

RESEARCH REPORT

Experiences and perceptions of gamblers using gambling, mental health and alcohol and other drug use online forums: A natural language processing approach

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Table of contents

Acknowledgements	2
Table of contents	3
List of figures	5
Executive summary	7
Background and aims	7
Research approach	7
Results	8
Conclusions	9
Background	10
Context	10
Co-morbidities associated with gambling problems	10
Help-seeking for gambling	13
Natural Language Processing	14
Cross-jurisdictional comparisons	16
Rationale	18
Project aims	18
Approach	20
Data sources and extraction	20
Data cleaning and selection	20
Data cleaning	20
Data selection	21
Data analysis	21
Descriptive statistics	21
Latent Dirichlet Allocation	21
Ethics approval	23
Results	24

Study 1 – Relationship between gambling and mental health/alcohol and other drug problems	24
Gambling Help Online (Australia)	24
Beyond Blue (Australia)	29
GamCare (UK)	35
PsychForums (US).....	41
Summary of Study 1 Results	44
Study 2 – Help-seeking.....	45
Gambling Help Online (Australia)	45
Beyond Blue (Australia)	54
GamCare (UK)	60
PsychForums (US).....	69
Summary of Study 2 Results	76
Conclusions	78
Summary of main findings.....	78
Strengths and limitations.....	81
Clinical and research implications.....	82
References	85
Appendices	89
Appendix 1. Keywords for BeyondBlue	89
Appendix 2. Keywords for Study 1	89
Appendix 3. Keywords for Study 2	89
Appendix 4. LDA topic models for Study 1	90
Appendix 5. LDA topic models for Study 2	94

List of figures

Figure 1. Top 50 most commonly used words in Gambling Help Online posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues	25
Figure 2. Correlations between mental health and alcohol and other drug keywords in Gambling Help Online ...	25
Figure 3. Gambling Help Online – 7-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues	26
Figure 4. Top 50 most commonly used words in Beyond Blue posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues.....	29
Figure 5. Correlations between mental health and alcohol and other drug keywords in Beyond Blue	30
Figure 6. Beyond Blue – 11-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues	31
Figure 7. Top 50 most commonly used words in GamCare posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues	36
Figure 8. Correlations between mental health and alcohol and other drug keywords in GamCare ($\phi > 0.15$)....	37
Figure 9. Correlations between mental health and alcohol and other drug keywords in GamCare ($\phi > 0.20$)....	37
Figure 10. GamCare – 7-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues	38
Figure 11. Top 50 most commonly used words in PsychForums posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues.....	41
Figure 12. Correlations between mental health and alcohol and other drug keywords in PsychForums.....	42
Figure 13. PsychForums – 3-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues	43
Figure 14. Top 50 most commonly used words in Gambling Help Online posts exploring help-seeking.....	45
Figure 15. Correlations between help-seeking keywords in Gambling Help Online	46
Figure 16. Gambling Help Online – 14-topic model exploring help-seeking.....	47
Figure 17. Top 50 most commonly used words in Beyond Blue posts exploring help-seeking.....	54
Figure 18. Correlations between help-seeking keywords in Beyond Blue.....	55
Figure 19. Beyond Blue- 13-topic model exploring help-seeking	56
Figure 20. Top 50 most commonly used words in GamCare posts exploring help-seeking.....	61
Figure 21. Correlations between help-seeking keywords in GamCare ($\phi > 0.15$)	62
Figure 22. Correlations between help-seeking keywords in GamCare ($\phi > 0.20$)	63
Figure 23. GamCare - 15-topic model exploring help-seeking	64
Figure 24. Top 50 most commonly used words in PsychForums posts exploring help-seeking	69
Figure 25. Correlations between help-seeking keywords in PsychForums	71
Figure 26. PsychForums- 14-topic model exploring help-seeking.....	71
Figure 27. Gambling Help Online - 50-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues	91

Figure 28. Beyond Blue - 30-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues	91
Figure 29. GamCare - 70-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues	93
Figure 30. PsychForums - 45-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues	94
Figure 31. Gambling Help Online - 40-topic model exploring help-seeking	94
Figure 32. Beyond Blue- 45-topic model exploring help-seeking	95
Figure 33. GamCare - 45-topic model exploring help-seeking	96
Figure 34. PsychForums- 45-topic model exploring help-seeking	98

Executive summary

Background and aims

Research has shown high rates of co-occurring gambling problems and mental health disorders across gambling, mental health and alcohol and other drug (AOD) samples. Understanding the nature of the temporal relationship between these conditions is growing, but there is limited research examining the interaction between gambling problems and mental health/AOD issues from the gambler's perspective. Moreover, despite self-directed help-seeking being the most utilised help-seeking option, research relating to the help-seeking behaviour of gamblers has predominately utilised samples of treatment-seeking gamblers from face-to-face treatment services.

There is now a large amount of rich data available through online sources. Few studies have drawn on samples of online gambling forum users to understand the co-occurrence and help-seeking for gambling problems, mental health and AOD issues. This is due, in part, to limitations of existing methodologies in which data extraction and analysis of large data sets was not feasible. To address these limitations, the study will use Natural Language Processing (NLP) techniques. This approach consists of a range of computational techniques that can be used to understand patterns in written text. NLP techniques represent cutting-edge methodology in the automated analysis of large databases of text-based information.

Study 1 will be the first to apply NLP techniques to explore experiences and perceptions of the *relationship* between co-morbid gambling and mental health/AOD problems among Australian gambling and mental health/AOD online forum users. Also using NLP techniques, Study 2 will explore experiences and perceptions of gambling, mental health or AOD *help-seeking* in Australian gambling and mental health/AOD online forum users. Given differences in gambling preferences and treatment services provision across jurisdictions, each study will also examine jurisdictional differences in such experiences and perceptions relative to UK and US online gambling forum users.

Research approach

The methodological approach consisted of three main steps: (1) data sourcing and extraction; (2) data cleaning and selection; and (3) data analysis.

1. **Data sourcing and extraction:** Data were sourced from gambling and mental health forums across Australia, the UK and the US. This included Gambling Help Online (Australia), Beyond Blue (Australia), GamCare (UK) and PsychForums (USA). Data was extracted from these forums between July 2019 and February 2020, utilising various approaches depending on the forum structure.
2. **Data cleaning and selection:** A series of pre-processing steps aimed to prepare the text so that NLP techniques could be applied. Text was cleaned to remove whitespace, symbols, numbers and stopwords (i.e., words that did not add meaning to the data such as 'and' and 'is'). Cleaning also involved removing salutations, facilitator posts and applying stemming techniques that transformed the data to the root form (i.e., gambling to gamble). Data selection involved the generation of a set of plain language key words that reflected the focus on the study (e.g., sad and alcohol for Study 1, and help and treatment for Study 2). This set of key words was applied to the sourced data to create a smaller pool of data relevant to the research questions.

3. Data analysis: NLP techniques were applied to the selected text to identify patterns in the data. Descriptive statistics were generated based on word frequency analyses (the most frequently occurring words) and correlation analyses (words that frequently appear together). NLP techniques were then conducted to identify common themes (referred to as topics) within the text, based on how words cluster together within the text (e.g., a theme could include words like relapse, stress, trigger, trying). The topics most relevant to each research question were extracted and given a label based on the deduced meaning of the co-occurring words (e.g., relapse), as well as the posts that are most emblematic of each topic. Each topic was then subject to sentiment analysis, which identified the emotional content of each topic (e.g., negative, positive, neutral).

Results

Analysis of Australian gambling, mental health and AOD forum text indicated that forum users discussed their experiences and perceptions of the relationship between gambling problems and mental health/AOD issues. Data extracted from the Australian forum Gambling Help Online (3,598 posts) identified seven different topics. Four topics related to gambling and mental health issues: (i) the bi-directional relationship between gambling and mental health; (ii) the relationship between gambling and mental health issues; (iii) the emotional impact of gambling; and (iv) finances and other stress. Three topics related to gambling and AOD issues: (i) addiction swapping; (ii) self-exclusion from venues which supply alcohol; and (iii) the relationship between gambling and alcohol.

Forum text across Australia, UK and US jurisdictions all contained discussions on gambling and mental health issues (i.e., depression and anxiety), as well as other addictive disorders (i.e., hazardous alcohol use). While identified topics differed across Gambling Help Online and Beyond Blue, there were similarities in the topics identified across the three gambling forums. Topics identified from Beyond Blue (3,718 posts; 11-topics) related to gambling and a broad range of mental health issues (e.g., bipolar disorder, medication for mental health disorders, abusive relationships). The UK based GamCare (53,775 posts; 6-topics) also identified topics on the relationship between gambling and mental health issues, and the relationship between gambling and AOD. GamCare also included several topics that focused on work-related stress and gambling recovery. The US-hosted PsychForums (8,095 posts; 2-topics) contained topics on the relationship between gambling and mental health issues, and gambling as being similar to substance-based addictions.

Analysis of Australian gambling, mental health and AOD forum text indicated that forum users extensively discussed their experiences and perceptions of gambling, mental health and AOD help-seeking. Help-seeking data extracted from Gambling Help Online (2,600 relevant posts) identified 14 different topics. Of these six topics referred to specific help-seeking services or self-help strategies: (i) self-exclusion; (ii) help-services; (iii) 100-day challenge; (iv) information seeking; (v) Gamblers Anonymous; and (vi) financial self-help strategies. Five topics related to wanting to change and the common factors associated with the change process: (i) relapse; (ii) change-related; (iii) gambling history and stopping gambling; (iv) gambling urges; and (v) quit attempts). A further two topics addressed the benefits of the use of forums and one topic reflected forum users' experiences and perceptions of gambling as an addiction.

Forum text across Australia, UK and US jurisdictions all contained discussions on gambling and help-seeking. Beyond Blue (4,180 posts; 13-topics) discussion on specific help-seeking services or treatments was focused on psychiatric illness diagnoses and medications, coping strategies, help-seeking information provision, and professional help-seeking. Discussions on the UK forum GamCare (37,154 posts; 14-topics) focused on online blocking software, Gamblers Anonymous, spiritual recovery program, help services, and financial self-help strategies. Similarly, discussions on the US forum PsychForums (6,340 posts; 14-topics) was focused on Gamblers Anonymous, financial self-help strategies, and self-exclusion.

Other top topics related to help seeking also emerged across the four forums. Beyond Blue top contained several topics that did not directly relate to help-seeking but highlight other common issues that arise when dealing with any mental health or addiction issues, such as stigma. GamCare's identified topics included common factors associated with the change and recovery process (i.e., abstinence, recovery process, changing for the better, gambling free days, turning life around, and relapse). PsychForums' identified topics also included a discussion on the change process (i.e., goal of treatment, rock bottom, readiness to change, controlled gambling, life changing, fighting addiction, and relapse), as well as how to identify a problem and how to talk honestly with family members.

Conclusions

Gambling problems and mental health/ AOD commonly co-occur in Australia and internationally. The current study found people discuss their experiences and perceptions of these co-occurring conditions and help-seeking options mostly in gambling forums, but also in non-gambling forums. The focus of these discussions was on understanding the nature and impact of the relationship between gambling and mental health/AOD issues, such as finances and work-related stress, understanding the temporal order of these relationships, and understanding the similarities between gambling and AOD.

The current study also highlighted that all gambling forum users more frequently described their experiences with self-directed help-seeking options (e.g., self-exclusion), as well as Gambling Anonymous. In contrast to the other jurisdictions, Australian gambling forum users also discussed their experiences with specific face-to-face and distance-based help-seeking options (e.g., financial support, helplines), highlighting the availability and awareness of these services in Australia.

The current project is one of the first in the gambling field to utilise NLP techniques to quantitatively synthesise text sourced from online forum data. This method has resulted in a substantially larger and potentially more representative sample of help-seeking gamblers, as opposed to most research which has typically focussed on face-to-face help-seeking gamblers. The findings of this project highlight several clinical and research areas for consideration. This could include:

- Translating the topics identified in this project by creating new or enhancing existing prevention and treatment resources. The findings highlight specific areas that these resources could target including gambling and stress, gambling debt and finances, and the impact of mental health and AOD on gambling problems and recovery.
- Using gambling and mental health/AOD online forums to promote and increase access to gambling-related information and resources (e.g., new and advanced help-seeking options).
- Understand the optimal combination and sequencing of treatment needs. This requires research exploring whether it is feasible and effective to target multiple mental health and AOD concerns concurrently or sequentially. Alternatively, depending on the co-occurring conditions, transdiagnostic interventions that targets underlying similarities between multiple addictive behaviours might be required.

Background

Context

The current report is based on an innovative project that employs Natural Language Processing (NLP) techniques to investigate the experiences and perceptions of gamblers accessing online forums in Australia, UK and USA on: (1) the *relationship* between gambling problems and key comorbidities (i.e., depression, anxiety, family violence, and other addictions) and (2) *help-seeking* for gambling problems and mental health/AOD issues. This background section will first provide an overview of what we know about comorbidity in gambling, followed by help-seeking in gambling. It will then provide an overview of NLP and its use in various research fields. Finally, given the cross-jurisdictional nature of some of the research questions, this section will then provide an overview of jurisdictional differences in gambling worldwide.

Co-morbidities associated with gambling problems

Recent research has shown that gambling problems in Australia is associated with a substantial burden of harm, comparable to that of alcohol use dependence and major depressive disorder (Browne, Greer, Rawat, & Rockloff, 2017). The harms associated with gambling problems are widespread and include those related to finances, health, relationships, work and study, and emotional and psychological harms (Langham et al., 2016).

National and international research exploring the psychological harms associated with gambling problems has identified high rates of co-morbid mental health disorders in general population and clinical gambling samples. A systematic review and meta-analysis of co-morbid mental health disorders in population-representative samples of people with gambling problems, noted high rates of alcohol and other drug use disorders (57.5%), mood disorders (37.9%) and anxiety disorders (37.4%; Lorains, Cowlshaw, & Thomas, 2011). Similarly, high rates of co-morbid mental health disorders have been found in treatment-seeking gamblers, with a systematic review and meta-analysis revealing that 74.8% of treatment-seeking gamblers report any co-morbid mental health disorder, including mood disorders (23.1%), alcohol use disorders (21.2%), anxiety disorders (17.6%) and other drug use disorders (7.0%; Dowling et al., 2015).

Conversely, there is growing national and international evidence suggesting that people experiencing gambling problems are over-represented in alcohol and other drug (AOD) and mental health populations. A systematic review and meta-analysis of the prevalence of gambling problems in AOD treatment services revealed that 2.8% to 52.7% (mean of 13.7%) of individuals seeking treatment in AOD services were also experiencing a gambling problem (Cowlshaw, Merkouris, Chapman, & Radermacher, 2014). Similarly, rates of gambling problems are elevated in a range of mental health populations; however, these rates vary across studies, most likely due to methodological considerations. These estimates can range from as low as 0.7% in psychiatric outpatient populations to as high as 29.1% in individuals experiencing post-traumatic stress disorder (Biddle, Hawthorne, Forbes, & Coman, 2005; Zimmerman, Chelminski, & Young, 2006).

While these findings indicate the highly co-occurring relationships between gambling problems and numerous psychiatric disorders (i.e., mood, anxiety, alcohol and substance use disorders), these studies are cross-sectional in nature, hence the temporal order between these disorders cannot be ascertained (i.e., gambling as a risk factor for a psychiatric disorder or vice versa). Inferences relating to the temporal nature of gambling problems and co-morbid psychiatric conditions, however, have been explored through the retrospective examination of the onset and pattern of these disorders, with

mixed findings identified (Hodgins, Peden, & Cassidy, 2005; Kessler et al., 2008; Quilty, Watson, Robinson, Toneatto, & Bagby, 2011). For example, respondents in a large nationally representative sample of the US population reported that anxiety disorders (82%), mood disorders (65%), and alcohol or other drug use disorders (57%) began at an earlier age than problem gambling, whereas a similar number of respondents reported that the onset of PTSD predated the onset of problem gambling and the onset of problem gambling predated the onset of PTSD (Kessler et al., 2008). In a naturalistic sample of gamblers that had recently quit gambling, respondents indicated that major depressive disorder was just as likely to precede (40%) or follow (44%) the age of onset of gambling problems. In contrast, both alcohol (74%) and other drug (84%) disorders were more likely to precede the age of onset of gambling problems (Hodgins et al., 2005). Finally, a study of psychiatric samples with a history of bipolar and depressive disorders found that after accounting for the stability of symptom severity, any direct association between gambling problems and mood disorder symptom severity was eliminated (Quilty et al., 2011).

While these accounts provide some insight into the relationship between gambling problems and comorbid psychiatric disorders, these retrospective study designs are limited by potential recall and reporting biases (Lubman et al., 2017). There has, however, been an increase in longitudinal study designs, which have the capacity to determine the course of a clinical phenomenon (Lubman et al., 2017). A meta-analysis exploring the early risk and protective factors that are longitudinally associated with the development of gambling problems found that alcohol use frequency, cannabis use, illicit drug use and depressive symptoms were significantly positively associated with subsequent gambling problems, albeit with small to moderate effect sizes (Dowling et al., 2017). In contrast, anxiety symptoms did not significantly predict subsequent gambling problems (Dowling et al., 2017). A recent scoping review of longitudinal studies concluded that mental health and other addictive disorders can represent a predictor of gambling problems (Hartmann & Blaszczynski, 2018).

This review also concluded that psychiatric disorders can represent a precursor of gambling problems (Hartmann & Blaszczynski, 2018). There is, however, much less evidence that gambling problems are a risk factor for subsequent psychiatric disorders. For example, Chou and Afifi (2011) found that gambling problems predicted the incidence of bipolar disorder, generalised anxiety disorder, PTSD, alcohol use disorder, and alcohol dependence disorder in a large nationally representative US sample. Another study identified a dose-response relationship between different levels of gambling problems and the subsequent onset of any mood, anxiety, drug use, and alcohol use disorder, and PTSD (Parhami, Mojtabai, Rosenthal, Afifi, & Fong, 2014). This study also found that gambling problems were associated with the onset of major depressive episodes, dysthymia, hypomanic episodes, generalised anxiety disorder, and social phobia (Parhami et al., 2014). In a sample of older adults, Pilver, Libby, Hoff, and Potenza (2013) identified that experiencing any gambling problem (i.e., at-risk, problem/pathological gambling) was positively associated with the incidence of any Axis I disorder, mania, panic disorder, any drug use disorder and alcohol abuse/dependence. Finally, evidence suggests that gambling problems at a younger age (i.e., 17) predicted an increase in depressive symptoms from the age of 17 to 23 years (Dussault, Brendgen, Vitaro, Wanner, & Tremblay, 2011). More recently, a study of Tasmanian adults found that while depression and anxiety were associated with the subsequent development of any-risk gambling, any-risk gambling was not associated with the subsequent development of any mental health symptoms (depression or anxiety) or substance use (hazardous alcohol use, daily tobacco use or drug use; Dowling et al., 2019). Finally, data based on the Swedish longitudinal gambling study found that gambling predated experiences of depression and suicidal events for men only, whereas gambling problems predicted anxiety, depression and substance use issues in women (Sundqvist & Rosendahl, 2019). Further complicating these mixed findings regarding the temporal relationship between gambling problems and psychiatric disorders are recent transdiagnostic models of addiction and psychopathology, which suggest that these disorders are manifestations of common underlying issues, such as, impulsivity and emotional dysregulation (Kim & Hodgins, 2018).

While these studies suggest that the majority of psychiatric disorders tend to predate and predict the onset of gambling problems, few studies have conducted in-depth explorations of the relationship between gambling problems and co-morbid psychiatric disorders from the gambler's perspective. For example, Holdsworth, Nuske, and Breen (2013) interviewed 20 electronic gaming machine (EGM) gamblers (10 recreational and 10 help-seeking gamblers) about their motivations to gamble, changes to their behaviour over time and the perceived differences between men and women's experiences. This study revealed that while few recreational gamblers spoke about co-morbidities, all of the help-seeking gamblers in this sample discussed the range of co-morbid conditions they were experiencing and the complex needs associated with these conditions. In this sample, participants reported experiencing depression, bipolar disorder, anxiety disorders, substance abuse and/or anorexia. Several participants indicated that these co-morbid conditions were exacerbated by gambling and vice-versa, with only one participant eluding to the difficulties of seeking treatment when dealing with multiple disorders. Holdsworth, Nuske, and Hing (2015) qualitatively explored the relationship between gambling and co-morbid psychiatric disorders in a sample of 20 recreational gamblers and 20 individuals experiencing gambling problems. This study used a grounded theory approach and found that while both groups of gamblers experienced significant life events and psychological co-morbidity, individuals experiencing gambling problems were more likely to increase their gambling behaviour in order to cope with these events. Moreover, this study found that recreational gamblers were more likely to have strong social support networks and resilience to help cope with significant life events and psychological co-morbidities, as opposed to gamblers experiencing harm. Finally, a study by Yakovenko, Clark, Hodgins, and Goghari (2016) explored the association between gambling and psychosis in a sample of eight individuals diagnosed with gambling disorder and schizophrenia or schizoaffective disorder. Using a qualitative approach, this study explored the antecedents associated with participants gambling and the functional consequences of gambling. Content analysis revealed the bi-directional nature of this relationship with some participants perceiving that their gambling exacerbated their psychosis and that their symptoms of schizophrenia led to greater involvement in gambling.

Overall, very few studies have attempted to examine a more in-depth understanding of the relationships between gambling and co-morbid psychiatric disorders from the perspective of gamblers themselves. The few studies that have explored this relationship have focused on a particular sub-set of gamblers (i.e., women who gamble on EGMs or individuals with co-morbid gambling disorder and schizophrenia or schizoaffective disorder) and have been limited by qualitative study designs that employ small samples and limit the generalisability of the findings. Moreover, these studies have focussed on understanding the reciprocal and complex nature of these relationships, with minimal exploration of the help-seeking behaviours of individuals with co-occurring gambling and mental health/AOD issues (Dowling, Merkouris, & Lorains, 2016; Winters & Kushner, 2003).

Taken together, numerous study designs, with varying levels of evidence, have explored the relationships between gambling problems and co-morbid psychiatric disorders. The cross-sectional literature has shown that there are high rates of co-occurring gambling problems in mental health and AOD populations and high rates of mental health and AOD in gambling populations. While less consistent, results from cross-sectional retrospective age of onset studies and prospective longitudinal studies have shown that mental health and AOD conditions typically predate and predict the onset of problem gambling and that these conditions are risk factors for the development of subsequent gambling problems. These studies also suggest that some disorders (i.e., PTSD) may occur after the development of gambling problems. The results also indicate that gambling problems are a risk factor for the development of subsequent mental health and AOD conditions. The complex nature of the relationship between gambling problems and psychiatric conditions has been further highlighted by the few qualitative studies exploring individuals' experiences of these complex relationships. Overall, these findings have implications for treatment, as these co-occurring relationships may complicate treatment plans and hinder gambling and mental health related treatment outcomes, particularly if co-

occurring conditions go unidentified and untreated (Chou & Afifi, 2011). These findings highlight the importance of gaining a more in-depth understanding of the perceptions and experiences of people with gambling and co-morbid psychiatric disorders, with a view to untangling the complex interaction between these issues and understanding their help-seeking needs and behaviours (Shaffer and Korn, 2002).

Help-seeking for gambling

Recent conceptualisations of help-seeking in the gambling field indicate that a wide range of help-seeking options are available (Rodda, Dowling, & Lubman, 2018). This conceptualisation is consistent with the World Health Organisation's definition of help-seeking in which any action or activity undertaken to improve or resolve an issue is considered help-seeking (Barker, 2007). In this context, three categories of help-seeking behaviour have been identified. The first is the traditional face-to-face category, which includes speaking to a counsellor face-to-face, speaking to a financial counsellor by phone or face-to-face, staying in a residential facility, speaking to a psychologist, psychiatrist or general practitioner (GP) about gambling or attending a support group for gambling. The second category is distance-based help-seeking, which includes talking to a gambling counsellor via phone, talking to a gambling counsellor online or sending an email to a gambling counsellor. Lastly, self-directed help-seeking options include reading or posting in an online forum, reading information websites, completing a self-help module program or module, signing up for self-exclusion (land-based or online venue), talking to family or friends, or trying a self-help strategy (e.g., budgeting, stimulus control).

Despite these numerous help-seeking options, the dominant funded model of treatment in Australia, to date, has been the delivery of face-to-face treatment. Research, however, shows that only a small proportion of individuals experiencing gambling problems seek face-to-face psychological treatment, with help-seeking rates in Australia estimated at 8-17% (Productivity Commission, 2010). Common barriers to accessing face-to-face psychological treatment include a range of personal factors (e.g., shame and denial) and resource/practical limitations (e.g., geographical inaccessibility, scheduling conflicts, time requirements and treatment costs; Suurvali, Cordingley, Hodgins, & Cunningham, 2009).

A recent study explored rates of help-seeking in a sample of 277 gamblers recruited from the Australian online counselling service (Gambling Help Online; Rodda, Dowling, et al., 2018). This study found that 61.3% of help-seeking gamblers had previously accessed a distance-based help-seeking option, with 43.0% previously accessing a face-to-face help-seeking option. Interestingly, 92.8% of participants had attempted a self-directed help-seeking option. This study indicated that reading information online was the most common self-directed help-seeking option, followed by talking to family or friends, trying a self-help strategy, completing a self-help module, reading or posting in an online forum and signing up for self-exclusion.

Despite self-directed options being the most commonly reported type of help-seeking, studies of treatment-seeking gamblers, nationally and internationally, have typically been drawn from face-to-face services, and to a lesser extent helpline and online services (e.g., Evans & Delfabbro, 2005; Gainsbury, Hing, & Suhonen, 2014; Pulford et al., 2009; Rodda & Lubman, 2014). Consequently, our knowledge of gambling-related help-seeking is not representative of the help-seeking gambling population as it has been drawn from the small number of help-seekers who seek formal face-to-face help.

While there has been an increase in the development and evaluation of online self-directed programs for gambling (e.g., Carlbring & Smit, 2008; Casey et al., 2017; Dowling et al., 2021), few studies have employed samples of gamblers recruited from self-directed help-seeking options in naturalistic

settings, such as online discussion forums. Studies that have examined this help-seeking population have focused on specific topics. For example, Browne et al. (2016) examined 469 Gambling Help Online (GHO) forum posts to validate themes relating to gambling problems, which were initially developed through other methodological approaches. Rodda, Hing, et al. (2018), on the other hand, utilised thematic analysis to examine 2,158 GHO forum posts to determine the types of change strategies utilised by online community forums users. Internationally, Wood and Wood (2009) explored the use of two UK online forums for gamblers and affected others by conducting content and thematic analysis on 60 forum posts to examine the nature of gambling problems. Similarly, Caputo (2015) utilised content analysis to understand the motivations and expectations of 24 Italian gamblers utilising the Gamblers Anonymous (GA) forum.

Taken together, these studies indicate that limited research in the gambling field has employed naturalistic samples of online forum users. Furthermore, the research to date has utilised qualitative thematic and content analytic approaches to explore specific issues, such as gambling problems and behaviour change strategies. These studies have generally been limited by relatively small data sets, thus impacting on the generalisability of the findings. Research employing samples of online forum users will enable the exploration of individual experiences and perceptions from a different group of help-seeking gamblers that have not yet been adequately studied and that represent a broader spectrum of people with gambling problems. Moreover, the sense of anonymity provided by the Internet, suggests that these online forums may also reflect more genuine user perceptions and experiences. Finally, large and freely accessible online discussion forum datasets lend themselves well to be analysed using novel and innovative analytic techniques, such as Natural Language Processing (NLP).

Natural Language Processing

Natural Language Processing (NLP) consists of a range of computational techniques that can be used to understand patterns in written text (Cambria & White, 2014; Liddy, 2001). NLP techniques use data-driven, statistically based approaches, which focus on developing generalised models of linguistic phenomena based on examples provided within the body of a large corpus of text (Liddy, 2001). NLP techniques represent cutting-edge methodology in the automated analysis of massive databases of text-based information.

There are numerous NLP methods for analysing linguistics. At a basic level, NLP can involve simple descriptive statistics, such as examining word frequencies or word correlations within a particular corpus of text. More advanced NLP analytic techniques can include sentiment analysis (i.e., determining whether data is positive, negative, or neutral) and Latent Dirichlet Allocation (LDA), which uses a generative probabilistic model to identify how words cluster together into themes within a body of text (Blei, Ng, & Jordan, 2003). Conceptually, LDA is analogous to a thematic or content analysis in qualitative research, in which themes arise from the data. LDA, however, relies on data-driven statistical modelling to identify linguistic based themes.

NLP approaches are advantageous to traditional text-based analytic techniques (e.g., thematic and content analyses in qualitative research) as they can handle big datasets to efficiently and straightforwardly analyse a very large body of written text. With advances in technology and statistical methodologies, NLP approaches have also advanced. Specifically, the Internet has enabled access to very large bodies of text through websites, social media and online forums, which were never previously available to researchers (Hirschberg & Manning, 2015). This, along with an increase in computer power, has allowed a greater understanding of the structure of human language and how it is utilised in social contexts. The development of successful machine learning methods (i.e., statistical techniques that give computers the ability to 'learn' using data [(El Naqa & Murphy, 2015)]) has also allowed for the emergence of advanced NLP approaches, such as LDA (Hirschberg & Manning,

2015). These approaches are also advantageous as they enable the examination of the user's perceptions and experiences through their own words as they would in a real-world setting (i.e., their own home).

NLP approaches are currently being used in many fields, such as psychology, medicine/health and, more commonly, in marketing, whereby companies analyse emails and social media to generate targeted advertising (Calvo, Milne, Hussain, & Christensen, 2017). A considerable amount of NLP-related research, to date, has utilised clinical/health records as the data source (e.g., Downs et al., 2017; Iqbal et al., 2015). However, with the ever-expanding use of social media there is now an increase in NLP approaches utilising non-clinical text. In fact, a recent scoping review of NLP approaches in mental health research using non-clinical text, indicated that social media, including Twitter, Facebook, blogs and forums, have been the most commonly utilised data source (Calvo et al., 2017). Discussion forums, in particular, can be investigated to explore common questions and misconceptions about relevant topics so that website information and service provision can be improved (Hirschberg & Manning, 2015). Importantly, peer-to-peer forum data can also provide rich conversational data thus enabling a more in-depth study of language, including the sentiment associated with certain topic areas (Hirschberg & Manning, 2015).

While NLP is an emerging field within the behavioural sciences, it has been most prominently and successfully employed in the area of depression (e.g., De Choudhury, Counts, & Horvitz, 2013; Homan et al., 2014; O'Dea et al., 2015). In this context, research has shown the applicability of NLP techniques using social media data (e.g., Twitter, Facebook and online forums) to detect and predict depression, suicidal ideation and distress. For example, Ramirez-Esparza, Chung, Kacewicz, and Pennebaker (2008) used NLP to quantitatively identify themes (i.e., LDA) within English and Spanish depression forums. This study highlighted differences between themes across the English and Spanish forums, with Spanish-language writers more likely to mention relational concerns and English-language writers more likely to mention medical concerns. Findings from this type of study have implications for informational and support needs in online support across cultures. In addition, an emerging area of research using NLP techniques has focussed on sentiment-based analyses. For example, Kramer (2010) analysed the use of 'emotion words' in Facebook posts of 100 million users to provide an estimate of the 'gross national happiness of countries', which was calculated by the standardised difference between the use of positive and negative words aggregated across days. Kramer (2010) argues that this metric can serve as a representation of the overall emotional health of a nation. This was further validated by Golder and Macy (2011) who explored global trends in mood sourced from Twitter messages. Text analysis of the positive and negative affect in 509 million Twitter messages showed that when people wake up they are in a relatively good mood, which then declines throughout the day (Golder & Macy, 2011). Similarly, Dodds, Harris, Kloumann, Bliss, and Danforth (2011) were able to measure real-time levels of happiness by examining 46 billion words contained in nearly 4.6 billion expressions from Twitter.

Only recently have NLP techniques been used in the gambling field. Specifically, Fino, Hanna-Khalil, and Griffiths (2021) conducted LDA and sentiment analysis on Twitter data to explore the public's perception of gambling addiction. This study identified a five-topic model that included the perceptions of gambling addiction amid the COVID-19 outbreak, the risks and support available from home, their interpretation of gambling addiction, the different forms of gambling used during the pandemic, and gambling advertising and how it impacts on families. The sentiment analysis was conducted on the entire corpus and revealed underlying fear, trust, sadness and anger. In addition, Bradley and James (2021) conducted topic modelling (i.e., LDA) on the support forum provided by the UK online gambling help website, Gambling Therapy, with the aim of identifying key issues raised by the gamblers using the forum. This study identified a ten-topic model that fell within four overarching categories: (1) negative emotions caused by gambling; (2) the process of recovery; (3) gambling products; and (4) money-related concerns.

Taken together, NLP is an innovative and emerging area of research, which has progressed along with advancements in technology and social media. NLP approaches are able to automatically and efficiently conduct analyses, some of which are analogous to qualitative thematic analysis, on large text-based datasets. Such NLP techniques have only recently been employed in the gambling field, with further use of this cutting-edge methodology required, given its far-reaching implications (e.g., creating online pathways that can direct individuals of relevant information or identifying those in need of psychological assistance).

Cross-jurisdictional comparisons

International standardised prevalence rates of problem gambling are estimated to range from 0.5% to 7.6%, with the average rate worldwide estimated at 2.3% (Williams, Volberg, & Stevens, 2012). Based on these standardised rates, jurisdictions such as Australia (2.0%) and the US (2.2%) sit within close proximity to this worldwide average rate, with jurisdictions like the UK sitting on the lower end (0.9%; Williams et al., 2012). Despite similarities in political systems and governmental structures between Australia, the UK and the US, these countries vary in the regulation, aetiological frameworks, participation profile and treatment service provision of gambling.

