THE INFLUENCE OF COMORBID NEGATIVE MOOD ON CRAVING’S
RELATIONSHIP TO POST-TREATMENT ALCOHOL USE

Jennifer Connolly, BSc (Hons)
School of Applied Psychology
Faculty of Health
Griffith University
Queensland
Australia

Submitted in fulfilment of the requirements of the degree of
Doctor of Philosophy in Clinical Psychology

November 2012
Abstract

**ABSTRACT**

Alcohol is ranked as the third highest burden of disease worldwide and the eighth highest leading cause of death. An estimated 19.5% of Australians consume alcohol in quantities that place them at risk of alcohol-related injury or disease over their lifetime. Alcohol misuse is also highly problematic, being associated with a range of negative physical, psychological and social consequences. While treatments are effective in helping people to achieve reductions, relapse rates are high, with up to 80% of treated alcohol users eventually relapsing. The ability to identify which treatment seekers may be at greater risk for relapse would enable appropriate tailoring of interventions and planning of aftercare.

Craving has been widely studied as a potential predictor of relapse, but has performed inconsistently. The effect of comorbid depression on craving’s predictive performance however, has been largely neglected, despite demonstrated associations between negative affect and craving, and between negative affect and substance use. The aim of this thesis was to explore the performance of craving as a predictor of post-treatment alcohol use outcomes in the presence of comorbid depressed mood, under the hypothesis that presence of negative affect would augment effects of craving, strengthening its predictive power and increasing vulnerability to post-treatment relapse. Two studies were conducted, one with a sample of drinkers with comorbid depression, and the other with a sample of drinkers with a range of depression severity.

Study 1 included 284 males and females who self-referred for a randomised controlled trial of treatments for comorbidity of depression with alcohol use. Participants scored 17 or greater on the Beck Depression Inventory-II and reported at
Abstract

least two occasions in the previous month of greater than 6 standard drinks (6 x 10g ethanol) for men, or greater than 4 for women. Craving was measured prior to treatment using the obsessive subscale of the Obsessive Compulsive Drinking Scale. Two drinking outcomes, average weekly drinks and frequency of alcohol binges, were assessed 18 weeks and 12 months post-baseline. Interaction effects between craving and depression were examined by including an interaction term in the analyses. Craving was found to be a significant predictor of 18-week average weekly drinking and of higher frequency of binges at 18 weeks and 12 months. Neither depression by itself, nor the interaction of depression with craving were significant, although this may have been due to lack of sufficient spread in depression scores to detect an effect. Item analysis suggested different influences of craving over time, with items pertaining to interference from drinking thoughts and success in diverting thoughts being related to 18-week outcomes, and items pertaining to frequency of thoughts and efforts to resist thoughts being related to 12-month outcomes.

Study 2 included 242 males and females who self-referred for a randomised controlled trial of treatments for alcohol use disorder. Participants were consuming more than 28 standard drinks per week for men, or more than 14 per week for women, and met diagnostic criteria for an alcohol use disorder. Craving was measured prior to treatment using the obsessive subscale of the Obsessive Compulsive Drinking Scale and a newly developed craving measure, the Alcohol Craving Experience questionnaire. Depression was measured using the Depression, Anxiety and Stress Scale-21. Outcome assessments, measuring the same outcomes as in Study 1, were conducted 3 and 12 months post-baseline. Identical analyses were conducted as in Study 1, including an interaction term between craving and depression. Unlike Study 1, craving by itself was not a significant predictor of either of the outcomes at any time point, although the
Abstract

interaction between craving and depression was a predictor of average weekly drinking at 12 months. Consistent with Study 1, depression was not related to outcomes. Results were also consistent with the item analyses of Study 1, with items pertaining to intrusiveness of alcohol thoughts and efforts to not think about alcohol performing most strongly in the prediction of 12-month drinking.

The finding that craving was predictive of treatment outcomes in the high depression sample of Study 1, and interacted with depression to predict outcomes in Study 2, appears to provide preliminary support for a potential moderating effect of depression on the relationship between pre-treatment craving and post-treatment alcohol use. Furthermore, results suggest that risk from craving may come from how alcohol thoughts are managed, rather than from the thoughts themselves.
STATEMENT OF ORIGINALITY

This work has not previously been submitted for a degree or diploma in any university.
To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself. The data reported in the studies of this thesis were collected by myself and a team of research assistants during the course of two randomised controlled trials.

