. The results of Studies 4 and 5 of this thesis extend on previous work and offer support for the roles of NSSI and drinking specific cognitions (i.e., expectancies and self-efficacy beliefs) in the associations between alexithymia and engagement in NSSI and risky drinking. Further, these results support the Cognitive-Emotional Model of NSSI (Hasking et al., 2016) and The Motivational Model of Alcohol Use (Cox & Klinger, 1988). However, from perspectives of both model's other behaviour-specific factors such as functions and motives should be considered (Cox & Klinger, 1988; Hasking et al., 2016).

The results of the final two studies of this thesis open avenues to explore the role of NSSI and drinking functions and motives in the context of alexithymia. Specifically, how NSSI and drinking functions and motives differ across individuals with high and low levels of alexithymia. Also, how these motives or functions might influence whether a specific outcome from engaging in a behaviour is perceived as desirable or undesirable (e.g., pain). For example, anti-dissociation motives and functions of NSSI and drinking may be more strongly endorsed by individuals who have high levels of alexithymia compared to individuals who have lower levels of alexithymia. Specifically, people who are emotionally stoic (high levels of alexithymia) could be more motivated to engage in self-injury or risky drinking to “feel something” than individuals who are able to confidently feel and comprehend their emotions (low levels of alexithymia). Thus, individuals who are motivated to engage in NSSI or risky drinking for anti-dissociation purposes may anticipate self-injury/risky drinking to result in physical outcomes (e.g., pain or hangovers) and perceive these as positive outcomes, thus increasing their likelihood of engaging in NSSI/risky drinking. Yet, these are suggestions and cannot be confirmed without assessing NSSI and risky drinking motives and functions. Theoretically, understanding what expectancies are perceived as desirable for people with varying levels of alexithymia and potential associations with both motives and functions of NSSI/risky drinking would provide a more nuanced understanding of the Cognitive-Emotional Model of NSSI (Hasking et al., 2017) and the Motivational Model of Alcohol Use (Cox & Klinger, 1988).

However, there is a tendency in the NSSI literature to explore functions and not motives of NSSI (Klonsky & Glenn, 2008). Conversely, in the drinking literature motives and not functions are generally examined (Cooper, 1994). For some individuals, the motivation for engaging in a behaviour may be different than the

function it serves. For example, a university student may be motivated to drink to enjoy themselves at a party (social motives) but once they drink at the party, they may find that alcohol relieves tension (function; Merrill et al., 2014). Similarly, an individual may be motivated to self-injure to communicate their distress to others but find that it helps them to regulate emotions (function; Muehlenkamp et al., 2012). By examining both motives and functions of NSSI and risky drinking this could provide a better understanding of the theoretical underpinnings of both behaviours in university students. In the context of alexithymia, it is possible that a university student with high levels of alexithymia might be motivated to drink to better express their emotions in social situations but finds when consuming alcohol that drinking helps them to escape the feelings, they are having difficulties appraising. Future research could explore how motives and functions of NSSI, and risky drinking differ in university students with varying levels of alexithymia. Additionally, research could compare the role of alexithymia and behaviour specific expectancies in university students motivated to drink/engage in NSSI for different reasons (e.g., anti-dissociation vs. communication vs. emotion regulation).

A notable theoretical implication of the current research program is to be more cautious when applying theories of alcohol use to NSSI. Initially, many models designed to predict NSSI or theories to explain engagement in NSSI drew from theories predicting/explaining alcohol use. For example, drinking to cope with negative affect and tension (e.g., Cooper et al., 1995) is often applied to theories of NSSI (e.g., Experiential Avoidance Model of Self-Harm; Chapman et al., 2006). While we did observe relationships between alexithymia and both behaviours, we did note that there are some key differences in these associations. Although emotion played a role in both behaviours, a student who has difficulties appraising negative emotions may drink

alcohol to increase confidence in their expression of emotions, but they may engage in self-injury to relieve negative emotions. While the alcohol literature is a good starting point, the findings highlight the importance of comparing behaviours and suggest significant differences in expectations of engaging in NSSI and risky drinking among university students. Thus, when exploring emotion regulation models of both behaviours it may be more accurate to compare groups of individuals based on function/motives rather than purely on behaviour engagement.

### ***The Role of Self-Efficacy Beliefs***

I highlighted a similar role for behaviour-specific refusal self-efficacy in both associations in later studies of this PhD. Specifically, students with elevated levels of alexithymia might think they cannot resist engaging in self-injury or drinking alcohol under conditions that entail them to put attention on and/or consider their emotions. Thus, in support of Social Cognitive Theory (Bandura, 1997), students who have difficulties processing emotions may have difficulties not engaging in NSSI/risky drinking when they believe these behaviours will influence events (e.g., being able to express their feelings to others at a party) and their internal experiences. However, behaviour-specific refusal self-efficacy is believed to be situation-specific rather than resisting engaging in the behaviour in general. Due to power and measurement restraints (i.e., only a short measure of self-efficacy to resist NSSI was available at the time of data collection) I measured behaviour-specific refusal self-efficacy as a general construct. However, an individual who has high levels of alexithymia might have different beliefs about behaviour engagement across varying situations (Bandura, 1997, 1989). For example, they may have stronger beliefs in their ability to resist engaging in NSSI in social situations (e.g., when in class) but weak beliefs in their ability to resist NSSI in circumstances when they are experiencing heightened distress. The current

research program opens up avenues to explore context-specific refusal self-efficacy among individuals with elevated levels of alexithymia . By assessing context-specific refusal self-efficacy, high-risk situations for individuals with elevated levels of alexithymia could be identified and possibly targeted in therapy.

### ***The Role of Outcome Expectancies in Theories of NSSI***

Considering the results of the current research program, behaviour-specific outcome expectancies could be implemented into models of NSSI and risky drinking. Motivational theories of drinking suggest that the reasons for consuming alcohol are informed by the anticipated outcomes of drinking (Cox & Klinger, 1988). In support, Kuntsche et al. (2007) found that outcome expectancies predicted drinking motives which in turn predicted risky drinking. Considering the results of the current research program, NSSI-specific outcome expectancies should also be included in motivational/functional models of NSSI (e.g., The Four-Function Model of NSSI; Nock & Prinstein, 2004). Specific-outcome expectancies could have differential associations with different functions of NSSI. For example, expectations of pain might be a deterrent from engaging in NSSI for individuals looking for behaviours/strategies to regulate their emotions but could be an enticement for individuals wanting to ‘feel something’ (anti-dissociation functions/motives of NSSI). Future research could test the utility of including outcome expectancies in The Four-Function Model of NSSI.

Emotion regulatory models of NSSI and risky drinking typically do not consider the role of behaviour-specific outcome expectancies (e.g., Chapman et al., 2006). Considering the results of the current research program, it could be beneficial to implement a role for behaviour-specific outcome expectancies in the Experiential Avoidance Model of Deliberate Self-Harm (Chapman et al., 2006). Chapman et al.

(2006) suggest that engagement in self-injury is usually maintained via negative reinforcement by providing an avenue to avoid or escape from adverse emotional states. Furthermore, Chapman and colleagues state that other behaviours such as alcohol use and restrictive eating are also engaged in to escape or avoid adverse emotional states (Chapman et al., 2006). The association between emotional distress and emotional regulatory behaviours via experiential avoidance could be influenced by outcome expectancies. Theoretically, an individual experiencing emotional distress will be more likely to engage in NSSI and/or consume alcohol in a risky pattern if they anticipate that the behaviour will help them to escape/regulate the adverse emotional state. Future research could explore the role of outcome expectancies in the context of the Experiential Avoidance Model.

### ***The Role of Experiential Avoidance***

A component of this thesis was to explore the role of experiential avoidance in the associations between alexithymia and both behaviours (Study 2) and although experiential avoidance may have utility in distinguishing between individuals who engage in NSSI from individuals who engage in risky drinking, this was only in interaction with the unreliable externally orientated thinking subscale of the TAS-20. Given that experiential avoidance was not a key focus of this PhD, I moved onto exploring the roles of behaviour-specific cognitions in the final two studies. However, there is an avenue for future research investigating the interaction between alexithymia and experiential avoidance. Using pre-existing data, I explored experiential avoidance as a unidimensional trait (BEAQ; Gámez et al., 2014), but experiential avoidance is generally considered to have multiple dimensions (Gámez et al., 2011). Alexithymia may interact differently with the diverse facets of experiential avoidance (e.g., behavioural avoidance, distraction, and suppression). For example, individuals who

have difficulties identifying and describing feelings, and a tendency to suppress internal feelings may have a greater tendency to engage in NSSI/risky drinking as a strategy to suppress the feelings they are having difficulties to identify and describe. Conversely, a tendency to not suppress internal feelings may be a protective factor for individuals with high levels of alexithymia. Exploring the interactions between the facets of alexithymia and experiential avoidance could provide a more detailed understanding of how combinations of alexithymia and experiential avoidance could predict and differentiate NSSI and risky drinking.

### *Sex Differences*

A significant component of this thesis was aimed at assessing the impact biological sex had on the associations between alexithymia and both NSSI and risky drinking. However, sex differences were minimal with the association between general alexithymia and NSSI being possibly stronger for women (Study 1) and men, but not women, who have difficulties describing feelings having higher odds of engaging in risky drinking than NSSI (Study 2). However, sex differences were inconsistent across studies in this PhD and the wider literature. Further, these differences were not explained by sex differences in behaviour-specific outcome expectancies (Study 4). Thus, a student's biological sex does not seem to play a crucial role in the associations between alexithymia and both behaviours.

Sex differences found in studies included in this PhD and more generally in the literature may be indicative of masculine/feminine traits rather than biological sex itself. Individuals who have been raised according to traditional models of masculinity, where they are encouraged to restrict their expression of emotions, are likely to have high levels of alexithymia (Levant, 1992; Levant et al., 2009). Specifically, if an individual is

discouraged or punished as a child from expressing and discussing their feelings by others (e.g., parents and teachers), they will not develop the vocabulary for or an awareness for their feelings as they reach adulthood (Levant et al., 1992; Levant et al., 2009). Although a misconception, NSSI is often believed to be a feminine behaviour (Lewis et al., 2014) that only young women engage in. This misconception is likely due to consumption of online content and other media, with many websites stating that primarily women self-injure (Lewis et al., 2014) and with movies and television programs more likely to have young female characters engage in NSSI (Whitlock et al., 2009) than men or older women. Therefore, individuals who strongly endorse traditional masculine traits may engage in risky drinking instead of NSSI, because drinking is typically considered a more masculine behaviour (De Visser et al., 2007). Future research could study whether there are differences in the associations between alexithymia and both behaviours by investigating the roles of masculine and feminine traits.

## **Implications and Avenues for Future Research**

### **Methodological Implications**

In Study 3 I found that the Toronto Alexithymia Scale (TAS-20) and the Perth Alexithymia Questionnaire (PAQ) can both be used to accurately assess alexithymia among individuals who do and individuals who do not self-injure and drink in a risky pattern in young adult samples. Thus, we can have some confidence that differences in alexithymia based on the TAS-20 and PAQ are true differences in alexithymia and not artificial group differences due to differential interpretations of scale items. Importantly, the results of Study 3 give us confidence in studies included in this PhD and the wider literature measuring alexithymia in the context of NSSI and drinking populations.

Previous work investigating the associations between alexithymia and dysregulated behaviours has not considered the role of valence-specific alexithymia. Studies 3 and 4 of this thesis emphasise the value of measuring valence-specific alexithymia in the context of NSSI and risky drinking. Specifically, compared to individuals who had not self-injured or consumed alcohol in a risky fashion, individuals who had engaged in either of these behaviours had considerably more difficulties appraising negative feelings than positive feelings. Further, distinguishable behaviour-specific outcome expectancies were associated with difficulties appraising positive feelings and difficulties appraising negative feelings. Thus, it appears that positive and negative valenced alexithymia play distinguishable roles in predicting engagement in NSSI and risky drinking and are associated with different anticipated outcomes for these behaviours. Consequently, valence-specific interventions might be needed to address difficulties in appraising negative emotions and difficulties appraising positive emotions. However, further research is needed investigating the role of valence-specific alexithymia (particularly difficulties appraising positive emotions) in predicting dysregulated behaviours.