In Australia, a public health approach to gambling research and regulation has been applied (Delfabbro & King, 2012). In doing so, the aim of policy is to primarily reduce harm associated with gambling, followed by the implementation of prevention and treatment intervention strategies (Delfabbro & King, 2012). In terms of regulation and policy, the state and territory governments hold most of the responsibility (with the exception of internet gambling laws). Australia uses a licence-based system, in which venues across the Australian states and territories can operate as gambling service providers, with the appropriate licence (Nikkinen, 2014). With the exception of Western Australia, hotels and clubs act as service providers increasing the availability of gambling opportunities. Similarly, lottery operators are licensed at a state or territory level. Online gambling in Australia using Australian-based companies is illegal, with the exception of sports betting and lotteries. There is no law, however, that prohibits the use of off-shore sites by Australians.

This availability in gambling opportunities is reflected in past year gambling participation rates in which 63.9% of Australian adults gamble at least once a year (Dowling, Youssef, et al., 2016). In Australia, the most common gambling activity is lotteries (49.2%), followed by instant scratch tickets (22.0%), EGMs (20.7%) and horse or greyhound races (15.9%; Dowling, Youssef, et al., 2016), with online gambling participation estimates ranging from 1.5% to 8% (Dowling, Youssef, et al., 2016; Gainsbury, Russell, et al., 2014). With the exception of Western Australia, gambling and problem gambling behaviours are consistent across Australian states and territories. For example, lotteries, scratch tickets, EGM gambling and betting on horse or greyhound racing are consistently among the most preferred gambling activities across all states and territories (Browne et al., 2020; Paterson, Leslie, & Taylor, 2019; Queensland Government, 2018; Rockloff et al., 2020; Stevens, Gupta, & Flack, 2019; The South Australian Centre for Economic Studies, Delfabbro, & ENGINE Asia Pacific Pty Ltd, 2021; Woods, Sproston, Brook, Delfabbro, & O'Neil, 2018). Moreover, problem gambling prevalence estimates are relatively consistent ranging from 0.40% in Tasmania to 1.37% in the Northern Territory (Browne et al., 2020; Paterson et al., 2019; Queensland Government, 2018; Rockloff et al., 2020; Stevens et al., 2019; The South Australian Centre for Economic Studies et al., 2021; Woods et al., 2018).

Similar to Australia, the UK is currently moving towards viewing gambling problems as a public health concern (Bowden-Jones et al., in press; Gambling Commission, 2018). The UK utilises a licence-based system in which foreign operators may apply for a gambling licence and operators do not have to be fully government-owned or to conduct their business through a company registered in the relevant country (Nikkinen, 2014). The UK also has a monopolised national lottery system, private

(charitable) lotteries and casinos that are operated by certain commercial providers through licensing (Nikkinen, 2014). Unlike Australia, online gambling is legal in the UK and is well regulated. Gambling sites, within and outside the UK, are legally allowed to offer services to UK residents if they are licensed by the Gambling Commission. Past month gambling participation rates are estimated at 47%, with the most popular gambling activity being the National Lottery (30%), followed by other lotteries (13%), scratch cards (10%), sports betting (6.7%) and to a lesser extent EGMs (less than 5%; Gambling Commission, 2020). In the UK, past month online gambling participation rates have increased to 21% (Gambling Commission, 2020).

Unlike Australia, the US views gambling as an addiction or disease. Similar to Australia, however, gambling regulation in the US is controlled within individual states but is also subject to federal laws. Gambling is legal across the majority of the US states (except Hawaii and Utah); however, the types of gambling and venues differ across states (e.g., race-track, riverboat and land-based casinos). Despite differences in venue types, these tend to consist mostly of table games and EGMs. Note that there is no national US lottery, with each state running its own lottery. Online gambling laws in the US are much less cohesive than those in the UK and Australia, with each state responsible for regulation. In recent years, several states have legalised online gambling and have issued the appropriate licences, with other states planning to do the same and others debating the issue. In the US, past year gambling participation rates are estimated at 76.9%, with lotteries (including instant scratch tickets) the most common form of gambling activity (62.0%), followed by casino gambling (including cruise ship or riverboat; 26.2%), card games (not casino; 19.2%), EGMs (not at casino; 17.4%), and sports betting (16.0%; Welte, Barnes, Tidwell, Hoffman, & Wiecezorek, 2015). Internet gambling participation rates in the US have been estimated at 2.1% (Welte et al., 2015).

In addition to differences in gambling availability and participation across gambling types, these jurisdictions also differ in relation to treatment service provision. Australia has a comprehensive range of treatment services specifically developed to help gamblers and their affected others, which are predominantly funded and run by state or territory governments or allocated agencies. These treatment services include a range of face-to-face counselling services, financial counselling, a national gambling helpline and a national online service. In addition, individuals seeking help for gambling problems can access psychological treatment through a national rebate scheme. Given the public health approach to problem gambling, Australia has also seen an increase in harm minimisation and prevention interventions funded and delivered through its services.

In the UK, gambling treatment services, excluding GA and those in the private sector, are funded exclusively by industry (George & Bowden-Jones, 2016). Industry donates approximately 0.1% of its revenue to a fund, the Responsible Gambling Trust, which is responsible for commissioning treatment services (George & Bowden-Jones, 2016). Current treatment services in the UK include a National Health Service clinic and a string of third sector agencies.

In contrast, treatment services for gambling in the US differ from state to state. A review of treatment services in the US reported that only 78% of states had publicly-funded gambling treatment services in 2013 (Marotta, Bahan, Reynolds, Vander Linden, & Whyte, 2014). In addition, this review identified extensive variability across states in the types of gambling services that were funded, ranging from multiple levels of treatment to a single service (e.g., gambling helpline only). Consistent with the disease/addiction approach to gambling, GA is a common help-seeking option in the US, whereas in Australia, GA is less commonly employed as a help-seeking option, given its exclusive focus on abstinence (Delfabbro & King, 2012).

Taken together, Australia, the UK and the US are relatively similar in terms of access to numerous gambling opportunities. Given differences in gambling aetiological approaches, regulation, participation profiles, and the extent of treatment service provision, however, it is logical to assume

that there may also be jurisdictional differences in individuals' experiences and perceptions of the *relationship* between gambling problems and co-morbid mental health or AOD issues, and related *help-seeking* behaviour.

Rationale

It is evident that national and international research has exemplified high rates of co-occurring gambling problems and psychiatric disorders across gambling and mental health or AOD samples. While research relating to the temporal relationship between these conditions is growing, there is limited research examining the relationship between gambling problems and mental health/AOD issues from the perspective of gamblers. In addition, national and international research relating to help-seeking behaviour of gamblers has predominately utilised samples of treatment-seeking gamblers from face-to-face treatment services and, to a lesser extent, users of gambling helpline and online services. Despite the large amount of rich data available, few studies have drawn on samples of online gambling forum users, in part, due to limitations of existing methodologies in which data extraction and analysis of such large data sets was not feasible. Moreover, despite established high rates of people experiencing gambling problems in mental health and AOD populations, there is even less research exploring gambling-related help-seeking behaviour in this context. Finally, the limited studies that have explored these issues have, to date, utilised traditional qualitative analyses (i.e., content or thematic analysis) and have therefore been limited by small sample sizes and a lack of generalisability. As such, the proposed project will be the first to draw on a sample of users of online gambling, mental health and AOD forums to explore their experiences and perceptions of the *relationship* between gambling problems and comorbid mental health or AOD issues, as well as related *help-seeking* behaviour. Moreover, given the jurisdictional differences in gambling preferences and treatment services provision, this study will be the first to compare the experiences and perceptions of these issues across Australian, UK and US online gambling forum users. This will also be one of the first studies in the gambling field to use the cutting-edge methodology of NLP to quantitatively look for patterns in text sourced from online forum data.

Project aims

In summary, this project is one of the first in the gambling field to utilise NLP statistical techniques to quantitatively synthesise text sourced from online forum data. This project has been broken down into two studies.

Study 1 aims to:

1. Explore the experiences and perceptions of the *relationship* between gambling and comorbid mental health/AOD (depression, anxiety, and family violence) problems in Australian gambling, mental health and AOD forum users; and
2. Examine jurisdictional differences between the experiences and perceptions of the *relationships* between gambling and comorbid mental health/AOD problems *across* Australian, UK and US gambling forum users;

Study 2 aims to:

1. Explore the experiences and perceptions of gambling, mental health or AOD *help-seeking*, in which gambling is referenced, in Australian gambling, mental health and AOD forum users; and

2. Examine the experiences and perceptions of gambling, mental health or AOD *help-seeking* across Australian, UK and US gambling forum users.

Approach

The methodological approach consisted of three main steps: (1) data sourcing and extraction; (2) data cleaning and selection; and (3) data analysis. These steps are outlined in more detail below.

Data sources and extraction

The `rvest` package in R (Wickham, 2021) was used to extract the relevant posts from each forum. Data for both studies were sourced from the same gambling and mental health forums across Australia, the UK and the US. Data were sourced from Gambling Help Online (Australia's largest and most promoted peer-to-peer gambling forum), Beyond Blue (one of Australia's largest peer support forums for mental health and AOD issues), GamCare (UK's leading provider of gambling-related information and support) and PsychForums (USA's leading online community support site for all mental health and addictive disorders, including gambling).

The process of data extraction differed for each forum. For Gambling Help Online, all posts available up until the 2nd of July 2019 were extracted, however, only posts within the 'The Courtyard', 'Your Diary of Recovery', and 'Strategies for Change' forums were employed in the data cleaning and selection stage (n=12,589 after removal of blank posts). This is because there were several other forums (e.g., 'Hot Topics' and 'New Research') that were not applicable to the research questions of the current project. Similarly, while PsychForums consists of forums across many mental health and addictive disorders (e.g., depression and substance use), only posts from the Gambling Addiction Forum up until the 21st of January 2020 were extracted and employed in the data cleaning and selection stage (n=18,652 after removal of blank posts). In contrast, due to the number of posts in GamCare, it was not feasible to extract all of the posts within the entire forum. As such, only posts from relevant forums were extracted from this forum up until the 11th of February 2020, including posts within the 'Overcoming Problem Gambling', 'Recovery Diaries' and 'Success Stories' forums (n=215,388 after removal of blank posts). Given Beyond Blue is an online forum for mental health issues, only threads related to gambling were extracted. Specifically, a list of gambling-related keywords (e.g., gambling, gamble, pokies) was developed and only threads that included these keywords in any of their posts up until the 4th of February 2020 were extracted (n=9,607; see Appendix 1 for the list of keywords). For the sake of clarity, note that gambling and gambling-related terms, were used as a screening criterion to identify relevant threads from the Beyond Blue forum as it was the only forum without a specific gambling section. This screening criterion was not required, and therefore not used, for Gambling Help Online, GamCare, or PsychForums, as posts were extracted from gambling-relevant forums therein.

Data cleaning and selection

The `tm`, `dplyr` and `tidytext` packages in R was used for all data cleaning and selection (Feinerer & Hornik, 2020; Silge & Robinson, 2016; Wickham, François, Henry, & Müller, 2021).

Data cleaning

To prepare the data for analysis, a series of data cleaning steps occurred. These pre-processing steps were based on recommendations from the literature (Hagg et al., submitted) and included: (1) changing letters from upper case to lower case; (2) removing whitespace; (3) removing numbers; (4) removing 'stopwords' (i.e., words that add no meaning to the data, such as 'and', 'it', and 'to'; Lo, He, & Ounis, 2005); (5) removing symbols (e.g., '?' and '&'); (6) removing acronyms (e.g., 'etc' and 'ps'); and (7) removing words with one to two letters (e.g., 'cg'), where possible. Several pre-processing

steps, specific to forums, were also conducted. These included the removal of: (1) salutations (e.g., 'hello' and 'goodbye'); (2) forum-related and internet-based words (e.g., 'com' and 'www'); and (3) facilitator posts.

Stemming, which is the process of transforming words into the root form of the word (e.g., 'gambler' and 'gambling' transformed into 'gamble'), was manually conducted by reviewing the list of unique words across all four forums. Due to the large number of words used across these forums, only unique words that appeared five or more times were included in the stemming process. For data analytic purposes, all unique words, regardless of frequency were included.

Data selection

To answer the research questions, only posts relevant to each research question were included in the data analysis. To identify the relevant posts, a data-driven approach was employed. Specifically, a list of all words that could potentially relate to mental health and AOD (Study 1; e.g., 'sad', 'depression') and help-seeking, the change process or recovery (Study 2; e.g., 'help', 'treatment', 'change') were identified from the entire list of words used in the forums. Given the datasets had already been limited to gambling-related posts during the data sourcing and extracting phase, gambling and gambling-related terms were not included in these lists of keywords. Only posts that included these keywords were subsequently used in data analysis, and from herein have been referred to as the *restricted mental health/AOD dataset* and *restricted help-seeking dataset*. This approach ensured that all posts that were potentially relevant to the research questions were identified based on lay language used by forum users. See Appendices 2-3 for the full list of keywords employed for each study.

Data analysis

Descriptive statistics

Word frequency analysis was used to examine the 50 most commonly appearing words in the selected data for each research question. In addition, word correlations, which examine how often words appear together in forum posts relative to how often they appear separately were conducted. Specifically, the Phi correlation was used to identify words that were strongly correlated with the keywords used to develop the *restricted mental health/AOD* and *restricted help-seeking datasets* (see Appendices 2-3) (note that $\phi > 0.15$ indicates strong correlation and > 0.25 indicates a very strong correlation; Akoglu, 2018). For ease of interpretation, these correlations were limited to phi values greater than 0.15. Visual representation of these correlations was presented, with thicker lines between words representing correlations. Only keywords that were strongly correlated ($\phi > 0.15$) with at least three other words were discussed in the results. In addition, any words that had a dual meaning were only discussed when used in the relevant context (e.g., grass was only discussed in the results if it referred to the slang word for marijuana). Similarly, results that included usernames were considered irrelevant and not discussed (Schofield, Magnusson, & Mimno, 2017). The 'wordcloud' and 'widy' packages in R were used to conduct the word frequency analyses and correlation analyses, respectively (Fellows, 2018; Robinson, Misra, & Silge, 2021).

Latent Dirichlet Allocation

LDA was employed to identify common topics within each corpus (i.e., dataset). LDA is a generative probabilistic model that is used to identify large clusters of words that share a common theme within a body of text (Blei et al., 2003). It examines how co-occurring words cluster together within forum posts, and, from these clusters, common themes can be deduced from the meaning of those co-occurring words.

The 'topicmodels' package in R was used to conduct the LDA (Hornik & Grün, 2011). To conduct the LDA, the corpus was first converted into a document-term-matrix, in which each row reflects a forum post (i.e., document = forum post) and the columns reflect each word within the corpus (term = word). LDA models were estimated using Gibbs sampling and default hyperparameter settings ($\alpha = 50/k$; $\delta = 0.1$).

To identify the best fitting model, we conducted a series of LDA analyses. Specifically, we estimated a series of models, for each analysis, that sequentially increased the assumed number of topics underlying the data from 5-topics through to 50-topics, in increments of 5 (with the exception of GamCare for Study 1 which went up to 75). In each of these models, we used a 5-fold cross validation approach. In a five-fold cross validation, the corpus is randomly split into five sections and the LDA model is trained on four of these sections and tested (i.e., validated) on the fifth. This results in five different models, as the process is repeated until each section of data has been used once. Model fit was quantified using *perplexity* (Bao & Datta, 2014; Blei et al., 2003), which is a likelihood-based metric that quantifies the extent to which the validation dataset is "perplexed" (i.e., a measure of misfit) by the model that was learned in the training datasets. Performance of each model was thus quantified as the average perplexity score for the model across the 5-fold cross validation. Whilst models with lower perplexity scores are considered better fitting, currently, there is no standard approach for selecting the number of LDA topics that best fit the corpus. Previous research has utilised a combination of various quantitative and qualitative approaches (Hagg et al., 2021). The current project used a quantitative approach, based on the rate of perplexity change (RPC) between each sequential model (i.e., 5-topic model (t_5), 10-topic model (t_{10}), i -topic model (t_i)). This approach is described in Zhao et al. (2015), with the best fitting LDA model identified when the RPC of model i is less than the RPC of the sequential model $i+1$ (i.e., $RPC(i) < RPC(i+1)$).

Interpretation of the best fitting LDA model was then based on: (1) β values, which reflect the probability that each word would be generated by a specific topic; and (2) γ values, which reflects the probability that any specific forum post is generated by a specific topic (Asmussen & Møller, 2019). The current project focused its interpretation of the topics on the 10 most relevant words per topic (based on β values) and through inspection of the 10 most relevant forum posts per topic (based on γ values), which enabled the contextualisation of the words and how they were used by a forum user within a post. Note that not all of the top 10 most relevant words per topic were used in the interpretation of the relevant topic. For example, if forum user's usernames/pseudonyms appeared in the top 10 most relevant words, these words were not used to aid the interpretation of the topic and were therefore not explained in any detail in the results section.

Once the appropriate LDA topic model was determined, however, it was evident that not all of the topics related to the research question (see Results section for examples). As such, it was determined that only topics that included any keyword within the top 10 most relevant words would be interpreted (see Appendix 2 and Appendix 3 for mental health and AOD, and help-seeking keywords, respectively). This is consistent with past research and LDA recommendations, which suggest that selecting the number of LDA topics should be an iterative process that is influenced not only by model fit but also interpretability of the topics (Asmussen & Møller, 2019; Banks, Woznyj, Wesslen, & Ross, 2018; Chen, Zhu, & Conway, 2015; Kosinski, Wang, Lakkaraju, & Leskovec, 2016). To gain a more in-depth understanding of the final topics, the top 10 most relevant forum posts per topic (based on γ values) were reviewed and summarised. Based on the interpretation of the topics, the authors then selected and presented quotes that were considered illustrative of each topic. These illustrative quotes were selected from the top 10 most relevant forum posts per topic (based on γ values).

Sentiment analysis

To examine the emotional content of the corpus, sentiment analysis was conducted on each topic using the R package 'tidytext' (Silge & Robinson, 2016). While there are many dictionaries available for use, the current study used the 'afinn' dictionary (Nielsen, 2011) as it presents a numeric value for each word within a topic. These values range from -5 (very negative) to 5 (very positive), with scores of less than 0 reflecting negative valence and scores greater than 0 reflecting positive valence.

The 'afinn' dictionary consists of 2,477 words (878 positive and 1,598 negative) that have been identified to be particularly relevant to microblogging platforms, including Internet lingo and obscene words (Nielsen, 2011). The sentiment values assigned to each of these words have been validated against other sentiment analysis dictionaries and have been used in previous research (Chakraborty et al., 2020; Nielsen, 2011).

Originally, the sentiment analysis was conducted on the top 10 words within each topic, however, this resulted in many topics without a sentiment analysis as too few words within the topics were included in the 'afinn' dictionary. For a meaningful analysis, it was therefore decided to expand this analysis and explore the sentiment across the top 20 words (based on β values) within each topic. The average sentiment for each topic was then created and presented.

Ethics approval

The current project was approved by the Deakin University Human Research Ethics Committee (Project number: 2018-405). While forum data, such as that utilised in this project, is publicly available (i.e., anyone can read posts and comments without logging in) and users typically create pseudonyms, some research has suggested that the use of pseudonyms may be indicative of users not intending for their posts to be public (Eysenbach & Till, 2001). Given this, no posts or comments that included the name of a person, place, business or anything else identifiable have been included in this report.

Results

Study 1 – Relationship between gambling and mental health/alcohol and other drug problems

Study 1 explored the experiences and perceptions of the *relationship* between gambling and comorbid mental health/AOD problems, and jurisdictional differences therein, among Australian, UK, and US online forum users. The results are presented separately for each forum (AUS: Gambling Help Online, Beyond Blue; UK: GamCare; US: PsychForums), as the data was analysed separately.

Gambling Help Online (Australia)

Descriptive statistics

Word frequencies

Figure 1 displays the 50 most used words in forum posts related to the relationship between gambling and mental health/AOD problems within Gambling Help Online (extracted from its relevant forums, including The Courtyard, Your Diary of Recovery, and Strategies for Change). The most common words were those commonly used in everyday language (e.g., day, can, just), as well as addiction-related words (e.g., gambling, addiction, money, pokies).

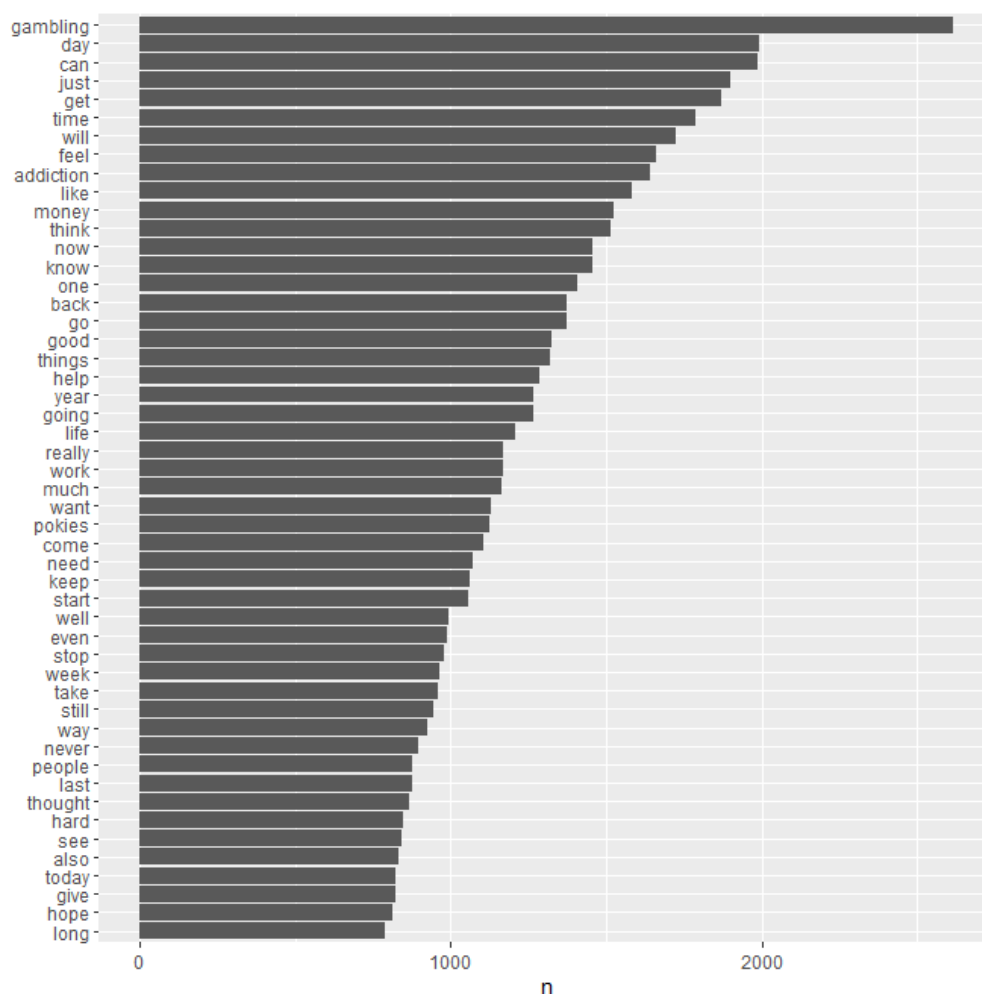


Figure 1. Top 50 most commonly used words in Gambling Help Online posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues

Word correlations

Presented in Figure 2 are the words that are strongly to very strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted mental health/AOD dataset (e.g., 'sad', 'depression') within the Gambling Help Online forum. These findings indicate that:

- LSD (i.e., lysergic acid diethylamide, a hallucinogen) was correlated with ego ($\phi = 0.43$), therapy ($\phi = 0.32$), trip ($\phi = 0.28$), potential ($\phi = 0.25$), explore ($\phi = 0.22$), substance ($\phi = 0.19$), legal ($\phi = 0.18$), chapter ($\phi = 0.17$), and creative ($\phi = 0.15$);
- withdrawal was correlated with bank ($\phi = 0.23$), symptom ($\phi = 0.22$), limit ($\phi = 0.20$), cash ($\phi = 0.20$), atm ($\phi = 0.18$), transfer ($\phi = 0.16$) and card ($\phi = 0.16$); and
- alcohol was correlated with drug ($\phi = 0.27$), drink ($\phi = 0.21$) and wine ($\phi = 0.16$).

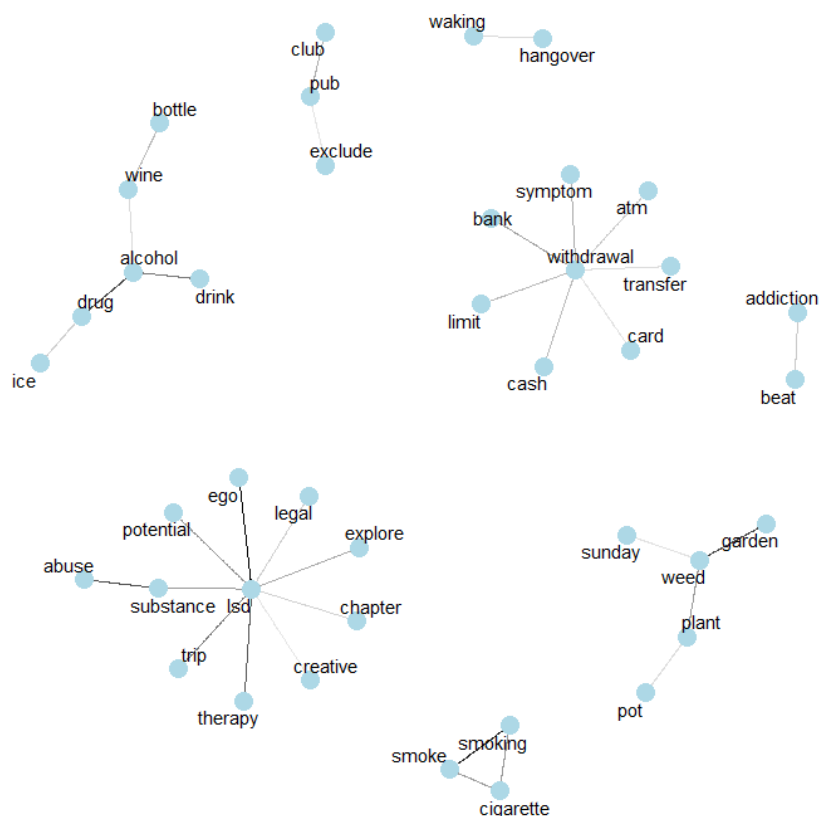


Figure 2. Correlations between mental health and alcohol and other drug keywords in Gambling Help Online

LDA and sentiment analysis

A LDA was conducted on the restricted mental health/AOD dataset (3,598 posts). Using rate of perplexity change, the results indicated that a 50-topic model was the best fit for this data. The results of this 50-topic model can be found in Appendix 4. When restricted to topics that included any of the keywords relating to mental health and AOD, 7-topics (see Figure 3) were retained for interpretation. The interpretation of these topics, the associated sentiment analysis and illustrative quotes are presented below.

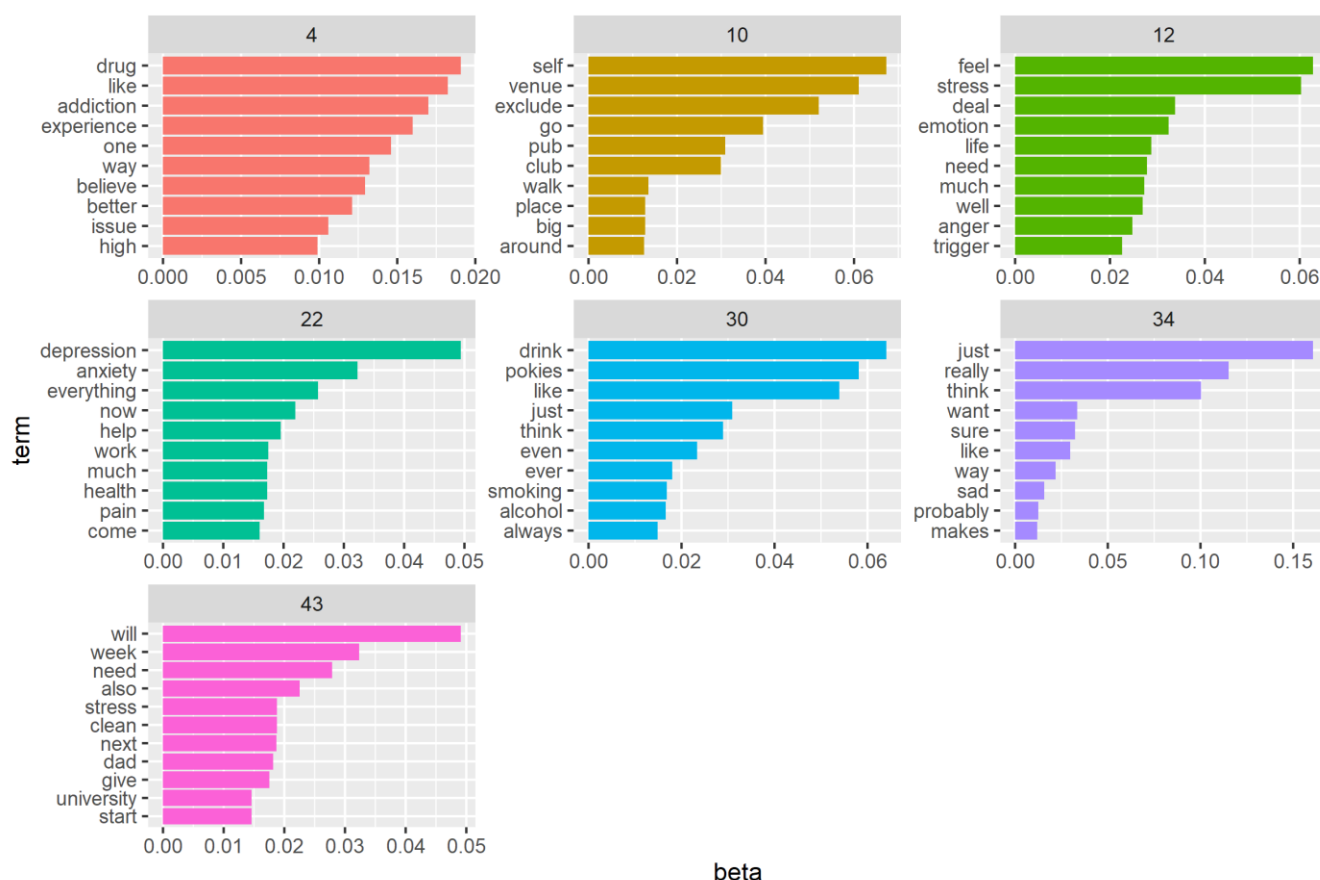


Figure 3. Gambling Help Online – 7-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues

Topic 4 – Addiction swapping and illicit substances as treatment for gambling

Topic 4 related to two specific threads of posts relating to: (1) “addiction swapping”; and (2) the use of illicit substances as a treatment option for gambling. Specifically, the first thread discussed their speculation that a person’s previous illicit substance use may have led to brain changes and that the person’s gambling may now be a substitute for previous substance use (i.e., “addiction swapping”). The second thread discussed the use of LSD as a treatment option for gambling problems. Overall, this topic was associated with a positive valence (M=2.00, n=2, keywords: better, like) based on the sentiment analysis. The tone of the posts varied, however, with some forum users expressing their difficulties and issues with addiction swapping, and others describing their positive experiences with using illicit substances to treat their gambling problems.

“I’ve abused MDMA in the past so there is the possibility I have depleted serotonin levels. It does seem like I’ve switched one addiction for another the rush you get from those big wins is quite similar to a drug high.”

“Psychotherapists have used LSD on their patients in the past but obviously due to the legal status of the drug unfortunately no therapist is going to be able to offer you LSD whilst doing conversational therapy... I was fortunate to have a breakthrough after taking one tab and that was the only time I have taken LSD. Following that I stopped gambling for 6-months which is the longest time I have abstained from gambling and at the present time seems like an impossible task.”

Topic 10 – Self-exclusion from venues including pubs

Topic 10 related to self-exclusion from gaming venues, including pubs. While this topic does not relate directly to the relationship between gambling problems and mental health or AOD issues, it highlights the need for self-exclusion from pubs. Specifically, this topic referred to the need for commitment in order for self-exclusion to work, as well as how some pubs do not take self-exclusion seriously. While this topic was associated with positive valence overall ($M=0.33$, $n=3$, keywords: allow, big, exclude), it was close to zero, as indicated by the combination of posts with negative and positive sentiment.

“Self exclusion can only really work if you make the commitment yourself to never visit the pub / club again. Also the pub / club has to be supportive by detecting your presence and advising that you must leave the property”

“...advised them of the pubs that are not taking self exclusion seriously. They said they would contact each pub that lets me in and remind them about their responsibilities. There should be penalties for pubs / clubs that allow people in that have been excluded.”

Topic 12 – Bi-directional relationship between gambling and mental health

Topic 12 related to the bi-directional relationship between gambling and mental health issues, in which certain forum users referred to gambling as a means of escaping their emotions (e.g., stress, anxiety, depression), and others referring to depression as a consequence of gambling and/or quitting gambling. This topic was associated with negative valence ($M=-2.00$, $n=5$, keywords: anger, avoid, escape, guilt pain).

“A big reason why I gamble is to simply escape. Escape the pressure of everyday life, escape our emotions, whether that be grief, guilt, shame, anger, sadness or anything else we may be feeling. Much like alcoholics or drug addicts we gamble to escape.”