__________________________________________
Jennifer Connolly
# TABLE OF CONTENTS

ABSTRACT .......................................................................................................................... II

STATEMENT OF ORIGINALITY ....................................................................................... V

TABLE OF CONTENTS ......................................................................................................... VI

LIST OF TABLES ................................................................................................................ IX

LIST OF FIGURES ................................................................................................................ XII

LIST OF APPENDICES ......................................................................................................... XIII

LIST OF PUBLICATIONS ....................................................................................................... XIV

ACKNOWLEDGEMENTS ....................................................................................................... XV

CHAPTER 1 OVERVIEW ........................................................................................................ 1

CHAPTER 2 WHY WORRY ABOUT ALCOHOL? ................................................................. 5
  2.1 High prevalence ........................................................................................................... 5
  2.2 Consequences of alcohol misuse ............................................................................... 6
  2.3 Treatment and relapse ............................................................................................... 9
    2.3.1 Common treatment approaches ........................................................................... 9
    2.3.2 Recent advances in treatment ............................................................................. 14
    2.3.3 Treatment impact .................................................................................................. 16

CHAPTER 3 ROLE OF CRAVING IN ADDICTION ............................................................. 21
  3.1 What is craving? ......................................................................................................... 21
  3.2 Why craving is important ........................................................................................ 23
  3.3 Models of craving in addiction theory ...................................................................... 24
    3.3.1 Cognitive model ................................................................................................... 25
    3.3.2 Negative reinforcement theory and affective model of drug motivation .......... 26
    3.3.3 Positive reinforcement and opponent-process theory of motivation ................. 29
    3.3.4 Biological theories of addiction and the incentive-sensitisation model ............. 31
    3.3.5 Elaborated intrusion theory of craving ............................................................... 35
  3.4 Implications of craving ............................................................................................... 38

CHAPTER 4 CRAVING AS A PREDICTOR OF SUBSTANCE TREATMENT OUTCOMES ........... 40
  4.1 High variability between studies .............................................................................. 48
# Table of contents

4.1.1 Measurement limitations ............................................. 50
4.1.2 Outcome variability ..................................................... 58
4.2 Methodological issues .................................................... 62
4.3 Implications of variability and methodological issues .......... 64

**CHAPTER 5 ROLE OF NEGATIVE AFFECT IN ADDICTION ......... 66**

5.1 Relationship between negative affect and substance use ........ 67
5.1.1 Evidence of proximal associations ................................. 67
5.1.2 Relationship to substance treatment outcomes ............... 70
5.2 Relationship between negative affect and craving ............... 73
5.2.1 Negative affect and substance cue reactivity .................. 73
5.2.2 Negative affect and craving in situ ............................... 77
5.3 Summary of role of negative affect in addiction .................. 78
5.4 Dynamic association between craving, negative affect and substance use ................................................................. 80
5.5 Craving as a predictor of outcomes in the context of negative affect 83

**CHAPTER 6 AIMS OF THIS THESIS ............................................ 86**

6.1 Studying craving as a predictor in drinkers with comorbid depressed mood .............................................................. 86
6.2 Using context and construct relevant measures .................. 87
6.3 Use of continuous outcome measures ............................... 88

**CHAPTER 7 STUDY 1: CRAVING AS A PREDICTOR OF TREATMENT OUTCOMES IN HEAVY DRINKERS WITH COMORBID DEPRESSED MOOD ............................................. 89**

7.1 Introduction ...................................................................... 89
7.2 Method ............................................................................ 93
7.2.1 Participants .................................................................. 93
7.2.2 Measures ..................................................................... 95
7.2.3 Interventions .................................................................. 99
7.2.4 Procedure ..................................................................... 100
7.2.5 Statistical analysis ......................................................... 100
7.3 Results ............................................................................. 102
7.3.1 Data adjustments .......................................................... 104
7.3.2 Missing data ............................................................... 105
7.3.3 Average weekly drinks .................................................. 106
7.3.4 Frequency of binges ....................................................... 110
7.3.5 OCDS-O items ............................................................. 114
7.3.6 Sensitivity analyses ......................................................... 117
7.4 Discussion ....................................................................... 118
7.5 Conclusion ....................................................................... 125
# Table of contents

## CHAPTER 8  STUDY 2: THE INFLUENCE OF MOOD-CRAVING RELATIONSHIPS ON ALCOHOL TREATMENT OUTCOMES ..................................................127

