

**Title: Exploring the emotional experiences of alcohol hangover syndrome in healthy UK based adults.**

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**Abstract**

Alcohol hangover syndrome (AHS) is a highly heterogeneous state encompassing a range of physiological and psychological symptoms. The syndrome is experienced regularly among alcohol consumers and remains poorly understood. The present study sought to gain insight into whether certain emotions were tied to AHS and how these emotions were experienced. Twenty participants took part, 14 female and 6 male, aged 21 to 39 years. Inductive thematic analysis of semi structured interview data produced four themes; 'The Tyranny of the Shoulds', 'Bias and the Persistence of Memory', 'Staring into the Void' and 'Emotive behavioral response'. The four themes demonstrate the complexity of emotional experiences associated with AHS and account for concurrent constructs including cognition, mood and behavior. Guilt, shame, dread, anger and regret were all commonly experienced, with rumination, negative interpretation bias, nostalgia, self-flagellation, isolation and camaraderie being essential in how these emotions were described by participants. The study adds greater understanding of the diversity of emotions that can be experienced during AHS, with important implications for the wellbeing of those who suffer most from the state. It is suggested that self-help techniques targeting cognitions could be explored to help alleviate aspects of the negative emotions experienced.

## Introduction

*'I don't think I have written a poem when I was completely sober. But I have written a few good ones or a few bad ones under the hammer of a black hangover when I didn't know whether another drink or a blade would be the best thing'*

From 'Charles Bukowski Speaks Out' – March, 1963 (Calonne, 2003)

Bukowski here encapsulates an emotional darkness induced by a night of heavy drinking that is well known to the world of 20<sup>th</sup> century American literature but generally absent from empirical research. Alcohol hangover syndrome (AHS) is a cluster of physiological and psychological symptoms induced by excessive alcohol consumption during the previous day/night (Wiese, Shlipak, & Browner, 2000). Symptom onset occurs when blood alcohol concentration approaches zero following alcohol consumption (Verster, Lantman, van de Loo, & Mackus, 2017). The symptom profile includes physical pain, fatigue, thirst, gastrointestinal complaints, disrupted circadian rhythms, increased sensitivity to light and sound, cognitive impairment and mood effects such as depression, anxiety and irritability (Verster, 2008) with considerable symptomatic heterogeneity existing between alcohol consumers (Prat, Adan, & Sánchez-Turet, 2009). Alcohol has played a part in human history for millennia (Dietler, 2006) with fermented drinks being believed to have been created as early as the Neolithic period (Patrick, 1952). A range of physiological factors are theorized to cause AHS including electrolytic interference, hypoglycemia, dehydration, circadian rhythm interruption, gastric disturbance (Prat et al., 2009) and increased concentrations of acetaldehyde in the blood (Inoue, Fukunaga, Kiriya, & Komura, 1984). Acute alcohol withdrawal (Swift & Davidson, 1998) and potentially toxic interactions caused by congeners in alcoholic beverages (Calder, 1997) have also been presented as possible causal influences. Regardless of the theorized explanations, no universal hangover cure has been demonstrated to be effective (Jayawardena, Thejani, Ranasinghe, Fernando, & Verster, 2017), suggesting that AHS will remain an experience for

alcohol consumers for the foreseeable future. One significant consequence of the lack of a cure is the substantial economic cost caused by AHS through decreased productivity (presenteeism) and work absences (Crofton, 1987; Single, Robson, Xie, & Rehm, 1998; Wiese et al., 2000).

Four constructs and the interactions between them inform the present study; emotion, mood, behavior and cognition. As affective science continues to face scrutiny due to its subjective nature (Weidman, Steckler, & Tracy, 2017) the present study will outline how each construct will be engaged with. Emotion is generally considered an automatic reactionary process to a form of internal or external stimuli, evolving as a survival mechanism (Al-Shawaf, Conroy-Beam, Asao, & Buss, 2016; Darwin, 1872/1965). Defining emotion as a psychological construct has been challenging for researchers due to difficulties empirically measuring such a concept (Gendron, 2010; Wierzbicka, 1992). Broad agreement among researchers suggests that three factors make up an emotion; neurobiological processes, experiential feelings and cognitive perceptual processes (Izard, 2010). Various theories of emotion have been presented including Ekman's basic human emotion theory distinguishable by facial expressions (Ekman, Friesen, & Ellsworth, 1972) and Plutchik's 'wheel of emotion' (1980). Distinguishing emotion and mood as distinct but intrinsically linked constructs is important within psychology (Beedie, Terry, & Lane, 2005) and philosophy (Bobier, 2017). Frijda suggests that moods lack the specificity of an emotional response (2009), are more cognitive in nature, last longer than emotions and are more easily defined as either good or bad (1994). Moods do not necessarily culminate in a response toward a person or object, whereas emotions tend to have direction (Davis, 2009). Therefore, the present study considers mood as an ongoing state as opposed to the reactionary, temporal nature of emotion.