“Reflecting on how things were are the start of this journey my life has become so much better and the stress in my life has gone from about 100 to 7. Of course you still have the stresses of everyday life but not piling on all the stresses that come with Gambling feels sooooo good.”

Topic 22 – Relationship between gambling and mental health issues

Topic 22 was quite similar to Topic 12 as it related to the relationship between gambling and various mental health issues, mainly depression and anxiety. Specifically, this topic consists of various stories from forum users about their experiences with co-occurring gambling and mental health issues, including how for some the mental health issue was much worse than the gambling, how gambling was an escape from the mental health issue, and how being on medication for mental health issues exacerbated the gambling problems. This topic was associated with negative valence ($M=-1.00$, $n=4$, keywords: anxiety, help, pain, suffer).

“The gambling addiction seemed like nothing compared to the anxiety attacks”

“Pokies were my safe place to be”

“I was on anti-depressants for work place anxiety and depression, at first they were ok (well I think they were) but as I stayed on them for 2 years and my dosage increased....that is when my problems escalated.”

Topic 30 – Relationship between gambling and alcohol

Topic 30 related to the complex relationship between gambling and alcohol. Specifically, this topic consisted of various stories from forum users about their experiences with gambling and alcohol, including how their gambling issues started due to going to the pub for the purpose of drinking or for social outings (i.e., meals and drinks with friends), how some people only gamble when they have been drinking, or how some people use alcohol as a way of breaking their gambling cycle (i.e., drink so they won't gamble). While this topic was associated with an overall positive valence ($M=0.50$, $n=4$, keywords: fun, hate, leave, like) in the sentiment analysis, it was quite close to zero, with inspection of the top 10 posts associated with this topic highlighting that the sentiment was mostly negative.

“A big part of my gambling culture in my early days and until I met my partner, was based around the social aspect of my local pubs. I'd start off by having drinks with mates or a meal then make my way to the gaming area.”

“The fact that you don't go near them or even think about them when not drinking means you gotta give up drinking.”

Topic 34 – Emotional impact of gambling

Topic 34 related to the various emotional harms experienced by forum users due to their gambling problems. In particular, this topic related to forum users' experiences of being overcome by feelings of hopelessness, sadness, loneliness and terribleness when gambling or after gambling. This topic was associated with an overall negative valence, close to zero ($M=-0.25$, $n=4$, keywords: crazy, like, sad, want).

“I feel pretty hopeless most the time I guess”

“There are so many stories on here that I can relate to, that feeling of just terribleness that comes over you when you're at the casino or whatever your preferred method of gambling is...”

Topic 43 – Financial and other stress

Topic 43 related to feelings of stress and being overwhelmed. While forum users discussed several reasons for this stress, this mostly related to paying off gambling debt and cash advancements, as well as stress related to university assignments. While this topic was associated with a positive valence ($M=1.50$, $n=2$, keywords: clean, want), this sentiment analysis was based only on two words and did not include the key word of stress. Inspection of the top 10 posts highlighted that this topic was mostly associated with negative valence, with some users referring to positive stories of almost paying off their debt.

“I am doing ok, just stressed with all the assignments I currently have on and trying to please my dad.”

“I have no idea how the heck I am going to pay it off. Way too much debt at the moment to be able to put a chunk towards it. Doing my best to keep my head up, it is an emotional time for me and a stressful time...”

Beyond Blue (Australia)

Descriptive statistics

Word frequencies

Figure 4 displays the 50 most used words in forum posts related to the relationship between gambling and mental health/AOD problems within Beyond Blue. As mentioned earlier, given that Beyond Blue is an online forum for mental health issues, only threads that included gambling-related keywords (e.g., 'gambling', 'gamble', 'pokies') were extracted. The most common words were words used in everyday language (e.g., think, can, like), followed by mental health-related terms (e.g., depression, bipolar).

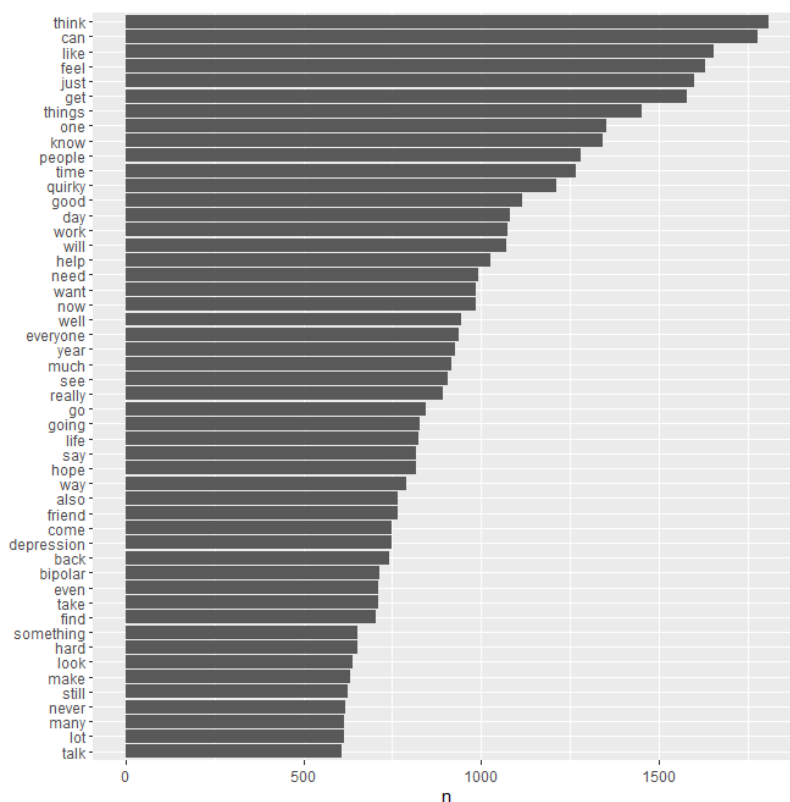


Figure 4. Top 50 most commonly used words in Beyond Blue posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues

Word correlations

Presented in Figure 5 are the words that are strongly to very strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted mental health/AOD dataset (e.g., 'sad', 'depression') within the Beyond Blue forum. These findings indicate that:

- abuse was correlated with emotion ($\phi = 0.21$), domestic ($\phi = 0.17$) and relationship ($\phi = 0.15$);
- domestic was correlated with violent ($\phi = 0.39$), victim ($\phi = 0.21$), emotion ($\phi = 0.21$), expose ($\phi = 0.17$) and abuse ($\phi = 0.17$);
- depression was correlated with diagnose ($\phi = 0.19$), anxiety ($\phi = 0.17$), suffer ($\phi = 0.17$), manic ($\phi = 0.16$) and anti ($\phi = 0.15$);

- addiction was correlated with pornography (phi = 0.35), gambling (phi = 0.26), drug (phi = 0.16) and alcohol (phi = 0.16);
- drug was correlated with alcohol (phi = 0.26), gambling (phi = 0.17) and addiction (phi = 0.16);
- alcohol was correlated with drug (phi = 0.26), drink (phi = 0.22), gambling (phi = 0.19) and addiction (phi = 0.16);
- suicide was correlated with rate (phi = 0.31), men (phi = 0.28), male (phi = 0.23), openly (phi = 0.22), attempt (phi = 0.22), female (phi = 0.20), woman (phi = 0.17), and desperate (phi = 0.16);
- beyondblue was correlated with topic (phi = 0.45), google (phi = 0.44), and thread (phi = 0.17);
- pot was correlated with tea (phi = 0.19), nain (i.e., slang for miniature; phi = 0.18), plant (phi = 0.15) and smoke (phi = 0.15)
- smoke was correlated with smoking (phi = 0.35), cigarette (phi = 0.31), cannabis (phi = 0.26), quit (phi = 0.19), habit (phi = 0.17), substance (phi = 0.16) and pot (phi = 0.15);
- cannabis was correlated with substance (phi = 0.32), concentrate (phi = 0.29), advertisement (phi = 0.27), smoke (phi = 0.26), quit (phi = 0.22), user (phi = 0.20), use (phi = 0.18), chemical (phi = 0.18), however (phi = 0.16), and psychotic (phi = 0.15); and
- substance was correlated with cannabis (phi = 0.32), concentrate (phi = 0.22), quit (phi = 0.19), advertisement (phi = 0.18), user (phi = 0.18), input (phi = 0.17) and smoke (phi = 0.16).

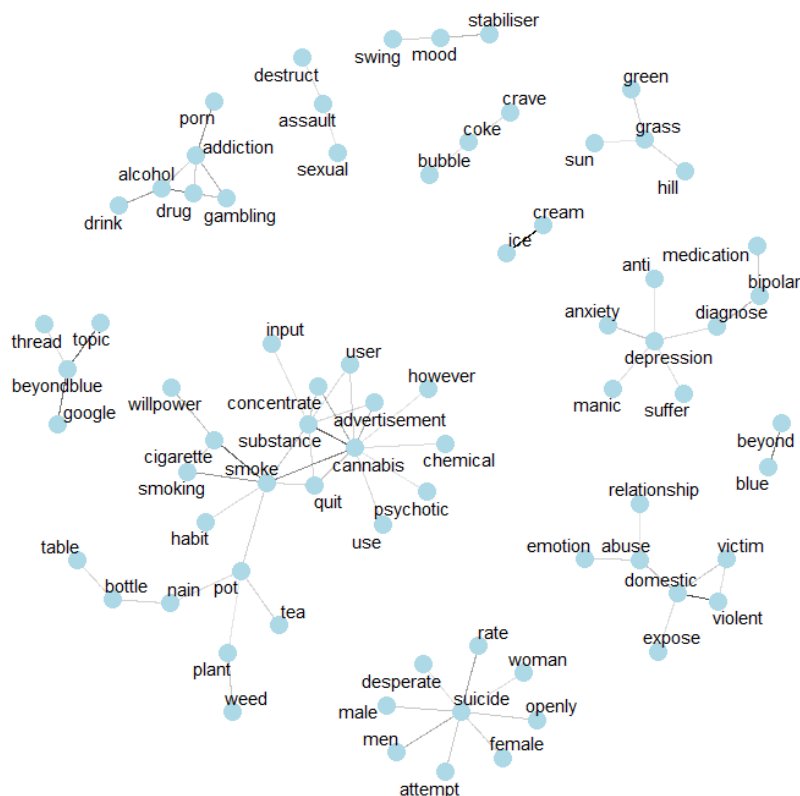


Figure 5. Correlations between mental health and alcohol and other drug keywords in Beyond Blue

LDA and sentiment analysis

A LDA was conducted on the restricted mental health/AOD dataset (3,718 posts). Using rate of perplexity change, the results indicated that a 30-topic model was the best fit for this data. The results of this 30-topic model can be found in Appendix 4. When restricted to topics that included any of the keywords relating to mental health and AOD, 11-topics (see Figure 6) were retained for interpretation. The interpretation of these topics, the associated sentiment analysis and illustrative quotes are presented below.



Figure 6. Beyond Blue – 11-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues

Topic 3 – Painful events

Topic 3 related to specific painful and traumatic events experienced by forum users. Specifically, this topic consisted of stories from forum users about past events, mostly related to loss and death, in which they describe their memories of these traumatic events. This topic was associated with an overall negative valence, close to zero ($M=-0.17$, $n=6$, keywords: dear, fail, help, matter, pain, sad).

“I have been living in her absence for many many years now, but recollection of the memory also recalls the pain; and, if only for a short time, it is oh so real again.”

“Having to deal with trauma such as suicide or death by age/natural causes is ultra because there's no text book which covers the emotional raw pain the people left behind have to deal with.”

Topic 4 – Bipolar disorder

Topic 4 related to forum users' experience with bipolar disorder. Specifically, this topic consisted of forum users' experiences with the extreme moods associated with bipolar disorder, including the extreme lows and highs. Some users also discussed how medication has helped them with these moods. While this topic overall was associated with positive valence ($M=0.67$, $n=3$, keywords: glad, hope, worry), it was quite close to zero. This is supported by the posts which include a combination of positive posts, in which users are encouraging and supporting each other to seek help and stay strong, and negative posts, in which users share their difficulties in living with bipolar disorder.

“When I was not on medication my life was chaotic I was not happy just manic or very low.”

“yes you can do it. I am so glad you asked for help. I find that hard too as I feel like I am admitting I am not coping but I now feel that asking for help is a good sign we are coping.”

“I could always know how low I was it was the incredible enticing highs that had me confused and I thought everyone was trying to control me as I was having way too much fun.”

Topic 6 – Association between food and mood

Topic 6 related to the association between food and mood (i.e., how the type of food people eat can depend on their mood). Specifically, forum users referred to eating less when they were down or on a high, and how losing control of eating behaviours can be a sign of other problems in life. This topic was associated with positive valence ($M=2.50$, $n=2$, keywords: clean, haha), however, this analysis only consisted of two words.

“I have an appetite that swings with my moods. When I am very down / anxious etc I barely eat. When I am on the up I eat less. When I am in the happy middle I am a piggy.”

“These days a really intense craving for food is a warning sign that something in my life is out of control emotionally. For me binge eating is an old friend that helps me cope with life.”

Topic 7 – Abusive relationships

Topic 7 related to the various types of abuse that one can experience in relationships, whether that be with an intimate partner, family members or friends. This topic mostly consisted of stories of psychological and emotional abuse, however, there were also some stories relating to physical abuse. Within this topic, forum users were very supportive of each other, tried to help one another understand the signs of such abuse, and provided information about accessing help, where needed. This topic was associated with overall negative valence, quite close to zero ($M=-0.75$, $n=4$, keywords: abuse, accept, guilt, true).

“If he's drinking in order to cope with the challenges of mental illness (which is sometimes the case with folk), then he's obtaining a sense of relief whilst expecting you to stay in a somewhat mentally and emotionally abusive relationship.”

I am going through similar and hope I can be of some assistance with what I have learnt... Chances are one of our parents are a narcissist therefore it appears normal at 1st to accept this type of behavior. This is our normal and all we know.. Someone genuinely treating us nice feels \“wrong\”.

“Wish I could jump through my laptop and give you the most consoling and inspiring hug. First, I would advise you pay a visit to your local police station so as to document the event/assault”

Topic 10 – Medications for mental health issues

Topic 10 related to forum users' experiences with various medications for different mental health issues, including depression and bipolar disorder. These experiences differed, with some forum users discussing the adverse effects of these medications (e.g., insomnia, headaches) and others describing relief from their symptoms after taking the appropriate medications. This topic was associated with negative valence ($M=-2.00$, $n=2$, keywords: disorder, illness), however, this sentiment analysis was only based on two words.

“I originally went to my general practitioner thinking that I was suffering from depression and anxiety and was prescribed selective serotonin reuptake inhibitors, however they didn't work... in fact, they had the opposite effect on me - I was in a bad place, high and low at the same time, irritable and restless but feeling hopeless and depressed and having suicidal thoughts.”

“I didn't think it was bipolar because I didn't think the moods could switch so much in such a short period of time. I haven't had it since being on mood stabilizers but it was exhausting and frustrating!”

Topic 11 – Cannabis as a treatment for depression

Topic 11 related to the use of cannabis as a treatment for depression. Specifically, this topic comprised consistent stories from forum users about the positive effects of smoking cannabis on their depressive symptoms, and the lack of success of typical treatments, such as antidepressants. Moreover, this topic referred to the judgement and stigma associated with the use of cannabis for this purpose, as well as its general use. This topic was associated with negative valence ($M=-2.00$, $n=4$, keywords: anxiety, illness, pain, suffer).

“Yes I agree that current antidepressants seem to have some really dramatic side effects, they tend to replace one issue with others (some of which nobody wants to experience). Those of us that have used in the past have seen the benefits of cannabis after ceasing use. I strongly believe even a cannabis extract for health food supplements would have many positive attributes.”

“I'm sure many look at anything to do with cannabis, as those looking to get high. I just feel it gets a bad rap, especially from those who watch a cheech and chong video thinking the special effects (hazy, hallucinogenic) relates to the substance at all. Because of the perception others have, the substance gets completely overlooked. All i know is from my experiences with the substance, i wasn't depressed, showed respect and care for others around me and most important my concentration issues were a thing of the past. Since not using many issues have returned and some additional from the antidepressant medication.”

Topic 13 – Employment and financial stress

Topic 13 related to the stress caused by lack of employment and finances, which for several people either occurred in the context of pre-existing mental health issues or caused subsequent mental health issues. This topic was associated with negative valence ($M=-1.50$, $n=2$, keywords: anxiety, leave).

“By this stage it was July and I was starting to feel the financial pressure. To pay my bills I started throwing a lot more attention at my online freelance web design business which was bringing in an average of \$300 p/wk. Given that my expenses were more than that winter would see me spiral into a hole of anxiety and depression.”

“I am diagnosed as depressed I take 300mg of my medication a day, and some days i go to 450mg, which numbs me down, but little less anxious, and feel calmer, I am stressed, it is impacting my work, no motivation”

Topic 14 – Mental health issues in men

Topic 14 related to a specific thread that focuses on emotional wellbeing and mental health issues in men. Specifically, this topic consisted of various posts that discussed the difference between men and women in relation to how they are built physically and emotionally. Moreover, this topic discussed the higher rates of suicide in men, compared to women, and suggested that these higher rates may be attributed to men not being as open, honest or supportive with one another when it comes to mental health issues. This topic was associated with a neutral valence ($M=0$, $n=2$, keywords: like, suicide), however, this sentiment analysis only consisted of two words.

“The differences between men and women (strictly my opinion) is more vast than society is making out in terms of thinking mentality.”

“I think I've realised why male suicide rates are so high. Men not asking for help openly. Men not supporting men. Men feeling alienated. Women not supporting men. Women supporting each other If women didn't support each other then maybe suicide rates for women would be higher.”

Topic 15 – Loneliness

Topic 15 related to the concept of loneliness. Specifically, this topic consisted of forum posts that discussed how forums, such as Beyond Blue, provide a great forum for people to find a reprieve from their loneliness by finding like-minded people to talk to. In addition, this topic consisted of forum posts that described individuals' experiences with being lonely and sad. While this topic is associated with a positive valence overall ($M=0.33$, $n=6$, keywords: alone, care, interest, like, sad, want), it was quite close to zero, as supported by the combination of positive and negative stories relating to loneliness, including the need for alone time.

“I hope even if some people get some reprieve from loneliness knowing that here on Beyond Blue they're not alone with their pain and real people are listening and talking.”

“I'm really sorry to read how lonely you feel and how sad it makes you. I do understand. Maybe from a different perspective, but loneliness can be very hard to deal with. I do so hope you are able to find some thing that adds to your sense of contentment.”

“MY TIME, HER TIME AND OUR TIME... We tend to get bogged down in spending most of our time together. This is not a good way to spend your life. Financial restrictions can cause this to occur. Reconsider your time together.”

Topic 24 – Relationship between gambling and AOD

Topic 24 related to addictive disorders in general, highlighting the similarities between alcohol, drug use and gambling-related problems, and the potential difficulties associated with these addictive disorders. Mostly, this topic consisted of forum posts that provide help-seeking information about these different addictive disorders, including helplines and websites. This topic was associated with positive valence (M=1.00, n=5, keywords: difficult, help, please, reach, support), as it mostly related to reaching out for help and support.

“Personally, I believe that any form of dependent behaviour, regardless of whether it’s alcohol, gambling, etc tends to reflect underlying pain and issues. So I think, if he hasn’t already, a good starting point for receiving help is perhaps making an extended appointment with his GP.”

“Starting a conversation about someone’s alcohol/drug/gambling use can be tricky and scary. Before you have the conversation I would familiarise yourself with information about the issue and if you’re not feeling confident about how to approach the issue, you could call one of the AOD services in your state and talk it over.”

Topic 25 – Criticism

Topic 25 related to criticism from various sources, including one’s inner critic, criticism from others and the criticism we make towards others. In particular, this topic related to feelings of being upset when people are critical of us, as well as when we are critical of ourselves, and about giving people that kind of power over us. This topic was associated with an overall negative valence, quite close to zero (M=-0.67, n=3, keywords: negative, thanks, upset).

“When people are really critical of course that upsets me too and I apologise profusely as I always think things are my fault.”

“I do try to rationalise the unhelpful comments and not give the power to upset me but I find this hard”

GamCare (UK)

Descriptive statistics

Word frequencies

Figure 7 displays the 50 most used words in forum posts related to the relationship between gambling and mental health/AOD problems within GamCare (extracted from its relevant forums, including Overcoming Problem Gambling, Recovery Diaries, and Success Stories). The most common words were addiction-related words (e.g., gambling, addiction), followed by words commonly used in everyday language (e.g., day, just, will).

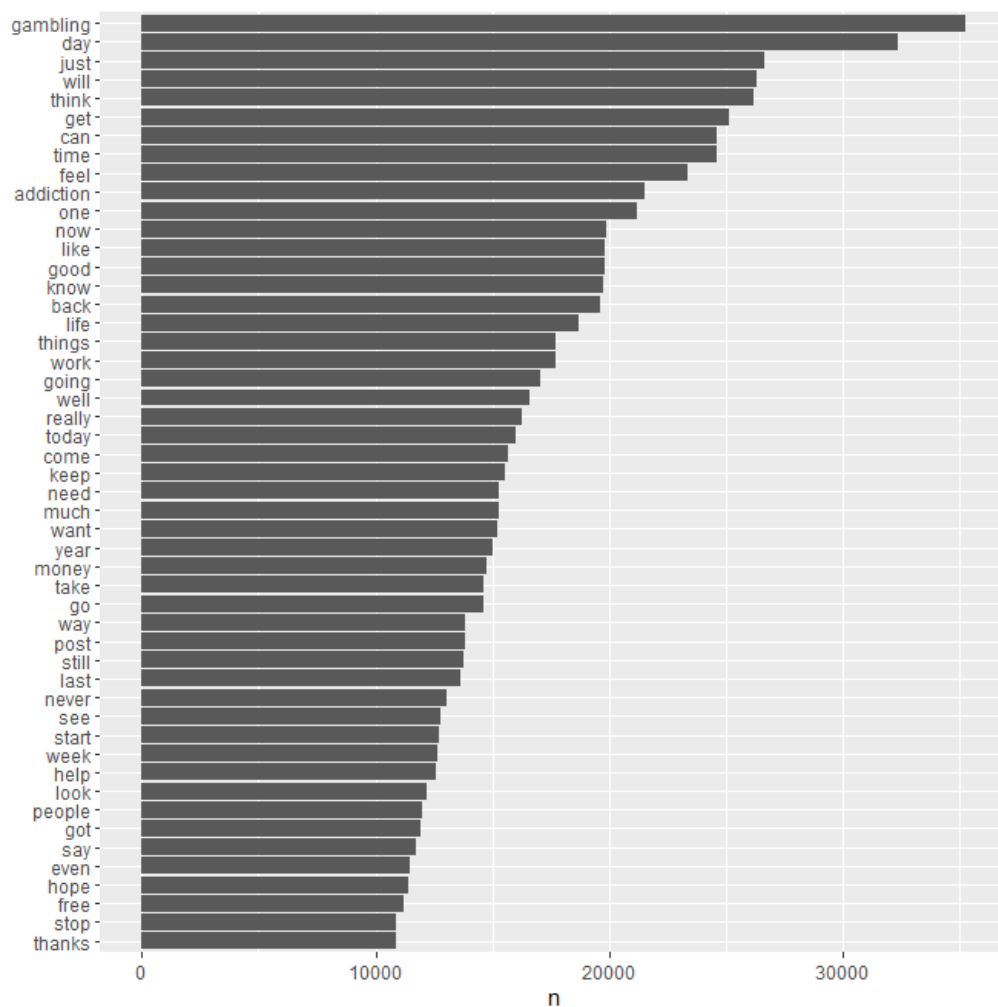


Figure 7. Top 50 most commonly used words in GamCare posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues

Word correlations

Presented in Figure 8 are the words that are strongly to very strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted mental health/AOD dataset (e.g., 'sad', 'depression') within the GamCare forum. As evident in Figure 8, there were numerous correlations at a ϕ value of greater 0.15 making visualisation and interpretation of these correlations difficult. Hence for the purpose of this forum, only correlations at a ϕ value greater than 0.20 have been discussed (see Figure 9). These findings highlight that:

- aggressive was the only word that was strongly to very strongly correlated ($\phi > 0.20$) with at least three other words, including passive ($\phi = 0.29$), internalise ($\phi = 0.23$), confront ($\phi = 0.22$), unreasonable ($\phi = 0.22$), intimacy ($\phi = 0.21$), adverse ($\phi = 0.21$), indicator ($\phi = 0.21$), and karate ($\phi = 0.20$).

Note that the remaining words in Figure 9 have dual meaning and were not relevant to the current context. Therefore these correlations have not been described in further detail here.

LDA and sentiment analysis

A LDA was conducted on the restricted mental health/AOD dataset (53,775 posts). Using rate of perplexity change, the results indicated that a 70-topic model was the best fit for this data. The results of this 70-topic model can be found in Appendix 4. When restricted to topics that included any of the keywords relating to mental health and AOD, 7-topics (see Figure 10) were retained for interpretation. However, further inspection of topic 10 revealed that the keyword wasted (i.e., potential colloquial term for drunk) was used in the context of being wasteful (e.g., wasting money on things unrelated to mental health or AOD-related issues). As such, topic 10, was not relevant to the current research question and was not interpreted. The interpretation of the remaining topics, the associated sentiment analysis and illustrative quotes are presented below.

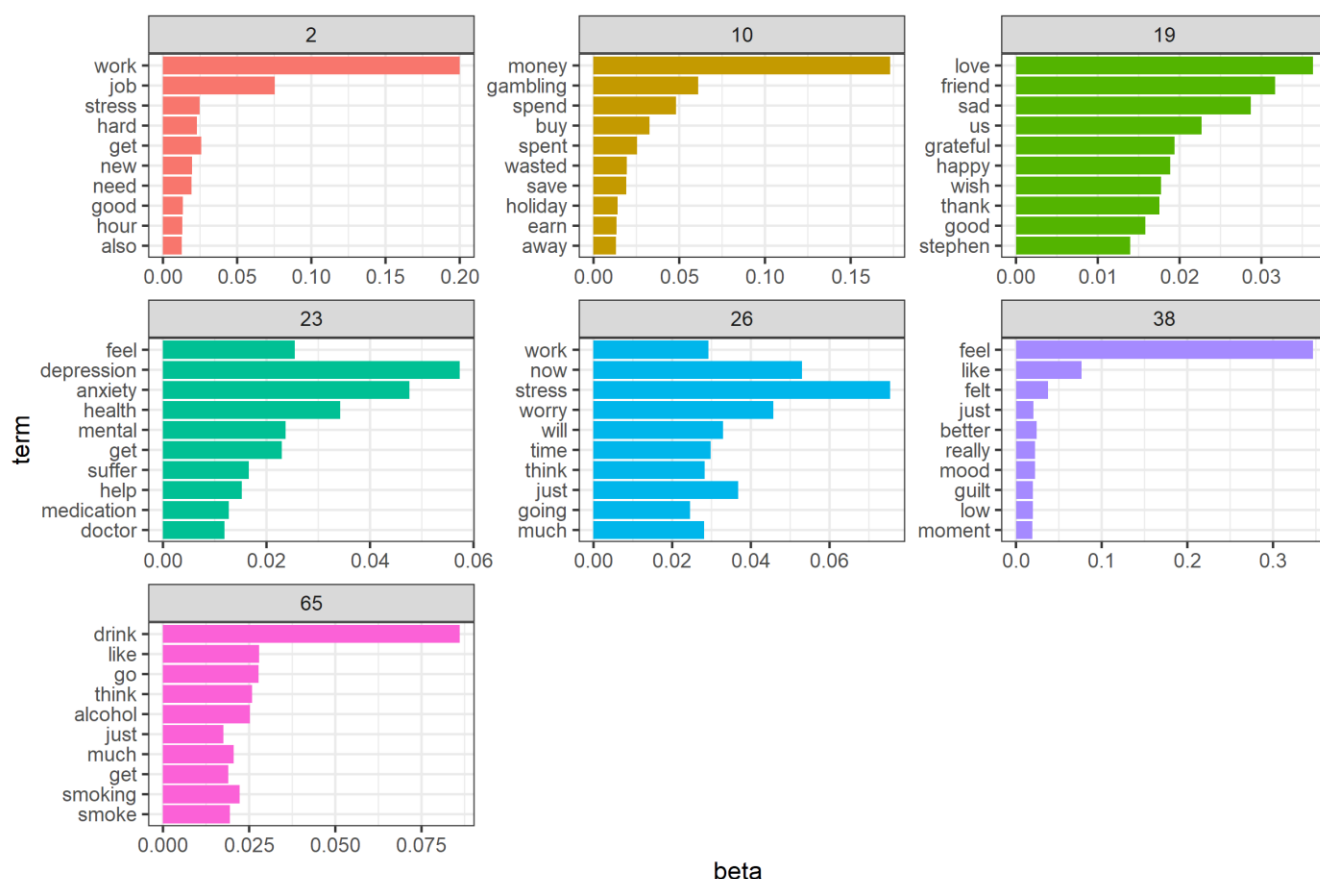


Figure 10. GamCare – 7-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues

Topic 2 – Work-related stress and gambling

Topic 2 related to the stress created from current work or unemployment. In particular, this topic highlighted how work-related stress can impact on an individual’s recovery and potentially act as a trigger for gambling behaviour. For the individuals in this topic also experiencing mental health issues, high-demanding jobs were particularly stressful, as was the idea of a permanent job. This topic was associated with positive valence (M=1.00, n=2, keywords: good, hard), however, this analysis only consisted of two words.

“I can relate to your work situation. I am now in a job that I have been in for 7 years and that that is longest time I have stayed in one job... I have had 2 promotions in my present job and I

do feel like you the pressure of it being permanent and it is stressful... In fact I started gambling heavy after taking this job on so I think my job might have been a trigger for me to end up in the oblivion world of online slots."

"Mine are under control right now too, i had some urges today though. I've noticed that i only get them when I'm stressed which helps me to ignore them. Today i went into the local council and they told me that my new job means I'd be better off not working the 16 hours a week as it just means I'm working for the same that i was already getting on benefits so that's where the stress came from."

Topic 19 – Happiness for recovery progress

Topic 19 consisted of congratulatory posts and messages of support from forum users relating to the progress and hard work other forum users have made towards their recovery. While the relevant keyword here is 'sad', this topic mostly highlighted forum users' ability to withstand or comeback from sadness and grief and continue on their gambling-free journey. This topic was therefore associated with positive valence (M=2.00, n=14, keywords: bless, god, good, grateful, great, happy, hope, love, sad, share, strength, thank, wish, wonderful).

"You have consistently shown great courage and fortitude even on the days you may be felt a little sad."

"You have had a skirmish with the addiction and been left saddened and bruised but you are back, which is a great relief. You are loved and respected by many of us who will be wishing you well."

Topic 23 – Relationship between gambling and mental health issues

Topic 23 related to forum users' personal experiences with gambling and co-occurring mental health issues, mainly depression, anxiety and panic attacks. Specifically, this topic consisted of forum users' opinions that mental health issues tend to occur before the gambling problems, but that ultimately both the mental health and gambling problems need to be addressed and that treatment ought to be tailored to individual needs for it to be effective. Within this topic, some forum users also expressed their frustration and disappointment with the National Health Service and other help services, as they have not helped treat them. This topic was therefore associated with negative valence (M=-1.50, n=8, keywords: anxiety, bad, better, help, panic, suffer, worry, worse).

"Everyone who has an addiction has some degree of poor mental health. It's not a chicken and egg situation of which came first - addiction or poor mental health. Poor mental health always precedes."

"I have done cognitive behavioural therapy, telephone therapy, had several different types of meds, spoke to mental health workers, seen numerous general practitioners and family support therapists but the outcome is always the same. The key issue with all this help is it's mostly not tailored for me (but instead is generic) without taking my circumstances into consideration."

P26 – Stress and gambling urges

Topic 26 related to the relationship between stress and the experience of gambling urges. Within this topic, forum users mostly referred to stress from work and divorce and they discussed the impact that this kind of stress can have on gambling urges. Specifically, most forum users referred to life being good and not experiencing urges as they did not have this kind of stress in their life. They also referred

to the need to stay calm and in control in order to block out these urges, as well how one can never become complacent in their recovery. This topic was associated with a negative valence overall, quite close to zero ($M=-0.33$, $n=3$, keywords: good, hard, worry).

“Staying calm and controlled has helped as had no urges for last few days no desire to gamble to block it all out.”

“No urges for a while now and don't expect anytime soon as my life as a routine now only when that changes they will come time off from work will bring them as the routine is broke and boredom creeps in on unplanned days the urges can come from an unexpected happening a bad day at work a plan that's gone wrong which then leads to stress.”

Topic 38 – Gambling as a coping mechanism

Topic 38 related to the use of gambling as a coping mechanism. Specifically, this topic highlighted that moods are constantly changing, and that it is normal to feel sad, low, and even depressed after quitting gambling, but that it is important during these times not to resort back to gambling as a coping mechanism. This topic was associated with a negative valence overall, quite close to zero ($M=-0.10$, $n=10$, keywords: anger, anxiety, bad, better, good, guilt, happy, like, positive, sad).

“Remind myself that moods are changing, my moods are constantly changing. Have been feeling really crappy lately and I may feel crappy again tomorrow or even later today. But am coping without using gambling as a comfort blanket.”

“Don't let your brain tempt you into thoughts of gambling. You have to allow yourself to feel down sometimes and allow yourself to bounce back naturally too. There are some great ways to boost your mood; for one, feel proud of your decision to be gamble free.”