One possible avenue for future research is investigating the interaction between valence-specific alexithymia and positive and negative affect, which are significant predictors of dysregulated behaviours (Hasking et al., 2017; Weiss et al., 2018). Specifically, positive, and negative affect both explain unique variance in NSSI (Hasking et al., 2017; Slabbert et al., 2020) and risky drinking (Weiss et al., 2018) suggesting that positive and negative affect are distinguishable constructs and not simply opposites. High levels of positive affect appear to be protective against engaging in NSSI even in the presence of elevated negative affect (Hasking et al., 2017). Also, increasing an individual's levels of positive affect has been found to have a positive

impact on their psychological wellbeing (Cheng, 2006; Yamasaki & Uchida, 2016). Yet, as high levels of positive affect are associated with addiction, mania, and bipolar disorders, experiencing extreme positive states may be adverse for some people (Gruber, 2011). Some individuals might engage in dysregulated behaviours to not only regulate negative emotions but also to decrease positive emotions (Jenkins & Schmitz, 2012). Theoretically, individuals who have difficulties identifying and describing positive emotions might perceive intense positive states as aversive and engage in behaviours such as NSSI and risky drinking to regulate intense positive emotion. Thus, enhancing a person's ability to identify and describe positive feelings might be a key factor in increasing levels of positive affect or perceiving positive states as enjoyable. However, more valence-specific research is required to assess the interplay between affect and alexithymia in predicting NSSI and risky drinking. Future research could investigate the impact of increasing an individual's capacity to identify and describe both positive and negative emotions on their overall level of positive and negative affect and how this in turn is associated with engagement in dysregulated behaviours.

Results from Study 5 suggesting that some outcome expectancies (e.g., affect regulation and sexual enhancement) may be more accurately captured by lab-based measures, whereas other expectancies (e.g., increased confidence) may be more accurately captured by questionnaires is a key methodological implication of the current research program. These results imply that a multi-method approach to measuring behaviour-specific outcome expectancies may be valuable in the context of NSSI and risky drinking. Further, the measurement utility of expectancies questionnaires is supported, as the majority of the questionnaire-measured expectancies being as equally or more strongly related to alexithymia and NSSI/risky drinking than/as lab-measured expectancies (Study 5). Considering that generally survey studies are less resource and

time consuming than lab-based studies these results justify the use of expectancy questionnaires to measure expectancies, especially when there are time and cost restraints. However, both the sentence-completion tasks and self-report questionnaires tap into an individuals' explicit beliefs about self-injury and drinking. Answering questions about explicit beliefs requires an individual to have a degree of insight into their own thoughts and beliefs (Marissen et al., 2005). In comparison, implicit expectancies are generally fast, and require little insight as the individual is generally unaware of what is being measured (Wiers & Stacy, 2006). Additionally, implicit, and explicit expectancies may measure different aspects of outcome expectancies and offer unique variance in predicting behavioural outcomes such as NSSI and risky drinking (Reich et al., 2010). Measuring implicit expectancies may be particularly valuable in determining the anticipated outcomes of NSSI and risky drinking among people with a tendency to focus externally rather than internally. Specifically, people who possess externally orientated thinking styles usually lack insight into their internal thoughts and beliefs and may not be able to accurately answer questionnaires about personal thoughts and beliefs (Preece et al., 2017). Replication of studies 4 and 5 using/developing implicit measures of outcome expectancies (e.g., Implicit Association Tests or Cognitive Bias Tests) that do not require a strong degree of insight (Wiers & Stacy, 2006) is warranted.

### **Clinical Implications**

Individuals who have elevated levels of alexithymia tend to have difficulties successfully engaging in psychological interventions, predominantly emotion-focused interventions where it is necessary for an individual to have insight into their emotions (Allemand et al., 2013). However, there is evidence that behaviour-focused therapies are more successful in treating alcohol use disorders among individuals with elevated

levels of alexithymia (Rufer et al., 2010). Given, our findings that behaviour-specific thoughts and beliefs (i.e., expectancies and self-efficacy beliefs) play key roles in the associations between alexithymia and both NSSI and risky drinking (Studies 4 and 5), there may be some utility in focusing on challenging behaviour-specific beliefs.

Challenging behaviour-specific thoughts and beliefs brings the focus onto the behaviour rather than focusing solely on understanding emotional experiences. Short-term positive outcomes of NSSI and risky drinking could be devalued by the therapist, whereas the therapist could emphasise long and short-term consequences of NSSI/risky drinking (Scott-Sheldon et al., 2012). Specifically, for NSSI, a therapist could acknowledge that self-injury may provide emotional relief in the short term but emphasise that engaging in self-injury can lead to elevated levels of negative affect in the long term and negative self-beliefs (e.g., guilt) and social outcomes. Likewise, for risky drinking, a therapist could acknowledge that alcohol can increase confidence and emotional expression in the short-term but emphasise that drinking can lead to negative short-term outcomes such as hangovers and heightened levels of negative affect in the long-term.

Encouraging individuals to focus on negative long-term and short-term outcomes may be useful for them to reform their expectations about a specific behaviour (McEvoy et al., 2017).

Further, if an individual's belief in their ability to avoid consuming alcohol or engaging in self-injury is strengthened, they may be less likely to engage in NSSI/risky drinking in the future. However, Lewis and Hasking (2019) noted that purely focusing on the cessation of a behaviour as a marker for recovery dismisses other factors relate to recovery and is impractical. A clinician should highlight to their client that recovery is not a linear process, and that the client will likely have relapses in their behaviour. If an individual measures their success based purely on not engaging in NSSI/risky drinking

this can leave them feeling unmotivated if they do engage in these behaviours which in turn may weaken their behaviour-specific self-efficacy beliefs (Lewis & Hasking, 2019). Yet, if an individual is able to accept that relapse is part of the recovery process, it will give them the opportunity to focus on other parts of recovery beyond behaviour cessation. For example, if a clinician focuses on an individual's ability to resist engaging in NSSI/risky drinking, it will allow an individual to develop short-term goals and increase feelings of accomplishment during treatment while increasing behaviour-specific self-efficacy (Muehlenkamp, 2006).

There are several factors which may impact an individual's self-efficacy beliefs; their own behavioural experiences, verbal encouragement, or discouragement from other individuals, witnessing other individuals performing the behaviour, imagined behaviour engagement, and their emotional state or mood at the time (Bandura, 1997). One method a clinician could use to help an individual strengthen their belief in their ability to resist engaging in NSSI or risky drinking is by encouraging the individual to think of past situations where they have resisted engaging in NSSI/risky drinking. This could enhance their confidence in resisting engaging in the specific behaviour in the future. Furthermore, a clinician could ask the client to imagine a distressing situation where they resist engaging in self-injury or drinking (Kress et al., 2013). A clinician may help the individual rescript the imagined distressing situation, by focusing on strategies the individual could use "overcome" the situation (Blackwell, 2019). Imagined success in overcoming a distressing situation can increase the individual's confidence in their ability to resist engaging in self-injury and/or drinking when experiencing similar situations (Blackwell, 2019).

Yet, given that individuals may switch between behaviours when underlying emotional difficulties are not addressed (Garke et al., 2019; Sauer-Zavala et al., 2017),

treating alexithymia itself is also important. Thus, once an individual is engaged in therapy, the clinician may address the underlying emotional processing issues which are characteristic of high levels of alexithymia. However, considering that we found some differences in the associations between alexithymia and both behaviours, emotion-focused therapies may have to be tailored slightly differently for NSSI and risky drinking. Across studies, our findings highlight that focusing on increasing an individual's capacity to appraise both positive and negative emotions may be key to reduce the incidence of NSSI and risky drinking. A clinician could help improve an individual's emotional processing skills by adapting Dialectical Behaviour Therapy (DBT; Linehan, 2014). In DBT, a person initially learns to identify, accept, and express their thoughts, feelings, and physical sensations. For example, a clinician might complete emotion mapping activities, whereby the individual is asked to think about a strong emotion (e.g., anger) and identify the areas of the body where they might feel the specific emotion (e.g., feel face flushing, and tension from muscles; Edward et al., 2018). As people with elevated levels of alexithymia are inclined to over-focus on bodily sensations, this exercise might be particularly useful to connect these sensations to emotions (Edward et al., 2018; Linehan, 2014). Recent research (Edwards et al., 2018) found that emotion mapping activities improved abilities in identifying and describing emotions for individuals with high levels of alexithymia.

Additionally, for individuals seeking therapy for alcohol use, it may also be beneficial to develop strategies for drawing one's attention away from the external world onto their personal thoughts and feelings. This could be implemented clinically by building emotional acceptance through Acceptance Commitment Therapy (ACT; Hayes et al., 2016). Initially, an individual may practice accepting adverse emotional experiences rather than placing their attention externally. Next, an individual could

develop behaviour-specific goals and alternative strategies to regulate their emotions for when they feel the impulse to move their focus away from internal thoughts and feelings onto the external world (Hayes et al., 2016). These first and second stages combined give the individual opportunity to accept emotional difficulties and therefore reduce the need to engage in risky drinking. Considering that across studies externally orientated thinking was not a unique predictor of NSSI it may not be helpful to focus on developing these skills for individuals who are seeking treatment for NSSI.

### **Education-Based Implications**

Starting university is a stressful time in the life of a young adult with new financial, and personal responsibilities, and living away from the family home for the first time (Arnett, 1997; Bewick et al., 2010). Many students experience increased emotional distress (Arnett, 1997; Bewick et al., 2010) putting them at risk of engaging in dysregulated behaviours (Hamza & Willoughby, 2014; Poznyak & Rekve, 2015) . The results of the current research program indicate that individuals who have difficulties appraising adverse feelings may be inclined to engage in NSSI to regulate their feelings or consume alcohol to articulate their feelings. Thus, workshops that focus on managing and expressing emotions (e.g., Schoeps et al., 2019; Kuk et al., 2019; Pool et al., 2012) may be beneficial for new university students before they begin engaging in NSSI or risky drinking. These workshops typically involve modules on understanding one's emotions and developing skills in expression, both of which could be beneficial for students who have emotion processing difficulties. However, for emotion-focused workshops to be successful they should be readily available and promoted to first-year university students (Schoeps et al., 2019; Kuk et al., 2019; Pool et al., 2012).

A comprehensive approach involving students and staff is also important in addressing self-injury and risky drinking on university campuses (Lewis et al., 2019; Neighbors et al., 2007). Availability of mental health literacy for students and staff in regard to NSSI and risky drinking is important (Lewis et al., 2019; Neighbors et al., 2007). Information could include why students engage in NSSI and risky drinking, and how to effectively respond to a student or a friend who is engaging in NSSI or risky drinking. For example, outlining ways to approach a friend who you are concerned is drinking alcohol as a way to help them to express emotions. Or how to respond to a friend or a student who is engaging in NSSI to avoid intense emotional situations (e.g., exam stress or relationship problems; Lewis et al., 2019).

Recently, the WHO has implemented The World Health Organization World Mental Health International College Student Survey (WMH-ICS) as a way of screening for mental health problems in early university and providing cost-effect internet-based interventions and preventions for at-risk students (Cuijpers et al., 2019). Currently, the surveys assess six disorders: substance and alcohol use disorders, depressive disorder, hypomania/mania, panic disorder and generalized anxiety disorder. A similar screening system could be implemented for behaviours such as NSSI and risky drinking.

Considering that there may be diverse reasons for engaging in NSSI and risky drinking among university students, it would also be important to consider key risk factors (e.g., alexithymia) as well as behaviour-specific thoughts and beliefs. Considering, key risk and behaviour-specific factors is important to ensure that students are directed to interventions and preventions that are relevant for them. For example, an individual who has difficulties processing their emotions and believes that drinking will regulate these emotions may be directed to an online intervention that focuses on managing emotions. Yet, a student who is drinking in a risky pattern for social reasons may not

benefit from an emotion focused intervention but instead an intervention that focuses on challenging social norms of drinking among university students (e.g., Bewick et al., 2008).