It has been theorized that bidirectional links exist between cognition, behavior and emotion (Dolan, 2002; Lazarus, 1982; Leventhal & Scherer, 1987). These interactions have been a historical target for psychological interventions (Beck, 1970; Ellis, 1958) and form the foundation of cognitive behavioral therapy (Butler, Chapman, Forman, & Beck, 2006), a mode of therapy regularly utilized in the UK for

the treatment of common mental health disorders (Clark, 2011). A consideration of how participants think, behave and feel during AHS is integral to the present study. The advent of neuroscience has allowed for the exploration of these links and are discussed in depth in elsewhere (Kanai & Rees, 2011; Pessoa, 2008).

Most alcohol and emotion research tends to examine the effects during acute intoxication as opposed to following intoxication (Curtin, Patrick, Lang, Cacioppo, & Birbaumer, 2001; K. J. Sher & Grekin, 2007) and the research that does consider AHS and affective constructs is predominantly quantitative in design (McKinney, 2010). The relative scarcity of research exploring the experience and implications of AHS has been previously documented (Molbak, Schou, & Tolstrup, 2017). One such study aimed to investigate the impact on aspects of mood and anxiety after a night of alcohol consumption (McKinney & Coyle, 2006). The researchers recruited a student sample (mean age = 23.38 years) and instructed participants to consume a quantity of alcohol that was 'normal' for them between the hours of 22.00 and 02.00. Participants completed a range of questionnaires that provided information on drinking practices, hangover symptoms, sleep quality, anxiety, perceived stress levels and cognitive interference. The researchers found that heavy alcohol consumption significantly lowered mood, disrupted sleep, increased anxiety, and produced emotional symptoms during the morning following acute intoxication. Guilt was discussed in the study as a potential explanation of low mood and emotional disturbance. By controlling the drinking duration, the researchers inadvertently limited the ecological validity of the study. Consumers can drink for a duration longer than four hours, especially those who 'pre-drink', (the act of consuming alcohol before going out to a public location such as a bar or a club with the aim of saving money (Labhart, Graham, Wells, & Kuntsche, 2013)) and therefore may experience higher levels of intoxication and more severe AHS symptoms than induced by McKinney & Coyle. The decision to set the time of consumption between 22.00 and 02.00 also poses questions about sleep interference as a potential cause for emotional disturbance (Gruber & Cassoff, 2014).

A caveat of quantitative based AHS research is that it is not ethically sound to administer the quantities of alcohol required to imitate binge drinking in real life (Dolinsky & Babor, 1997; Wood & Sher, 2000) and induce ecologically sound hangover states. It can also be expected that a nonresponse bias exists in AHS research, just as it does in alcohol research in general (Kypri, Stephenson, & Langley, 2004). Previous research suggest that participants volunteering for alcohol research studies may drink more than the general population (Cunningham, 2012; Shorter, Murphy, & Cunningham, 2017) but it is equally likely that participants who suffer severely from AHS would be unwilling to turn up to a laboratory study or respond to a survey while hungover. This means that experiences from those particularly prone to AHS are likely to be absent from the literature, though may be particularly useful in developing intervention strategies given the predictive relationship between reported experience of AHS and the likelihood of developing alcohol use disorder (Molbak et al., 2017). The present study addresses this issue by recruiting participants who subjectively report suffering from disturbed emotion and mood states while hungover.

Quantitative studies have shown that the way in which people evaluate negative alcohol-related consequences varies considerably. Students, for example often rate the negative consequences of their drinking in neutral or positive ways (Mallet, Bachrach, & Turrisi, 2008) or show little concern for consequences including missing work or school or getting into a physical fight (White & Ray, 2013; Barnett, Merrill, Kahler, and Colby, 2015). Qualitative research on how alcohol consumers experience emotion during AHS is scarce. A notable exception is Merrill, Rosen, Walker, and Carey (2018) who found that participants did not always view the 'negative' consequences of alcohol misuse in negative terms and that contextual factors such as level of intoxication and social context impacted upon reactions to consequences. The limited qualitative research in this area has tended to focus on young adults. One such study explored the moral emotions experienced by participants dubbed 'party drinkers' aged between 18 and 23 years (Fjær, 2015). Fjær found that when participants considered behavior from the previous night an evaluation process would take place causing participants to feel negative emotions such as shame, guilt and embarrassment. The