Topic 65 – Relationship between gambling and AOD

Topic 65 related to forum users' experience with gambling and other addictions, mostly smoking and drinking. Within this topic forum users discussed their addictive personalities and how they have been addicted to multiple substances or behaviours over time (i.e., gambling, cigarettes and/or alcohol). In addition, some forum users discussed their quit attempts across these various addictions, such as their need to quit all addictive behaviours, or their hopes that because they have successfully quit one addictive behaviour, they can also quit the other. This topic was associated with positive valence ($M=2.50$, $n=2$, keywords: good, like), however, this sentiment analysis only consisted of two words.

“I think gamblers like us all have addictive personalities and are prone to being addicted to pretty much anything if we are not careful”

“Think that's a really important point you raise about gambling and alcohol. No easy answer but the bottom line is you need to do whatever it takes to stay gamble free - and to keep those associated benefits. If that means cutting all booze, then there's your answer.”

“I think one piece of information I need to include is that I used to be an alcoholic for several years and I was able to get that under control... I am hoping gambling will be the same way”

PsychForums (US)

Descriptive statistics

Word frequencies

Figure 11 displays the 50 most used words in forum posts related to the relationship between gambling problems and mental health and AOD issues within PsychForums (extracted from its relevant forum [i.e., Gambling Addiction]). The most common words were addiction-related words (e.g., gambling, addiction, casino), followed by words commonly used in everyday language (e.g., can, get, think).

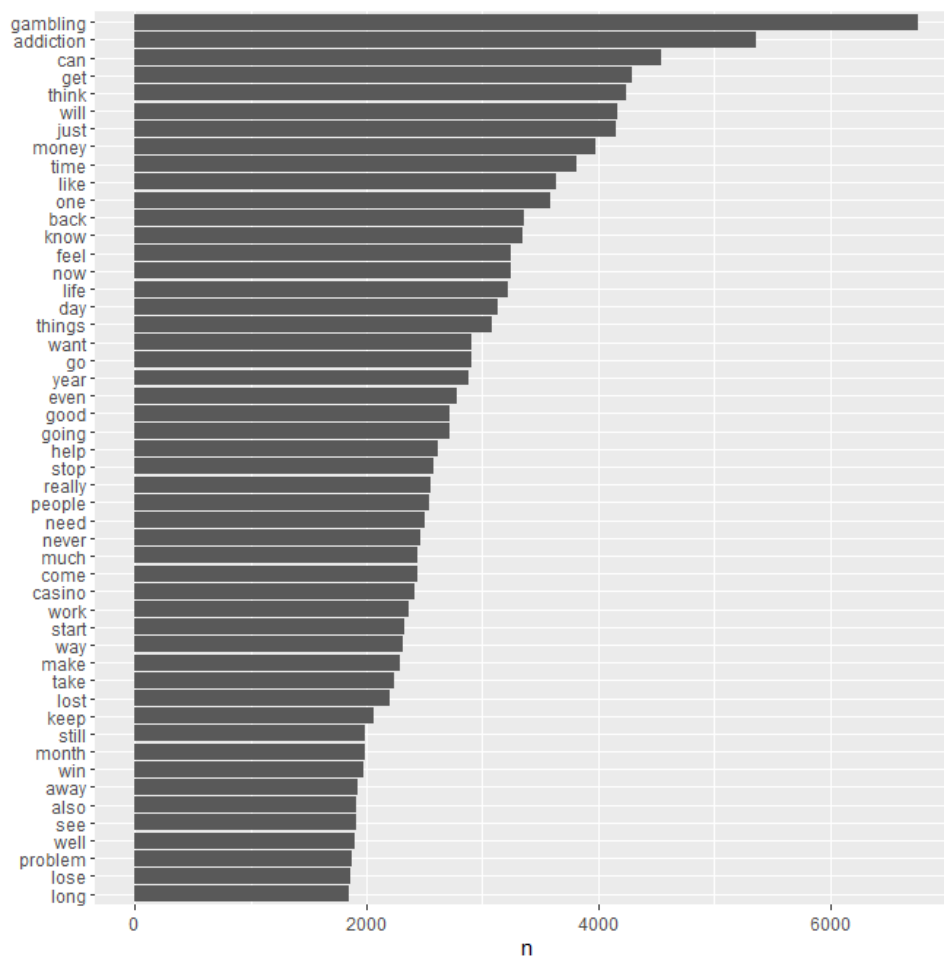


Figure 11. Top 50 most commonly used words in PsychForums posts exploring the relationship between gambling problems and mental health and alcohol and other drug issues

Word correlations

Presented in Figure 12 are the words that are strongly to very strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted mental health/AOD dataset (e.g., 'sad', 'depression') within the PsychForums forum. These findings indicate that:

- drink was correlated with alcohol ($\phi = 0.24$), alcoholic ($\phi = 0.20$) and drunk ($\phi = 0.16$);
- withdrawal was correlated with symptom ($\phi = 0.24$), reverse ($\phi = 0.18$), withdraw ($\phi = 0.18$) and ATM ($\phi = 0.17$); and
- cigarette was correlated with smoke ($\phi = 0.31$), smoking ($\phi = 0.29$) and pack ($\phi = 0.17$).



Figure 12. Correlations between mental health and alcohol and other drug keywords in PsychForums

LDA and sentiment analysis

A LDA was conducted on the restricted mental health/AOD dataset (8,095 posts). Using rate of perplexity change, the results indicated that a 45-topic model was the best fit for this data. The results of this 45-topic model can be found in Appendix 4. When restricted to topics that included any of the keywords relating to mental health and AOD, 3-topics (see Figure 13) were retained for interpretation. However, further inspection of topic 37 revealed that the keyword blue (i.e., potential colloquial term for sad) was used in the context of the colour blue. As such, topic 37 was not relevant to the current research question and was not interpreted. The interpretation of the remaining topics, the associated sentiment analysis and illustrative quotes are presented below.

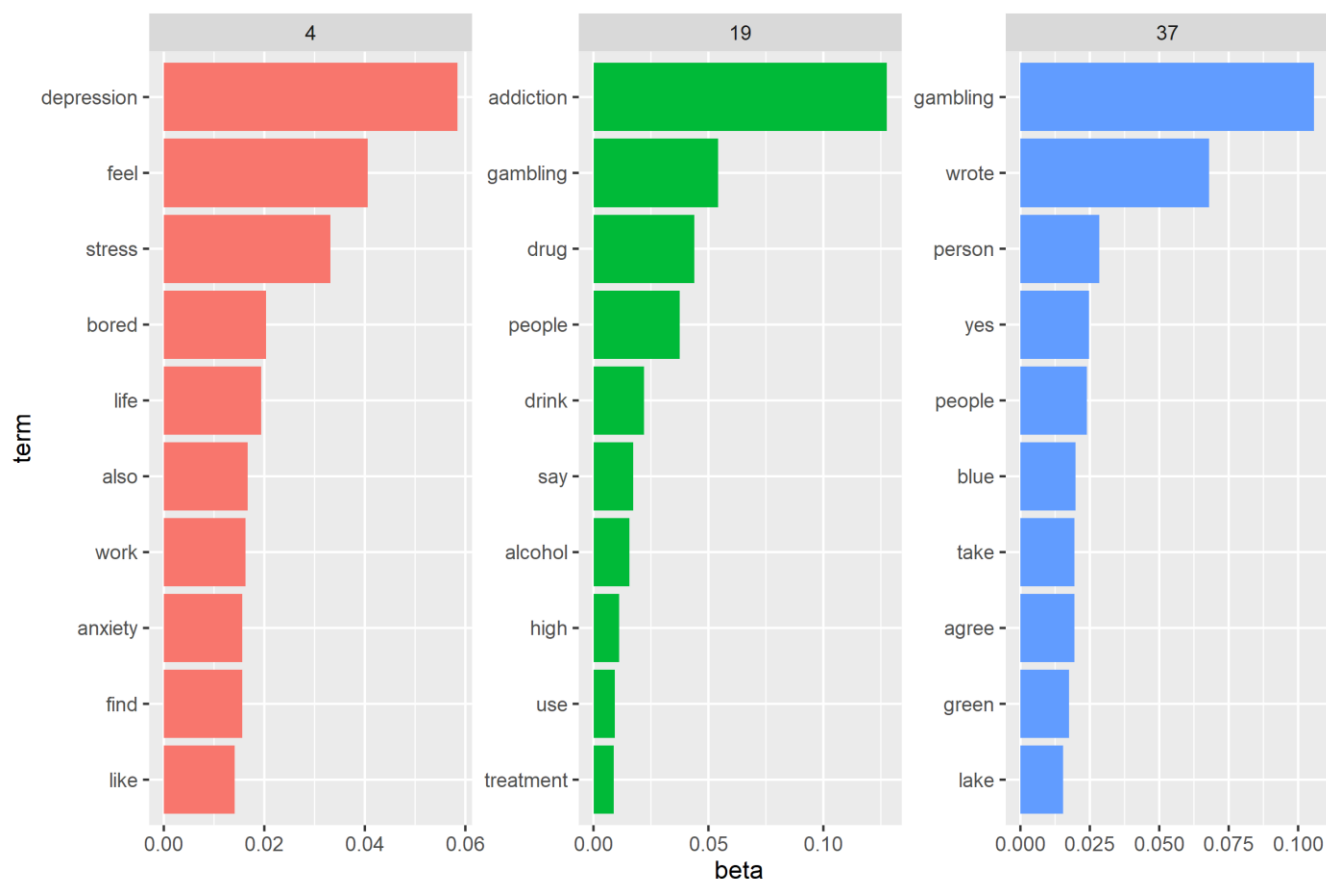


Figure 13. PsychForums – 3-topic model exploring the relationship between gambling and mental health and alcohol and other drug issues

Topic 4 – Relationship between gambling and mental health issues

Topic 4 related to the relationship between gambling and comorbid mental health issues, such as anxiety, depression and bipolar disorder. In particular, this topic related to how these comorbid mental health issues go hand in hand with gambling problems, and that they need to be dealt with simultaneously. In addition, this topic consisted of forum users' various experiences with gambling and comorbid mental health issues, with forum users having varying experiences as to which issue they experienced first. This topic was associated with negative valence ($M=-1.40$, $n=5$, keywords: anger, anxiety, bored, like, suffer).

“From my own experience, while the Gamblers Anonymous meetings are going to be very helpful, you can't only focus on your addiction without tackling bipolar. They go hand in hand.”

“Gambling addiction and depression go hand in hand in my opinion. For me gambling was the easiest (and most destructive) way to deal with my crippling depression.”

“But I feel like garbage ever since I quit. Trouble sleeping, sweating and anxiety and depressed feelings. Feelings of emptiness as well. Is it possible these are withdrawal symptoms?”

Topic 19 – Gambling addiction similar to substance-based addiction

Topic 19 related to the similarities between gambling addiction and substance-based addictions. Specifically, this topic consisted of forum posts explaining the physical and chemical effects on the brain produced by gambling, which are similar to substance-based addictions, such as cocaine,

heroin, and alcohol. This topic was associated with a positive valence ($M=2.00$, $n=1$, keyword: like), however, the sentiment analysis only consisted of one word.

“The American Psychiatric Association based its decision on numerous recent studies in psychology, neuroscience and genetics demonstrating that gambling and drug addiction are far more similar than previously realized. Research in the past two decades has dramatically improved neuroscientists' working model of how the brain changes as an addiction develops.”

“Recently scientists have classified gambling addiction as a neurobiological disorder, a chemical dependency of the brain similar to those addicted to drugs such as cocaine, crack cocaine, heroin, and alcohol.”

“Think of gambling addiction as if it was heroin.”

Summary of Study 1 Results

- Gambling Help Online (Australia) forum data produced a seven-topic model, including four mental health topics (*Bi-directional relationship between gambling and mental health; Relationship between gambling and mental health issues; Emotional impact of gambling; Financial and other stress*) and three AOD topics (*Addiction swapping and illicit substances as treatment for gambling; Self-exclusion from venues including pubs; Relationship between gambling and alcohol*).
- Beyond Blue (Australia) forum data produced an eleven-topic model, including five mental health topics (*Bipolar disorder; Medications for mental health issues; Cannabis as a treatment for depression; Employment and financial stress; Mental health issues in men*), three emotion topics (*Association between food and moods; Loneliness; Criticism*), and two trauma and abuse-related topics (*Painful events; Abusive relationships*), one AOD topic (*Relationship between gambling and AOD*).
- GamCare (UK) forum data produced a six-topic model, including four mental health topics (*Work-related stress and gambling; Relationship between gambling and mental health issues; Stress and gambling urges; Gambling as a coping mechanism*), one AOD topic (*Relationship between gambling and AOD*), and one emotion topic (*Happiness for recovery progress*).
- PsychForums (US) forum data produced a two-topic model, including one mental health topic (*Relationship between gambling and comorbid mental health issues*) and one AOD topic (*Gambling addiction similar to substance-based addiction*).

Study 2 – Help-seeking

While Study 1 explored the experiences and perceptions of the *relationship* between gambling and comorbid mental health/AOD (depression, anxiety, and family violence) problems, Study 2 explored the experiences and perceptions of *help-seeking* for gambling, mental health or AOD problems, and jurisdictional differences therein, among Australian, UK, and US online forum users. The results are presented separately for each forum (AUS: Gambling Help Online, Beyond Blue; UK: GamCare; US: PsychForums), as the data was analysed separately.

Gambling Help Online (Australia)

Descriptive statistics

Word frequencies

Figure 14 displays the 50 most used words in forum posts related to help-seeking within Gambling Help Online (extracted from its relevant forums, including The Courtyard, Your Diary of Recovery, and Strategies for Change). The most commonly used words related to gambling and addiction (e.g., gambling, addiction, pokies, money), followed by words commonly used in everyday language (e.g., can, day, get).

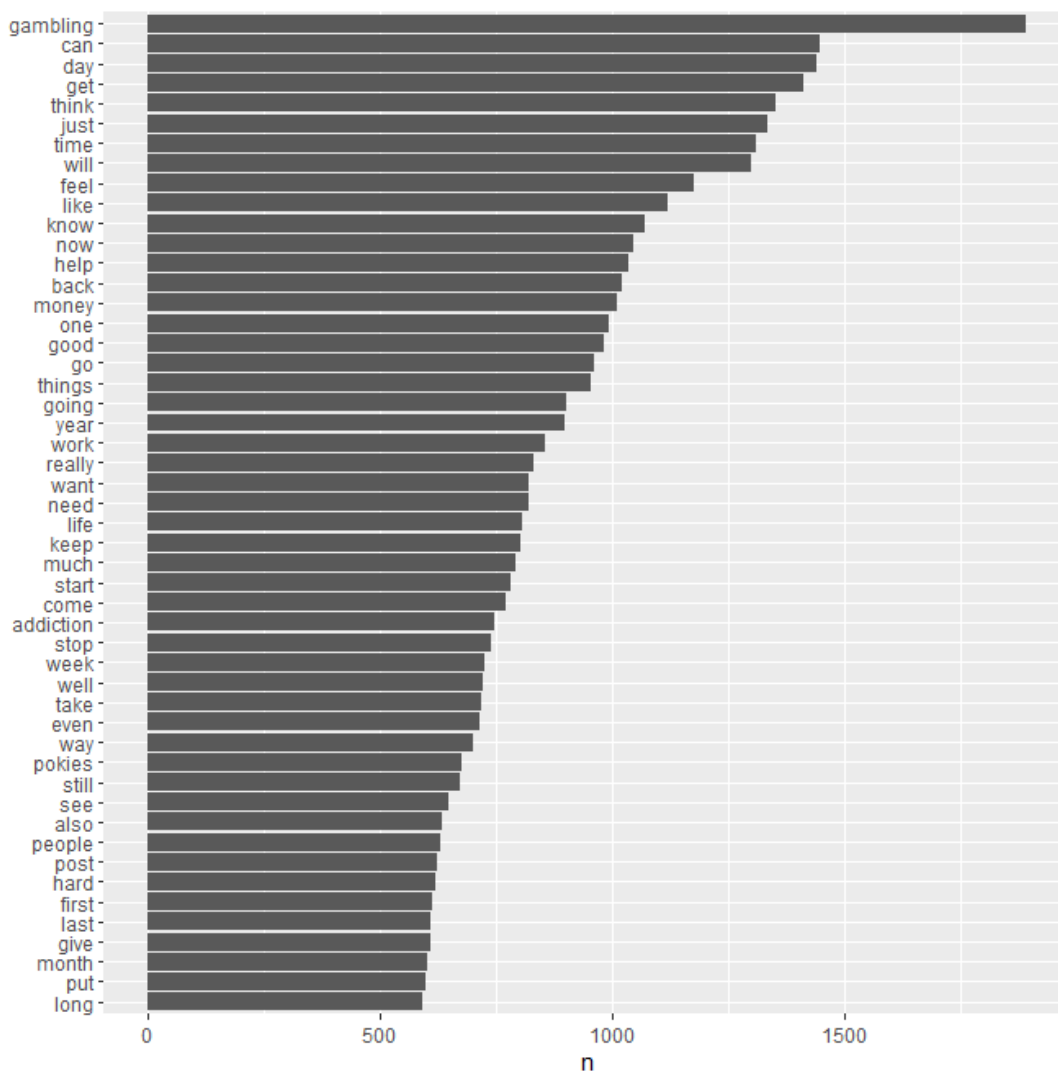


Figure 14. Top 50 most commonly used words in Gambling Help Online posts exploring help-seeking

LDA and sentiment analysis

A LDA was conducted on the restricted help-seeking dataset (2,600 posts). Using rate of perplexity change, the results indicated that a 40-topic model was the best fit for this data. The results of this 40-topic model can be found in Appendix 5. When restricted to topics that included any of the keywords relating to help-seeking, 14-topics (see Figure 16) were retained for interpretation. The interpretation of these topics, the associated sentiment analysis and illustrative quotes are presented below.

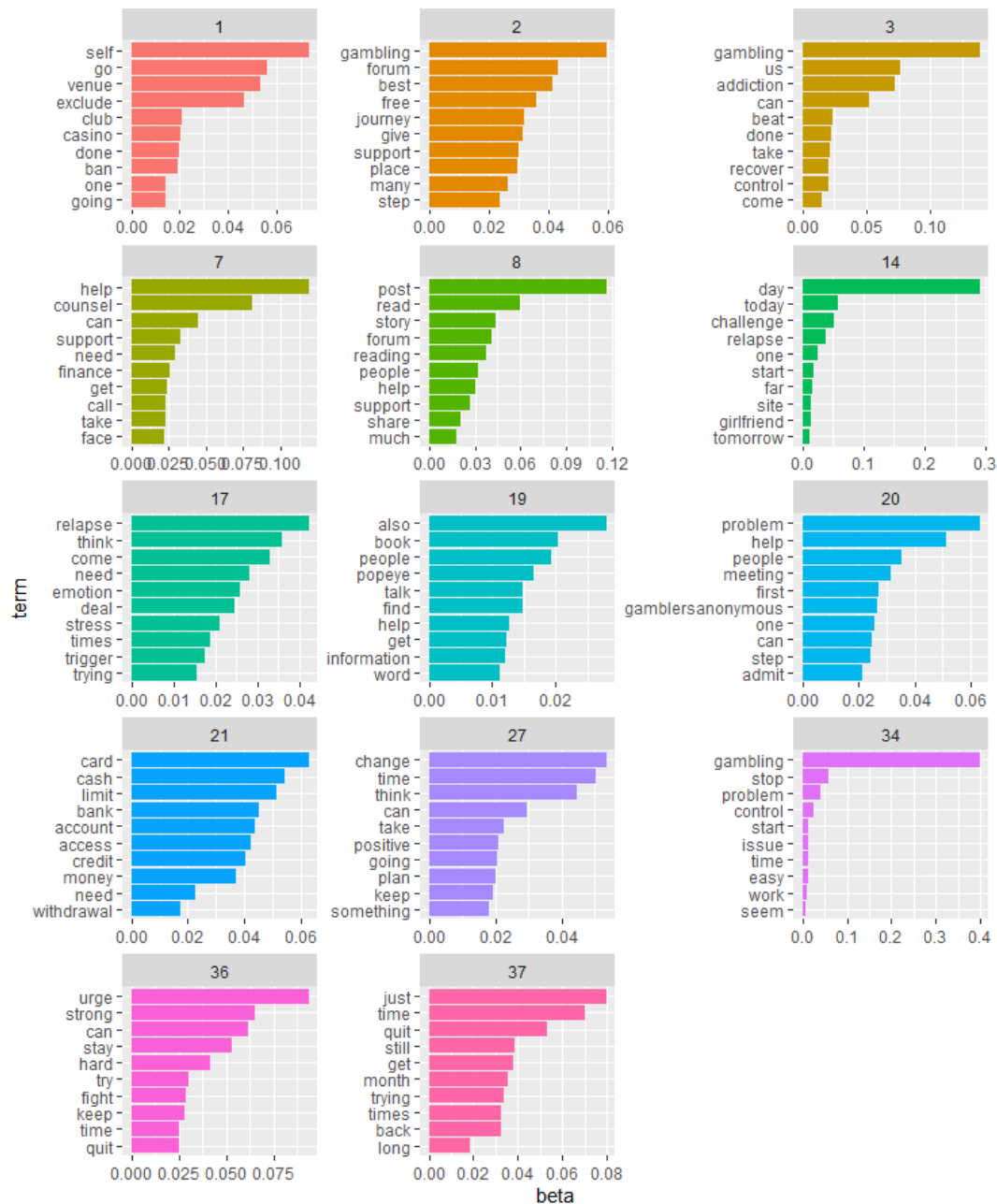


Figure 16. Gambling Help Online – 14-topic model exploring help-seeking

Topic 1 – Self-exclusion

Topic 1 related to self-exclusion, with forum users posting about: (1) their success (or lack thereof) with self-exclusion; (2) the process of self-exclusion and providing advice to others on how to self-exclude; and/or (3) simply informing others that they had just self-excluded. The results of the sentiment analysis suggested that this topic was negative in valence ($M=-0.67$, $n=3$, keywords: ban, exclude, want), however, this was quite close to zero and only three words contributed to this

sentiment analysis. Further inspection of the posts indicated that this topic was mostly positive or informative in nature.

“Self exclusion has been one of the best tools for me personally in regard to cutting down my gambling. I am one that fears authority - for me it works.”

“Well I just took the leap today and did it, I couldn't sit around anymore worrying about how it would turn out.”

“I hope you can find the strength to go to the casino to do the self-exclusion... Where I am the gambling helpline put you in touch with a gambling counsellor in your area and you can go to their offices, they are everywhere; and you do the self exclusion through them rather than having to go to the casino. I'm booked for next Tuesday to do more venues. Maybe you can do that too?”

Topic 2 – Benefits of the forum

Topic 2 related to the Gambling Help Online forum itself, demonstrating that users are utilising the forum to talk about their personal journeys towards becoming free of gambling and encouraging and supporting other forum users by telling them that they are not alone in their journey to becoming gambling free. This is further supported by the sentiment analysis, which indicated an overall positive valence (M=1.38, n=8, keywords: best, commit, free, hard, support, welcome, wish, worthy).

“You're right, this is the first step [posting on the forum] and congrats on having the courage to take it. I found that cold turkey was they only way to go, for me that is. Now, I know that may seem impossible but breaking it down into days or even hours of being gamble free made it seem much more achievable.”

“Congrats on taking the first step [posting on the forum] in your road to being gamble free. It's unfortunate that it takes us hitting rock bottom to make us realize that we need help beating this demon called gambling. We, on this forum, have been where you are and struggle with our addiction every day. Bright side is that you are not alone in your journey.”

Topic 3 – Gambling as an addiction

Topic 3 reflected forum users' view of gambling as an addiction, as well their views on the process of recovery. Specifically, users indicated that people can recover from gambling, but that it is a difficult process. Moreover, many users compared gambling problems to substance-based addictions, with some suggesting that problem gambling is worse than a substance-based addiction. Interestingly, the sentiment analysis indicated that this topic was associated with a positive valence (M=2.00, n=2, keywords: hope, important), however, this analysis only consisted of 2 words (hope and important). These findings highlight that some forum users were referring to the importance of beating the addiction and maintaining hope.

“This will be the battle of your life as it will be mine and others. You just need to understand that, according to research done so far, gambling addiction is exactly like cocaine addiction. It is triggered by the same part of our brain and they operate the same way.”

“You are on your own, my friend, and so am I and everyone else with this problem. You have to beat it with the power of the mind and it will not be easy. It ruined my life but I still have hope.”

“Ain't that the truth. Gambling kills you slowly. It's like being tortured. I think gambling addiction is worse than a drug addiction! I have done my fair share of drugs and let me tell you this addiction grabs you like no other. I found it relatively easy to quit drugs although I often wonder if my substance abuse has something to do with why I gamble.”

Topic 7 – Help services

Topic 7 related to the various gambling support services such as counselling, financial support and helplines. Specifically, forum users wrote about these help services in the following ways: (1) to provide information about the different types of services available to other users; and (2) to discuss their experiences of these support services. The sentiment analysis indicated that this was generally a positive topic ($M=1.67$, $n=3$, keywords: help, please, support), however, the posts varied, with some users expressing dissatisfaction with the services they have accessed (e.g., helpline and online) and others indicating satisfaction (e.g., financial counselling).

“Does anyone feel frustrated with the level of "help" the past six months, I have been actively trying to quit, but it goes no where, not because I don't want to continue with help, because I can't even get initiated into the first phase of help! I have no home phone, and by the time I feel the I need to talk to someone, I can't talk on a phone, so I try online, and online, I get the same one liners and just walk away feeling insulted. I vented the most I ever had last week to an online counsellor, I think I outlined how urgently I need help and how I am sick of being told I need to wait weeks, months, days to get this "instant" help.”

“The bank put the stop on cash withdrawals as I have large debt with them. This happened after financial counsellor made a payment arrangement on my behalf with the bank. I didn't ask for I, but very grateful that step was taken & it is working.”

“Info below.....I think it is emergency help with food etc. The helpline should be able to tell you more or refer you to the correct area for advice :)”

Topic 8 – Welcome to the forum

Topic 8 consisted of terms commonly used within forums. Specifically, this topic consisted mostly of supporting and encouraging posts made from more experienced forum users to new forum users. For example, experienced forum users welcomed new users to the forum, encouraged them to read as many posts as they can, and encouraged them to share their stories. The sentiment analysis suggested that this topic was associated with a positive valence ($M=1.00$, $n=6$, keywords: alone, easy, help, share, support, thank).

“Welcome to the forum. You have started. You knew that you need help and this is the start. It is hard to open up to strangers. We are not strangers to the gambling addiction. Read other peoples posts... daily if you can... and you will find your OWN story written many times. We are here to support you as only we understand. The forum does get quiet at times... don't let that stop you. take the opportunity to read other stories or read the information on the website.”

“It is a terrible addiction... a disease.. that destroys our lives. There are many many stories on this site and on the internet. Learning to understand how gambling worked on our mind to get us addicted helps us understand why recovery is difficult. It is a lifetime commitment to stay in recovery.”

Topic 14 –100-day challenge

Topic 14 related mostly to the 100-day challenge (i.e., self-directed challenge that assists gamblers either cut back on their gambling, take a break or stop permanently), as well as relapse. The posts were also somewhat supportive of the positive valence of this topic (M=1.50, n=4, keywords: challenge, congratulation, good, proud), as some of the posts were supportive and encouraging messages about the user's progress with the 100-day challenge and remaining gambling free. Some of these posts, however, also relayed stories of relapse after a successful period of abstinence.

"Thanks for the update, I'm proud of your achievement so far and you should be to. Your so close to the 100 day challenge, I only made it 46 days and relapsed unfortunately until returning here again. Each day without gambling is a better day then the last when you did gamble."

"Hi and well done! I am 29 days gambling free today! You aren't really that far behind me but I know those first few days seem to go so slow! Like you at 9 days, there wasn't much to see re increased finance but the good news is that I can now see a huge difference!!!"

Topic 17 - Relapse

Topic 17 related to relapse, particularly about the stress and consequences associated with relapsing. Some forum users also posted about ways of dealing with relapses and gaining a greater understanding of why they relapse. Unfortunately, no sentiment analysis could be conducted for this topic as none of the top 20 words were included in the sentiment analysis dictionary used for this analysis.

"I hope you come back on and keep posting no matter what has happened. It is important to keep trying, and to get out of your head where things can get so intense and worse than what they are. I recently read through your posts and all the replies and can understand the devastation a relapse can put your emotions through."

"I did some reading about dealing with relapse and had some valuable insights today concerning my own relapse the other night. I have been so used to functioning a certain way most of my life that it has been difficult for me to manage stressors and new feelings and understand to take it slow because as my life changes and transformations take place my emotions can feel so unstable and I lose patience to cope. That is when I relapse as a way to feel 'normal' again."

"I feel really weird today. Upset that i slipped up, but somewhat glad the slip up monkey is off my back for now. The stress of slipping up was increasing the longer i went without gambling."

Topic 19 – Information-seeking

Topic 19 related to books in which forum users could find helpful information. Specifically, forum users were seeking advice on where to obtain self-help books, as well as seeking a resource in which helpful information, articles and research on gambling can be shared via the forum. The sentiment analysis indicated that this topic was associated with positive valence (M=2.50, n=2, keyword: good, help), which is somewhat supported by the top 10 posts, which were of an inquisitive nature.

"I just found this forum while reading and searching on how to help my brother. I am thinking to order some self help books and go through them together with him... Are there any good books that you guys suggest???"

"I wonder is there a way to have an area designated specifically with links to information, articles, research on gambling, the facilitators and users could add links if they find something that would be helpful. Sometimes I'll remember that a link was added into one of the many threads in this website and then I find it hard to find it again..."

Topic 20 – Gamblers Anonymous

Topic 20 related to Gamblers Anonymous as a form of help-seeking. Specifically, some forum users were posting their personal stories about how Gamblers Anonymous has worked for them, whereas others were querying and seeking information about Gamblers Anonymous. This topic was associated with a neutral valence ($M=0$, $n=4$, keywords: admit, help, problem, share), with an equal split of words with positive and negative sentiment.

"I need help and I know the 12-step program works if you are committed as many members have stopped gambling for years and have done this from attending and embracing the Gamblers Anonymous program. Even attending one a fortnight, you are able to obtain a phone list, get sponsor (someone you trust and get on with and has a few years gable free). "It's great to here other people stories, and when you share yourself (which can be intimidating at first) it is just fantastic to get it off your chest. I only have three meetings a week to go to where I live and the meetings are small I am told as I have only been to one meeting which was Saturday which only had 4 people, but I have felt stronger than I felt in a long time."

"I've never been to Gamblers Anonymous meetings and I don't know really what happens there but I thought of something reading your post. I wonder if Gamblers Anonymous meetings are modelled on the old alcoholics anonymous program..."

Topic 21 – Financial self-help strategies

Topic 21 related to common self-help strategies employed by gamblers to limit their gambling expenditure, specifically limiting access to cash and money. Forum users were sharing stories and tips about financial self-help strategies that have helped them in the past. The sentiment analysis indicated that this topic was of negative valence ($M=-2.00$, $n=2$, keywords: pay, withdrawal). This analysis, however, only consisted of two words and contradicts the sentiment of the posts, which were mostly positive (i.e., successful strategies employed) or inquisitive (i.e., sourcing information about the types of strategies that can be employed) in nature.

"Just thought it might be good to share some of the financial strategies you use in order to manage your money....I have a few! consolidate credit cards: if you owe money on credit cards with high interest rates, do a balance transfer to one with a low rate/0% interest for 6 months card to buy yourself some time to pay it off. reduce limits on credit card: banks don't like doing it and make it really tricky sometimes, but you can ask for your limit to be reduced - I've now got one card with a \$1000 limit because I figure I can always manage to pay that off. Leave your credit cards at home or send them to live with a friend: simple really, but if you leave your credit card at home you can't use it. if you are dodgy with credit cards, give them to a friend. That way you have to make a conscious decision to use it AND go and get it - mine lives with a friend in another state! Say no or opt out of those bank messages that ask you if you would like a credit limit increase... what are some of yours??"

"Which bank can help me!!!!!! I want to be able to do internet banking to pay my bills but i also want to limit cash withdrawals. Has anyone found a bank that will do it?"

Topic 27 – Change-related

Topic 27 related to change and the change process. Specifically, forum users were discussing different reasons why people change (e.g., increased reasoning abilities) and providing some strategies for change (e.g., replacing negative/bad habits with positive/good habits), as well as posting encouraging messages about keeping up any changes that have been made and that they are responsible for making that change. The sentiment analysis revealed that this topic was positive but only included one word (M=2.00, n=1, keyword: positive).

“It was an interesting article and it did have some merit however I too think it is a change of reasoning or even perception rather than an increase in will power which is required to overcome unwanted actions, behaviours or thoughts.”

“To be gamble free is the outcome we are all wanting to achieve, the process is about making the necessary changes to be able to get to that point. It's not going to happen to by itself, our 'wanting' to change is a beginning of the process but not enough to truly succeed and reach our goal.”

“Keep it up, focus and fight any urges. Replace old habits with new good ones that will benefit you rather than those that don't.”

Topic 34 – Gambling history and stopping gambling

Topic 34 related to forum users' gambling history, as well as discussions of how to stop and control their gambling behaviours. Specifically, this topic consisted of posts in which users were introducing themselves, sometimes as problem gamblers, and telling their story about their gambling behaviour (e.g., when it started, frequency of gambling, gambling expenditure). These posts also related to advice seeking or giving about how to stop gambling, including information about treatment outcomes and support services. This topic was associated with a negative valence, quite close to zero, (M=-0.67, n=3, keywords: easy, problem, stop), which generally supported the tone of the posts, in which most users were sharing stories about difficult times in their life.

“Hi, I'd like to share my story from a different perspective. For my story, rather than talk about x dollars and telling the story from an event base level, I thought I'd rather share my story from the perspective of what is going in my head and what I'm feeling whilst I gamble.”