### **Limitations and Ideas for Future Research**

I addressed several limitations of the research program in each study (Chapters 2 through 6), and these include but are not limited to the cross-sectional nature of data and the limitations of self-report data. As such I do not note study specific limitations again here.

A key rationale for comparing behaviours is the idea of behaviour-shift/symptom-shift whereby an individual stops engaging in one behaviour (e.g., NSSI) only to start engaging in another (e.g., drinking), particularly when underlying emotional difficulties are not addressed (Garke et al., 2019). Although cross-sectional data (used throughout this thesis) is a good starting point for comparing behaviours across emotional-cognitive variables (e.g., behaviour-specific thoughts and beliefs and alexithymia) it does not allow us to determine if/when a behaviour/symptom-shift occurs. Also, using cross-sectional data we are unable to determine how changes in treatments, emotion processing (e.g., alexithymia), and behaviour-specific thoughts and beliefs coincide with reduction, shifts between, and cessation of behaviour(s). Future research could use longitudinal designs (e.g., Ecological Momentary Assessment (EMA)) to determine if/what changes in: alexithymia, behaviour-specific thoughts and beliefs, and treatment might contribute to individuals shifting between behaviours. Variables associated with behaviour shift could be targeted in treatment interventions to decrease the chance of individuals switching between behaviours.

University students are a group of high interest regarding self-injury and risky drinking due to the increased prevalence of both behaviours in students (Swannell et al., 2014) and the negative psychological (Hamza & Willoughby, 2014; Poznyak & Rekve, 2015) and educational outcomes (Kiekens et al., 2016) associated with both behaviours. However, other populations such as adolescents and clinical populations also have high prevalence rates of self-injury and risky drinking (AHIW, 2016; Swannell et al., 2014), and the research into the role of alexithymia and behaviour-specific cognitions are also warranted in these populations. Further, for practical reasons I focused on only NSSI and risky drinking in the current research program but several eating disorders (e.g., Bulimia & Anorexia Nervosa; Westwood et al., 2017) and other behaviours such as risky cannabis use (Lyvers, & Jamieson et al., 2013 ) are also associated with alexithymia. Considering that students may use multiple methods to alter or help them to express their emotions, future research exploring alexithymia or emotional difficulties, may consider a range of dysregulated behaviours and how these behaviours may be engaged in for similar or different reasons.

The focus of the current research program was to compare the associations between alexithymia and both NSSI and risky drinking. However, future research could move away from cross-sectional methodologies onto intervention-based research to test the Cognitive-Emotional Model of NSSI (Hasking et al., 2016) and the Motivational Model of Alcohol Use (Cox & Klinger, 1998). Above I stated that individuals with alexithymia tend not to respond well to emotion-focused treatments and suggest behaviour-specific expectancy challenges and self-efficacy strengthening strategies may be beneficial to treat NSSI and risky drinking for individuals with alexithymia. After the individual is engaged emotion-focused therapies may be implicated. Future research

could explore the efficacy of this approach for treating dysregulated behaviours for individuals with high levels of alexithymia.

### **Final Conclusion**

Whilst alexithymia is significantly associated with both self-injury and risky drinking there are some key differences in both associations. Perhaps, most importantly the results imply that the anticipated outcomes of self-injury and risky drinking differ in the context of alexithymia (specifically negative-valanced alexithymia). While students who have difficulties identifying and describing negative feelings may engage in self-injury because they believe it will help them to regulate negative feelings, they may drink because they believe it will give them more confidence in articulating their emotions in social situations. Therefore, the results of my PhD suggest that there may be some differences in the functions and motives between self-injury and risky drinking, particularly for students who have difficulties identifying and describing negative emotions. Future research could consider how alexithymia is associated with different functions and motives of NSSI and risky drinking in university students. Also, explore how different functions and motives of these behaviours might influence whether a behaviour-specific outcome is perceived as positive or negative. Nevertheless, outcome expectancies and self-efficacy beliefs played significant roles in both associations, and there may be utility in intervention initiatives that challenge an individual's beliefs about NSSI and risky drinking and/or strengthen their self-efficacy beliefs. Future research is needed to explore the efficacy of behaviour-based approaches for treating NSSI and/or risky drinking for individuals with high levels of alexithymia.

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**“Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.”**

## Appendices

### Appendix A

Database searches, example data extraction form, study exclusion details and risk of bias and quality assessment tables (Study 1)

No	Query	Results	Date
#1	Alexithymia or "alexithymic features" or alexithymic	14248	07/08/2018
#2	NSSI or "non-suicidal self-injury" or "non-suicidal self injury" or "self-injur*" or "self injur*" or "self-harm*" or "self harm*" or "self-mutilat*" or "self mutilat*" or parasuicide	65635	07/08/2018
#3	"Alcohol use disorder" or "alcohol dependence" or "alcohol abuse" or "alcohol use" or "alcoholism" or "binge drinking" or "alcohol intoxication" or "alcohol abstinence" or "alcohol problem" or "problematic alcohol use" or "problematic drinking" or "risky drinking" or "risky alcohol use" or "harmful drinking" or "harmful alcohol use" or "hazardous drinking" or "hazardous alcohol use"	850859	07/08/2018
#4	#1 AND #2	352	07/08/2018
#5	#1 AND #3	1286	07/08/2018

All Journals@Ovid (Abstracts and Full Text), PsycARTICLES Full Text, Joanna Briggs Institute EBP Database, AGRICOLA, AMED, Embase, Global Health, ICONDA MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily, and Versions(R) PsycINFO PsycTESTS

Data Extraction Form (NSSI)							
	Included?		Reasons if not included?				
Systematic Review	Yes						
Meta-analysis	yes						
Source							
Citation	Zlotnick, C., Shea, M., Pearlstein, T., Simpson, E., Costello, E., & Begin, A. (1996). The relationship between dissociative symptoms, alexithymia, impulsivity, sexual abuse, and self-mutilation. <i>Comprehensive Psychiatry</i> , 37, 12-16. doi:10.1016/s0010-440x(96)90044-9						
Row in Dataset	5						
Study Characteristics							
Purpose	To increase our understanding of mechanisms of NSSI in a sample of female inpatients						
Country	United states of America						
Methods							
Design	Cross-sectional , correlational						
Sampling/recruitment	Female patients admitted to a psychiatric unit were asked to participate						
Rewards/incentives	Not stated						
Response rate	Not stated						
Participants							
Sample Type	clinical/non-clinical		Detailed type (inpatients, undergraduates)		Age (children, young adults, adolescents)		
	Clinical		inpatients		Adults		
Sample Size	All		Male		Female		
	148				148		100
Controls	Age	Gender	Depression	Anxiety	History of mental illness	Psych distress	Other:
Yes/no?	no	no	no	no	no	no	
Age	M		SD		MIN		MAX
	33		9.23				
Measures							
NSSI Definition	“ direct deliberate harm to one’s body without a conscious intent to die”						
NSSI Measure	Self-injury inventory developed by the authors. Defines NSSI by the above definition, measures frequency, duration and type of behaviour						
Time period (e.g. history, 12-month)	Life History	12month	frequency		Severity	Other	
Yes/No?	no	yes	no		no	no	
Definition (i.e. how frequency was measured etc.)							
Alexithymia	TAS-full score		DIF		DDF		EOT
Yes/no? (used in analysis)	Yes		no		no		no
Other measures (e.g. dissociation, emotion regulation)	Dissociative experiences scale, sexual assault questionnaire						
Results							
	All		Male		Female		
	N		%		N		%
Lifetime							
12 months	103 of 148		69.59%				

	Effect Sizes			
Type of NSSI (history, current frequency)	Current (correlation r)			
Analysis information				
Full TAS	.33			
DIF				
DDF				
EOT				
Other measures				
Frequency of NSSI	.36			
DES	.39			
Sexual abuse	.31			

### Screen #1 Title screening exclusions NSSI

1. Unrelated to NSSI or Deliberate self-harm (Trichotillomania, cultural practices, about suicide. Self-cannibalism) (ONLY NSSI systematic review) (119)
2. About suicide attempts or ideation (15)
3. Literature collections (n = 4)
4. Unrelated to Alexithymia (85)
5. Molecular level (brain pathways and structures) (4)
6. Non-human participants (1)
7. Qualitative studies (2)
8. Dissertations collections (4)
9. abstract collections (6)
10. Case studies (1)
11. poster presentations (1)
12. Indexes (8)
13. conference proceedings (3)
14. reviews (systematic literature, meta-analysis) (12)
15. No title/authors/information (2)

*Notes: exclusions sum to greater than 164 because some articles were excluded on the basis of more than one criterion; I scanned the reference list of reviews for any studies that may have been missed in our data-base searches.*

### Screen #2 Abstract screening exclusions NSSI

1. Unrelated to NSSI (measures BPD but not NSSI, does not distinguish suicide/NSSI, psychogenic excoriation, challenging behaviour, eating disorders) (11)
2. Not alexithymia (emotion variables that are not alexithymia, DERS, experiential avoidance) (18)
3. Not peer-reviewed articles (dissertation) (2)
4. Dissertation abstract (1)
5. Review (literature, systematic) (5)
6. Qualitative (2)

*Notes: exclusions sum to greater than 38 because some articles were excluded on the basis of more than one criterion; I scanned the reference list of reviews for any studies that may have been missed in our data-base searches.*

### **Screen #3 Full-text/Methods screening exclusions NSSI**

1. Is not aligned with ISSS definition of NSSI (Combines or does not specify suicide intent, only cutting, combines all BPD symptoms, includes hanging and drowning in definition) (15)
2. Does not use TAS-20 (DERS, emotion regulation difficulties) (3)
3. Conference abstract (no publication of full text)(2)
4. Does not provide appropriate statistics (after contacting author) (3)
5. Dissertation abstract (nonpublication) (6)
6. Full text not available in English (2)
7. Case study (1)
8. Review (1)

*Notes: exclusions sum to greater than 30 because some articles were excluded on the basis of more than one criterion; I scanned the reference list of reviews for any studies that may have been missed in our data-base searches.*

### **Screen #1 Title screening Risky Drinking**

1. Unrelated to Risky drinking (drug addiction, gambling addiction, gaming, psychoactive substances, self-injury, eating disorders) (455)
2. not Alexithymia (personality disorders, emotional intelligence, emotion regulation ) (379)
3. Molecular level (brain pathways and structures, clinical drug trials) (63)
4. Qualitative studies (6)
5. Dissertations collections (1)
6. Dissertation (1)
7. abstract collections (8)
8. editor's choice (1)
9. Case studies (1)
10. Errata (2)
11. Indexes (9)
12. conference proceedings (2)
13. reviews (systematic literature, meta-analysis) (46)
14. commentary (1)
15. oral communication lecture (1)
16. corrections(5)
17. Duplicate (3)
18. Top cited articles (1)

#some may have been removed for more than one reason.