8.1 Introduction ........................................................................................................127
8.2 Method ..................................................................................................................131
  8.2.1 Participants ....................................................................................................131
  8.2.2 Measures .......................................................................................................134
  8.2.3 Interventions .................................................................................................137
  8.2.4 Procedure .....................................................................................................139
  8.2.5 Statistical analysis .........................................................................................140
8.3 Results ................................................................................................................142
  8.3.1 Data adjustments ..........................................................................................145
  8.3.2 Missing data ................................................................................................146
  8.3.3 Average weekly drinks .................................................................................147
  8.3.4 Frequency of binges ......................................................................................156
  8.3.5 Sensitivity analyses .....................................................................................164
8.4 Discussion ............................................................................................................166
8.5 Conclusion ...........................................................................................................176

## CHAPTER 9  GENERAL DISCUSSION .................................................................177

9.1 Evidence for moderating effect of depression ....................................................180
9.2 Inconsistencies and implications ........................................................................182
  9.2.1 Prediction of average weekly drinks ............................................................183
  9.2.2 Prediction of alcohol binges ........................................................................185
9.3 Consistencies and implications ...........................................................................186
  9.3.1 Variance explained by craving ......................................................................186
  9.3.2 Nature of significant craving items ...............................................................188
  9.3.3 Lack of prediction by depression ..................................................................189
9.4 Clinical implications .............................................................................................191
9.5 Limitations of this body of work .........................................................................193
9.6 Future directions ................................................................................................195
9.7 Conclusions .........................................................................................................197

## REFERENCES  199

## APPENDICES  222
LIST OF TABLES

Table 4.1 Studies predicting post-treatment substance use outcomes from pre-treatment craving measurements ........................................................................................................... 41

Table 7.1 Demographic characteristics of the full sample (n=284) ........................................ 95

Table 7.2 Baseline characteristics of the analysed sample (N = 260) ......................... 102

Table 7.3 Correlation matrix of baseline variables ............................................................. 104

Table 7.4 Results of correlations (r) and ANOVAs (F) of baseline and treatment variables with average weekly drinks at each follow-up time point .......... 107

Table 7.5 Results of partial correlations (r) and ANCOVAs (F) of baseline and treatment variables with average weekly drinks at each follow-up time point, controlling for baseline consumption ......................................................... 108

Table 7.6 Coefficients of baseline and treatment variables predicting average weekly drinks at 18 weeks at each step of hierarchical linear regression (n = 205) .................................................................................................................................................. 109

Table 7.7 Results of ANOVAs (F) and chi-squares ($\chi^2$) of baseline and treatment variables with frequency of binges at each follow-up time point ............ 111

Table 7.8 Results of ANCOVAs (F) and likelihood ratio tests ($\chi^2$) of baseline variables with frequency of binges at each follow-up time point, controlling for baseline binge frequency ................................................................................................................. 112

Table 7.9 Parameter estimates for baseline variables predicting binge frequency at each follow-up time point (n = 207). Reference category is ‘half or more of the week’ ................................................................................................................................................. 114
List of tables

Table 7.10  Regression coefficients and semi-partial correlations for OCDS-O items predicting 18-week average weekly drinks (n = 205) ........................................ 115

Table 7.11  Likelihood ratio tests ($\chi^2$) and parameter estimates (B) for OCDS-O items predicting post-treatment binge frequency (n = 206). Reference category is ‘half or more of the week’ ................................................................. 116

Table 8.1  Demographics characteristics of the full sample (N = 242) ...................... 134

Table 8.2  Baseline characteristics of the full sample (N = 242) .............................. 143

Table 8.3  Correlation matrix of baseline variables .................................................. 144

Table 8.4  Results of correlations (r) and ANOVAs (F) of baseline and treatment variables with average weekly drinks at each follow-up time point .......... 149

Table 8.5  Results of partial correlations (r) and ANCOVAs (F) of baseline and treatment variables with average weekly drinks at each follow-up time point, controlling for baseline consumption ........................................ 150

Table 8.6  Coefficients of baseline variables, with craving measured using the OCDS-O, predicting average weekly drinks at 12 months (N = 239) .................. 152

Table 8.7  Coefficients of baseline variables, with craving measured using the ACE-Intrusions, predicting average weekly drinks at 12 months (N = 229) ..... 154

Table 8.8  Coefficients of baseline variables at step 4 of the linear regressions predicting 12-month average weekly drinks from the interactions of depression with the OCDS-O and ACE-Intrusions (N = 226) ....................................... 156

Table 8.9  Results of ANOVAs (F) and chi-squares ($\chi^2$) of baseline and treatment variables with frequency of binges at each follow-up time point ............ 158

Table 8.10  Results of ANCOVAs (F) and likelihood ratio tests ($\chi^2$) of baseline variables with frequency of binges at each follow-up time point, controlling for baseline binge frequency ......................................................... 160
Table 8.11 Parameter estimates for baseline variables predicting frequency of binges at
3-month follow-up (N = 227). Reference category is ‘half or more of the
week’ ................................................................................................................. 162