“Hi All, New here and am ready to try manage my bordering pathological Gambling addiction. I guess the first step is admitting the issue, the next step is actually doing something about it, so this is a first for me. Seeking help that is. I've been gambling for 22 years now, maybe slower periods in that time when i was parting in my mid 20s, but otherwise fairly consistent. I was introduced to pokies at the ripe underage of 15, this is when my addiction started. I am single middle aged guy and gambling is consuming me and my life and it needs to change.”

“Hi there. I think a good place to start is to use the counselling service offered here, and be guided to a financial consultant. When I first truly accepted and admitted that I had a gambling problem (which was years after I had realised that I had a problem) I attended Gamblers Anonymous.”

Topic 36 – Gambling urges

Topic 36 related to the experience of gambling urges. Specifically, this topic consisted of: (1) the provision of practical tips for managing urges; (2) messages of support and encouragement telling other forum users to keep up the good work fighting the urges; (3) positive stories of overcoming

urges; (4) negative stories about recent relapses and giving in to urges; and (4) descriptions of the experience of urges. The variety in these posts is reflected in the sentiment analysis, which was quite close to zero despite showing a positive valence ($M=0.80$, $n=5$, keywords: best, fight, free, hard, strong).

"I think it is great that you are working hard on quitting your gambling BEFORE you have lost your money. I think limiting access to your funds is going to be critical - urges are much, much stronger when the subconscious gambler in you knows there's money around that could be gambled. So you will need to put in rock solid strategies in place to limit your access - otherwise your urges may be too hard to resist."

"This is day 3. I just received \$450 from someone that owed me and the amazingly strong feeling I have to quit has overpowered any urges to gamble with this money. The tab is 5 minutes away but NO, they are not getting a cent! Anyone else quitting gambling once and for good just be strong, if u have the guts to quit, then that courage will overpower the urges! Stay strong!"

"Thank you for sharing your story and the effects of your gambling, the urges. I too suffer from frequent urges. I had relapses in past week at the pokies, losing almost all my income."

"I'm getting urges to gamble (last night and today), but they aren't too strong at the moment. There are physical sensations that accompany these urges (sweating, hot flushes), as well as the psychological stuff."

Topic 37 – Quit attempts

Topic 37 related to quitting gambling. Specifically, users posted about their quit attempts, their lapses and how quitting gambling is a long process in which they may experience many lapses but that it is important to keep trying. The sentiment analysis indicated that this topic is of negative valence ($M=-2.00$, $n=1$, keyword: fail), however, this analysis consisted only of one word (i.e., fail). The top 10 posts, however, suggested that this topic was mixed in terms of sentiment, with some discussing relapse and past quit attempts in a negative manner, and others discussing the fact that lapses are normal and that individuals should be discouraged by this, instead they should keep trying.

"So back here again.....and in the same spot as my first post. Bills piling up and out of control gambling again. I'm very upset, frustrated and just don't know what to do. I have tried time and time again and cannot give it up. I haven't played the pokies in months however springtime or and carnival with the races gets me back in every single time."

"You know what they say, if at first you don't succeed, try, try, try, try and try again. That's all it is, I have tried and failed so many time before I still find it hard to believe that it's been nearly 10 months since I last slipped \$50 into a poker machine. I believe the difference this time is the support system and barriers I have put in place to stop me from gambling. Support has been a huge issue for me in the past, I had tried to do this on my own so many times only to fail and fall further into depression and despair. So this time I made sure I had plenty of support, I told my parents, joined this forum and started email counselling. I also put barriers in place to guard my money and against impulse gambling."

Beyond Blue (Australia)

Descriptive statistics

Word frequencies

Figure 17 displays the 50 most used words in forum posts related to help-seeking within the Beyond Blue forum. As mentioned earlier, given that Beyond Blue is an online forum for mental health issues, only threads that included gambling-related keywords (e.g., 'gambling', 'gamble', 'pokies') were extracted. The most common words were words commonly used in everyday language (e.g., think, can, like), as well as help-related words (e.g., help, change, support) and emotive words (e.g., hope, feel, good).

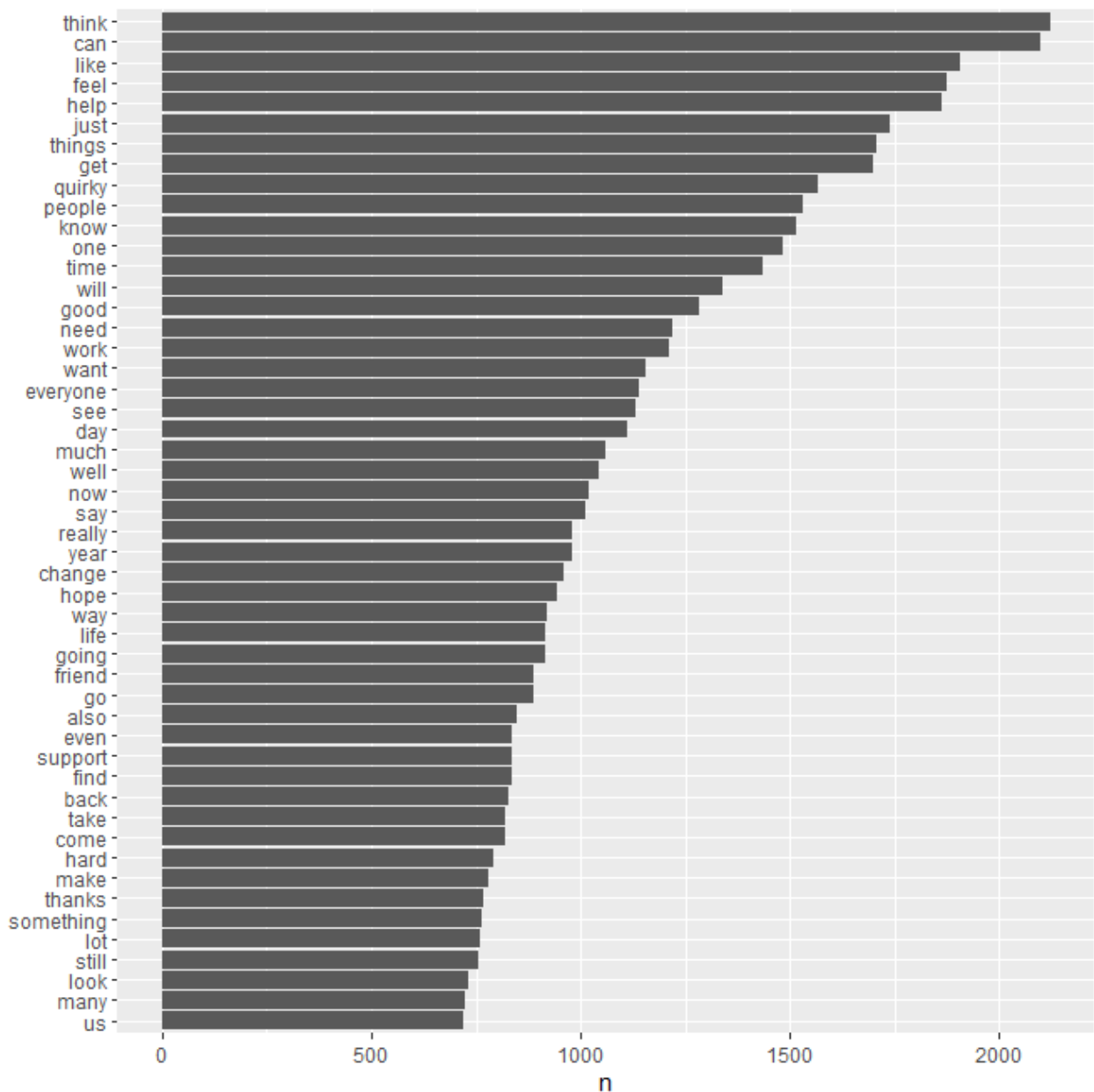


Figure 17. Top 50 most commonly used words in Beyond Blue posts exploring help-seeking

Word correlations

Presented in Figure 18 are the words that are strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted help-seeking dataset (e.g., 'help', 'treatment') within the Beyond Blue forum. These findings indicated that:

- psychiatry was correlated with medication ($\phi = 0.21$), the gp (general practitioner; $\phi = 0.17$), appointment ($\phi = 0.17$), doctor ($\phi = 0.17$) and prescribe ($\phi = 0.15$);
- quit was correlated with substance ($\phi = 0.20$), smoke ($\phi = 0.20$), smoking ($\phi = 0.17$), cannabis ($\phi = 0.19$) and cigarette ($\phi = 0.15$); and
- relapse was correlated with trial ($\phi = 0.20$), error ($\phi = 0.16$) and period ($\phi = 0.15$).

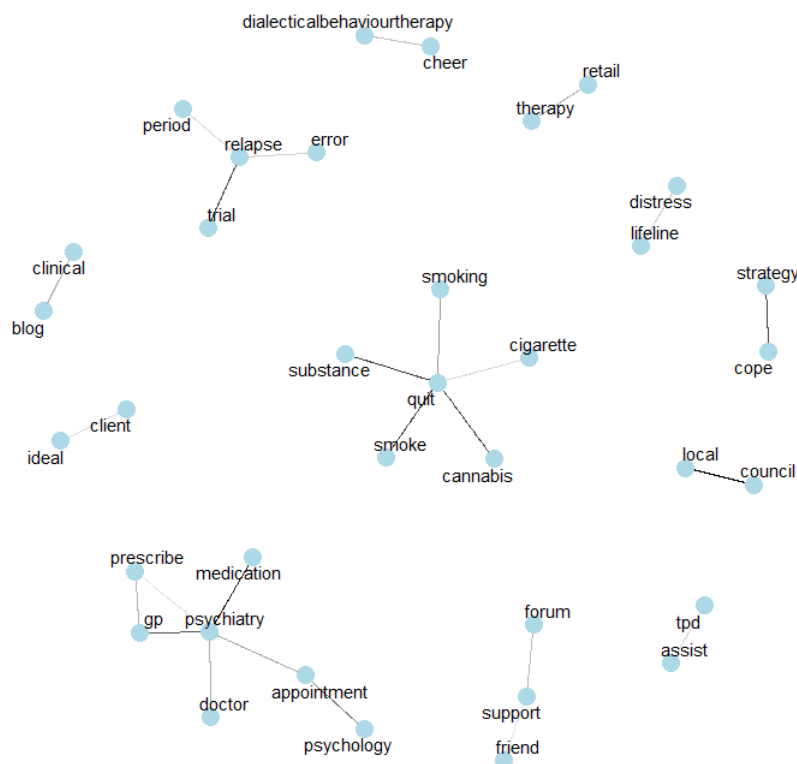


Figure 18. Correlations between help-seeking keywords in Beyond Blue

LDA and sentiment analysis

A LDA was conducted on the restricted help-seeking dataset (4,180 posts). Using rate of perplexity change, the results indicated that a 45-topic model was the best fit for this data. The results of this 45-topic model can be found in Appendix 5. When restricted to topics that included any of the keywords relating to help-seeking, 13-topics (see Figure 19) were retained for interpretation. The interpretation of these topics, the associated sentiment analysis and illustrative quotes are presented below.

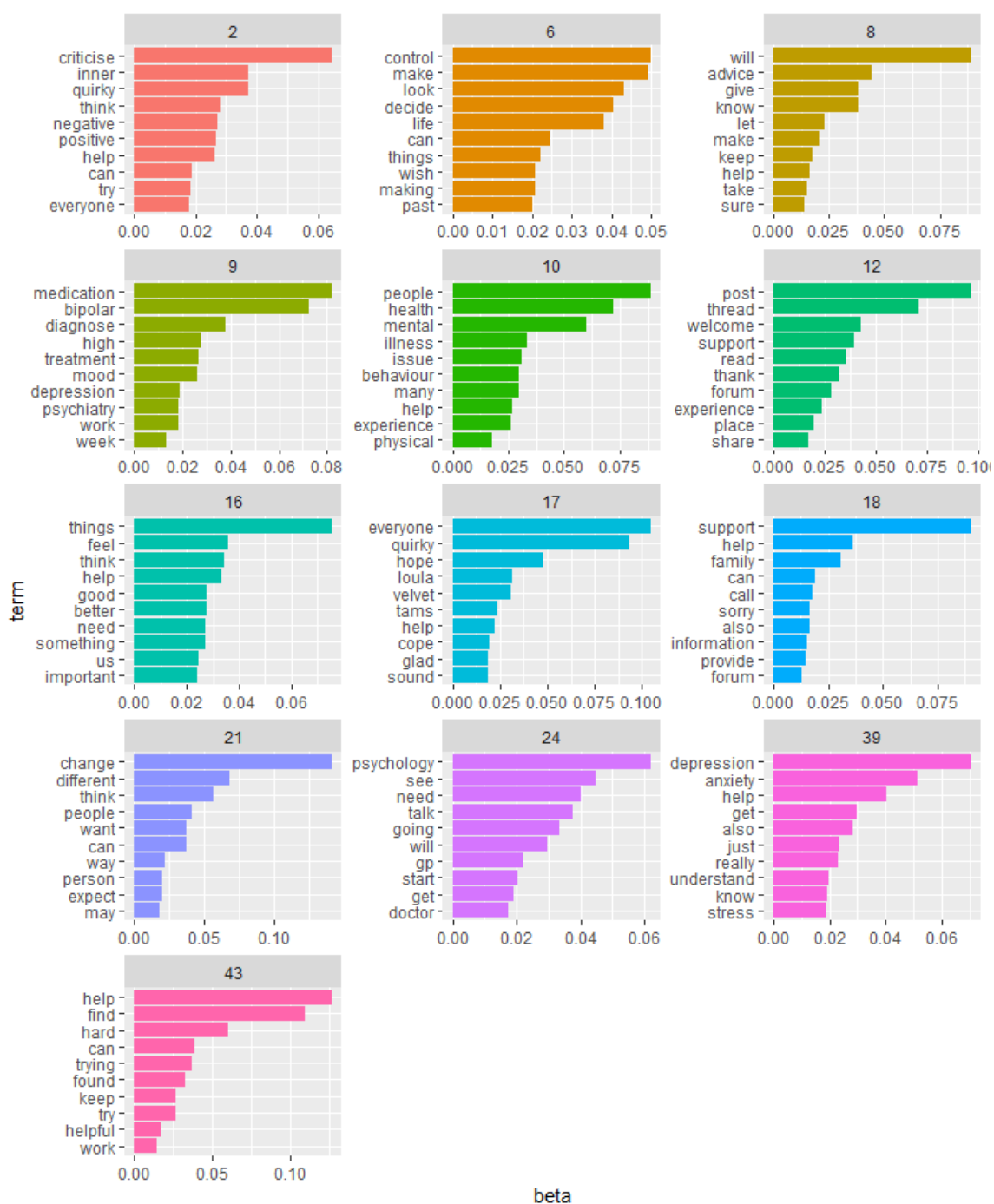


Figure 19. Beyond Blue- 13-topic model exploring help-seeking

Topic 2 – Inner critic

Topic 2 related to a specific thread of posts relating to one’s inner critic and how it can be tamed. Forum users indicated that their inner voice could be either positive or negative depending on the situation, which was supported by the sentiment analysis, in which the overall valence was approaching neutral (M=0.17, n=6, keywords: encourage, harsh, help, ignore, negative, positive).

“Welcome to my thread, I am looking forward to sharing ideas on ow to tame the inner critic, the one who tries to undermine you, who doubts your decisions, who can even spoil the good times”

“I think my inner critic and voice of reason are like two sides of the same person. Its like my inner devil and inner angel. It really depends on the situation to determine who is stronger and the bigger influence.”

Topic 6 – Control and decision-making

Topic 6 related to taking control of one’s life, as well as the decision-making onus that comes with that. Forum users spoke about different aspects of control and decision-making across this topic, including: (1) the fact that many of them never had control over their own lives and making their own decisions, therefore taking control is new to them and not something with which they feel comfortable; (2) the importance (or lack thereof) of being in control of their own lives and decisions; and (3) how they have not always made the best decisions. While the sentiment analysis revealed a positive valence (M=1.00, n=4, keywords: best, good, wish, worry), this was not entirely reflective of the tones of the posts in which several forum users indicated that they did not like having to be in control.

“No. I don’t like being in control at all. I don’t trust me to make decisions because my decision making usually results in some kind of trouble. This being in control is very new to me, and it’s something I don’t like or handle very well.”

“I wouldn’t say that control was important to me, because it’s not something I’ve ever really had in the past. I’ve not had control before. This is a new thing”

Topic 8 – Mental health disability claims

Topic 8 related to a specific thread about forum users experience with making disability claims and included providing advice to other forum users about seeking help from lawyers with these claims. Despite the content area (i.e., disability claims), these posts were mostly positive in nature, with users giving advice to other users and sharing stories of winning their claims, as outlined by the sentiment analysis (M=2.40, n=5, keywords: best, help, hope, please, win).

“I have just successfully won my Total and Permanent Disability claim! I would definitely encourage you to seek the assistance of a lawyer, on a 'no win, no fee' basis to assist you.”

“I’m going through the same thing myself. Personally, I am using a lawyer as its too stressful for me to do...no win no fee and very reasonable cost if I do win... If you do get a lawyer make sure you do some research on them as there are crap lawyers too...my doctor recommended my lawyer as he’d helped other patients. Good luck...any other questions you have or just feel like ranting (I do this often) please yell out”

Topic 9 – Psychiatric illness diagnoses and medications

Topic 9 related mostly to forum users experience of psychiatric illness (i.e., bipolar disorder), in particular sharing their diagnosis and in some cases describing misdiagnoses prior to the correct diagnosis being made. Several users also discussed help-seeking in terms of the various medications they have been on and the side effects of these medications. The sentiment analysis revealed an overall negative valence for this topic (M=-2.00, n=2, keywords: disorder, illness).

“I’ve been diagnosed with Bipolar for 2 years but recently Bipolar 1 Rapid Cycle. I have been on 5 different medications one made me toxic 3 sent me to zombie land and the latest one is working with my mania but not my depression”

“The additional new medicine usually prescribed for another condition has resulted in a few nights of restful sleep and 1 night not so flash. My body is adjusting to the new med, a real low dose, have headaches and feeling nauseous but will persevere.”

Topic 10 – Stigma

Topic 10 related to forum users experience of stigma relating to their mental health issues. Forum users describe the judgement they have experienced from others, and the shame that they have felt because of their diagnosis. While the sentiment analysis, revealed a negative valence (quite close to zero), forum users were still supportive of each other, indicating that they should not be ashamed or blame themselves (M=-0.57, n=7, keywords: accept, bad, certain, difficult, help, illness, poor).

“It is useful to recognize what helps us to maximize our mental health in the same way we do what we can to maximize our physical health but we shouldn't blame ourselves for our mental health issues”

“I really noticed the lack of understanding and being judged since Christmas last year.”

Topic 12 – Welcome to the forum

Topic 12 consisted of terms commonly used within forums. Specifically, this topic consisted of welcoming messages to new forum users from more experienced forum users, as well as messages of support and encouragement. This is supported by the sentiment analysis, which indicated an overall positive valence (M=1.67, n=9, keywords: free, glad, join, kind, please, share, support, thank, welcome).

“Welcome to this thread. We are a friendly and supportive group here.”

“Welcome to this thread and to the forum. So glad to meet you. As X said this is full of caring and support. We all have different experiences but we also share things in common.”

Topic 16 – Personal identity and values

Topic 16 consisted of posts from forum users expressing their thoughts and feelings on a range of issues relating to their own personal identity and values. For example, several users posted about trying to fit in with other people's values instead of their own, and that they have learnt a lot from seeking help about living by their own values instead. Others also indicated that by going back to their own personal values they were able to make difficult decisions. This topic was associated with a positive valence (M=2.00, n=6, keywords: better, comfort, fit, good, help, important).

“I am learning I am allowed to live by my own rules. This is probably one of the most important aspects of therapy. Often we get so used to acting how we think we should act or how others think we should act we don't even know what is important for ourselves.”

“Sometimes thinking about my own values helps make difficult decisions.”

Topic 17 – Coping strategies

Topic 17 consisted of various posts relating to coping strategies and help-seeking as a means of coping. Specifically, this topic consisted of supportive messages between forum users about hope that specific treatments (e.g., medication, psychologist) will help them cope, supportive messages to forum users about coping, and other tips and strategies for making sure forum users have enough support to

be able to cope. The supportive nature of these posts was consistent with the sentiment analysis, which revealed a positive valence ($M=1.25$, $n=4$, keywords: exhausted, glad, help, hope).

“I like routine too so I know how hard it is to cope with change. Hopefully the medications will help you cope with a new routine”

“I am so glad you asked for help. I find that hard too as I feel like I am admitting I am not coping but I now feel that asking for help is a good sign we are coping.”

Topic 18 – Help-seeking information provision

Topic 18 related to forum users sharing information and links to help-seeking for various mental health and addictive disorders. These links mostly consisted of helplines and websites that forum users could access at any time, mostly for themselves but also for affected others seeking help on how to help their loved ones with addiction. The sentiment analysis indicated an overall positive valence for this topic ($M=1.00$, $n=4$, keywords: help, reach, sorry, support).

“Starting a conversation about someone’s alcohol/drug/gambling use can be tricky and scary. Before you have the conversation I would familiarise yourself with information about the issue and if you’re not feeling confident about how to approach the issue, you could call one of the AOD services in your state and talk it over.”

“Keep seeing your general practitioner and psychologist. If you would like some professionally endorsed self-help resources to refer to, I recommend these...”

Topic 21 - Can people change?

This topic related to a specific thread in which a user asked whether you can be yourself without changing. This led to a variety of responses about whether it is possible to change, as well as how people feel pressure from others to change. The sentiment analysis revealed an overall positive valence, quite close to zero, ($M=0.75$, $n=4$, keywords: accept, interesting, pressure, want), which is supportive of this topic in that it seemed to be mostly inquisitive in nature.

“I am so sorry you felt you had to change to be accepted”

“It is a vexed question about change. We all know we can only change ourselves, or do we?”

Topic 24 – Professional help-seeking

Topic 24 related to professional help-seeking. Specifically, this topic consisted of various recommendations and information provision relating to professional help-seeking (i.e., GPs, psychiatrists) for various mental health and addictive disorders. In addition, this topic consisted of forum users sharing their positive and negative experiences of professional help-seeking. While the results of the sentiment analysis were positive ($M=1.00$, $n=1$, keyword: want), this was based on only one word, and inspection of the posts revealed mixed sentiment.

“Yes I feel completely sidelined. He is seeing both and both on the same page re diagnosis. His psychologist has ALWAYS had me sidelined.”

“Have you checked the fees of a suitable psychiatrist? It would be worthwhile to ask your doctor about a referral to a psychiatrist and get a couple of names”

Topic 39 – Religion and mental health

Topic 39 related to how forum users who identify with a particular religion (e.g., Christianity) have mixed experiences with mental health issues. For example, some forum users have experienced empathy, while others have experienced judgement. This topic also related to how various religions do not necessarily understand how to deal with and help individuals with mental health issues, but that many people have still been helped by their faith (i.e., through the Bible). While the overall valence for this topic was negative, the average sentiment was close to zero ($M=-0.60$, $n=5$, keywords: anxiety, god, help, struggling, suffer), highlighting the mix of positive and negative sentiment within this topic.

“I am a born again Christian and I hear what you are saying! I don't open up to just anyone that I feel depressed but my close friends know and they are Christian. I have had some unhelpful comments definitely but for the most part I am lucky I guess to some extent that the church i go to recognizes illnesses like this and my friends are empathetic”

*“As a Christian you are better off confessing to ***** than depression, as you will get far more sympathy and understanding with the former”*

“I have found so much help and comfort through the Bible and the love of God.”

“If you read through some of my old post you will see how I have been judged by the church and how I chose to get help despite what the church said.”

Topic 43 – What helps you?

Topic 43 varied greatly in the types of posts that contributed to this topic. Within this topic, forum users discussed the treatments or self-help strategies that were helpful for them, as well as the importance of admitting that you need help when you cannot cope. The sentiment analysis revealed that this topic was positive in nature ($M=0.60$, $n=5$, keywords: hard, help, helpful, hope, problem), which accurately reflected the top 10 posts attributed to this topic, which were encouraging and supportive in nature.

“I was in denial and tried to manage for many years without medication but finally realised for me if I wanted a stable life I need medication”

“I agree with the physical exertion thing... I got confidence and was pleased I had helped.”

“It is good you have made a few steps in reaching out for help. Many people never admit they can't cope and need help but you have.”

GamCare (UK)

Descriptive statistics

Word frequencies

Figure 20 displays the 50 most used words in forum posts related to help-seeking within GamCare (extracted from its relevant forums, including Overcoming Problem Gambling, Recovery Diaries, and Success Stories). The most commonly used word was gambling, however, most of the top 50 words were words commonly used in everyday language (e.g., day, will, can). This was followed by some change and help-related terms (e.g., recover, help, abstinent).

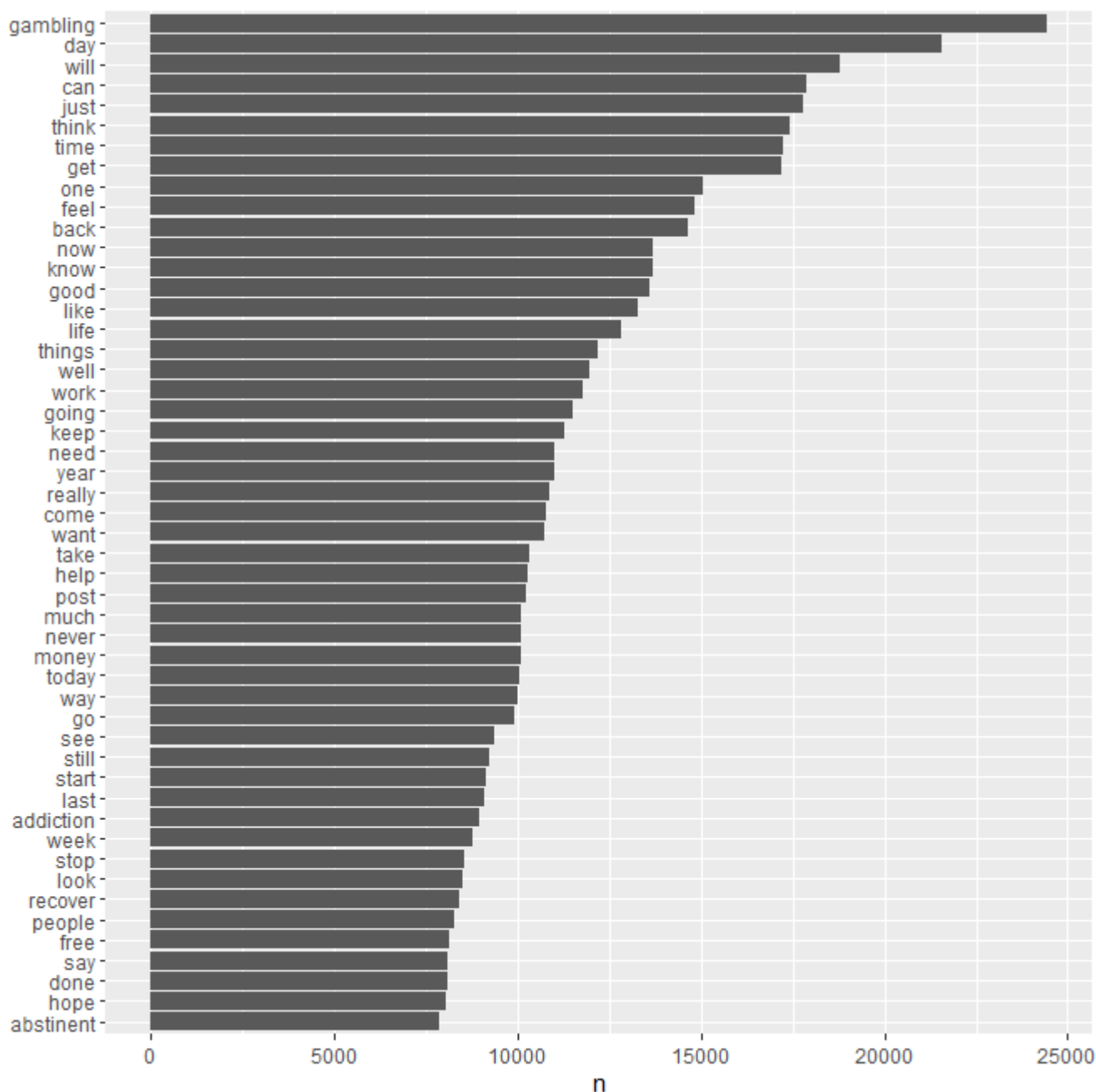


Figure 20. Top 50 most commonly used words in GamCare posts exploring help-seeking

Word correlations

Presented in Figure 21 are the words that are strongly to very strongly correlated ($\phi > 0.15$) with the keywords used to create the restricted help-seeking dataset (e.g., 'help', 'treatment') within the GamCare forum. As evident in Figure 21, there were numerous correlations at a ϕ of greater than 0.15 making visualisation and interpretation of these correlations difficult. Hence for the purpose of this forum, we have presented the words that are strongly to very strongly correlated with the help-seeking words at ϕ greater than 0.20 (see Figure 22). These findings highlight that:

- Gamstop is correlated with registered ($\phi = 0.26$), sign ($\phi = 0.24$), register ($\phi = 0.23$) and online ($\phi = 0.20$);

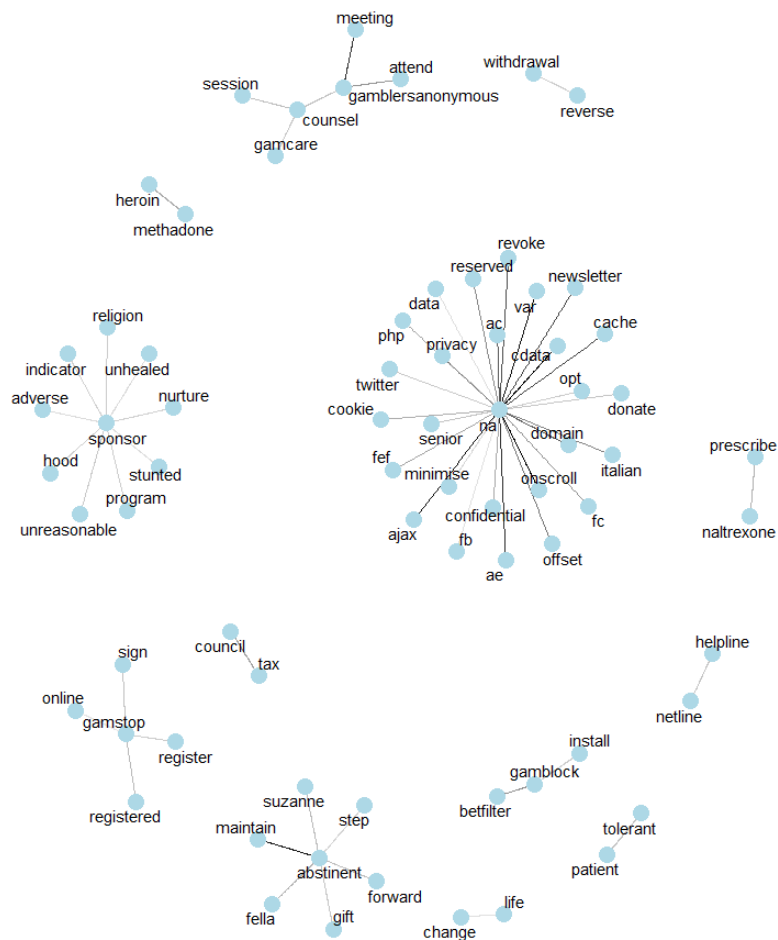


Figure 22. Correlations between help-seeking keywords in GamCare ($\phi > 0.20$)

LDA and sentiment analysis

A LDA was conducted on the restricted help-seeking dataset (37,154 posts). Using rate of perplexity change, the results indicated that a 45-topic model was the best fit for this data. The results of the 45-topic model can be found in Appendix 5. When restricted to topics that included any of the keywords relating to help-seeking, 15-topics (see Figure 23) were retained for interpretation. However, further inspection of topic 23 revealed that this topic was formed based on posts that included html language. As such, topic 23 was not relevant to the current research question and was not interpreted. The interpretation of the remaining topics, the associated sentiment analysis and illustrative quotes are presented below.



Figure 23. GamCare - 15-topic model exploring help-seeking

Topic 5 – Online blocking software

Topic 5 related to online self-exclusion via the installation of blocking software on computers and mobile phones. Several users specifically refer to their use of, and experiences with, BetFilter, GamBlock and Gamban software. While the sentiment analysis revealed a negative valence ($M=-1.00$, $n=3$, keywords: block, exclude, stop), this analysis was based on words such as stop and exclude. Within the context of the top 10 posts, however, the sentiment of this topic was mixed with forum users describing both negative and positive experiences with this type of software.

“I have searched and searched and not been able to find any software that will block gambling from my Android phone. I tried GamBlock and all it did was corrupt my phone.”

“I have recently installed Gamban across all my laptop and mobile devices (3 months free trial but only a tenner a month after) and cannot rave enough about it.”

Topic 6 – Gamblers Anonymous

Topic 6 related to Gamblers Anonymous as a form of help-seeking. Specifically, the posts within this topic mostly provided information on how Gamblers Anonymous works, including the different types of Gamblers Anonymous meetings (e.g., open meeting, meetings focused on a specific step of 12-step approach). This topic also consisted of forum users’ positive experiences with GA, with forum users indicating that it is an effective form of help-seeking, as well as supportive. This is supported by the sentiment analysis, which revealed a positive valence ($M=2.00$, $n=2$, keywords: help, like).