### **Screen #2 Abstract screening risky drinking**

1. Not related to risky drinking (general addiction, cognitive functioning, combined substance and alcohol use, emotional abuse, abstinence after being dependent, cannabis, non-alcoholic outpatients, gambling only, binge drinking) (83)
2. Not alexithymia (Emotion regulation (DERS), facial emotion recognition, experiential avoidance) (38)
3. Dissertation abstract (7)
4. Qualitative(2)
5. Doesn't use AUDIT (alcohol consumption, binge drinking, dsm alcoholism, obsessive compulsive drinking, emotional abuse, alcohol dependence, MAST, ICD) (55)
6. Does use tas-20 (other emotion regulation, neural, Amsterdam Alexithymia scale, French alexithymia scale, BVAQ, LEAS, Alexithymia Provoked Response Questionnaire (APRQ) (13)
7. Qualitative review of current literature (2)
8. Reviews (4)
9. Neural level measurement (3)
10. Letter to the editor (2)

### **Screen #3 Methods/full text screening risky drinking**

1. Poster abstract (not published) (3)
2. Conferences abstract (full article not published or under different name) (15)
3. Does not use AUDIT (alcohol consumption (units), alcohol perceived risks assessment, MAST, DSM, euroaspi, timeline follow back Rutgers Alcohol Problem Index, quantity, obsessive compulsive drinking scale, YAACQ ) (36)
4. Does not use TAS-20 (BEAQ, PANAS, personality test) (3)
5. Not risky alcohol use (general substance abuse) (2)
6. Full text not in English (6)
7. Dissertation abstract (3)

**Supplementary Table 2.1.**

## Risk of bias and quality assessment for NSSI papers

	Unbiased selection of sample	Adequate description of sample	Validated measure for determining NSSI	Adequate handling of missing data
Anderson and Crowther (2012)	Yes	Yes	Yes	Not reported
Bedi et al. (2014)	Yes	Yes	Partial, definition followed in clinical interview	Partial, not much detail given
Cerutti et al. (2018)	Yes	Yes	Yes	Not reported
Evren and Evren (2005)	Yes	Yes	partial, not widely used but follows ISSS definition	Not reported
Greene, Boyes, and Hasking (2019)	Yes	Yes	Yes	Yes
Garisch and Wilson (2010)	Yes	Yes	partial, not typical measure but follows ISSS definition	Not reported
Garisch and Wilson (2015)	Yes	Yes	Yes	Not reported
Gatta et al. (2016)	Yes	Yes	Partial, clinical interview	Not reported
Hasking and Claes (2019)	Yes	Yes	Yes	Yes
Howe-Martin et al. (2012)	Yes	Yes	Yes	2 missing cases deleted, individual data points not reported
Lin et al. (2017)	Yes	Yes	Partial	Not reported
Lüdtke et al. (2016)	Yes	Yes	Yes (proposed DSM criteria)	Not reported
Mojahed et al. (2018)	Partial	Yes	Yes	Not reported
Paivo and McCulloch (2004)	Partial	Yes	Yes	Not reported
Polk and Liss (2007)	Partial	Yes	Partial, accurate definition	Not reported
Sleuwaegen et al. (2017)	Yes	Yes	Yes	Yes
Swannell et al. (2012)	Yes	Yes	Yes	Not reported

Verrocchio et al. (2010)	Partial	Yes	Yes	Not reported
Wester and king (2018)	Yes	Yes	Yes	Not reported
Zlotnick et al. (1996)	Partial	Yes	Partial (definition followed)	Not reported

### Supplementary Table 2.2.

#### Risk of bias and quality assessment for risky drinking papers

	Unbiased selection of sample	Adequate description of sample	Validated measure for determining risky drinking	Adequate handling of missing data
Andres et al. (2014)	Partial	Yes	Yes	Not reported
Bujarski et al. (2010)	Partial	Yes	Yes	Not reported
Founta et al. (2018)	Yes	Yes	Yes	Yes
Greene, Hasking, & Boyes (2019)	Yes	Yes	Yes	Yes
Hasking & Claes (2019)	Yes	Yes	Yes	Yes
Karukivi et al. (2010)	No	Yes	Yes	Not reported
Karukivi et al. (2014)	Partial	Yes	Yes	Not reported
Khosravani et al. (2018)	Partial	Yes	Yes	Yes
Kopera et al. (2018)	Partial	Yes	Yes	Not reported
Lyvers, Bremner et al. (2017)	Partial	yes	Yes	Not reported
Lyvers, Brown et al. (2018)	Yes	Yes	Yes	Yes
Lyvers, Coundouris et al. (2018)	Partial	Yes	Yes	Not reported
Lyvers, Duric et al. (2014)	Partial	Yes	Yes	Not reported
Lyvers, Hanigan et al. (2018)	Partial	Yes	Yes	Not reported
Lyvers, Hasking et al. (2011)	Partial	Yes	Yes	Not reported

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Lyvers, Hinton et al. (2014)	Partial	Yes	Yes	Not reported
Lyvers, Jamieson et al. (2013)	Partial	Yes	Yes	Partial
Lyvers, Kohlsdorf et al. (2017)	Partial	Yes	Yes	Not reported
Lyvers Lysychka et al. (2014)	Partial	Yes	Yes	Not reported
Lyvers, Makin et al. (2014)	Partial	Yes	Yes	Partial
Lyvers, McCann et al. (2018)	Partial	Yes	Yes	Not reported
Lyvers, Narayanan et al. (2018)	yes	yes	yes	Not reported
Lyvers, Onuoha et al. (2018)	No	yes	yes	Not reported
Lyvers, Simons et al. (2013)	Partial	Yes	Yes	Not reported
Lyvers, Stafford et al. (2016)	Partial	yes	yes	Not reported
Moretta and Buodo (2018)	Partial	Partial	Yes	Not reported
Pedersen et al. (2016)	Yes	Yes	Yes	Not reported
Rengade, Kahan et al. (2009)	Yes	Yes	Yes	Not reported
Thorberg, Young et al. (2011a)	Yes	Yes	Yes	Not reported
Thorberg, young et al. (2011b)	Yes	Yes	Yes	Not reported
Thorberg, Young et al. (2010)	Yes	Yes	Yes	Not reported
Wahlstrom et al. (2012)	Partial	Yes	Yes	Not reported

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## Appendix B

### Ethics approval letters for data used in Study 2



#### Office of Research and Development

GPO Box U1987  
Perth Western Australia 6845

**Telephone** +61 8 9266 7863  
**Facsimile** +61 8 9266 3793  
**Web** research.curtin.edu.au

20-Sep-2016

Name: Penelope Hasking  
Department/School: School of Psychology and Speech Pathology  
Email: Penelope.Hasking@curtin.edu.au

Dear Penelope Hasking

[Chapter 1 RE: Ethics approval Approval number: HRE2016-0312](#)

Thank you for submitting your application to the Human Research Ethics Office for the project **Personality and coping behaviours**.

Your application was reviewed by the Curtin University Human Research Ethics Committee at their meeting on **06-Sep-2016**.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **06-Sep-2016** to **05-Sep-2017**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Hasking, Penelope	CI
Claes, Laurence	Co-Inv

[Chapter 2 Standard conditions of approval](#)

1. Research must be conducted according to the approved proposal

2. Report in a timely manner anything that might warrant review of ethical approval of the project including: proposed changes
  - to the approved proposal or conduct of the study unanticipated problems that might affect continued ethical acceptability of the project
  - major deviations from the approved proposal and/or regulatory guidelines
  - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the [Western Australian University Sector Disposal Authority \(WAUSDA\)](#) and the [Curtin University Research Data and Primary Materials policy](#)
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the [Australian Code for the Responsible Conduct of Research](#), the [National Statement on Ethical Conduct in Human Research](#), applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

#### Chapter 3 Special Conditions of Approval

**This letter constitutes ethical approval only.** This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Professor Peter O'Leary  
Chair, Human Research Ethics Committee

## MEMORANDUM



Curtin University

To:	Penelope Hasking School of Psychology and Speech Pathology
CC:	
From:	Dr Catherine Gangell, Manager Research Integrity
Subject:	Ethics approval Approval number: RDHS-236-15
Date:	13-Oct-15

Office of Research and  
Development  
Human Research Ethics Office

TELEPHONE 9266 2784  
FACSIMILE 9266 3793  
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Office for the project: 6455  
The experience and regulation of emotion

Your application has been approved through the low risk ethics approvals process at Curtin University.

Please note the following conditions of approval:

1. Approval is granted for a period of four years from **13-Oct-15** to **13-Oct-19**
2. Research must be conducted as stated in the approved protocol.
3. Any amendments to the approved protocol must be approved by the Ethics Office.
4. An annual progress report must be submitted to the Ethics Office annually, on the anniversary of approval.
5. All adverse events must be reported to the Ethics Office.
6. A completion report must be submitted to the Ethics Office on completion of the project.
7. Data must be stored in accordance with WAUSDA and Curtin University policy.
8. The Ethics Office may conduct a randomly identified audit of a proportion of research projects approved by the HREC.

Should you have any queries about the consideration of your project please contact the Ethics Support Officer for your faculty, or the Ethics Office at hrec@curtin.edu.au or on 9266 2784. All human research ethics forms and guidelines are available on the ethics website.

Yours sincerely

Dr Catherine Gangell  
Manager, Research Integrity

## Appendix C

## Information sheets, consent forms, and questionnaires used in Study 2

**Default Question Block****PARTICIPANT INFORMATION SHEET**

HREC Project Number:	<b>RDHS-236-15</b>
Project Title:	The experience and regulation of emotion
Principal Investigator:	Associate Professor Penelope Hasking Dr Mark Boyes
Version Number:	V1.0
Version Date:	5 October 2015

How we experience and regulate emotions is thought to play a crucial role in both psychological distress and mental health. The experience of emotion depends on the probability that an emotion is elicited in any given situation (reactivity), the intensity with which an emotion is felt (intensity) and how long the emotion is felt (perseveration). However there are no published studies exploring these different aspects of emotion in relation to outcomes such as self-injury, harmful alcohol use or general psychological distress. In the current study we will explore these relationships to better understand how people experience and regulate emotion.

You are invited to take part in this study. Please read this Information Sheet in full before making a decision.

**Why were you chosen for this research?**

All undergraduate students enrolled in the Curtin University Psychology and Speech Pathology Undergraduate Participant Pool are eligible to participate.

**What does the research involve?**

You are invited to complete a questionnaire online that can be completed whenever you like. If you agree to participate, you will be asked questions about any experiences you have had with self-injury, your experiences drinking alcohol and your general psychological wellbeing.

You will also be asked about your belief in your ability to cope with stress and how you experience and regulate emotions.

Most people complete the questionnaire in between 45-60 minutes. It does not all need to be completed at once. You may come back to finish the questionnaire anytime within a 1 week period. After 1 week your responses will be lost and you will need to start the questionnaire again.

**Possible benefits**

While you may not personally benefit from participating in this study the results will help us further the theoretical understanding of emotion and emotion regulation, as well as emotion-related outcomes such as alcohol use and self-injury. This knowledge may identify potential targets for future intervention efforts.

You will be awarded 4 credit points if you answer at least 80% of the questions in the survey.

**Possible risks**

It is unlikely that participating in this study will incur any risks beyond normal day-to-day living. However some of the questions asked could trigger upsetting thoughts and memories for some people. Being in this study is voluntary and you are under no obligation to consent to participate. If you do consent to participate but later change your mind, you may withdraw from further participation by simply closing your browser. However data you have entered prior to closing the browser may still be used in the overall analyses.

If you do become upset at any stage while completing the questionnaire we suggest you take a break or stop the questionnaire. A list of useful resources is provided at the bottom of this information sheet, and at the end of the questionnaire.

**Confidentiality**

We will ask for your name and student ID number to allow us to match your responses to your record in SONA, allowing us to award you course credit. However after the grades have been ratified at the end of semester all identifying information will be removed from the data and we will no longer be able to identify any individual responses. From this point all data will be anonymous.

De-identified data may be placed in a public repository in future, made available to other researchers, or included as material supplementary to published reports. No information that could identify any participant will ever be released to a third party or made public in any way.

**Storage of data**

Data collected will be stored in accordance with Curtin University regulations, kept on University premises, in a password protected file for 7 years. A report of the study may be submitted for publication, and data may be used to support student research projects (e.g. theses), but individual participants will not be identifiable in any report or student thesis.

**Results**

If you would like to be informed of the aggregate research finding, please contact Penelope.Hasking@curtin.edu.au in December 2016.

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the Curtin University HREC. This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007). If you have any concerns and/or complaints about the project, the way it is being conducted or your rights as a research participant, and would like to speak to someone independent of the project, please contact: The Curtin University Ethics Committee by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Below you will find some resources you might find helpful in managing stress or learning more about alcohol use and self-injury.

[Useful resources](#)  
[Stress management](#)  
[Alcohol fact sheet](#)  
[Self injury fact sheet](#)  
[A guide for young people](#)

---

I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

- I agree  
 I do not agree

## Info sheet

### PARTICIPANT INFORMATION SHEET

HREC Project Number:	HRE2016-0312
Project Title:	Personality and Coping Behaviours
Principal Investigator:	Associate Professor Penelope Hasking
Co-Investigators:	Professor Laurence Claes
Version Number:	v1.0
Version Date:	14 July 2016

Behaviours such as non-suicidal self-injury (NSSI), risky alcohol use and unhealthy eating (e.g. binge eating) are common among young people, and appear elevated in university students. Each of these behaviours is associated with numerous adverse outcomes, including psychological distress, harm to self and others (both physical and psychological), and increased suicide risk.