importance of alcohol induced amnesia and how a lack of memory could lead to the suspicion of a moral failure was also a key feature of the interviews. The study provides insight into how emotions experienced by young adults can be shaped by the context of alcohol consumption, with the suggestion that 'party practices' are morally ordered with an unspoken set of rules of allowable behaviors. Should a participant act outside of the suggested allowable behavior, negative emotions would be experienced the following day. Fjær suggests that a key part of how the participants of the study would cope with difficult emotions was through social interaction with other drinkers including the recounting of stories from the previous night and teasing. This social coping acted to alleviate emotional distress. The present study aims to take a different approach by interviewing adult drinkers (aged 21 and over) who are at various stages of life to try and establish a broad idea of the emotions experienced during AHS, not tied to specific social activities such as parties nor aimed solely at a student population. A party environment with an age range of 18-23 is likely to differ from the environments experienced by adults while drinking. Risk taking, for example, has been demonstrated to be higher in younger adults than older adults (Byrnes, Miller, & Schafer, 1999) meaning that behavior will tend to be more risky in younger adults regardless of alcohol intake. Should the emotions experienced during AHS be tied predominantly to a moral judgment on intoxicated behavior, it is plausible that emotional disturbance during AHS would be less severe as consumers aged. This is supported by a cross sectional study of 51,645 men and women aged between 18 and 94 years in Denmark (Tolstrup, Stephens, & Grønbaek, 2014). The study found that occurrence of AHS following a binge drinking episode decreased with increasing age. Interestingly, this could not be explained by amount of alcohol ingested nor frequency of binge drinking. As far as the present researchers are aware, how healthy adults experience emotion during AHS remains relatively unknown.

It has also been demonstrated that negative affectivity, perception of drinking, neuroticism and previous life events are related to the development of AHS symptoms, regardless of whether a consumer is a light, moderate or heavy drinker (Harburg, Davis, Cummings, & Gunn, 1981). This

highlights that AHS is not fixed solely to the context of the previous night, suggesting factors other than the amount of alcohol ingested and specific actions undertaken while intoxicated can impact how an individual experiences AHS.

Alcohol's extensive impact on the nervous and immune systems may contribute to emotional disturbance during AHS. The two neurotransmitter systems theorized to be most affected by alcohol consumption are the GABAergic and glutamatergic systems (Weight, Aguayo, White, Lovinger, & Peoples, 1991) both of which are linked to emotion processing (Stan et al., 2014). GABA and glutamate are major inhibitory and excitatory neurotransmitters respectively (Ozawa, Kamiya, & Tsuzuki, 1998; Watanabe, Maemura, Kanbara, Tamayama, & Hayasaki, 2002). By increasing GABA production and suppressing glutamate production alcohol has a profound effect on central nervous system functioning (Valenzuela, 1997). Alcohol has also been shown to increase levels of dopamine (Boileau et al., 2003) and serotonin (LeMarquand, Pihl, & Benkelfat, 1994), release noradrenaline (Bailey, Andrews, McKnight, Hughes, & Little, 2000) and interact with endogenous opioids (Mitchell et al., 2012), all of which are key components in how emotion and mood manifest (Ruhé, Mason, & Schene, 2007; L. Sher, 1997) and have been described in detail elsewhere (McIntosh & Chick, 2004). Modulated cytokine functioning during AHS (Kim et al., 2003) has also been proposed as a possible cause of mood interference (Verster, 2008).

Alcohol consumption in the UK is common and it has been estimated that 29 million adults aged 16 and above consumed alcohol the week prior to responding to the Opinions and Lifestyle Survey (Office for National Statistics, 2017). The same survey estimated that 7.8 million people are likely to have consumed 'binge' quantities on their heaviest drinking day. The frequency of heavy drinking in the UK means that AHS is likely to occur regularly but trying to estimate the proportion of the population that is affected by AHS is challenging. Three randomized crossover trials included 172 participants from Sweden and the United States, 76% of which reported alcohol hangover after moderate alcohol intoxication (Howland et al., 2008). The Howland et al. study controlled alcohol

content intake by calculating the number of milliliters of alcohol ingested by weight and gender of individual participants. Ethical considerations mean that the amount deemed 'moderate' in this case is likely to be less than what alcohol drinkers would consume in a real life setting. Therefore, it is probable that 76% of drinkers experiencing AHS is a conservative estimate, potentially higher in the alcohol consuming population. Beverage type, participant age and sex were not associated with whether a participant experienced AHS. It is however, important to note that estimates vary widely, partly as a function of study method but have been as low as 12% in 18-29 year olds (Tolstrup et al., 2013).

A focus on student drinkers and limited qualitative research on AHS means that the experiences of adults at various life stages have been missed. AHS is a complex, highly heterogenous and societally costly syndrome that is poorly understood to the detriment of those who suffer from it and the economy. The present study aims to examine how emotions might manifest during alcohol hangover, with a concurrent consideration of mood, cognition and behavior. The study asks, are certain emotions particularly connected to alcohol hangover syndrome?