“The local group to me (at least at the open meeting) go round the room to introduce themselves and then the chair asks for an existing member to volunteer to buddy the new member for the first week. I’ve also seen some fairly intensive discussions at the door to the street, where regular members are encouraging new members and a lot of support takes place before and after the actual meeting.”

“There are few places in the world you’ll find more honesty, courage & support than in a 12 Step room. It’s one of the most amazing experiences you can have.”

Topic 9 - Abstinence

Topic 9 related to forum user’s stories of abstaining from gambling. Specifically, this topic consisted of forum users expressing positive stories of abstinence, staying strong and determined, and the importance of taking it one day at a time. This is supported by the sentiment analysis, which revealed a positive valence ($M=1.83$, $n=6$, keywords: free, good, positive, strong, thanks, wish).

“196 whole days of not spending even one single penny on any form of gambling and feeling strong and determined as ever today”

“My choice today abstaining and maintaining one day at a time, and enjoying all the gifts that recovery gives me, and they don’t cost even one single penny”

Topic 18 – Impact of gambling addiction on recovery

Topic 18 related to the difficulties of stopping gambling as it is an addiction. Specifically, this topic referred to forum users’ experiences in abstinence being the only option for recovery, especially for people with gambling problems. There were, however, some (albeit fewer) forum users who discussed successful recovery stories involving controlled gambling or who queried whether it was possible. While this topic was associated with a negative valence close to zero ($M=-0.67$, $n=3$, keywords: free, problem, stop), this topic was not entirely negative in nature, as it also consisted of many positive stories of recovery.

“The only way to stop wanting to gamble is by treating gambling as something that should be forbidden and never ever again allowed in your life, not even a bit.”

“You will read a lot of advice on here about the need to give up all forms of gambling in order to move forward. Personally i find this a very difficult thing to accept, I have (had?) a big problem with roulette on the fixed odds betting terminals in the bookies. That was my ONLY

problem part of gambling that I had, the only other things i really gambled on were football and once in a blue moon an odd horse racing bet.”

Topic 19 – Spiritual recovery program

Topic 19 related to a specific thread by an individual forum user telling their story of joining a spiritual recovery program to assist them in recovering from a gambling problem, including how he/she is becoming physically, mentally and spiritually healthier. While this topic was associated with negative valence (M=-2.00, n=3, keywords: fear, pain, unhealthy), inspection of the posts revealed that the sentiment of this topic was mixed, with posts relating to negative stories about their addiction, as well as positive stories relating to their recovery journey.

“I am a compulsive Gambler! I am becoming a healthy spiritual person each day, yet I am not a religion person. I have dropped down by over 20 pounds in recent months and it is not hard for me to value myself today.”

“I am becoming healthier in a spiritual way. Yet I am not a religious person. Sadly when I walked in to the recovery program I did not fully appreciate how unhealthy I was.”

Topic 21 – Recovery process

Topic 21 related to recovery, with forum users sharing their experiences of recovery and providing information to other users about what has worked best for them (i.e., Gamblers Anonymous, GamCare, SMART recovery, or a combination of many things). This topic also related to the lifetime commitment and hard work required to recover from gambling problems, with many forum users highlighting the need to put as much time and effort into one’s recovery as one put into their gambling. This topic was associated with positive valence (M=1.75, n=4, keywords: best, commit, important, wish).

“We are all different and we all probably approach our recovery's in different ways. And so it should be. I do not claim to have found the answer to compulsive gambling but I do seem to have found a way that is working for me ... It doesn't matter whether that way is the GA way, the Gamcare way, the SMART recovery way or a combination of many different ways, it is what works for us. Personally I take bits from all over the place...if I see a good strategy then I will use it, I don't care which program it comes from as long as it works for me.”

“Embrace recovery, gift it all the effort you gift addiction.”

Topic 22 – Help services

Topic 22 related to the various types of help-seeking services and strategies available for people who are wanting to change their gambling. Specifically, this topic provided information about the various types of support available including the GamCare helpline, free counselling services, self-exclusion and gambling blocking software, as well as supportive and encouraging messages about taking that important first step and asking for help. This topic was associated with positive valence (M=1.20, n=5, keywords: best, help, please, problem, support).

“The GamCare helpline is available from 8am - might help you to give them a call. You're not alone here, many of us here have lost our savings and more - myself included - it's not easy, it might take time but you can come through this. There are things you can do to make it more difficult to gamble like self-exclusion, blocking software and handing over control of your finances. GamCare offer free counselling which has helped many people and can help you.”

“You have taken a very bold step by admitting you have a gambling problem, and a second step of asking for help; There is help.”

Topic 25 – Changing for the better

Topic 25 consisted of forum users experience of, and need for, change in order for their lives to get better. This topic also included concepts relating to acceptance about what needs to be changed in order for their lives to get better. This topic was associated with positive valence (M=1.75, n=4, keywords: accept, better, happy, want).

“A time comes in your life when you finally get it... You realize that it's time to stop hoping and waiting for something to change”

“For many years I wanted to change my life for the better, and thought that I'd be able to make that change by gambling to win money. But I have now accepted that it's not going to happen. So I have committed to find other ways to Change-My-Life”

Topic 26 – Gambling free days

Topic 26 related to forum users' experiences of abstinence. Specifically, this topic included posts in which forum users describe their achievements in relation to how many days it has been since they last gambled. In addition, this topic also consisted of forum users discussing their goals in terms of the number of days abstinent they are aiming to reach, which for some, has resulted in relapse soon after reaching that goal. This topic was associated with positive valence (M=1.50, n=4, keywords: easy, free, happy, reach).

“I'm 12 days gamble free, not many urges till now”

“Day 24, only 5 more days until I reach my target of 29 days which will be the longest time I have abstained from gambling for several years”

“I have also made numerous attempts to quit gambling and always used to aim for the big 100 days of abstinence. I have achieved this twice now only to fall not long after I achieved this aim.”

Topic 29 – Forum-related encouragement

Topic 29 consisted of terms commonly used within forums (e.g., post, read). Specifically, this topic consisted of supporting and encouraging messages from forum users in response to reading other forum users posts and diaries. This was supported by the sentiment analysis, which revealed that this topic was associated with positive valence (M=2.63, n=6, keywords: appreciate, great, hope, kind, support, thank)

“Great to read your diary and to see the progress you are making each and every day.”

“Sorry to hear of your latest troubles hopefully you'll be up and about in no time. I have read snippets of your diary and read some of your post on others and I just want to say congratulations.”

Topic 33 – Turning life around

Topic 33 related to stories of forum users turning their lives around and deciding to quit gambling. In doing so, this topic also consisted of stories about the impact of problem gambling on their lives prior

to deciding to quit. This topic was associated with positive valence ($M=2.33$, $n=3$, keywords: enjoy, gift, great).

"We are all in this for the right reason, to better our lives by eradicating the misery that is our compulsion to gamble"

"I came to this forum a broken man, the compulsion to gamble, my relentless feeding addiction had detached me from the world, my sense of belonging gifted to addiction, I would simply do anything to fund the next punt. There is in my life simply no place for a punt in any form, the pure arrogance and ignorance that gambling brought to my life is motivation enough to see that there is always another way to get through the day without turning to the futile act of gambling."

Topic 38 – Relapse

Topic 38 related to relapse, in particular, forum users' responses to other users' stories of relapse. This topic highlighted that relapse is a normal part of the recovery process but that you cannot give up, and that you must remain strong and keep fighting. This topic was associated with a neutral valence ($M=0$, $n=5$, keywords: easy, fight, hard, sorry, strong), which is consistent with the combination of posts relating to relapse and supportive and encouraging responses from users about relapse.

"Relapsing is gut wrenching but you are not giving up and that's what matters, you come back and you keep fighting"

"It's hard pal, but it can be done, we all have relapses... stay strong, if you really want to stop you will get there"

Topic 42 – Gambling is an addiction

Topic 42 related to forum users views of gambling as an addiction. Specifically, this topic consisted of posts that provide information to other forum users about gambling being an addiction, and in some cases, worse than substance-based addictions. This topic highlighted forum users' views of how dangerous gambling problems can be. While this topic was associated with a positive valence close to zero ($M=0.50$, $n=2$, keywords: escape, like), this sentiment analysis was only based on two words, and the tone of the posts reflects a more negative valence.

"When you learn about this addiction you will realise how it gets us in all sorts of ways and it does make us frustrated because it plays with our delusion and reality."

"People continue to gamble because its the worst drug addiction going in my view."

"A gambling addiction is dangerous and insidious. You have to fully learn what you are dealing with. It takes over the mind so we are not actually in control..."

Topic 43 – Financial self-help strategies

Topic 43 related to common self-help strategies employed by gamblers to limit their gambling expenditure, specifically restricting the type of bank cards they have access to (i.e., credit cards from which cash cannot be withdrawn). In addition, this topic consisted of stories highlighting forum users' disappointment with the banking system and online gambling website operators, which make it easy to overdraw bank accounts and open gambling accounts. This topic was associated with negative valence ($M=-3.00$, $n=1$, keyword: withdrawal).

“I also have an AMEX credit card that I use for petrol, supermarket shopping etc as you can't use AMEX credit cards for online gambling or getting cash from an ATM.”

“I'm not looking to blame anyone for my gambling losses, but I believe the bank could have handled things better to help me. Does anyone agree that banks should do more to help problem gamblers? My bank were absolutely useless and still are when it comes to helping me with my gambling addiction.”

“It baffles me how online sites get away with the way they operate. They make it so easy to open an account and deposit funds, no checks whatsoever. However, when it comes to withdrawing, they make it so difficult.”

PsychForums (US)

Descriptive statistics

Word frequencies

Figure 24 displays the 50 most used words in forum posts related to help-seeking within PsychForums (extracted from its relevant forum [i.e., Gambling Addiction]). The most common words were gambling and addiction-related terms (e.g., gambling, addiction, problem, casino, money), as well as words commonly used in everyday language (e.g., can, will, think), and change and help-related terms (e.g., help, quit).

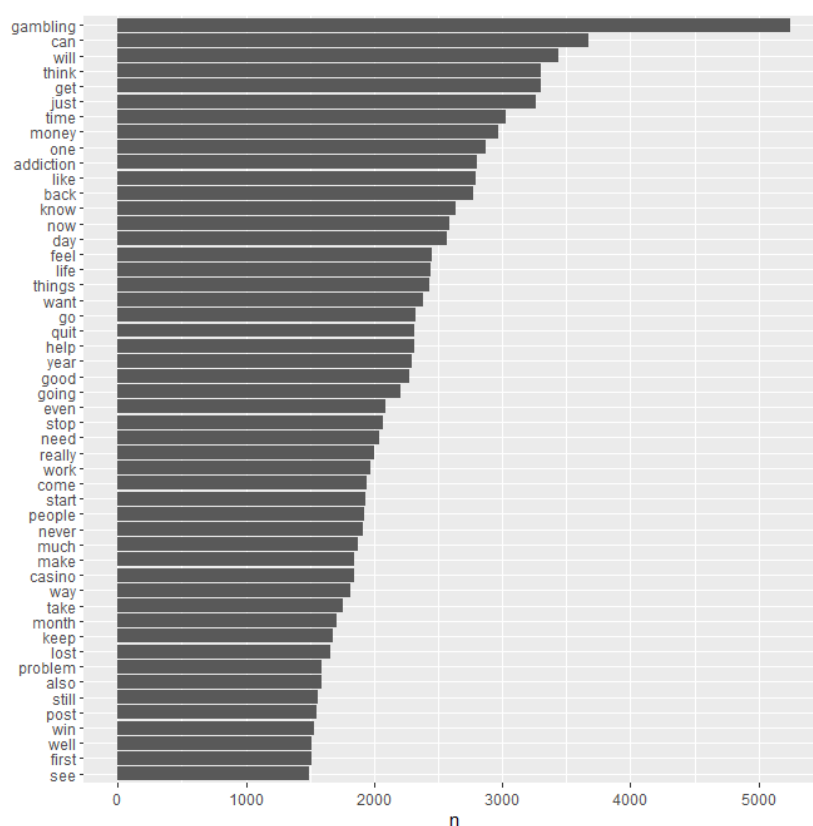


Figure 24. Top 50 most commonly used words in PsychForums posts exploring help-seeking

Figure 25. Correlations between help-seeking keywords in PsychForums

LDA and sentiment analysis

A LDA was conducted on the restricted help-seeking dataset (6,340 posts). Using rate of perplexity change, the results indicated that a 45-topic model was the best fit for this data. The results of this 45-topic model can be found in Appendix 5. When restricted to topics that included any of the keywords relating to help-seeking, 14-topics (see Figure 26) were retained for interpretation. The interpretation of these topics, the associated sentiment analysis and illustrative quotes are presented below.

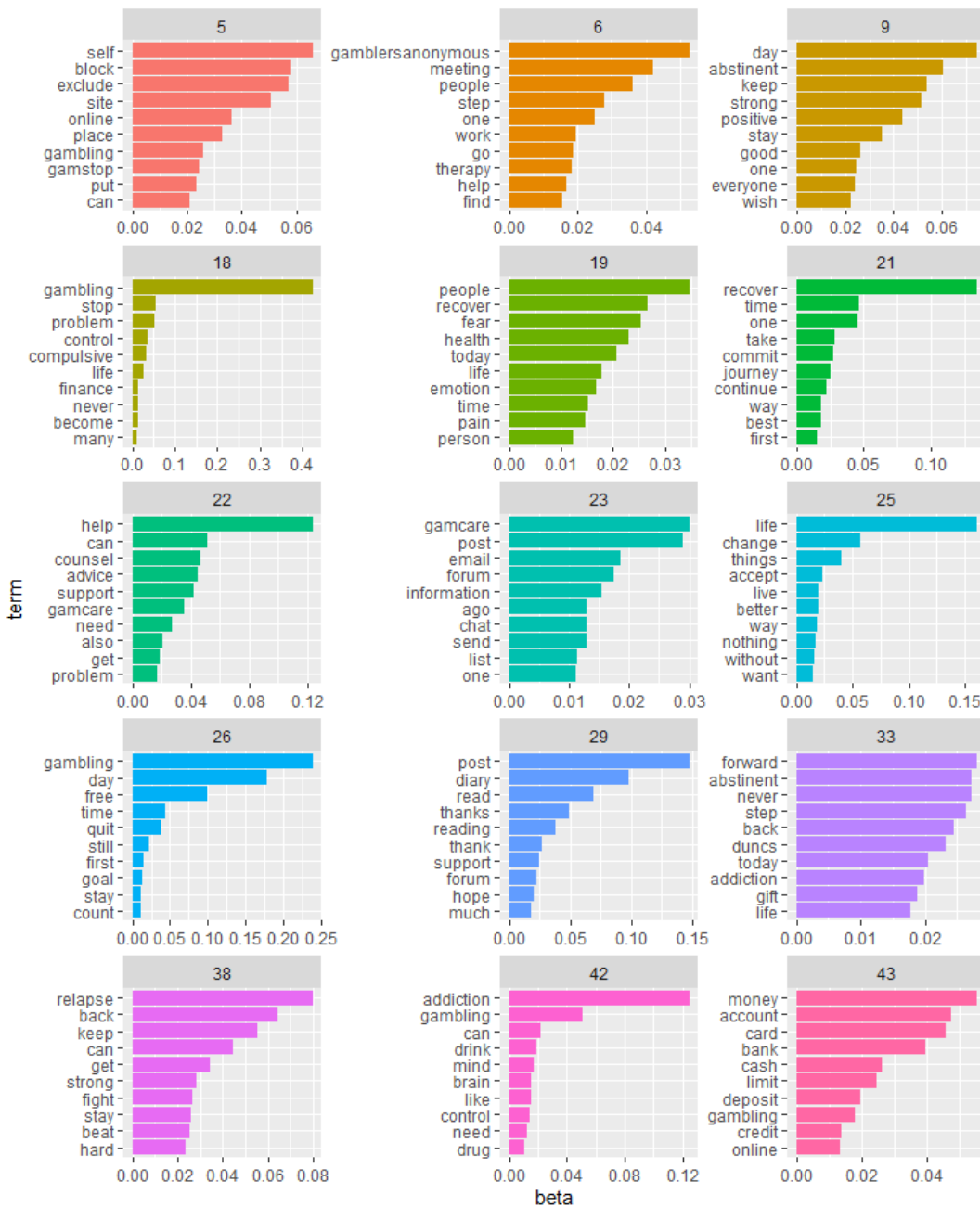


Figure 26. PsychForums- 14-topic model exploring help-seeking

Topic 3 – Gamblers Anonymous

Topic 3 related to Gamblers Anonymous as a form of help-seeking. Specifically, users were either sharing information about where to attend meetings, the different types of meetings that are available (e.g., open, closed, topic-specific, step-specific, GA101), and the difference between Gamblers Anonymous and GamAnon, or posting positive stories about their experiences with Gamblers Anonymous. Specific to the US, this topic also consisted of the negative experiences of users trying to find help for their gambling but not having enough money or sufficient insurance to get the help they needed. For these forum users, GA provided a free and helpful alternative. This topic was associated with a positive valence ($M=2.00$, $n=2$, keywords: help, support).

“I just looked up Gamblers Anonymous for..., and they have meetings every day of the week except Sundays.”

“They list meetings by open/closed, topic, step or GA101. Sometimes, they have reflection mtgs, etc. Step mtgs mean they pick a step within the 12 steps and focus on that - that group mtg is focusing on working the steps.”

“As I understand it, Gam-Anon is a group of people who are relatives, spouses, or friends of addicted gamblers. There you would find some support and help on what to do about your partner. The regular GA meetings are specifically for the addicted gamblers, although Gam-Anon members sometimes join in to those meetings.”

“I was gutted. Where could I go for help? I found the free answer, the GA program. I was financially drained and this was my best option.”

Topic 9 – Goal of treatment

Topic 9 related to the differences in quitting gambling altogether as opposed to controlled gambling. Specifically, this topic consisted of posts in which forum users discussed their preference to quit gambling altogether as controlled gambling can be difficult and does not always work. In addition, this topic consisted of forum user's stories of extended periods of abstinence prior to relapse. Despite the negative valence from the sentiment analysis ($M=-0.75$, $n=4$, keywords: excuse, negative, stop, want), it was close to zero, with posts within this topic mostly supportive in nature (i.e., forum users encouraging others to commit to quitting their gambling and at times providing strategies to help them cut down).

“Quitting gambling for good is the only way out to this addiction, not controlled gambling.”

“The only way I ever felt better in relation to gambling is when I quit doing it”

“It is an eye opener that even though we stop or abstain gambling for a long time there is still the risk of getting back after no gambling for years! The mere fact you stopped for 3 years it means that you can stop it really. This time do it life time of no gambling! It is a commitment. Work harder in life and do other things you are passionate about.”

Topic 12 - Financial self-help strategies

Topic 12 related to common self-help strategies employed by gamblers to limit their gambling expenditure, specifically limiting access to cash and cards. In addition, this topic consisted of stories indicating how easy it has been in US casinos to break check-cashing limits or self-imposed gambling limits by receiving cash advances, casinos not adhering to cash-checking limits, and cash withdrawals via casino tellers. While the sentiment analysis revealed a negative valence ($M=-2.00$, $n=2$, keywords: cut, withdrawal), this topic consisted of a combination of negative experiences about individuals

accruing debt due to inability to stick to their limits, as well as positive stories about the self-help strategies that have worked for them.

“When I first quit, I actually cut my debit card in half. That way I still had the number if I wanted to order online, but I couldn’t use the actual card. This helped me a lot, because to get cash, I had to physically go in the bank and cash a check.”

“For me, the last year has been a nightmare of ATM withdrawals to fund slot machine play. And thanks to me noticing a small sign posted at a casino tellers cage stating that bank debit card withdrawals can be made via a teller, my losses have gone beyond anything that I ever thought imaginable!”

Topic 14 – Welcome to the forum

Topic 14 consisted of terms commonly used within forms (e.g., welcome). Specifically, this topic consisted mostly of supporting and encouraging messages to new forum users about reading specific threads, creating their own threads, and about the supportive nature of the forum and its users. In addition, this topic consisted of posts that reminded forum users of the forum rules around treating other users with respect. The sentiment analysis is consistent with the positive and supportive nature of this topic, with a positive valence revealed (M=2.00, n=7, keywords: best, good, help, please, support, welcome, wish).

“Welcome to the forum. Please take a few moments to read the Strategies thread, if you haven’t already. There is a lot of good advice from our members there. You are also welcome to start your own thread.”

“There is lots of good advice from poster here - things that have worked for them. You can do this . It’s not quick and it’s not easy, but it’s not impossible.”

“I’m just leaving this here. All members are expected to treat other members with courtesy and respect.”

Topic 17 – Gratitude for forum

Topic 17 also consisted of terms commonly used within forms (e.g., post, read, share). This topic, however, differed slightly to topic 14 in that the commonality in these posts related to people thanking others for sharing their stories, and acknowledging that they have been reading and helped by other people’s posts. This is consistent with the sentiment analysis, which revealed a positive valence (M=2.00, n=7, keywords: appreciate, great, help, hope, share, success, thank).

“I just want everyone who’s written their stories here and shared their suffering, to know that they’ve been a positive in this world and I’m grateful.”

“Yay for you! I was so happy to read your post. I’m done as well and appreciated your suggestions.”

Topic 18 – Rock-bottom

Topic 18 related to forum users experience of needing to hit rock bottom before they acknowledged that they had a problem with gambling and prior to seeking help. In addition, this topic consisted of several posts that referred to it being up to the individual to decide that they are ready to stop, and that successful change was made at that point in their recovery journey. The sentiment analysis revealed that this topic was associated with negative valence, albeit quite close to zero, (M=-0.20, n=5,

keywords: admit, help, please, problem, stop), which is consistent with the stories of individuals hitting rock bottom.

“Generally people decide to seek help when they hit their rock bottom and are desperate. It's up to you where you decide your rock bottom is.”

“The main reason for my success is that I stopped making excuses and started going to weekly GA meetings”

Topic 19 – Readiness to change

Topic 19 related to forum user's realisation that it is up to the individual gambler to decide when they are ready to quit, and that it is ultimately up to them to commit to changing their gambling behaviour. Forum users expressed views that people can be successful in changing their gambling once they make that decision to quit and are determined to do so. This topic was associated with a positive valence (M=2.00, n=4, keywords: best, good, want, wish).

“One thing I have learned is that there's no one on this planet that can make us realize and accept the fact that we need to quit. It's ourselves.”

“I also believe if we really want to quit, we CAN quit. In other words, I want to quit, so I will quit, no excuses.”

Topic 22 – Self-exclusion

Topic 22 related to self-exclusion. Specifically, forum users posted about their success stories with self-exclusion, as well as how casinos (in-venue and online) are not necessarily compliant with self-exclusion regulations and try to find ways to reel people back in. While the results of the sentiment analysis indicated that this topic was generally negative in valence (M=-1.33, n=3, keywords: ban, exclude, stop), it was only based on three words, and the tone and content of the posts suggested both positive and negative experiences with self-exclusion.

“Hey can't believe it, I've self-excluded from websites and it definitely helped.”

“The industry is very shady. Especially the online casinos. They make much more money off problem gamblers so they do their best to reel us back in, even after we self-exclude.”

Topic 29 – Controlled gambling

Topic 29 related to a specific thread within this forum that discussed controlled gambling as a treatment goal. Specifically, this thread consisted of debate surrounding controlled gambling as a legitimate treatment goal, with some forum users indicating that the suggestion that some people can control their gambling makes light of the seriousness of problem gambling, while other forum users indicated that controlled gambling can have some benefits over abstinence. The results of the sentiment analysis indicated that this topic was positive in valence (M=1.00, n=2, keywords: agree, yes), however, only two words contributed to this sentiment analysis.

“You definitely seem to suggest that gambling is not so evil, some people can control it, so we should be open-minded about it, that's what you say...I said it before and I will say it again - just like I am 100% absolutely against smoking a cigarette, and would never ever try to take one, not even one... for me even one cigarette is a taboo, it's prohibited - because I've seen what it did to other people (incl. my father who passed away directly because of smoking!) - Similarly, I'm against gambling.”

“The idea of controlled gambling as treatment, is that it avoids some of the negative effects of abstinence - withdrawal, craving, relapses. Because the activity (whichever addiction) isn't entirely removed then the idea that some of those rewards (brain and behavioural) are still present, so the person doesn't irrationally crave the activity as much.”

Topic 32 – Life changing

Topic 32 related to how individuals who have quit gambling and/or accepted that they cannot do anything about their past gambling behaviour (e.g., losses) have experienced positive changes to their life, such as reduction in debt. This topic was associated with positive valence (M=2.00, n=3, keywords: accept, best, better).

“I'm now 7 weeks into recovery, life has improved greatly for me.”

“I'm amazed and pleased that a year has now nearly passed since I finally finally quit throwing my money away gambling. A lot has changed for me. Not only am I fitter financially but also mentally and physically.”

Topic 33 – Honesty with family

Topic 33 related to forum users' experiences of lying to or being lied to by a family member about their gambling problem. Within this topic, forum users recommended that others be honest with their family members about their gambling as they will find out anyway. Forum users also shared their experiences of telling their family members, and that, while difficult, many family members were able to help them. Interestingly, this topic was associated with a positive valence (M=2.00, n=5, keywords: clean, help, love, support, trust) as it consisted of words relating to trust, support and help. While some of these posts were positive stories of how family members supported and helped the gambler quit, many of these posts related to breaking trust by lying to their family member for so long.

“it may seem like a better idea to keep it a secret, but this addiction thrives in the dark. It's easy to continue to feed it because nobody knows it's there except you. I also agree that sooner or later , your wife is going to find out”

“I know how you must be feeling. I was terrified of telling my husband, I felt so ashamed, but he was going to find out sooner or later when he checked the savings account, so I had to tell him. It wasn't easy it was pretty horrible if truth be told... I think it was the strength of our family that kept us together. Once he got over his anger he did forgive me and offered to help me to quit. He quite rightly has charge of all our finances. I doubt he will trust me again, which is fair enough”

Topic 38 – Identifying a gambling problem

Topic 38 related to how one knows whether they have a gambling problem. This topic consisted of forum users sharing the Gamblers Anonymous 20 questions as a way of helping of other forum users determine if they have a gambling problem, as well as indicating that it is ultimately up to the individual to decide whether they have a problem. This topic was associated with a negative valence close to zero (M=-0.25, n=4, keywords: commit, difficult, problem, yes), as it consisted of words relating to difficulties and problems, however, it should be noted that the posts were mostly informative in nature.

“Read the twenty questions and see if they apply to you (if you answer yes to more than seven you show the signs of being a compulsive gambler...”

“It is up to you to decide but you might want to answer these questions:...”

Topic 40 – Fighting addiction

Topic 40 related to forum users' experiences of fighting gambling addiction. Specifically, this topic consisted of stories about fighting gambling addiction being hard and time consuming, but ultimately possible. Forum users also discussed how over time it becomes easier to fight the addiction and resist the urge to gamble, but that there is no magic pill to overcoming addiction. Forum users also referred to needing to try many different options (e.g., professional support, self-help strategies) before they were able to overcome their gambling addiction. This topic was associated with a positive valence, quite close to zero ($M=0.17$, $n=6$, keywords: battle, easy, fight, free, hard, strength).

"It's possible to overcome this compulsion and you do have the strength to do it, even if you don't believe that right now. Breaking free of this addiction is difficult because the addiction does not want to die. The fight is long, hard and exhausting."

There's no pill, no magic bullet, no "one thing" you have to do to stop the compulsion to gamble. It is the culmination of dozens of things - real life support from GA or a therapist, roadblocks to keep you from gambling no matter how desperately the addiction wants you to, plans for distractions when the urge hits you, restricting your access to cash and credit - including turning your finances over to a trusted friend or family member. Self-exclusion is a great roadblock.

Topic 41 – Relapse

Topic 41 related to relapse. In particular, this topic indicated that relapses are normal and are merely a setback that can teach gamblers a lot about their triggers and how to overcome them. The posts were encouraging forum users to remain strong and commit to their recovery again. Despite the negative connotations associated with relapse, this topic was associated with positive valence, quite close to zero, ($M=0.83$, $n=6$, keywords: clean, fail, free, glad, sorry, strong) as it consisted of users encouraging and supportive responses to stories of relapse.

"Relapse is a setback, not a failure... Relapse can teach us a lot, not the least of which is that we were right to quit in the first place. This one has shown you your biggest trigger and that knowledge will work for you now."

It takes courage to admit that you relapsed and it shows your commitment to recovery. Start again. It's as simple as that. You did it before, you can do it again. Do not let a relapse throw you into despair. It's a fall, not a failure. Pick yourself up and remind yourself of your own strength - the strength that you have proven that you have."

Summary of Study 2 Results

- Gambling Help Online (Australia) forum data produced a 14-topic model, including six topics related to specific help-seeking services or self-help strategies (*Self-exclusion; Help-services; 100-day challenge; Information-seeking; Gamblers Anonymous; Financial self-help strategies*), five change-related topics (*Relapse; Change-related; Gambling history and stopping gambling; Gambling urges; Quit attempts*); two forum-related topics (*Benefits of the forum; Welcome to the forum*), and one other topic (*Gambling as an Addiction*).
- Beyond Blue (Australia) forum data produced a 13-topic model, including four topics related to specific help-seeking services or treatments (*Psychiatric illness diagnoses and medications; Coping strategies; Help-seeking information provision; Professional help-seeking*), two change-

related topics (*Can people change?; What helps you?*), one forum-related topic (*Welcome to the forum*), and six indirectly related topics about issues faced when dealing with mental health/AOD (*Inner critic; Control and decision-making; Mental health disability claims; Stigma; Personal identity and values; Religion and mental health;*).

- GamCare (UK) forum data produced a 14-topic model, including five topics related to specific help-services or self-help strategies (*Online blocking software; Gamblers Anonymous; Spiritual recovery program; Help services; Financial self-help strategies*), five change-related topics (*Abstinence; Recovery process; Changing for the better; Gambling free days; Turning life around; Relapse*), one forum-related topic (*Forum-related encouragement*), and one other topic (*Gambling is an addiction*).
- PsychForums (US) forum data produced a 14-topic model, including seven change-related topics (*Goal of treatment; Rock bottom; Readiness to change; Controlled gambling; Life changing; Fighting addiction; Relapse*), two forum-related topics (*Welcome to the forum; Gratitude for forum*), three topics related to specific help-services or self-help strategies (*Gamblers Anonymous; Financial self-help strategies; Self-exclusion*), , and two other topics (*Honesty with family; Identifying a gambling problem*).

Conclusions

The current project is one of the first in the gambling field to utilise NLP statistical techniques to quantitatively synthesise text sourced from online forum data. This project consisted of two studies, in which Study 1 aimed to: (1) explore the experiences and perceptions of the *relationship* between gambling and comorbid mental health/AOD (depression, anxiety, and family violence) problems in Australian gambling, mental health and AOD forum users; and (2) examine jurisdictional differences between the experiences and perceptions of the *relationship* between gambling and comorbid mental health/AOD problems across Australian, UK and US gambling forum users. Study 2 then aimed to: (1) explore the experiences and perceptions of gambling, mental health or AOD *help-seeking*, in which gambling is referenced, in Australian gambling, mental health and AOD forum users; and (2) examine the experiences and perceptions of gambling, mental health or AOD *help-seeking across* Australian, UK and US gambling forum users.

Summary of main findings

Study 1 – *Relationship* between gambling and mental health/AOD problems

Findings from the LDA of the Gambling Help Online (Australia) forum data revealed a seven-topic model. Of these, four topics related to mental health issues, one of which was associated with positive valence (*Financial and other stress*) and three of which were associated with negative valence (*Bi-directional relationship between gambling and mental health*, *Relationship between gambling and mental health issues*, and *Emotional impact of gambling*). In addition, three topics related to AOD (*Addiction swapping and illicit substances as treatment for gambling*, *Self-exclusion from venues including pubs*, and *Relationship between gambling and alcohol*), all of which were associated with positive valence.

Findings from the LDA of the Beyond Blue (Australia) forum data revealed an eleven-topic model. Of these, five topics related to mental health issues, one of which was associated with positive valence (*Bipolar disorder*), three of which were associated with negative valence (*Medications for mental health issues*, *Cannabis as a treatment for depression*, and *Employment and financial stress*) and one of which was associated with neutral valence (*Mental health issues in men*). In addition, two topics related to trauma and abuse (*Painful events* and *Abusive relationships*), both of which were associated with negative valence. One topic related to AOD: *Relationship between gambling and AOD* (positive valence). Finally, three topics related to emotions: *Association between food and moods* (positive valence), *Loneliness* (positive valence), and *Criticism* (negative valence). Despite limiting this forum dataset to threads that referenced gambling, inspection of these topics highlighted that Beyond Blue forum users mostly spoke about their mental health and AOD issues in isolation or in conjunction with other mental health issues, with only one topic explicitly referring to users' experience of gambling and alcohol.

Interestingly, across these two Australian forums, one of which was gambling-specific (Gambling Help Online) and one of which was for mental health more generally (Beyond Blue), there was only one topic that was somewhat similar with both groups of forum users discussing their perceptions and experiences of the relationship between gambling and alcohol or other drugs. However, while users of Gambling Help Online discussed this relationship in terms of drinking leading to gambling or being used to break the gambling cycle, users of Beyond Blue discussed the similarities between gambling and other addictive disorders (including alcohol) and the difficulties associated with such disorders (e.g., consequences, underlying pain and issues).

Findings from the LDA of the GamCare (UK) forum data revealed a six-topic model. Of these topics, four addressed mental health related issues, one of which was associated with positive valence (*Work-related stress and gambling*) and three of which were associated with negative valence (*Relationship between gambling and mental health issues*, *Stress and gambling urges*, and *Gambling as a coping mechanism*). The remaining topics related to AOD issues (*Relationship between gambling and AOD*) and other emotion-related topics (i.e., *Happiness for recovery progress*), both of which were associated with positive valence.