Past research suggests that particular personality traits may increase risk of engaging in these behaviours (e.g. sensation seeking, extroversion). However factors like optimism, resilience can protect against this risk, while unhealthy coping can increase risk. In this study we will test a range of risk and protective factors in the relationship between personality, NSSI, risky drinking and unhealthy eating among university students.

You are invited to take part in this study. Please read this Information Sheet in full before making a decision.

All undergraduate students enrolled in the Curtin University Psychology and Speech Pathology Undergraduate Participant Pool are eligible to participate.

#### What does the research involve?

You are invited to complete a questionnaire online that can be completed whenever you like. If you agree to participate, you will be asked questions about any experiences you have had with self-injury, your experiences drinking alcohol, your eating habits and your general psychological wellbeing. You will also be asked about your belief in your ability to cope with stress and how you experience and regulate emotions.

Most people complete the questionnaire in between 45-60 minutes. It does not all need to be completed at once. You may come back to finish the questionnaire anytime within a 2 week period. After 2 weeks your responses will be lost and you will need to start the questionnaire again.

#### Possible benefits

While you may not personally benefit from participating in this study the results will help us further the theoretical understanding of personality and unhealthy coping behaviours, as well as how factors like resilience, optimism and coping exacerbate or mitigate risk of these behaviours. This knowledge may identify potential targets for future prevention and intervention efforts.

**If you are a Curtin University student who has enrolled for this study through SONA, you will be awarded 3 credit points if you answer at least 80% of the questions in the survey. Participants who were directed to this survey through another means (e.g. facebook) will not be reimbursed for their time.**

#### Possible risks

It is unlikely that participating in this study will incur any risks beyond normal day-to-day living. However some of the questions asked could trigger upsetting thoughts and memories for some people. Being in this study is voluntary and you are under no obligation to consent to participate. If you do consent to participate but later change your mind, you may withdraw from further participation by simply closing your browser. However data you have entered prior to closing the browser may still be used in the overall analyses.

If you do become upset at any stage while completing the questionnaire we suggest you take a break or stop the questionnaire. A list of useful resources is provided at the bottom of this information sheet, and at the end of the questionnaire.

**Confidentiality**

If you are an undergraduate psychology student at Curtin University, we will ask for your name and student ID number to allow us to match your responses to your record in SONA, allowing us to award you course credit. However after the grades have been ratified at the end of semester all identifying information will be removed from the data and we will no longer be able to identify any individual responses. From this point all data will be anonymous.

De-identified data may be placed in a public repository in future, made available to other researchers, or included as material supplementary to published reports. No information that could identify any participant will ever be released to a third party or made public in any way.

**Storage of data**

Data collected will be stored in accordance with Curtin University regulations, kept on University premises, in a password protected file for 7 years, or until participants are 25 years of age. A report of the study may be submitted for publication, and data may be used to support student research projects (e.g. theses), but individual participants will not be identifiable in any report or student thesis.

**Results**

If you would like to be informed of the aggregate research finding, please contact Penelope.Hasking@curtin.edu.au in December 2017.

Thank you for taking the time to complete this survey.

A/Prof Penelope Hasking: penelope.hasking@curtin.edu.au  
 Prof Laurence Claes: laurence.claes@kuleuven.be

All research in Australia involving humans is reviewed by an independent group of people called a Human Research Ethics Committee (HREC). The ethical aspects of this research project have been approved by the Curtin University HREC. This project will be carried out according to the National Statement on Ethical Conduct in Human Research (2007, updated May 2015). If you have any concerns and/or complaints about the project, the way it is being conducted or your rights as a research participant, and would like to speak to someone independent of the project, please contact: The Curtin University Ethics Committee by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Below you will find some resources you might find helpful in managing stress or learning more about alcohol use and self-injury.

[Useful resources](#)  
[Stress management](#)  
[Alcohol fact sheet](#)  
[Self injury fact sheet](#)

I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

- I agree  
 I do not agree

**ISAS**

In this next section we will ask you questions about your experience with self-injury.

If you become upset at any stage we suggest taking a break or completely stopping the questionnaire. Remember there are some resources you might find useful that are free to download at end of this questionnaire.

**Self-injury refers to directly and intentionally hurting yourself (such as by cutting, burning, excessively scratching, etc.) *without* the intention of killing yourself.**

Have you ever seriously considered self-injuring but not acted on those thoughts?

- Yes  
 No

Have you ever engaged in non-suicidal self-injury?

- Yes  
 No

What age did you start to self-injure?

How many times have you self-injured **in the last year**?

- None  
 Once  
 Twice  
 Three times  
 Four times  
 5 or more times

Please only endorse a behaviour if you have done it intentionally (i.e., on purpose) and without suicidal intent (i.e., not for suicidal reasons).

Please estimate the number of times **in your life** you have intentionally (i.e., on purpose) performed each type of non-suicidal self-injury (Please write a number)

Cutting	<input type="text"/>
Biting	<input type="text"/>
Burning	<input type="text"/>
Carving	<input type="text"/>
Pinching	<input type="text"/>

Pulling hair	<input type="text"/>
Severe scratching	<input type="text"/>
Banging or hitting yourself	<input type="text"/>
Interfering with wound healing	<input type="text"/>
Rubbing skin against rough surface	<input type="text"/>
Sticking yourself with needles	<input type="text"/>
Swallowing dangerous substances	<input type="text"/>
Other	<input type="text"/>

If you feel that you have a *main* form of self-injury, please indicate from the list below the behaviour(s) that you consider to be your main form/s of self-injury

- Cutting  
 Biting  
 Burning  
 Carving  
 Pinching  
 Pulling hair  
 Severe scratching  
 Banging or hitting yourself  
 Interfering with wounds healing  
 Rubbing skin against rough surface  
 Sticking yourself with needles  
 Swallowing dangerous substances  
 Other

Do you experience physical pain when you self-injure?

- Yes  
 No

When you self-injure are you alone?

- Yes  
 No

Typically how much time elapses from the time you have the urge to self-injure until you act on the urge?

- < 1 hour  
 1-3 hours  
 3-6 hours  
 6-12 hours  
 12-24 hours  
 > 1 day

**AUDIT**

Now we are interested in your drinking patterns

How often do you have a drink containing alcohol?

- Never      Monthly or Less      2-4 Times a Month      2-3 Times a Week      4 or More Times a Week
- 

How many drinks containing alcohol do you have on a typical day when you are drinking?

- 1 or 2      3 or 4      5 or 6      7 to 9      10 or More
- 

How often do you have six or more drinks on one occasion?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

How often during the last year have you found that you were not able to stop drinking once you had started?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

How often during the last year have you failed to do what was normally expected from you because of drinking?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

How often during the last year have you had a feeling of guilt or remorse after drinking?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

How often during the last year have you been unable to remember what happened the night before because you had been drinking?

- Never      Less than Monthly      Monthly      Weekly      Daily or Almost Daily
- 

Have you or someone else been injured as a result of your drinking?

No

- Yes, but not in the last year
- Yes, during the last year

Has a relative or friend, or a doctor or other health worker been concerned about your drinking or suggested you cut down?

- No
- Yes, but not in the last year
- Yes, during the last year

<b>TAS-20</b>					
	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Neither Agree nor Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
1. I am often confused about what emotion I am feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. It is difficult for me to find the right words for my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I have physical sensations that even doctors don't understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am able to describe my feelings easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I prefer to analyse problems than just describe them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. When I am upset I don't know if I am sad, frightened or angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I am often puzzled by sensations in my body	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I prefer to just let things happen rather than to understand why they turned out that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I have feelings that I can't quite identify	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Being in touch with emotions is essential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I find it hard to describe how I feel about people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. People tell me to describe my feelings more	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I don't know what's going on inside me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I often don't know why I am angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I prefer talking to people about their daily activities rather than their feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I prefer to watch 'light' entertainment shows rather than psychological dramas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. It is difficult for me to reveal my innermost feelings, even to close friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I can feel close to someone, even in moments of silence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I find examination of my feelings useful in solving personal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Looking for hidden meaning in movies or plays distracts from their enjoyment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Appendix D

### Ethics approval letters for data used in studies 3, 4, and 5



#### Office of Research and Development

GPO Box U1987  
Perth Western Australia 6845

**Telephone** +61 8 9266 7863

**Facsimile** +61 8 9266 3793

**Web** research.curtin.edu.au

04-Sep-2018

Name: Penelope Hasking  
Department/School: School of Psychology  
Email: Penelope.Hasking@curtin.edu.au

Dear Penelope Hasking

[Chapter 4 RE: Amendment approval Approval number: HRE2018-0536](#)

Thank you for submitting an amendment request to the Human Research Ethics Office for the project **Social, emotional, and cognitive factors associated with health risk behaviours**.

Your amendment request has been reviewed and the review outcome is: **Approved**

The amendment approval number is HRE2018-0536-01 approved on 04-Sep-2018.

The following amendments were approved:

Addition of four scales: an item asking whether participants have been diagnosed with a mental illness, and three validation questions to the questionnaire. The four scales added are the Perth Alexithymia Questionnaire (24 items), the Forms of self-criticism/attacking and self-reassuring scale (24 items), the Functions of self-criticising/attacking scale (21 items), and the Self-Efficacy to Resist NSSI scale (125 items).

Any special conditions noted in the original approval letter still apply.

[Chapter 5 Standard conditions of approval](#)

1. Research must be conducted according to the approved proposal

2. Report in a timely manner anything that might warrant review of ethical approval of the project
  - including: proposed changes to the approved proposal or conduct of the study unanticipated
  - problems that might affect continued ethical acceptability of the project
  - major deviations from the approved proposal and/or regulatory guidelines

serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the [Western Australian University Sector Disposal Authority \(WAUSDA\)](#) and the [Curtin University Research Data and Primary Materials policy](#)
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the [Australian Code for the Responsible Conduct of Research](#), the [National Statement on Ethical Conduct in Human Research](#), applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Catherine Gangell  
Manager, Research Integrity



### Research Office at Curtin

GPO Box U1987  
Perth Western Australia 6845

**Telephone** +61 8 9266 7863

**Facsimile** +61 8 9266 3793

**Web** research.curtin.edu.au

18-Feb-2019

Name: Penelope Hasking  
Department/School: School of Psychology  
Email: Penelope.Hasking@curtin.edu.au

Dear Penelope Hasking

[Chapter 6 RE: Ethics approval Approval number: HRE2019-0067](#)

Thank you for submitting your application to the Human Research Ethics Office for the project **Emotion and behaviour-specific beliefs about self-injury and risky drinking**.

Your application was reviewed by the Curtin University Human Research Ethics Committee at their meeting on **05-Feb-2019**.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **18-Feb-2019** to **18-Feb-2020**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Hasking, Penelope	CI
Greene, Danyelle	Student

Boyes, Mark	Supervisor
-------------	------------

#### Chapter 7 Standard conditions of approval

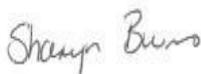
1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project
  - including: proposed changes to the approved proposal or conduct of the study unanticipated
  - problems that might affect continued ethical acceptability of the project major deviations from the approved proposal and/or regulatory guidelines
  - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the [Western Australian University Sector Disposal Authority \(WAUSDA\)](#) and the [Curtin University Research Data and Primary Materials policy](#)
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the [Australian Code for the Responsible Conduct of Research](#), the [National Statement on Ethical Conduct in Human Research](#), applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

#### Chapter 8 Special Conditions of Approval

**This letter constitutes ethical approval only.** This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au) or on 9266 2784.