Table 8.12 Likelihood ratio tests ($\chi^2$) and parameter estimates ($B$) for baseline variables
predicting frequency of binges at 12 months (N = 237). Reference category
is ‘half or more of the week’ ............................................................................. 163

Table 8.13 Likelihood ratio tests ($\chi^2$) and parameter estimates ($B$) for baseline and
treatment variables predicting frequency of binges 3 months (N = 237).
Reference category is ‘half or more of the week’ ........................................... 164
LIST OF FIGURES

Figure 7.1. CONSORT diagram showing flow of participants through Study 1 .......... 94

Figure 8.1. CONSORT diagram showing flow of participants through Study 2 ........ 133

Figure 8.2. Predicted values of 12-month average weekly drinks for people with low or high depression, at low craving (1SD below the standardised mean of OCDS-O) and high craving (1SD above) .......................................................... 153

Figure 8.3. Predicted values of 12-month average weekly drinks for people with low or high depression, at low craving (1SD below the standardised mean of ACE-Intrusion) and high craving (1SD above) ....................................................... 155
LIST OF APPENDICES

Appendix A Study 1 assessment measures ............................................................... 223
Appendix B Study 1 demographic characteristics of reduced sample .................. 242
Appendix C Results of Study 1 missing value analysis and imputation ................. 243
Appendix D Alcohol Craving Experience Questionnaire ....................................... 244
Appendix E Alcohol Craving Experience Questionnaire after item reduction ........ 248
Appendix F Study 2 assessment measures .............................................................. 250
Appendix G Results of Study 2 missing value analysis and imputation ................. 261
Appendix H Baseline and demographic differences between the populations of Study 1 and Study 2 ........................................................................................................... 262
LIST OF PUBLICATIONS

Publications arising from this thesis


Publications related to this thesis

ACKNOWLEDGEMENTS

Many people have provided valuable support and assistance throughout the course of this PhD. Without them, this research would not have been possible, and this thesis would never have finished the journey onto printed page.

An enormous thank you is owed to my principal supervisor, Dr Penelope Davis. You have been incredibly generous, patient and kind, and have stuck with me through the hard times when others might not have. I have greatly appreciated your guidance and support, and the personal, caring approach you brought to every supervision session. You never gave up on me, even when I thought I might, and this finished thesis is as much a consequence of your belief in me as it is of my effort. I’m more grateful than I could ever say.

This thesis would not have been possible without the generous support and contribution of Professor David Kavanagh. We have worked together for a very long time, but you are so much more than just a boss to me. A mentor, a colleague, and a friend, you have given so much of your time to help bring this thesis together. I have learned an incredible amount from you during this process, and your enthusiasm for research has been highly contagious. Thank you so much for everything.

Thank you also to my associate supervisor, Professor Sharon Dawe. You always made yourself available whenever needed, and offered important insights and advice at crucial times. Acknowledgement and gratitude also goes to Professor Amanda Baker for generously permitting use of data from her randomised controlled trial for this thesis.
Acknowledgements

I have also been blessed with amazing support from a number of people in my personal life, and it would not seem right to not mention them here when they have been beside me throughout this whole long journey, believing in me and encouraging me.

I am immensely grateful to my parents, who provided financial support throughout a substantial portion of my post-graduate studies and who made it clear that I could never disappoint them. My wonderful Dad told me in the very beginning that if it all got too much I could quit and come back home to potter around in the garden with Mum. Knowing I could never disappoint you gave me a sense of security and safety from which to draw enormous strength. I’m so grateful to have such amazing, supportive parents.

I am very grateful to my husband Shawn who provided unwavering support and encouragement throughout this long, long process. Thank you for the endless cups of tea, for the chocolate, and most of all, for massaging the knots out of my neck and shoulders from spending hours on end hunched over a keyboard!

Thank you to my best friend and cheer-leader, Kim Gavarra. You managed to turn every thesis frown into a smile, and helped me to laugh when I wanted to cry. You rode this emotional roller-coaster with me, and never tired of picking me up whenever I fell down. I am truly blessed to have such a loyal, dedicated friend.

Last, but definitely not least, a big big thank you to my friend and colleague Dr Lake-Hui Quek. You took the greatest interest when you had the least to gain. You encouraged me, motivated me, supported me, and on occasions, threatened me. You did whatever it took to keep me moving forward, and you are a large part of the reason this thesis exists today. I couldn’t have done it without you. Thank you so much.