Findings from the LDA of the PsychForums (US) forum data revealed a two-topic model. One topic addressed mental health related issues (*Relationship between gambling and comorbid mental health issues*) and was associated with negative valence. In contrast, the other topic addressed AOD issues (*Gambling addiction similar to substance-based addiction*) and was associated with positive valence.

Across the three jurisdictions, users of the gambling forums (Gambling Help Online, GamCare, and PsychForums) similarly discussed topics relating to the association between gambling and mental health issues, as well as gambling and other addictions. Further inspection of these topics highlighted that while Australian and US gambling forum users discussed the bi-directional relationship between gambling and mental health (i.e., mixed experiences with some users experiencing gambling problems first and others experiencing mental health issues first), UK gambling forum users discussed their experiences of mental health issues preceding their gambling issues. In contrast, forum users from all three jurisdictions discussed the relationship between gambling and other addictions in the context of addictive personalities, addiction swapping and the similarities between gambling and other substance-based addictions, with Australian gambling forum users also discussing the reciprocal relationship between gambling and alcohol use. In addition, stress (financial, work and school-related) was a topic discussed across both the Australian and UK gambling forums. While Australian gambling forum users discussed their stress due to financial pressure in paying off gambling-related debt and university assignments, UK gambling forum users discussed the impact of work-related stress on their recovery and its potential to act as a trigger for relapse.

Taken together, these findings highlight that gambling forum users across all three jurisdictions tend to discuss the relationship between gambling and mental health issues (i.e., depression and anxiety), as well as other addictive disorders (i.e., hazardous alcohol use). This is somewhat consistent with previous research in which help-seeking gamblers have reported high rates of co-occurring mood disorders, as well as alcohol use and anxiety disorders (Dowling et al., 2015; Holdsworth et al., 2013). The findings of the current study are also consistent with previous longitudinal and qualitative literature, which has shown mixed findings in relation to whether gambling issues predate the occurrence of mental health issues or vice versa (Hartmann & Blaszczynski, 2018; Holdsworth et al., 2013). In addition, the findings from GamCare, in which UK gambling forum users described their experiences with resorting to gambling as a coping mechanism for certain emotive states (e.g., sad, low) are consistent with past literature which has shown that individuals experiencing gambling problems were more likely to increase their gambling behaviour in order to cope with significant life events and comorbidity (Holdsworth et al., 2015). These findings are also consistent with theoretical models, including the pathways model of problem and pathological gambling, in which gambling problems are hypothesised to develop as gambling behaviour is used as a means of coping and escapism from pre-existing mental health symptomatology (Blaszczynski & Nower, 2002).

Study 2 – Help-seeking for gambling and mental health/AOD problems

Findings from the LDA of the Gambling Help Online (Australia) forum data revealed a 14-topic model. Of these, six topics referred to specific help-seeking services or self-help strategies, with three topics associated with positive valence (*Help-services*, *100-day challenge*, and *Information-seeking*), two topics associated with negative valence (*Self-exclusion* and *Financial self-help strategies*) and one

topic associated with neutral valence (*Gamblers Anonymous*). In addition, five topics related to wanting to change and the common factors associated with the change process, two of which had positive valence (*Change-related* and *Gambling urges*) and two of which had negative valence (*Gambling history and stopping gambling* and *Quit attempts*). Sentiment analysis could not be conducted for one topic (*Relapse*). Two topics, both associated with positive valence, addressed the benefits of using forums (*Benefits of the forum* and *Welcome to the forum*). Finally, there was one topic that reflected forum users' experiences and perceptions of gambling as an addiction (*Gambling as an Addiction*), which had a positive valence.

Findings from the LDA of the Beyond Blue (Australia) forum data revealed a 13-topic model. Of these, four topics referred to specific help-seeking services or treatments, three of which had positive valence (*Coping strategies*, *Help-seeking information provision*, and *Professional help-seeking*) and one of which had negative valence (*Psychiatric illness diagnoses and medications*). Moreover, two topics related to the change process, both of which had a positive valence (*Can people change?* and *What helps you?*), and one topic related to the benefits of forums (*Welcome to the forum*). Finally, this forum consisted of several topics that did not directly relate to help-seeking but highlighted other common issues that arise when dealing with mental health or addiction issues, such as stigma (*Stigma, Religion and mental health*; both negative valence), personal factors (*Inner critic, Control and decision-making, Personal identity and values*; all positive valence), and *mental health disability claims* (positive valence).

Consistent topics across these two Australian forums, one of which was gambling-specific and one of which was for mental health more generally, included users' experiences and perceptions relating to the benefits of such forums, as well as using these forums as a means of seeking or providing information relating to help-seeking. Interestingly, while both groups of forum users described their experiences and perceptions of various help-seeking sources, gambling forum users discussed self-directed help-seeking (e.g., self-exclusion, self-help strategies) and attending support groups (e.g., Gamblers Anonymous), whereas mental health/AOD forum users discussed their experiences with professional help-seeking services (e.g., GPs, psychiatrists).

Findings from the LDA of the GamCare (UK) forum data revealed a 14-topic model. Of these, five topics referred to specific help-services or self-help strategies, two of which were associated with positive valence (*Gamblers Anonymous* and *Help services*) and three of which were associated with negative valence (*Online blocking software*, *Spiritual recovery program*, and *Financial self-help strategies*). In addition, five topics related to change and the common factors associated with the change and recovery process, four of which were associated with positive valence (*Abstinence*, *Recovery process*, *Changing for the better*, *Gambling free days*, and *Turning life around*) and one of which was associated with neutral valence (*Relapse*). One topic addressed the benefits of using a forum (*Forum-related encouragement*), which was associated with positive valence. Finally, one topic reflected forum users' experiences and perceptions of gambling as an addiction (*Gambling is an addiction*), which was also associated with positive valence.

Findings from the LDA of the PsychForums (US) forum data revealed a 14-topic model. Of these, three topics referred to specific help-services or self-help strategies, one of which was associated with positive valence (*Gamblers Anonymous*) and two of which were associated with negative valence (*Financial self-help strategies* and *Self-exclusion*). In addition, seven topics related to change and the common factors associated with the change and recovery process, five of which were associated with positive valence (*Readiness to change*, *Controlled gambling*, *Life changing*, *Fighting addiction*, and *Relapse*) and two of which were associated with negative valence (*Goal of treatment* and *Rock bottom*). There were two topics, both associated with positive valence that reflected the benefits of using a forum (*Welcome to the forum* and *Gratitude for forum*). Finally, there was one topic that reflected forum users' experiences and perceptions of being honest with family about their gambling

problems (*Honesty with family*; positive valence) and one topic that reflected forum users' experiences and perceptions around identifying a gambling problem (*Identifying a gambling problem*; negative valence).

Across the three jurisdictions, gambling forum users were quite similar in discussing their experiences and perceptions of a range of help-seeking topics. For example, forum users across Australia, the UK and the US discussed their experiences with Gamblers Anonymous as an effective treatment approach. Consistent with the varying treatment systems (Delfabbro & King, 2012), however, this topic also highlighted that for US gambling help-seekers, Gamblers Anonymous is the only free treatment option that can be accessed, with many users highlighting that there are no other feasible treatment options without sufficient money or insurance. Forum users across these three jurisdictions were also quite similar in discussing their experiences and perceptions of financial self-help strategies that have worked for them. Interestingly, UK and US gambling forum users also described their disappointment in the ease in which any self-help strategies or limits (e.g., check-cashing limits) can be broken due to the systems in place by banking systems, online gambling operators and casinos. Moreover, forum users across these jurisdictions all referred to self-exclusion, albeit with Australian forum users mostly referring to exclusion from venues, US forum users referring to both venue and online exclusion, and UK forum users only discussing online blocking software. Lastly, all three jurisdictions discussed the benefits of using a gambling forum, relapse as a normal part of the recovery process, and their experiences of deciding that it was time to quit gambling.

Taken together, these findings highlight that gambling forum users more frequently describe their experiences with self-directed help-seeking options (e.g., self-exclusion), which is consistent with literature suggesting that these are the most frequently accessed help-seeking options (Rodda, Dowling, et al., 2018). In contrast to previous literature which has suggested that Gamblers Anonymous is a more common help-seeking option in the US than in Australia, gambling forum users in all three jurisdictions discussed their experiences with Gamblers Anonymous, with most users describing positive and helpful experiences with this support group. Interestingly, despite similarities in Australian and UK treatment provision, only Australian gambling forum users discussed their experiences with specific face-to-face and distance-based help services (excluding Gamblers Anonymous), such as counselling, financial support and helplines.

Strengths and limitations

This is the first study to use cutting edge NLP techniques to examine the experiences and perceptions of gambling and mental health/AOD problems and related help-seeking behaviour in samples of Australian gambling, mental health and AOD forum users, and UK and US gambling forum users. Whilst most individuals who are experiencing gambling problems utilise self-directed help-seeking options, including reading and posting in forums (Rodda, Dowling, et al., 2018), most research has focussed on face-to-face help-seeking gamblers. Given that most gamblers do not seek help for gambling (average help-seeking rates of 5-20%) and face-to-face services incur the greatest barriers to access (Loy, Grüne, Braun, Samuelsson, & Kraus, 2019), previous studies likely accounted for a narrow range of experiences and perceptions of gambling and mental health/AOD problems. Promisingly, a recent review found that help-seeking rates rose substantially when self-directed and informal services were considered (e.g., 7.3-53%; Loy et al., 2019). While this study's sample would therefore inevitably fail to account for the experiences and perspectives of all gamblers and may indeed represent a subgroup of those experiencing gambling problems (e.g., those with internet access and literacy), this study certainly extends our understanding by examining a substantially larger and potentially more representative sample of help-seeking gamblers than previous studies. Moreover, by using data obtained via forums, the current project provides insight into these issues by examining the user's own experiences and perceptions through their own words and in real-world

settings, as opposed to highly controlled settings in which most research occurs. Finally, given the sense of anonymity provided by the Internet, the use of online forum data for the current project provides a more genuine and in-depth understanding of these help-seekers' experiences and perceptions.

It is important to note, however, that the current project had methodological limitations and therefore some caution is required in interpreting the findings. First, the data sourcing and extraction process for Beyond Blue (i.e., mental health forum) was limited by the use of gambling-related keywords to identify and extract entire forum threads and not just the individual post that included the gambling-related keyword. In other words, a thread may have only had one post within it that referred to any of the gambling-related keywords. In addition, some of the keywords utilised (e.g., cards or bet) have dual meaning, suggesting that some of the extracted threads may not have been relevant to the gambling context. This led to some LDA output that was not relevant to the research questions. Second, caution should be taken in interpreting the results of the sentiment analysis as many of the words in the topics did not have an affective valence defined by the 'afinn' dictionary. This may be because the 'afinn' dictionary is focused on words relevant to microblogging and therefore the valence of several words, not relevant to microblogging, may not have been examined for inclusion. Third, the sentiment analysis does not consider the words in the context of the posts; rather, it views each word individually (e.g., 'best' vs 'I don't make the best decisions'). There were therefore some inconsistencies between the results of the sentiment analysis and the interpretation of the topics based on the top 10 posts. Fourth, there is currently debate in the NLP field regarding the use of stemming as part of the data cleaning process. Some research indicates that the process has the potential to impact the results, while other research indicates that, while LDA conducted on stemmed and unstemmed data produces similar topics, the topics based on stemmed data can be more difficult to interpret (Hagg et al., submitted; Yang, Torget, & Mihalcea, 2011). Taken together, future gambling research utilising NLP techniques should explore different sentiment analysis dictionaries and approaches to sentiment analysis, as well as the impact of stemming. Fifth, the current project used RPC to determine the number of topics that best fit the data. There is increasing research, however, exploring different approaches to determining the best model fit in LDA research. Given the topics identified in the current project appear to have face validity, future research should continue to explore the use of RPC as a means of determining model fit. Finally, while the use of online forum data is considered a major strength of this study, there are some potential limitations associated with this source of data. For example, the use of third-party moderators might lead to possible exclusion of some data, the opportunity for substantial individual contributions may lead to a slight overrepresentation of certain users' perceptions, and individual forum user's language may be influenced by other posts within a thread (e.g., mirroring terms) which may lead to overrepresentation of certain words. While these limitations are likely outweighed by the benefits of online forum data (e.g., access to a larger, more representative dataset; reduced stigma and increased honesty provided by relative anonymity), future studies may also benefit from comparing or corroborating online forum data with qualitative interviews (e.g., Jamison, Sutton, Mant, & De Simoni, 2018).

Clinical and research implications

Notwithstanding the above limitations, the current project has several clinical and research implications.

- The current project highlighted the complex reciprocal relationship between gambling problems and mental health issues (i.e., depression and anxiety) and AOD issues (mostly hazardous alcohol use), from the perspective of help-seeking gamblers. Given this: (1) regular screening for gambling problems in mental health and AOD services; and (2) regular screening for mental health and AOD issues in gambling services, is required.

Given UK forum users predominantly indicated that their mental health issues predated their gambling problems, particular screening efforts for gambling problems in mental health and AOD services are needed in the UK.

- The current project also indicated that forum users discussed the relationship between stress and gambling. In Australia, this was discussed in the context of financial stress due to debt, highlighting the need for the promotion of financial counselling services. In contrast, this was discussed in the UK in the context of stress (i.e., work-related) acting as a trigger for relapse, highlighting the need for relapse prevention efforts to address this high-risk situation. These findings provide a unique perspective to the relationship between stress and gambling, by highlighting these jurisdictional differences and the need for different approaches depending on the jurisdiction.
- The current project is one of the first to highlight, from the perspective of help-seeking gamblers, that forum users with co-occurring gambling problems and mental health issues feel the need for both sets of issues to be addressed in order for a successful recovery. These findings extend on previous qualitative research by gaining a greater understanding of the treatment needs of help-seeking gamblers with co-occurring gambling and mental health problems. These findings, therefore highlight the need for: (1) the development and evaluation of targeted interventions that address both gambling problems and various mental health (e.g., depression, anxiety) and AOD issues (e.g., hazardous alcohol use) simultaneously (e.g., Cunningham et al., 2020); (2) research exploring the impact of sequenced interventions (e.g., treat gambling problems first followed by mental health issue or vice versa) on gambling problems and mental health outcomes; and (3) effective and efficient referral pathways between existing gambling, mental health and AOD services.
- The current project suggested that Australian gamblers, but not UK and US gamblers, use mental health and gambling forums to seek information about various help-seeking services and strategies. Given this, gambling-related forums present a unique platform for the provision of gambling-related information that can be utilised to promote and enhance access to various help-seeking services, and advancements in treatment options, especially in Australia.
- The current project identified important jurisdictional differences in gambling forum users' experiences with help-seeking services. Specifically, while Australian and UK forum users have accessed and discussed their experiences with various help-seeking services (e.g., financial counselling, helplines), US forum users mostly discussed the helpfulness of Gamblers Anonymous, as it is the only free and easily accessible treatment option for those without a lot of money or adequate insurance. Given this, there is a need for jurisdictions such as the US to increase funding and resources to ensure equal access to a range of effective treatment options (e.g., face-to-face counselling, helplines). Moreover, this finding highlights the need for the development and evaluation of interventions that utilise online and mobile-based platforms, which can increase access to evidence-based interventions (e.g., Dowling et al., 2021; Hawker, Merkouris, Youssef, & Dowling, 2021; Merkouris, Hawker, Rodda, Youssef, & Dowling, 2020).
- The current project found that gambling forum users across all jurisdictions utilise financial self-help strategies, such as limiting their access to cash when they gamble. While the use of financial self-help strategies by help-seeking gamblers has been well-established (Lubman et al., 2015), these findings extend on this previous research by highlighting that while Australian forum users mostly described the types of strategies that had worked for

them, UK and US forum users indicated the ease in which these self-help strategies and limit-setting can be overcome by deficiencies in banking systems and venue and online gambling operators. Given this, a review of banking and gambling operator policies and regulations are required to ensure that individuals trying to manage their gambling problems cannot easily overcome these self-set limits.

References

- Akoglu, H. (2018). User's guide to correlation coefficients. *Turkish Journal of Emergency Medicines*, 18, 91-93.
- Asmussen, C. B., & Møller, C. (2019). Smart literature review: a practical topic modelling approach to exploratory literature review. *Journal of Big Data*, 6(1), 93.
- Banks, G. C., Woznyj, H. M., Wesslen, R. S., & Ross, R. L. (2018). A review of best practice recommendations for text analysis in R (and a user-friendly app). *Journal of Business and Psychology*, 33(4), 445-459.
- Bao, Y., & Datta, A. (2014). Simultaneously discovering and quantifying risk types from textual risk disclosures. *Management Science*, 60(6), 1371-1391.
- Barker, G. (2007). Adolescents, social support and help-seeking behaviour: an international literature review and programme consultation with recommendations for action.
- Biddle, D., Hawthorne, G., Forbes, D., & Coman, G. (2005). Problem gambling in Australian PTSD treatment-seeking veterans. *Journal of Traumatic Stress*, 18(6), 759-767. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1002/jts.20084>
- Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, 97(5), 487-499.
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *the Journal of machine Learning research*, 3, 993-1022.
- Bowden-Jones, H., Hook, R. W., Grant, J. E., Ionnaidis, K., Corazza, O., Fineberg, N. A., . . . Chamberlain, S. R. (in press). Gambling Disorder in the United Kingdom: Key research priorities and the urgent need for independent research funding. *Lancet Psychiatry*.
- Bradley, A., & James, R. J. (2021). Defining the key issues discussed by problematic gamblers on web-based forums: a data-driven approach. *International Gambling Studies*, 21(1), 59-73.
- Browne, M., Greer, N., Rawat, V., & Rockloff, M. (2017). A population-level metric for gambling-related harm. *International Gambling Studies*, 17(2), 163-175. Retrieved from <https://www.tandfonline.com/doi/full/10.1080/14459795.2017.1304973>
- Browne, M., Langham, E., Rawat, V., Greer, N., Li, E., Rose, J., . . . Goodwin, B. (2016). *Assessing gambling-related harm in Victoria: A public health perspective*. Retrieved from
- Browne, M., Rockloff, M., Hing, N., Russell, A., Boyle, C. M., Rawat, V., . . . Sproston, K. (2020). *NSW Gambling Survey, 2019*. New South Wales: NSW Responsible Gambling Fund
- Calvo, R. A., Milne, D. N., Hussain, M. S., & Christensen, H. (2017). Natural language processing in mental health applications using non-clinical texts. *Natural Language Engineering*, 23(5), 649-685. Retrieved from https://www.cambridge.org/core/product/identifier/S1351324916000383/type/journal_article
- Cambria, E., & White, B. (2014). Jumping NLP Curves: A Review of Natural Language Processing Research [Review Article]. *IEEE Computational Intelligence Magazine*, 9(2), 48-57. Retrieved from <http://ieeexplore.ieee.org/document/6786458/>
- Caputo, A. (2015). Sharing problem gamblers' experiences: a text analysis of gambling stories via online forum. *Mediterranean Journal of Clinical Psychology*, 3(1).
- Carlbring, P., & Smit, F. (2008). Randomized trial of internet-delivered self-help with telephone support for pathological gamblers. *Journal of Consulting and Clinical Psychology*, 76(6), 1090-1094. Retrieved from <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0013603>
- Casey, L. M., Oei, T. P. S., Raylu, N., Horrigan, K., Day, J., Ireland, M., & Clough, B. A. (2017). Internet-Based Delivery of Cognitive Behaviour Therapy Compared to Monitoring, Feedback and Support for Problem Gambling: A Randomised Controlled Trial. *Journal of Gambling Studies*, 33(3), 993-1010. Retrieved from <http://link.springer.com/10.1007/s10899-016-9666-y>
- Chakraborty, K., Bhatia, S., Bhattacharyya, S., Platos, J., Bag, R., & Hassaniien, A. E. (2020). Sentiment Analysis of COVID-19 tweets by Deep Learning Classifiers—A study to show how popularity is affecting accuracy in social media. *Applied Soft Computing*, 97, 106754.
- Chen, A. T., Zhu, S.-H., & Conway, M. (2015). What online communities can tell us about electronic cigarettes and hookah use: A study using text mining and visualization techniques. *Journal of Medical Internet Research*, 17(9).
- Chou, K.-L., & Afifi, T. O. (2011). Disordered (Pathologic or Problem) Gambling and Axis I Psychiatric Disorders: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *American Journal of Epidemiology*, 173(11), 1289-1297. Retrieved from <https://academic.oup.com/aje/article-lookup/doi/10.1093/aje/kwr017>
- Cowlshaw, S., Merkouris, S., Chapman, A., & Radermacher, H. (2014). Pathological and problem gambling in substance use treatment: A systematic review and meta-analysis. *Journal of Substance Abuse Treatment*, 46(2), 98-105. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0740547213002079>
- Cunningham, J. A., Hodgins, D. C., Keough, M., Hendershot, C. S., Schell, C., & Godinho, A. (2020). Online interventions for problem gamblers with and without co-occurring unhealthy alcohol use: Randomized controlled trial. *Internet Interventions*, 19, 100307.
- De Choudhury, M., Counts, S., & Horvitz, E. (2013). *Social media as a measurement tool of depression in populations*. Paper presented at the Proceedings of the 5th annual ACM web science conference.
- Delfabbro, P., & King, D. (2012). Gambling in Australia: experiences, problems, research and policy: Gambling in Australia. *Addiction*, 107(9), 1556-1561. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.2012.03802.x>
- Dodds, P. S., Harris, K. D., Kloumann, I. M., Bliss, C. A., & Danforth, C. M. (2011). Temporal Patterns of Happiness and Information in a Global Social Network: Hedonometrics and Twitter. *PLOS ONE*, 6(12), e26752. Retrieved from <https://dx.plos.org/10.1371/journal.pone.0026752>

- Dowling, N. A., Butera, C. A., Merkouris, S. S., Youssef, G. J., Rodda, S. N., & Jackson, A. C. (2019). The reciprocal association between problem gambling and mental health symptoms/substance use: Cross-lagged path modelling of longitudinal cohort data. *Journal of clinical medicine*, 8(11), 1888.
- Dowling, N. A., Cowlshaw, S., Jackson, A. C., Merkouris, S. S., Francis, K. L., & Christensen, D. R. (2015). Prevalence of psychiatric comorbidity in treatment-seeking problem gamblers: A systematic review and meta-analysis. *Australian & New Zealand Journal of Psychiatry*, 49(6), 519-539. Retrieved from <http://journals.sagepub.com/doi/10.1177/0004867415575774>
- Dowling, N. A., Merkouris, S. S., Greenwood, C. J., Oldenhof, E., Toubourou, J. W., & Youssef, G. J. (2017). Early risk and protective factors for problem gambling: A systematic review and meta-analysis of longitudinal studies. *Clinical Psychology Review*, 51, 109-124. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0272735815301963>
- Dowling, N. A., Merkouris, S. S., & Lorains, F. K. (2016). Interventions for comorbid problem gambling and psychiatric disorders: Advancing a developing field of research. *Addictive Behaviors*, 58, 21-30. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0306460316300375>
- Dowling, N. A., Merkouris, S. S., Rodda, S. N., Smith, D., Aarsman, S., Lavis, T., . . . Battersby, M. W. (2021). GamblingLess: a randomised trial comparing guided and unguided internet-based gambling interventions. *Journal of clinical medicine*, 10(11), 2224.
- Dowling, N. A., Youssef, G. J., Jackson, A. C., Pennay, D. W., Francis, K. L., Pennay, A., & Lubman, D. I. (2016). National estimates of Australian gambling prevalence: findings from a dual-frame omnibus survey: Australian dual-frame gambling survey. *Addiction*, 111(3), 420-435. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1111/add.13176>
- Downs, J., Velupillai, S., George, G., Holden, R., Kikoler, M., Dean, H., . . . Dutta, R. (2017). *Detection of suicidality in adolescents with autism spectrum disorders: developing a natural language processing approach for use in electronic health records*. Paper presented at the AMIA annual symposium proceedings.
- Dussault, F., Brendgen, M., Vitaro, F., Wanner, B., & Tremblay, R. E. (2011). Longitudinal links between impulsivity, gambling problems and depressive symptoms: a transactional model from adolescence to early adulthood: Impulsivity, gambling problems and depressive symptoms. *Journal of Child Psychology and Psychiatry*, 52(2), 130-138. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1111/j.1469-7610.2010.02313.x>
- El Naqa, I., & Murphy, M. J. (2015). What Is Machine Learning? In I. El Naqa, R. Li, & M. J. Murphy (Eds.), *Machine Learning in Radiation Oncology* (pp. 3-11). Cham: Springer International Publishing.
- Evans, L., & Delfabbro, P. H. (2005). Motivators for Change and Barriers to Help-Seeking in Australian Problem Gamblers. *Journal of Gambling Studies*, 21(2), 133-155. Retrieved from <http://link.springer.com/10.1007/s10899-005-3029-4>
- Eysenbach, G., & Till, J. E. (2001). Ethical issues in qualitative research on internet communities. *BMJ*, 323(7321), 1103-1105. Retrieved from <https://www.bmj.com/lookup/doi/10.1136/bmj.323.7321.1103>
- Feinerer, I., & Hornik, K. (2020). tm: Text Mining Package. R package version 0.7-8. Retrieved from <https://CRAN.R-project.org/package=tm>
- Fellows, I. (2018). Word Clouds. R package version 2.6. . Retrieved from <http://blog.fellstat.com/?cat=11>
- Fino, E., Hanna-Khalil, B., & Griffiths, M. D. (2021). Exploring the public's perception of gambling addiction on Twitter during the COVID-19 pandemic: Topic modelling and sentiment analysis. *Journal of Addictive Diseases*, 1-19.
- Gainsbury, S. M., Hing, N., & Suhonen, N. (2014). Professional Help-Seeking for Gambling Problems: Awareness, Barriers and Motivators for Treatment. *Journal of Gambling Studies*, 30(2), 503-519. Retrieved from <http://link.springer.com/10.1007/s10899-013-9373-x>
- Gainsbury, S. M., Russell, A., Hing, N., Wood, R., Lubman, D. I., & Blaszczynski, A. (2014). The prevalence and determinants of problem gambling in Australia: Assessing the impact of interactive gambling and new technologies. *Psychology of Addictive Behaviors*, 28(3), 769-779. Retrieved from <http://doi.apa.org/getdoi.cfm?doi=10.1037/a0036207>
- Gambling Commission. (2018). *Gambling-related harm as a public health issue: Briefing paper for Local Authorities and local Public Health providers*. UK: Gambling Commission
- Gambling Commission. (2020). *Gambling participation in 2019: behaviour, awareness and attitudes. Annual Report*. UK: Gambling Commission
- George, S., & Bowden-Jones, H. (2016). Treatment provision for gambling disorder in Britain: call for an integrated addictions treatment and commissioning model. *BJPsych bulletin*, 40(3), 113-115.
- Golder, S. A., & Macy, M. W. (2011). Diurnal and seasonal mood vary with work, sleep, and daylength across diverse cultures. *Science*, 333(6051), 1878-1881.
- Hagg, J., Merkouris, S. S., O'Dea, G. A., Francis, L. M., Greenwood, C. J., Fuller-Tyszkiewicz, M., . . . Youssef, G. J. (submitted). Examining analytical practices in Latent Dirichlet Allocation within Psychological Science: A Scoping Review. *JMIR*.
- Hartmann, M., & Blaszczynski, A. (2018). The longitudinal relationships between psychiatric disorders and gambling disorders. *International Journal of Mental Health and Addiction*, 16(1), 16-44.
- Hawker, C. O., Merkouris, S. S., Youssef, G. J., & Dowling, N. A. (2021). A smartphone-delivered ecological momentary intervention for problem gambling (GamblingLess: Curb Your Urge): Single-arm acceptability and feasibility trial. *Journal of Medical Internet Research*, 23(3), e25786.
- Hirschberg, J., & Manning, C. D. (2015). Advances in natural language processing. *Science*, 349(6245), 261-266.
- Hodgins, D. C., Peden, N., & Cassidy, E. (2005). The Association Between Comorbidity and Outcome in Pathological Gambling: A Prospective Follow-up of Recent Quitters. *Journal of Gambling Studies*, 21(3), 255-271. Retrieved from <http://link.springer.com/10.1007/s10899-005-3099-3>

- Holdsworth, L., Nuske, E., & Breen, H. (2013). All mixed up together: Women's experiences of problem gambling, comorbidity and co-occurring complex needs. *International Journal of Mental Health and Addiction*, 11(3), 315-328. Retrieved from <http://link.springer.com/10.1007/s11469-012-9415-0>
- Holdsworth, L., Nuske, E., & Hing, N. (2015). A grounded theory of the influence of significant life events, psychological co-morbidities and related social factors on gambling involvement. *International Journal of Mental Health and Addiction*, 13(2), 257-273. Retrieved from <http://link.springer.com/10.1007/s11469-014-9527-9>
- Homan, C., Johar, R., Liu, T., Lytle, M., Silenzio, V., & Ovesdotter Alm, C. (2014). *Toward Macro-Insights for Suicide Prevention: Analyzing Fine-Grained Distress at Scale*. Paper presented at the Proceedings of the Workshop on Computational Linguistics and Clinical Psychology: From Linguistic Signal to Clinical Reality, Baltimore, Maryland, USA. <http://aclweb.org/anthology/W14-3213>
- Hornik, K., & Grün, B. (2011). topicmodels: An R package for fitting topic models. *Journal of 600 statistical software*, 40(13), 1-30.
- Iqbal, E., Mallah, R., Jackson, R. G., Ball, M., Ibrahim, Z. M., Broadbent, M., . . . Dobson, R. J. B. (2015). Identification of Adverse Drug Events from Free Text Electronic Patient Records and Information in a Large Mental Health Case Register. *PLOS ONE*, 10(8), e0134208. Retrieved from <https://dx.plos.org/10.1371/journal.pone.0134208>
- Jamison, J., Sutton, S., Mant, J., & De Simoni, A. (2018). Online stroke forum as source of data for qualitative research: insights from a comparison with patients' interviews. *BMJ open*, 8(3), e020133.
- Kessler, R. C., Hwang, I., LaBrie, R., Petukhova, M., Sampson, N. A., Winters, K. C., & Shaffer, H. J. (2008). DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychological Medicine*, 38(9), 1351-1360. Retrieved from https://www.cambridge.org/core/product/identifier/S0033291708002900/type/journal_article
- Kim, H. S., & Hodgins, D. C. (2018). Component model of addiction treatment: A pragmatic transdiagnostic treatment model of behavioral and substance addictions. *Frontiers in psychiatry*, 9, 406.
- Kosinski, M., Wang, Y., Lakkaraju, H., & Leskovec, J. (2016). Mining big data to extract patterns and predict real-life outcomes. *Psychological Methods*, 21(4), 493.
- Kramer, A. D. (2010). *An unobtrusive behavioral model of "gross national happiness"*. Paper presented at the Proceedings of the SIGCHI conference on human factors in computing systems.
- Langham, E., Thorne, H., Browne, M., Donaldson, P., Rose, J., & Rockloff, M. (2016). Understanding gambling related harm: a proposed definition, conceptual framework, and taxonomy of harms. *BMC Public Health*, 16, 80. doi:10.1186/s12889-016-2747-0
- Liddy, E. D. (2001). Natural language processing.
- Lo, R. T.-W., He, B., & Ounis, I. (2005). *Automatically building a stopword list for an information retrieval system*. Paper presented at the Journal on Digital Information Management: Special Issue on the 5th Dutch-Belgian Information Retrieval Workshop (DIR).
- Lorains, F. K., Cowlshaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: systematic review and meta-analysis of population surveys: Comorbid disorders in pathological gambling. *Addiction*, 106(3), 490-498. Retrieved from <https://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.2010.03300.x>
- Loy, J. K., Grüne, B., Braun, B., Samuelsson, E., & Kraus, L. (2019). Help-seeking behaviour of problem gamblers: A narrative review. *Sucht*, 64(5-6), 259-272.
- Lubman, D. I., Manning, V., Dowling, N., Rodda, S., Lee, S., Garde, E., . . . Volberg, R. (2017). *Problem gambling in people seeking treatment for mental illness*. Victoria, Australia: Victorian Responsible Gambling Foundation
- Lubman, D. I., Rodda, S. N., Hing, N., Cheetham, A., Cartmill, T., Nuske, E., . . . Cunningham, J. (2015). *Gambler Self-Help Strategies: A Comprehensive Assessment of Self-Help Strategies and Actions*. Melbourne: Gambling Research Australia
- Marotta, J., Bahan, M., Reynolds, A., Vander Linden, M., & Whyte, K. (2014). *2013 National Survey of Problem Gambling Services*. Washington DC: National Council on Problem Gambling
- Merkouris, S. S., Hawker, C. O., Rodda, S. N., Youssef, G. J., & Dowling, N. A. (2020). GamblingLess: Curb Your Urge: Development and usability testing of a smartphone-delivered ecological momentary intervention for problem gambling. *International Gambling Studies*, 20(3), 515-538.
- Nielsen, F. Å. (2011). A new ANEW: Evaluation of a word list for sentiment analysis in microblogs. *arXiv preprint arXiv:1103.2903*.
- Nikkinen, J. (2014). The global regulation of gambling: a general overview. *Working papers/Department of Sociology*.
- O'Dea, B., Wan, S., Batterham, P. J., Cleave, A. L., Paris, C., & Christensen, H. (2015). Detecting suicidality on Twitter. *Internet Interventions*, 2(2), 183-188. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S2214782915000160>
- Parhami, I., Mojtabai, R., Rosenthal, R. J., Afifi, T. O., & Fong, T. W. (2014). Gambling and the Onset of Comorbid Mental Disorders: A Longitudinal Study Evaluating Severity and Specific Symptoms. *Journal of Psychiatric Practice*, 20(3), 207-219. Retrieved from <https://journals.lww.com/00131746-201405000-00006>
- Paterson, M., Leslie, P., & Taylor, M. (2019). *2019 ACT gambling survey*. ACT, Australia: Australian National University Centre for Gambling Research
- Pilver, C. E., Libby, D. J., Hoff, R. A., & Potenza, M. N. (2013). Problem gambling severity and the incidence of Axis I psychopathology among older adults in the general population. *Journal of Psychiatric Research*, 47(4), 534-541. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0022395612003834>
- Productivity Commission. (2010). *Gambling, Report no. 50*. Canberra
- Pulford, J., Bellringer, M., Abbott, M., Clarke, D., Hodgins, D., & Williams, J. (2009). Barriers to Help-seeking for a Gambling Problem: The Experiences of Gamblers Who Have Sought Specialist Assistance and the Perceptions of Those Who Have Not. *Journal of Gambling Studies*, 25(1), 33-48. Retrieved from <http://link.springer.com/10.1007/s10899-008-9113-9>