Yours sincerely



Associate Professor Sharyn Burns  
Chair, Human Research Ethics Committee

## Appendix E

## Participant information sheets questionnaires used in studies 3, 4, and 5

## Information sheet and consent

**PARTICIPANT INFORMATION STATEMENT**

<b>HREC Project Number:</b>	HRE2018-0536
<b>Project Title:</b>	Social, Cognitive, and Emotional Factors Associated with Health Risk Behaviours
<b>Principal Investigator:</b>	Associate Prof. Penelope Hasking
<b>Co-investigators:</b>	Dr. Mark Boyes, Dr. Joel Howell, Jessica Dawkins, Danyelle Greene, Ashley Slabbert, & Kate Tonta
<b>Version Number:</b>	1
<b>Version Date:</b>	21/05/2018

**What is the Project About?**

Health risk behaviours such as alcohol use and nonsuicidal self-injury (e.g. cutting, burning, punching walls, without suicidal intent) are prevalent in university populations. How people understand, express, and regulate their emotions can play a critical role in their psychological health outcomes including whether they engage in health risk behaviours such as drinking alcohol and engaging in self-injurious behaviours. In this study, we will explore how multiple social, cognitive, and emotional factors are related to these behaviours and how they might be used to regulate emotional experiences.

**Please read this information sheet fully before consenting to participate in the study.**

**Who is doing the Research?**

This study is being conducted by a group of researchers at Curtin, including several PhD students being supervised by A/Prof Penelope Hasking, Dr Mark Boyes and Dr Joel Howell. All PhD students are funded by the Australian Government through the Research Training Program. This project is funded by Curtin University.

**Who can participate?**

You can participate in this study if you are aged 18-25 and currently studying at an Australian University.

**What does participation involve?**

If you agree to participate, you will be asked to answer an online survey at a time and place convenient for you. The survey includes questions about your social connections as well as how you cope with and deal with emotions and your experience with alcohol. If you have ever engaged in self-injury you will be asked about these experiences.

The survey will take around 60 minutes to complete. You do not have to complete the study in one sitting. Once you begin the questionnaire you will have one week to complete the study. You can log back in as many times as you like within a week.

**Are there any benefits to being in the research project?**

There may be no direct benefit to you from participating in this research. However, the current study will add to scientific knowledge about factors related to self-injury and alcohol use in university students. This knowledge may also benefit people in the future by informing prevention and treatment.

If you are completing the study for course credits at Curtin University you will receive 4 SONA points. If you are not participating for credit points you will be placed in the draw to win an iPad or 1 of 10 \$25 Coles/Myer gift cards.

**Are there any risks, side-effects, discomforts or inconveniences from being in the research project?**

Participating in this survey is unlikely to have any risks beyond everyday living. However, it is possible that some questions in the survey may trigger upsetting thoughts and memories for some individuals. Remember that taking part in this study is voluntary and you are not obliged to participate. If you do consent to participate but change your mind at any point in the survey, you can withdraw by simply closing the survey. However, any questions you have answered prior to closing the survey may be used in the overall analysis.

We suggest taking a break or stopping the survey if you become upset whilst answering the questions. You will be provided with a list of counselling services and resources at the bottom of this information sheet and again upon completion of the questionnaire.

**Confidentiality and data access**

You will be asked for your name and student ID if you are participating for course credits at Curtin University. This will allow us to match your responses to your record on SONA, so we can award you points. However, at the end of the semester when your grades have been finalised all identifying information will be removed from the data, making the data anonymous from that point on.

For other participants, we will ask for your name and email address to contact you if you win a prize. Once the prizes are drawn all identifying information will be removed making your responses unidentifiable from that point on.

The following people will have access to the information we collect in this research: the research team and, in the event of an audit or investigation, staff from the Curtin University Office of Research and Development. The information in this research is electronic and will be stored on a password-protected computer. Anonymous data may be stored in an open access repository if required by a journal. The data we collect in this study will be kept under secure conditions at Curtin University for 7 years after the research has ended and then it will be destroyed.

**Will you tell me the results of the research?**

The results from this study may be presented at a conference or published in a journal but you will not be identifiable in any publications or presentations. If you wish to have a copy of the final results or have any questions, please contact us:

Penelope Hasking: Penelope.Hasking@curtin.edu.au  
 Mark Boyes: Mark.Boyes@curtin.edu.au  
 Joel Howell: Joel.Howell@curtin.edu.au  
 Danyelle Greene: Danyelle.greene@postgrad.curtin.edu.au  
 Jessica Dawkins: Jessica.C.Dawkins@postgrad.curtin.edu.au  
 Ashley Slabbert: Ashley.Slabbert@postgrad.curtin.edu.au  
 Kate Tonta: Kate.Tonta@postgrad.curtin.edu.au

Self injury fact sheet  
 Alcohol fact sheet  
 Useful resources

If you decide to take part in this research tick the consent box at the start of the Qualtrics survey. By doing this you indicate you have understood the information provided here in the information sheet.

Curtin University Human Research Ethics Committee (HREC) has approved this study (HRE2018-0536). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

- I agree  
 I do not agree

## Participant information sheet

**PARTICIPANT INFORMATION STATEMENT**

HREC Project Number:	HRE2019-0067
Project Title:	Emotion and Behavior-Specific Beliefs about Self-Injury and Risky Drinking
Chief Investigator:	A/Professor Penelope Hasking
Co-researchers:	Dr Mark Boyes and Danyelle Greene
Version Number:	1
Version Date:	03/01/2019

**What is this Project About?**

Health risk behaviours such as risky alcohol use and non-suicidal self-injury (e.g. cutting, burning or biting yourself, without suicidal intent) are prevalent amongst university students. How students regulate, express and understand their emotions can play an important role in their psychological health and influence whether they engage in these behaviours. In this study, we use both self-report and experimental tasks to investigate how multiple social, cognitive and behaviour-specific factors relate to self-injury and risky drinking. Further, we intend to use this information to explore similarities and differences in these behaviours.

**You are invited to take part in this study. Please read this Information Sheet in full before making a decision.**

**Why were you chosen for this research?**

We are aiming to recruit university students aged 25 or younger who are currently enrolled in the Curtin University School of Psychology undergraduate participant pool or paid participant pool. We are interested in recruiting individuals who have and individuals who have not engaged in self-injury and/or risky drinking.

**What does the research involve?**

This study has two-parts, if you agree to participate, you will be asked to answer an online survey (part one) and complete two lab-based computerised tasks (part two). The survey includes questions about how you cope and deal with emotions and your experiences with self-injury, alcohol and the internet. After you have completed the survey you will be asked to return to the SONA or The Curtin research Participation Scheme Paid Participant Pool website to sign-up to one of the available lab time slots in order to complete the computerised tasks. The computerised tasks involve indicating using a computer keyboard whether sentences related to alcohol use and self-injury are true or false for you. These computer tasks will take place in PERL-C located near the Japanese Gardens in the Psychology building (401) on the Bentley Curtin Campus during your chosen lab time.

The survey and the computerised tasks combined will take approximately 45- 60 minutes to complete. If you are recruited through the School of Psychology undergraduate participant pool (SONA), you will receive four participation points. If you are recruited through the Curtin Research Participation Scheme Paid Participant Pool, you will receive \$15. In order to receive the four points or the \$15 we ask you to participate in both part one (online survey) and part two (lab-based computer tasks) of the study.

**Possible benefits**

While you may not personally benefit from participating in this study, the results will help us further the theoretical understanding of self-injury and alcohol use. This knowledge may help us identify potential targets for future intervention and prevention efforts.

**Possible risks**

Participating in this research is unlikely to incur any risks beyond normal day-to-day living. Nevertheless, some of the questions asked may trigger upsetting thoughts or memories for some people. Participating in this study is voluntary and you are not obliged to consent to participate. If you do consent to participate but change your mind part way through the study, you can withdraw from further participation simply closing the survey or informing the researcher if you are in the lab. However, the data you provide before withdrawing may still be analysed and used in a publication or thesis.

The researcher will provide you with a list of useful resources that you can use if you feel distressed or upset about anything.

**Confidentiality**

We will ask for your name and student ID to allow us to award you SONA points, and match the different data you provide. However, once grades are finalised at the end of semester all identifying information will be removed and individual responses will no longer be identifiable. From this point on all data will be anonymous. Additionally, if you are recruited through the paid participant pool we will also ask you to provide your name and signature on a separate record form at the lab for proof of payment.

Some journals require data to be placed in public repositories, to make it available to other researchers, or as a supplementary material included as part of a published article. In these cases, no information that could identify a specific individual will be released to a third party or made public in any way.

**Storage of data**

All data collected will be stored in accordance with Curtin University regulations. Data will be stored in a password-protected file for 7 years on university premises. Results from this study may be submitted for publication, and data will be used to support student research projects (e.g. PhD thesis, Honours project), but individual participants will not be identified in any publication or student thesis.

Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number: HRE2019-0067). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au).

Resources you may find helpful

[Service Resources](#)

[Useful resources](#)  
[Stress management](#)  
[Alcohol and drugs fact sheet](#)  
[Self injury fact sheet](#)

I have received information regarding this research and had an opportunity to ask questions. I believe I understand the purpose, extent and possible risks of my involvement in this project and I voluntarily consent to take part.

- agree  
 disagree

#### Demographics

What is your age? (in years)

What is your sex?

- Male  
 Female  
 Another gender, please specify?  
  
 Prefer not to say

Do you consider yourself to be:

- Heterosexual  
 Homosexual  
 Bisexual  
 Another orientation, please specify?  
  
 Prefer not to say

What is your postcode?

What country were you born in?

Do you identify as Aboriginal or Torres Strait Islander?

- Yes  
 No

What course are you currently studying?

At what level are you currently studying?

- Associate Degree

Bachelor Degree

- Graduate Certificate
- Graduate Diploma
- Master Degree
- Doctoral Degree
- other

Have you ever been diagnosed with a mental disorder?

- Yes (please specify)
- No

**NSSI**

**Nonsuicidal Self-Injury**

This questionnaire asks about a variety of nonsuicidal self-injury behaviours. Nonsuicidal self-injury is defined as the deliberate physical self-damage or self-harm that is not accompanied by suicidal intent or ideation. Although cutting is one of the most well-known nonsuicidal self-injury behaviours, it can take many forms including but not limited to biting, burning, scratching, self-bruising or swallowing dangerous substances if undertaken with intent to injure oneself.

Have you ever thought about engaging in self-injury?

- Yes
- No

Have you ever engaged in nonsuicidal self-injury?

- Yes
- No

How many times have you self-injured in the last year?

- None
- Once
- Twice
- Three times
- Four times
- 5 or more times

Please estimate the number of times in your life you have intentionally (i.e., on purpose) performed each type of non-suicidal self-injury (e.g., 0, 10, 100, 500):

	Click to write
Cutting	<input type="text"/>
Biting	<input type="text"/>
Burning	<input type="text"/>
Carving	<input type="text"/>
Pinching	<input type="text"/>
Pulling hair	<input type="text"/>
Severe scratching	<input type="text"/>
Banging or hitting yourself	<input type="text"/>
Interfering with wound healing	<input type="text"/>
Rubbing skin against rough surface	<input type="text"/>
Sticking yourself with needles	<input type="text"/>
Swallowing dangerous substances	<input type="text"/>
Other	<input type="text"/>

**If you feel that you have a *main* form of self-injury, please indicate from the list below the behaviour you consider to be your main form of self-injury**

- Cutting
- Biting
- Burning
- Carving
- Pinching
- Pulling hair
- Severe scratching
- Banging or hitting yourself
- Interfering with wound healing
- Rubbing skin against rough surface
- Sticking yourself with needles
- Swallowing dangerous substances
- Other

**At what age did you (please write a number):**

	Click to write
First injure yourself?	<input type="text"/>
Most recently injure yourself?	<input type="text"/>

**Do you experience physical pain during self-injury?**

- Yes  Sometimes  No

**When you self-injure are you alone?**

- Yes  Sometimes  No

**Typically, how much time elapses from the time you have the urge to self-injure until you act on the urge?**

- <1 hour  1-3 hours  3-6 hours  6-12 hours  12-24 hours  >1 day

**Do/did you want to stop self-injuring?**

- Yes
- No

**This inventory was written to help us better understand the experience of nonsuicidal self-injury. Below is a list of statements that may or may not be relevant to your experience of self-injury. Please identify the statements that are most relevant for you.**

**When I self-injure I am...**

	Not relevant	Somewhat relevant	Very relevant
1. calming myself down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. creating a boundary between myself and others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. punishing myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. giving myself a way to care for myself (by attending to the wound)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. causing pain so I will stop feeling numb	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. avoiding the impulse to attempt suicide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. doing something to generate excitement or exhilaration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

01/12/2020

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	Not relevant	Somewhat relevant	Very relevant
8. bonding with peers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. letting others know the extent of my emotional pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. seeing if I can stand the pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. creating a physical sign that I feel awful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. getting back at someone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. ensuring I am self-sufficient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. releasing emotional pressure that has built up inside of me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. demonstrating that I am separate from other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. expressing anger towards myself for being worthless or stupid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. creating a physical injury is easier to care for than my emotional distress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. trying to feel something (as opposed to nothing) even if it is physical pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. responding to suicidal thoughts without actually attempting suicide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. entertaining myself or others by doing something extreme	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. fitting in with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. seeking care or help from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. demonstrating I am tough or strong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. proving to myself that emotional pain is real	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. getting revenge against others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. demonstrating that I do not need to rely on others for help	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. reducing anxiety, frustration, anger, or other overwhelming emotions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. establishing a barrier between myself and others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. reacting to feeling unhappy with myself or disgusted with myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. allowing myself to focus on treating the injury, which can be gratifying or satisfying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31. making sure I am alive when I don't feel real	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. putting a stop to suicidal thoughts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. pushing my limits in a manner akin to skydiving or other extreme activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. creating a sign of friendship or kinship with friends or loved ones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35. keeping a loved one from leaving or abandoning me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. proving I can take the physical pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37. signifying the emotional distress I'm experiencing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38. trying to hurt someone close to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
39. establishing that I am autonomous/independent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**We are interested in your thoughts about what might happen if someone engages in self-injury. If you personally have self-injured think about what you might expect the outcome to be when you self-injure. If you do not self-injure, think about what the outcome might be if you did.**

**How likely is it that after self-injuring:**

	Extremely unlikely	Somewhat unlikely	Somewhat likely	Extremely likely
1. I would feel less frustrated with the world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. My friends would be disgusted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I could make people do things for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I would feel physical pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I would feel like a failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I would feel better about myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. My friends would not approve of me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. It would be easier to get what I want from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. It would hurt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I would feel ashamed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I would feel calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. My family would be disgusted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31/12/2020

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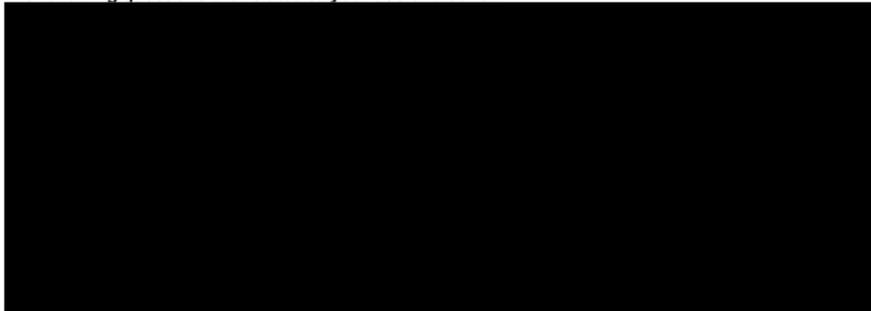
	Extremely unlikely	Somewhat unlikely	Somewhat likely	Extremely likely
13. Other people would notice and offer sympathy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I would not be aware of my physical pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I would feel numb	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. The future would seem more optimistic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. My parents would be angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I would feel that it would be easier to open up and express my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I would not feel any pain	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. I would feel emotionally drained	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. I would feel relieved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Other people would notice and think I was a freak	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. I would get care from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. The pain would be intense	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. I would hate myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please read each of the statements below carefully and select the answer which best fits how certain you are about how you would act in each of the following situations.

	Very uncertain					Very certain
1. How certain are you that you will not self-injure in the future?	<input type="radio"/>					
2. If at some point in the future you had self-injurious thoughts, how certain are you that you could resist self-injury?	<input type="radio"/>					
3. If at some point in the future you had self-injurious thoughts, how certain are you that you could resist self-injury if you were using alcohol or other drugs?	<input type="radio"/>					
4. How certain are you that you could control future thoughts of self-injury if you were experiencing physical pain?	<input type="radio"/>					
5. How certain are you that you could control future self-injurious thoughts if you lost an important relationship?	<input type="radio"/>					
6. How certain are you that you could control future self-injurious thoughts if you lost a job, could not find employment, or suffered a financial crisis?	<input type="radio"/>					

**Alcohol**

The following questions are related to your use of alcohol.



This guide contains examples of one standard drink. A full strength can or stubbie contains one and a half standard drinks. Try to answer the questions in terms of 'standard drinks'.

	never	monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
1. How often do you have a drink containing alcohol?	<input type="radio"/>				

	1-2	3-4	5-6	7-9	10 or more
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	<input type="radio"/>				

	never	less than monthly	monthly	weekly	daily or almost daily
3. How often do you have six or more drinks on one occasion?	<input type="radio"/>				
4. How often during the last year have you found that you were not able to stop drinking once you had started?	<input type="radio"/>				
5. How often in the last year have you failed to do what was normally expected of you because of drinking?	<input type="radio"/>				
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	<input type="radio"/>				
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	<input type="radio"/>				
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	<input type="radio"/>				

	No	Yes, but not in the last year	Yes, during the last year
9. Have you or someone else been injured because of your drinking?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The purpose of these questions is to find out about YOUR thoughts, feelings and beliefs about drinking. Please select the most appropriate response.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. I do not need alcohol to help me unwind after a hard day or week at work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Little things annoy me less when I'm drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Drinking makes me feel outgoing and friendly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Drinking alcohol makes me tense	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I have more self-confidence when I am drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Drinking makes me more sexually responsive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. When I am anxious or tense I do not feel the need for alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Drinking makes the future brighter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I drink alcohol because it's a habit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Drinking makes me bad tempered	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I am more aware of what I say and do if I am drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I feel that drinking hinders me in getting along with other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I feel restless when drinking alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I am more sullen and depressed when drinking alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I cannot always control my drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I am less concerned about my actions when I am drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. If I am drinking it is easier to express my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
18. I often feel sexier after I've been drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Drinking does not help to relieve any tension I feel about recent concerns and interests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Drinking increases my aggressiveness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. Drinking makes me feel like a failure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Drinking helps me to be more mentally alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. Drinking alcohol removes most thoughts of sex from my mind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. I tend to adopt a "who cares" attitude when I'm drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. I am addicted to alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Drinking brings out the worst in me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. I feel less shy when I am drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. Drinking makes me feel more violent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. I am less discreet if I drink alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. When I am drinking it's easier to open up and express my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
31. I am powerless in the face of alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. When I am drinking I avoid other people or situations for fear of embarrassment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. Drinking alcohol sharpens my mind	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. I feel disappointed in myself when drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35. I tend to avoid sex when drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. I lose most feelings of sexual interest after I have been drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
37. I am clumsier when drinking alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Listed below are 20 reasons people might be inclined to drink alcoholic beverages. Using the five-point scale below, decide how frequently your own drinking is motivated by each of the reasons listed.

	Almost Never/ Never	Some of the time	Half of the time	Most of the time	Almost Always/ Always
1. To forget your worries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Because your friends pressure you to drink.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Because it helps you enjoy a party.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Because it helps you when you feel depressed or nervous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. To be sociable.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. To cheer up when you are in a bad mood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Because you like the feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Almost Never/ Never	Some of the time	Half of the time	Most of the time	Almost Always/ Always
8. So that others won't kid you about not drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Because it's exciting.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. To get high.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Because it makes social gatherings more fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. To fit in with a group you like.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Because it gives you a pleasant feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Because it improves parties and celebrations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Almost Never/ Never	Some of the time	Half of the time	Most of the time	Almost Always/ Always
15. Because you feel more self-confident and sure of yourself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. To celebrate a special occasion with friends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. To forget about your problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31/12/2020

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	Almost Never/ Never	Some of the time	Half of the time	Most of the time	Almost Always/ Always
18. Because it's fun.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. To be liked.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. So you won't feel left out.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**For the following situations please indicate how easy it would be for you to refuse a drink containing alcohol.**

	I am very sure I would drink					I am very sure I would not drink
1. When I am out to dinner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. When I am watching TV	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. When I am angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. When someone offers me a drink	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. When I am at lunch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. When I feel frustrated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. When I am worried	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. When I feel upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. When I feel down	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. When I feel nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. When I am on the way home from work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. when I feel sad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. When my spouse or partner is drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. When I am listening to music or reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. When my friends are drinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. When I am by myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. When I have just finished playing sports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. When I am at a pub or club	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. When I first arrive home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Emotion**

**This questionnaire asks about how you perceive and experience your emotions. Please score the following statements according to how much you agree or disagree that the statement is true of you. Select one answer for each statement.**

**Some questions mention bad or unpleasant emotions, this means emotions like sadness, anger, or fear. Some questions mention good or pleasant emotions, this means emotions like happiness, amusement, or excitement.**

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. When I'm feeling bad (feeling an unpleasant emotion), I can't find the right words to describe those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. When I'm feeling bad, I can't tell whether I'm sad, angry, or scared.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I tend to ignore how I feel.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. When I'm feeling good (feeling a pleasant emotion), I can't find the right words to describe those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. When I'm feeling good, I can't tell whether I'm happy, excited, or amused.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I prefer to just let my feelings happen in the background, rather than focus on them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. When I'm feeling bad, I can't talk about those feelings in much depth or detail.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. When I'm feeling bad, I can't make sense of those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I don't pay attention to my emotions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. When I'm feeling good, I can't talk about those feelings in much depth or detail.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
11. When I'm feeling good, I can't make sense of those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Usually, I try to avoid thinking about what I'm feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. When something bad happens, it's hard for me to put into words how I'm feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. When I'm feeling bad, I get confused about what emotion it is.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I prefer to focus on things I can actually see or touch, rather than my emotions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. When something good happens, it's hard for me to put into words how I'm feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. When I'm feeling good, I get confused about what emotion it is.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I don't try to be 'in touch' with my emotions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. When I'm feeling bad, if I try to describe how I'm feeling I don't know what to say.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. When I'm feeling bad, I'm puzzled by those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. It's not important for me to know what I'm feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. When I'm feeling good, if I try to describe how I'm feeling I don't know what to say.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. When I'm feeling good, I'm puzzled by those feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. It's strange for me to think about my emotions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Using the scale provided as a guide, indicate how much you agree or disagree with each of the following statements. Give only one answer for each statement.