- Queensland Government. (2018). *Queensland Household Gambling Survey 2016-17*. Queensland: Department of Justice and Attorney-General
- Quilty, L. C., Watson, C., Robinson, J. J., Toneatto, T., & Bagby, R. M. (2011). The Prevalence and Course of Pathological Gambling in the Mood Disorders. *Journal of Gambling Studies*, 27(2), 191-201. Retrieved from <http://link.springer.com/10.1007/s10899-010-9199-8>
- Ramirez-Esparza, N., Chung, C. K., Kacewicz, E., & Pennebaker, J. W. (2008). *The Psychology of Word Use in Depression Forums in English and in Spanish: Texting Two Text Analytic Approaches*. Paper presented at the ICWSM.
- Robinson, D., Misra, K., & Silge, J. (2021). WidyR: Widen, Process, then Re-Tidy Data. R package version 0.1.4. Retrieved from <https://github.com/dgrtwo/widyR>
- Rockloff, M., Browne, M., Hing, N., Thorne, H., Russell, A., Greer, N., . . . Sproston, K. (2020). *Victorian population gambling and health study 2018-2019*. Melbourne: Victorian Responsible Gambling Foundation
- Rodda, S. N., Dowling, N. A., & Lubman, D. I. (2018). Gamblers seeking online help are active help-seekers: Time to support autonomy and competence. *Addictive Behaviors*, 87, 272-275. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0306460318303186>
- Rodda, S. N., Hing, N., Hodgins, D. C., Cheetham, A., Dickins, M., & Lubman, D. I. (2018). Behaviour change strategies for problem gambling: an analysis of online posts. *International Gambling Studies*, 1-19. Retrieved from <https://www.tandfonline.com/doi/full/10.1080/14459795.2018.1432670>
- Rodda, S. N., & Lubman, D. I. (2014). Characteristics of Gamblers Using a National Online Counselling Service for Problem Gambling. *Journal of Gambling Studies*, 30(2), 277-289. Retrieved from <http://link.springer.com/10.1007/s10899-012-9352-7>
- Schofield, A., Magnusson, M., & Mimno, D. (2017). *Pulling out the stops: Rethinking stopword removal for topic models*. Paper presented at the Proceedings of the 15th Conference of the European Chapter of the Association for Computational Linguistics: Volume 2, Short Papers.
- Silge, J., & Robinson, D. (2016). tidytext: Text Mining and Analysis Using Tidy Data Principles in R. *JOSS*, 1(3). doi:0.21105/joss.00037
- Stevens, M., Gupta, H., & Flack, M. (2019). *Northern Territory Gambling Prevalence and Wellbeing Survey Report, 2018*. (1922104310). Northern Territory: Menzies School of Health Research, Charles Darwin University
- Sundqvist, K., & Rosendahl, I. (2019). Problem gambling and psychiatric comorbidity—risk and temporal Sequencing among women and men: Results from the Swelogs case-control study. *Journal of Gambling Studies*, 35(3), 757-771.
- Suurvali, H., Cordingley, J., Hodgins, D. C., & Cunningham, J. (2009). Barriers to Seeking Help for Gambling Problems: A Review of the Empirical Literature. *Journal of Gambling Studies*, 25(3), 407-424. Retrieved from <http://link.springer.com/10.1007/s10899-009-9129-9>
- The South Australian Centre for Economic Studies, Delfabbro, P., & ENGINE Asia Pacific Pty Ltd. (2021). *Fifth Social and Economic Impact Study of Gambling in Tasmania*. South Australia: South Australian Centre for Economic Studies, University of Adelaide
- Welte, J. W., Barnes, G. M., Tidwell, M.-C. O., Hoffman, J. H., & Wieczorek, W. F. (2015). Gambling and Problem Gambling in the United States: Changes Between 1999 and 2013. *Journal of Gambling Studies*, 31(3), 695-715. Retrieved from <http://link.springer.com/10.1007/s10899-014-9471-4>
- Wickham, H. (2021). Rvest: Easily Harvest (Scrape) Web Pages. R package version 1.0.1. Retrieved from <https://rvest.tidyverse.org/>
- Wickham, H., François, R., Henry, L., & Müller, K. (2021). dplyr: A Grammar of Data Manipulation. R package version 1.0.7. . Retrieved from <https://CRAN.R-project.org/package=dplyr>
- Williams, R. J., Volberg, R. A., & Stevens, R. M. (2012). *The population prevalence of problem gambling: Methodological influences, standardized rates, jurisdictional differences, and worldwide trends*. Retrieved from
- Winters, K. C., & Kushner, M. G. (2003). Treatment issues pertaining to pathological gamblers with a comorbid disorder. *Journal of Gambling Studies*, 19(3), 261-277. Retrieved from <http://link.springer.com/10.1023/A:1024203403982>
- Wood, R. T. A., & Wood, S. A. (2009). An evaluation of two United Kingdom online support forums designed to help people with gambling issues. *Journal of Gambling Issues*(23), 5-30.
- Woods, A., Sproston, K., Brook, K., Delfabbro, P., & O'Neil, M. (2018). *Gambling Prevalence in South Australia (2018)*. South Australia: Department of Human Services
- Yakovenko, I., Clark, C. M., Hodgins, D. C., & Goghari, V. M. (2016). A qualitative analysis of the effects of a comorbid disordered gambling diagnosis with schizophrenia. *Schizophrenia Research*, 171(1-3), 50-55. Retrieved from <https://linkinghub.elsevier.com/retrieve/pii/S0920996415300815>
- Yang, T.-I., Torget, A., & Mihalcea, R. (2011). *Topic modeling on historical newspapers*. Paper presented at the Proceedings of the 5th ACL-HLT Workshop on Language Technology for Cultural Heritage, Social Sciences, and Humanities.
- Zhao, W., Chen, J. J., Perkins, R., Liu, Z., Ge, W., Ding, Y., & Zou, W. (2015). *A heuristic approach to determine an appropriate number of topics in topic modeling*. Paper presented at the BMC bioinformatics.
- Zimmerman, M., Chelminski, I., & Young, D. (2006). Prevalence and Diagnostic Correlates of DSM-IV Pathological Gambling in Psychiatric Outpatients. *Journal of Gambling Studies*, 22(2), 255-262. Retrieved from <http://link.springer.com/10.1007/s10899-006-9014-8>

Appendices

Appendix 1. Keywords for BeyondBlue

Bet or Bingo or Blackjack or Cards or Casino or Gamble or Gambling or Gaming or Horse/horse racing or Lottery or Lotto or Poker or Pokies or Punt or Punting or Roulette or Scratchie or Slot machine

Appendix 2. Keywords for Study 1

abuse or acid or adderall or addict or addiction* or aggressive or alanon or alcohol or alcoholic or alcoholicsanonymous or ale or amphetamine or anxiety or assault or battered or beer or benzodiazepine or beyondblue or bipolar or blue or booze or bottle or bourbon or brandy or caned or cannabis or cardhue or carlsberg or cascade or cider or cigar or cigarette or claret or cocaine or cocktail or coke or colada or corona or crack or crystal or depression or detox or devastate or diazepam or distress or domestic or dope or down or downbeat or downer or downhearted or downtrodden or drink or drug or drunk or dysthymia or ecstasy or flask or grass or grog or hammered or hangover or hash or heroin or ice or illicit or inject or injection or intoxicated or junkie or keg or lager or liquor or lsd or marijuana or mdma or melancholy or methadone or methamphetamine or molest or molly or mood or morphine or mushroom or na or narcotics or needle or nicotine or nicorette or nicotine or nightcap or opiates or overdose or overwhelm or pill or pimms or pinot or pint or pissed or plastered or pot or powder or psychedelic or ptsd or pub or rum or sad or scotch or shandy or sherry or slab or sloshed or smashed or smoke or snort or sober or sobriety or speed or spirits or steamed or steroids or stimulant or stoned or stress or substance or suicide or tinny or tipsy or tobacco or tot or upset or valium or violent or vodka or wasted or weed or whisky or withdrawal or wrecked

*The keyword of addiction was not used in the selection of topics that only included keywords as this resulted in many topics that related only to gambling addiction and not the relationship between gambling addiction, mental health issues or other addictive disorders

Appendix 3. Keywords for Study 2

(help & gambling) OR (support & gambling) OR (recover & gambling) OR (change & gambling) OR (control & gambling) OR (advice & gambling) OR (counsel & gambling) OR abstinent OR gamblersanonymous OR relapse OR quit OR treatment OR gamcare OR commit OR limit OR helpful OR seek OR na OR strategy OR therapy OR information OR ban OR cure OR anonymous OR helpline OR gamstop OR psychology OR withdrawal OR prevent OR council OR gp OR patient OR sponsor OR assist OR gamblock OR meditation OR cognitivebehaviouraltherapy OR gamban OR client OR agency OR alcoholicsanonymous OR telephone OR psychiatry OR helpless OR betfilter OR rehabilitation OR peer OR therapeutic OR lifeline OR headspace OR gamanon OR clinic OR antidepressant OR hypnotherapy OR intervention OR clinical OR cognitive OR shelter OR unhelpful OR hotline OR remedy OR gamblinghelponline OR shrink OR intervene OR diversion OR inpatient OR psychotherapy OR breakeven OR untreated OR antidote OR dialecticalbehaviourtherapy OR treatable OR naltrexone OR outpatient OR unsupported OR psychforums OR workbook OR methadone OR psychodynamic OR unchanged OR gambleaware OR gamblershelp OR citalopram OR sponsees OR alanon OR acetyl OR anglicare OR betblocker OR salvotionarmy OR antipsychotic OR cysteine

Appendix 4. LDA topic models for Study 1



beta

Figure 27. Gambling Help Online - 50-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues

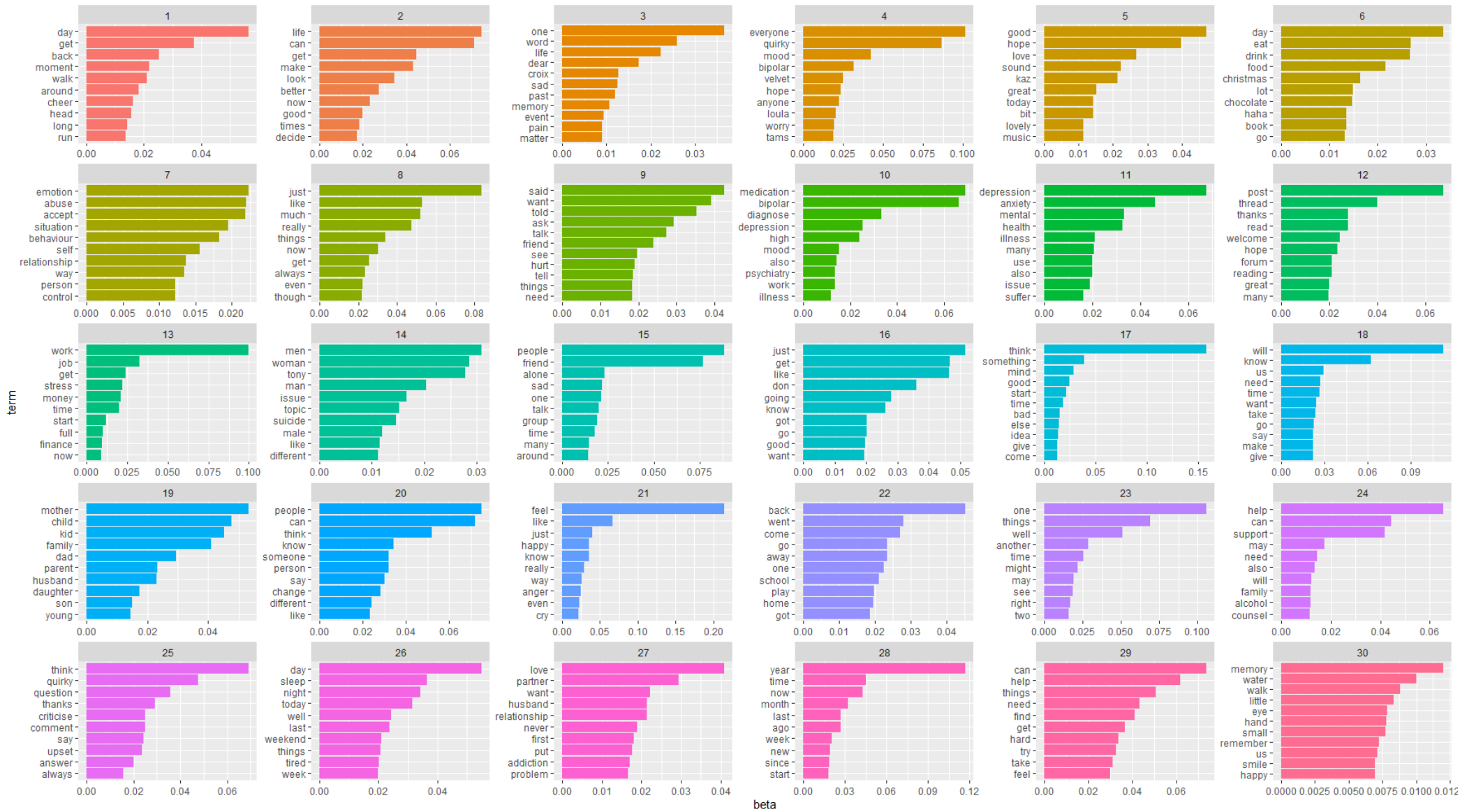


Figure 28. Beyond Blue - 30-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues

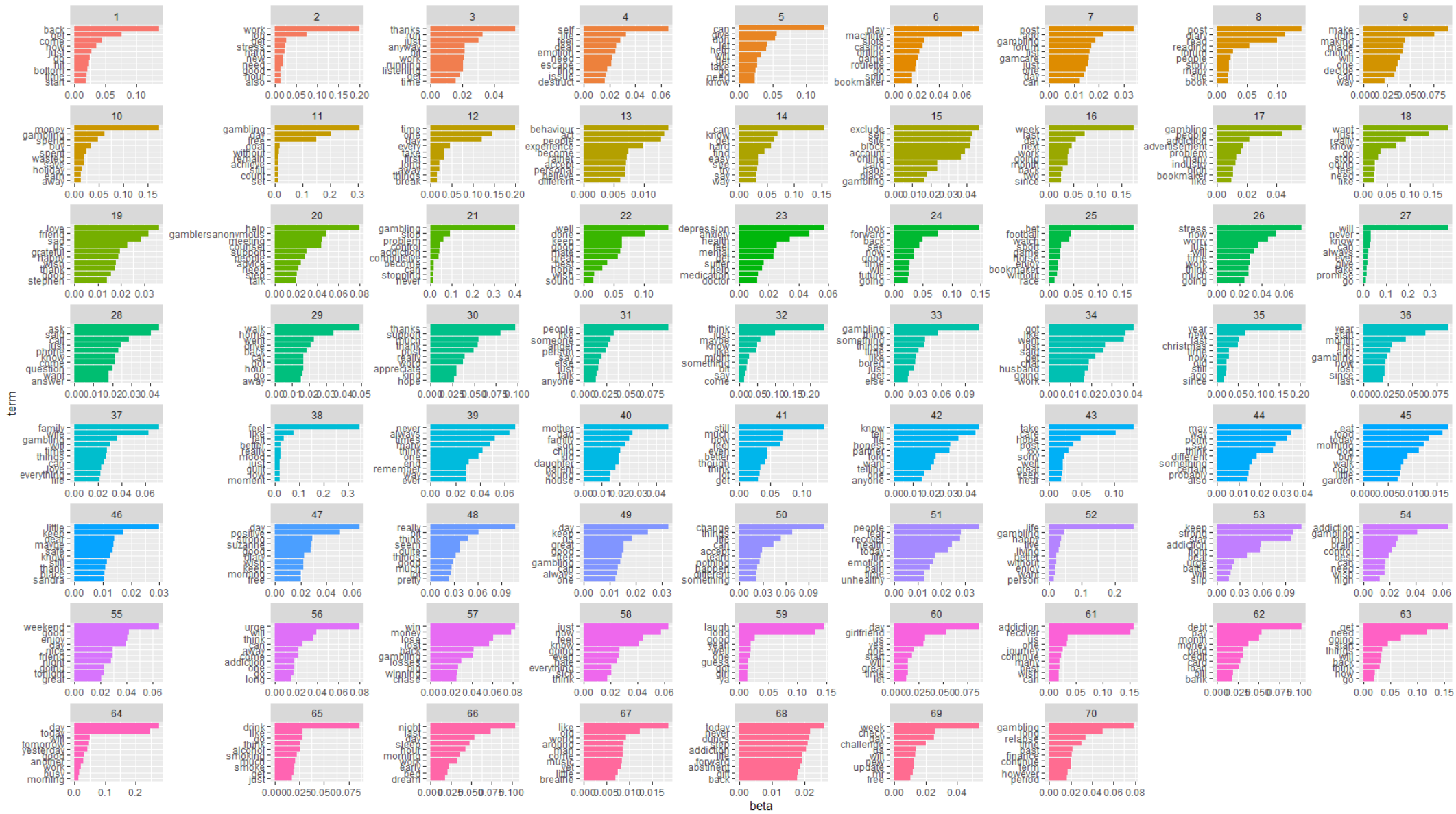


Figure 29. GamCare - 70-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues

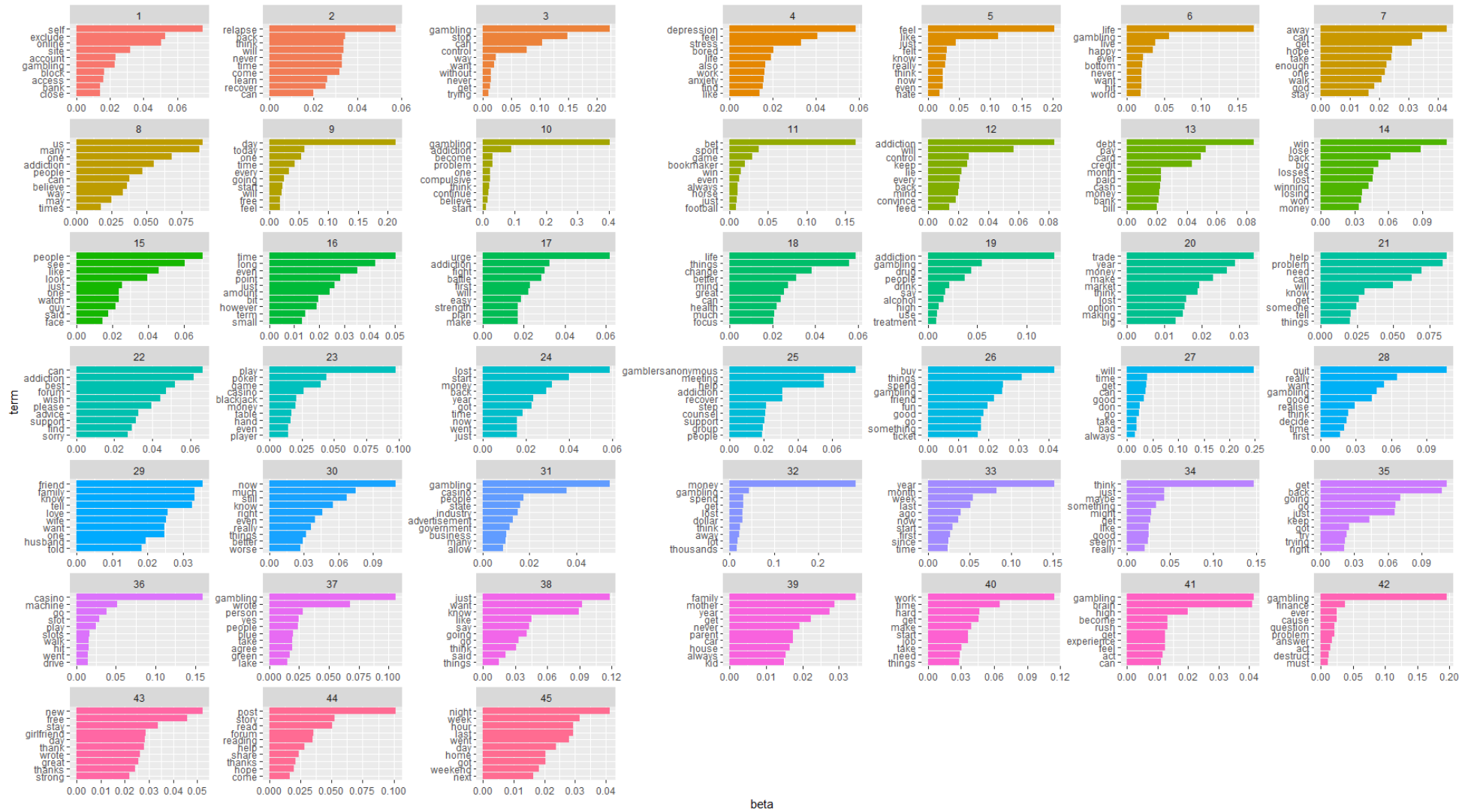


Figure 30. PsychForums - 45-topic model exploring the relationship between gambling problems and mental health and alcohol and other drug issues

Appendix 5. LDA topic models for Study 2

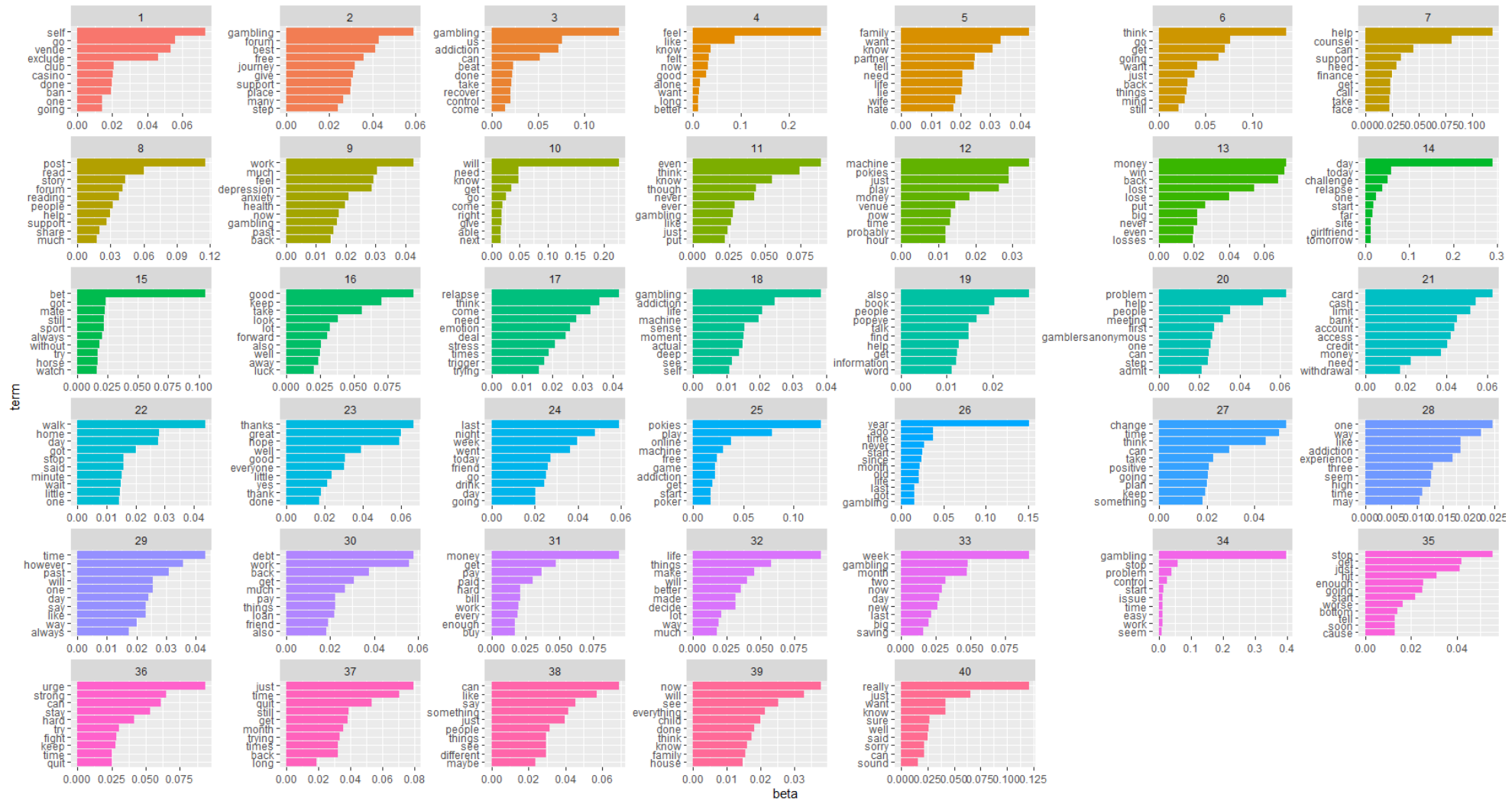


Figure 31. Gambling Help Online - 40-topic model exploring help-seeking

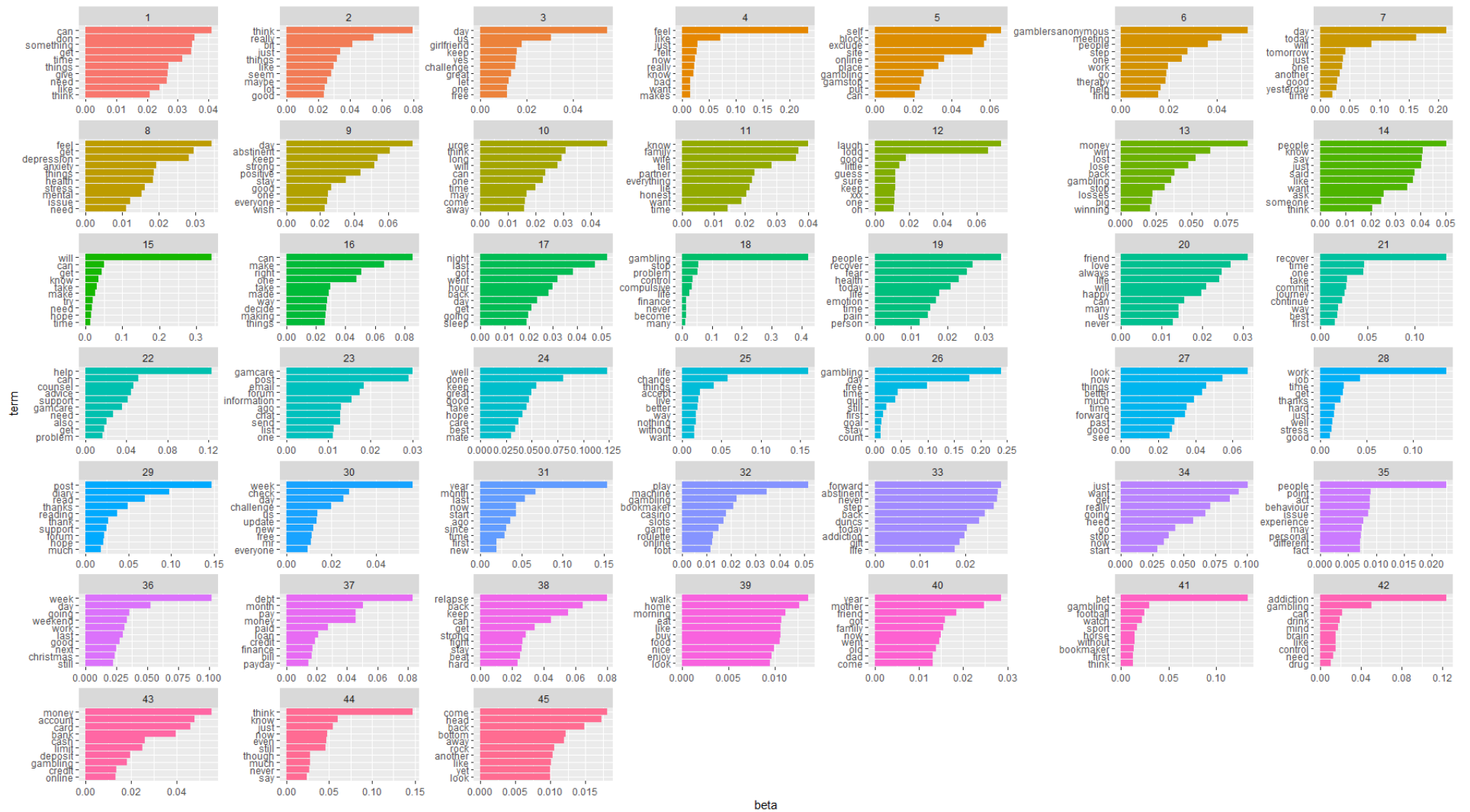


Figure 33. GamCare - 45-topic model exploring help-seeking

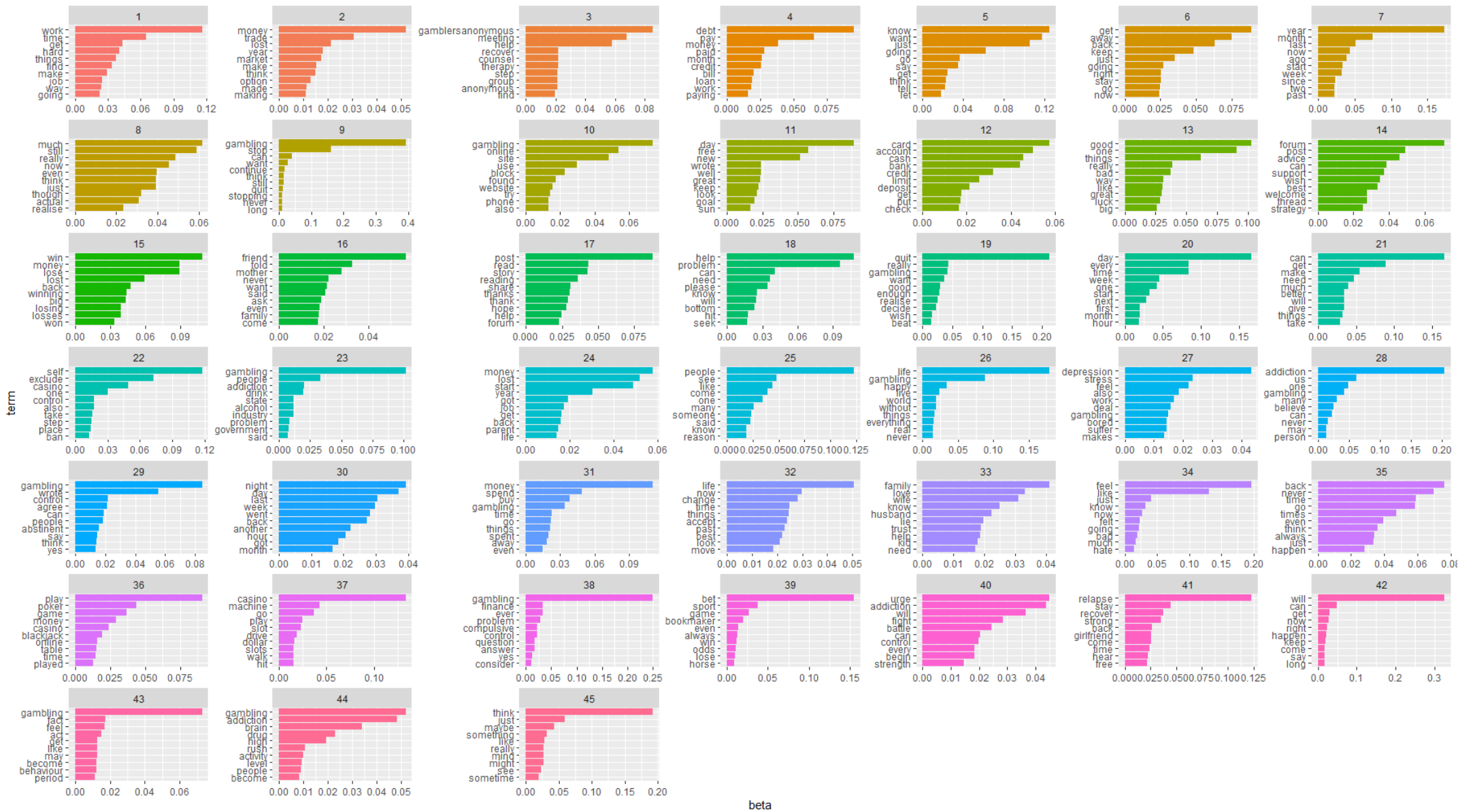


Figure 34. PsychForums- 45-topic model exploring help-seeking

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