	Strongly disagree	moderately disagree	Neither agree nor disagree	Moderately agree	Strongly agree
1. I am often confused about what emotion I am feeling.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. It is difficult for me to find the right words for my feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I have physical sensations that even doctors don't understand.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am able to describe my feelings easily.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I prefer to analyze problems rather than just describe them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. When I am upset, I don't know if I am sad, frightened, or angry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I am often puzzled by sensations in my body.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I prefer to just let things happen rather than to understand why they turned out that way.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I have feelings that I can't quite identify.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Being in touch with emotions is essential.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I find it hard to describe how I feel about people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. People tell me to describe my feelings more.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I don't know what's going on inside me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I often don't know why I am angry.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I prefer talking to people about their daily activities rather than their feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I prefer to watch "light" entertainment shows rather than psychological dramas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. It is difficult for me to reveal my innermost feelings, even to close friends.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I can feel close to someone, even in moments of silence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I find examination of my feelings useful in solving personal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. Looking for hidden meanings in movies or plays distracts from their enjoyment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the last 30 days how often...

	none of the time	a little of the time	some of the time	most of the time	all of the time
	<input type="radio"/>				

31/12/2020

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	none of the time	a little of the time	some of the time	most of the time	all of the time
1. Did you feel tired out for no good reason.	<input type="radio"/>				
2. Did you feel nervous.	<input type="radio"/>				
3. Did you feel so nervous that nothing could calm you down.	<input type="radio"/>				
4. Did you feel hopeless.	<input type="radio"/>				
5. Did you feel restless or fidgety.	<input type="radio"/>				
6. Did you feel so restless that you could not sit still.	<input type="radio"/>				
7. Did you feel depressed.	<input type="radio"/>				
8. Did you feel that everything is an effort.	<input type="radio"/>				
9. Did you feel so sad that nothing could cheer you up.	<input type="radio"/>				
10. Did you feel worthless.	<input type="radio"/>				

Please indicate below how often the following statements apply to you.

	almost never (0-10%)	sometimes (11-35%)	about half the time (36-65%)	most of the time (66-90%)	almost always (91-100%)
1. I am clear about my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I pay attention to how I feel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I experience my emotions as overwhelming and out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I have no idea how I am feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I have difficulty making sense out of my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am attentive to my feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I know exactly how I am feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I care about what I am feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I am confused about how I feel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. When I'm upset, I acknowledge my emotions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. When I'm upset, I become angry at myself for feeling that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. When I'm upset, I become embarrassed for feeling that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. When I'm upset, I have difficulty getting work done	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. When I'm upset, I become out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. When I'm upset, I believe that I will remain that way for a long time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. When I'm upset, I believe that I will end up feeling very depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. When I'm upset, I believe that my feelings are valid and important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. When I'm upset, I have difficulty focusing on other things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. When I'm upset, I feel out of control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. When I'm upset, I can still get things done	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. When I'm upset, I feel ashamed of myself for feeling that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. When I'm upset, I know that I can find a way to eventually feel better	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. When I'm upset, I feel like I am weak	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. When I'm upset, I feel like I can remain in control of my behaviours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25. When I'm upset, I feel guilty for feeling that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. When I'm upset, I have difficulty concentrating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. When I'm upset, I have difficulty controlling my behaviours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. When I'm upset, I believe there is nothing I can do to make myself feel better	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. When I'm upset, I become irritated at myself for feeling that way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. When I'm upset, I start to feel very bad about myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

31/12/2020

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	almost never (0-10%)	sometimes (11- 35%)	about half the time (36-65%)	most of the time (66-90%)	almost always (91-100%)
31. When I'm upset, I believe that wallowing in it is all I can do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
32. When I'm upset, I lose control over my behaviour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
33. When I'm upset, I have difficulty thinking about anything else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. When I'm upset, I take time to figure out what I'm really feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35. When I'm upset, it takes me a long time to feel better	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. When I'm upset, my emotions feel overwhelming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Rate yourself on each item, on a scale from 1 (almost never true) to 7 (almost always true).**

	Almost never true	Rarely true	Less than half the time true	Neutral	More than half the time true	Often true	Almost always true
Defends own beliefs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Independent	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assertive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strong personality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forceful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have leadership abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Willing to take risks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dominant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Willing to take a stand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aggressive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Validation Questions**

**Please answer the questions below based on how you have felt and conducted yourself regarding your internet use over the past 6 months. Please do your best to interpret these questions as they apply to your own experiences and feelings.**

**When considering your internet use time, think about any time you spend online, whether you are using a computer or a mobile device. Do not include time you spend texting unless you are using text messages to interact with an online application such as Facebook or twitter. Please select one answer per statement.**

	Never	Rarely	sometimes	Often	Very Often
1. Do you choose to socialise online instead of in-person?	<input type="radio"/>				
2. Do you have problems with face-to-face communication due to your internet use?	<input type="radio"/>				
3. Do you experience increased social anxiety due to your internet use?	<input type="radio"/>				
4. Do you fail to create real-life relationships because of the internet?	<input type="radio"/>				
5. Do you skip social events to spend time online?	<input type="radio"/>				
6. Do your offline relationships suffer due to your internet use?	<input type="radio"/>				
7. Do you feel irritated when you are not able to use the internet?	<input type="radio"/>				
8. Do you feel angry because you are away from the internet?	<input type="radio"/>				
9. Do you feel anxious because you are away from the internet?	<input type="radio"/>				
10. Do you feel vulnerable when the internet isn't available?	<input type="radio"/>				
11. Do you experience feelings of withdrawal from not using the internet?	<input type="radio"/>				
12. Do you put internet use in front of important, everyday activities?	<input type="radio"/>				
13. Do you avoid other activities in order to stay online?	<input type="radio"/>				
14. Do you neglect your responsibilities because of the internet?	<input type="radio"/>				

	Never	Rarely	sometimes	Often	Very Often
15. Do you lose motivation to do other things that need to get done because of the internet?	<input type="radio"/>				
16. Do you lose sleep due to nighttime internet use?	<input type="radio"/>				
17. Does time on the internet negatively affect your academic performance?	<input type="radio"/>				
18. Do you feel you use the internet excessively?	<input type="radio"/>				

Indicate how true each of the following statements are to you. Please select one answer per statement

	Not at all true	Hardly true	Moderately true	Exactly true
1. I can always manage to solve difficult problems if I try hard enough	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. If someone opposes me, I can find the means and ways to get what I want.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. It is easy for me to stick to my aims and accomplish my goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am confident that I can deal efficiently with unexpected events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Thanks to my resourcefulness, I know how to handle unforeseen situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I can solve most problems if I invest necessary effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I can remain calm when facing difficulties because I can rely on my coping abilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. When I am confronted with a problem, I can usually find several solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. If I am in trouble, I can usually think of a solution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I can usually handle whatever comes my way	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

name and student ID

Please enter your name and student ID so we can award you points in SONA and match your survey data to tasks you complete in the lab. These details will be removed from the data set after grades are ratified at the end of semester, at which point your responses to this survey will be anonymous.

Name:

Student ID

Thank you for taking the time to complete this survey. We realise some of the questions might have raised some uncomfortable memories for some people. You might find the following resources helpful.

[Self injury fact sheet](#)

[Alcohol fact sheet](#)

[Stress management](#)

[Service Resources](#)

Please return to the SONA undergraduate pool website or the paid participant pool website to sign-up to a lab-time slot to complete part-two of the study. To receive the four points or the \$15 we ask you to complete both part one (online survey) and part two (computer tasks) of this study. Part-two of the study will take place in the Perl-C lab. Perl-C is located near the Japanese gardens in the psychology building (401) on the Bentley Curtin campus.

## Appendix F

## NEQ and DEQ-R items compared to sentence-completion task items

NEQ item	Sentence Completion
<b>Affect Regulation</b>	
I would feel relieved	If I self-injured I would feel...relieved
I would feel calm	If I self-injured I would feel ...calm
I would feel less frustrated with the world	If I self-injured I would feel ...less frustrated
The future would seem more optimistic	If I self-injured I would feel ...optimistic
I would feel better about myself	If I self-injured I would feel ...better
<b>Negative Social Outcomes</b>	
My family would be disgusted	If I self-injured my family would be.....disgusted
My friends would be disgusted	If I self-injured my friends would be ...disgusted
My friends would not approve of me	If I self-injured my friends would ...not approve
My parents would be angry	If I self-injured my parents would be ...angry
Other people would notice and think I was a freak	If I self-injured other people would ...look down on me
<b>Pain Expectancies</b>	
It would hurt	If I self-injured it would ...hurt
I would not be aware of any physical pain (R)	If I self-injured it would ...cause pain
I would not feel any pain (R)	If I self-injured it would..... be painful
I would feel physical pain	If I self-injured I would feel.....physical pain
The pain would be intense	If I self-injured I would fell.....intense pain
<b>Negative self-beliefs</b>	
I would feel ashamed	If I self-injured I would feel ...ashamed
I would feel like a failure	If I self-injured I would feel ...a failure
I would feel numb	If I self-injured I would feel ...numb
I would feel emotionally drained	If I self-injured I would feel ...emotionally drained
I would hate myself	If I self-injured I would ...hate myself
<b>Communication expectancies</b>	
Other people would notice and offer sympathy	If I self-injured other people would ...offer sympathy
I could make other people do things for me	If I self-injured other people would ...do things for me
I would get care from others	If I self-injured other people would ...care for me
It would be easier to get what I want from others	If I self-injured other people would ...do what I want
I would feel that it would be easier to open up and express my feelings	If I self-injured other people would..... listen

DEQ-R item	Sentence Completion
<b>Negative Consequences</b>	
Drinking alcohol makes me tense	<b>NOT USED</b>
Drinking makes the future brighter (R)	<b>NOT USED</b>
I drink alcohol because it's a habit	<b>NOT USED</b>
Drinking makes me bad tempered	Drinking alcohol would make me...Bad tempered
I feel restless when drinking alcohol	<b>NOT USED</b>
I am more sullen and depressed when drinking alcohol	Drinking alcohol would make me feel...depressed
I cannot always control my drinking	<b>NOT USED</b>
Drinking increases my aggressiveness	Drinking alcohol would make me... more aggressive"
Drinking makes me feel like a failure	Drinking alcohol would make me feel... a failure
I am addicted to alcohol	<b>NOT USED</b>
Drinking brings out the worst in me	Drinking alcohol would bring out the...the worst in me
Drinking makes me feel more violent	Drinking alcohol would make me feel...more violent
I am powerless in the face of alcohol	Drinking alcohol would make me feel...powerless
When I'm drinking, I avoid other people	<b>NOT USED</b>
I feel disappointed in myself when drinking	Drinking alcohol would make me feel...disappointed in myself
<b>Increased Confidence</b>	
Little things annoy me less when I'm drinking	<b>NOT USED</b>
Drinking makes me feel outgoing and friendly	Drinking alcohol would make me feel...outgoing
I have more self-confidence when drinking	Drinking alcohol would make me feel... more confident"
Drinking makes me more sexually responsive	<b>NOT USED</b>
I am less concerned about my actions when I'm drinking	Drinking alcohol would make me less concerned about...my actions
If I'm drinking, it's easier to express my feelings	Drinking alcohol would make it easier to... express my feelings
When I am drinking, it's easier to open up and express my feelings	
I often feel sexier after I've been drinking	Drinking alcohol would make me feel... Sexier
I tend to adopt a "who cares" attitude when I'm drinking	Drinking alcohol would make me feel...carefree
I feel less shy when drinking	Drinking alcohol would make me feel... less shy"
I am less discreet if I drink alcohol	Drinking alcohol would make me... less discreet"
I am clumsier when drinking alcohol	<b>NOT USED</b>
<b>Sexual Enhancement</b>	
Drinking alcohol removes most thoughts of sex from my mind (R)	Drinking alcohol would remove thoughts of...thoughts of sex
I tend to avoid sex if I've been drinking (R)	Drinking alcohol would make me...avoid sex
I lose most feelings of sexual interest after I have been drinking (R)	Drinking alcohol would make me lose...sexual interest
<b>Cognitive Enhancement</b>	
I am more aware of what I say and do if I'm drinking	Drinking alcohol would make me... more aware
Drinking helps me to be more mentally alert	Drinking alcohol would make me...more mentally alert
Drinking alcohol sharpens my mind	Drinking alcohol would make me... sharp-witted"
<b>Tension Reduction</b>	
I do not need alcohol to help me unwind after a hard day or week at work (R)	Drinking alcohol would help me...unwind
Drinking does not help to relieve any tension I feel about recent concerns and interests (R)	Drinking alcohol would help me feel...less tense
When I am anxious or tense I do not feel the need for alcohol (R)	Drinking alcohol would help me feel...less anxious

## Appendix G

### Non-supervisor author approval

#### Re: Signature needed for measurement invariance study

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Mon 7/12/2020 4:12 PM

To: Danyelle Greene <danyelle.greene@postgrad.curtin.edu.au>

I, David Preece, give Danyelle Greene permission to include the article "Greene, D., Hasking, P., Boyes, M., & Preece, D. (2020). Measurement Invariance of Two Measures of Alexithymia in Students Who Do and Who Do Not Engage in Non-suicidal Self-Injury and Risky Drinking. *Journal of Psychopathology and Behavioral Assessment*, 42, 808-825" in her PhD thesis. I am a co-author of this journal article.

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## Appendix H

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