## **Method**

### ***Design***

A qualitative design was employed using semi structured interviews. An interview schedule was used to create flexible discourse regarding emotional experiences during AHS. Questions centered around the experiences of the participants with a broad focus on emotion. The schedule was initially piloted before being refined for the present study. The schedule was split informally into three sections, the first of which acted as a general introduction that probed participants about their drinking habits and the frequency of hangovers with the aim of establishing a sense of how hangovers manifested for each participant. Examples of questions include 'do you feel that you suffer from hangovers?', 'do you get hangovers regularly?', 'have your drinking habits changed over time?' The second section focused on emotion and mood exploration and explored how participants felt including questions such as, 'how do you feel during your hangovers?', 'how do you make sense of the emotions that you experience?' and 'How do you feel about yourself during a hangover?' The third and final section of the schedule focused primarily on behavior such as 'before (or during) drinking alcohol, do you anticipate how you might be affected the day (or days) following drinking?', 'Do you consider the physical symptoms or the psychological symptoms more?', 'Do you alter your behavior whilst hungover?' All interviews were conducted by the first author. The interviewer (30, male) has various person-centered work and voluntary experience (careers adviser, teacher, and trained suicide hotline volunteer) and related qualifications which made him ideal to complete the interviews in a sensitive and empathic manner. Participants were provided an information sheet that provided basic information about the study. If participants began to digress during the interview, the interviewer would politely attempt to redirect the discussion. This was an attempt to focus specifically on emotional experience during AHS, rather than the consequence of intoxicated actions. Data saturation was considered prior to completing the study and it was decided that participant

recruitment would conclude when a state of informational redundancy began to occur (Sandelowski, 2008). A thematic analysis informed by Braun and Clarke's methodological guidelines (2006, 2013) was conducted to develop and report themes from the interview transcripts. The study received ethical approval from the [blank for review] University Ethics Committee.

### ***Participants***

Participants were recruited as part of an opportunity sample through word of mouth, a recruitment email sent to the [blank for review] department and via social media. Participants were required to be a minimum of 21 years of age. A total of 20 participants took part (14 female, 6 male) and were aged between 21 and 39 years ( $M = 28.05$ ). All participants were in employment across various sectors with the exception of one full-time student. The sample was predominantly White-British with participants coming from various parts of the United Kingdom. Participants were screened prior to taking part. Any individuals with a diagnosis of alcohol use disorder (past or present) or individuals that were currently receiving treatment for a mental health condition were excluded from the study to avoid clinical elements that could impact emotional experience and thus the generalizability of the dataset. All participants were still active alcohol consumers but demonstrated variable drinking habits, with some only presently drinking on special occasions (less than monthly) and others drinking on a weekly or bi-weekly basis. The frequency of hangovers experienced mirrored this variability. Participants have been given pseudonyms and any identifiable information has been anonymized to protect confidentiality.

### ***Procedure***

Interviews, either face to face or via video call took place in private study rooms at [blank for review] and lasted between 25 minutes and 45 minutes (M = 32.42 minutes). Only the interviewer and the interviewee were present during each interview. Each interview was transcribed verbatim and included nonverbal utterances. A transcription notation system modelled on the Braun & Clarke framework (2013) adapted from Jefferson (2004) was used. Transcription took place as soon as possible after interviews to try to ensure optimum accuracy, minimizing the frequency of inaudible segments for each recording. Microsoft Word 2016 was used to transcribe the interviews and NVivo software (version 11) was used for coding and theme creation.

### ***Analysis strategy***

An inductive approach was adopted to ensure that the analysis remained strongly linked to the dataset, remaining as objective as possible, aiming to identify surface level meaning-based. Extracts from interviews were used illustratively alongside analytic points. The thematic analysis conducted followed the Braun and Clarke framework (2006, 2013) outlined below.

A period of familiarization with the data set was undertaken that included listening to the audio recordings and reading the interview transcripts several times. As the research question was broad, a complete coding of the data set was then undertaken to identify all possible instances that may have been of value to the research question. Coding centered on how participants described emotion. After several refinements, 74 codes remained and were used alongside thematic maps to develop five candidate themes. Coding was completed by the first author.

Codes were reviewed in search of compelling extracts from participants. These are discussed during the results section of the report. In line with Braun and Clarke guidelines (2013), extracts were 'cleaned up' to enhance readability. As per these guidelines, '[...]' was used to signify that an extract has been edited any further than repeated words and minor hesitation.

Once the candidate themes had been systematically reviewed, compared and refined, four themes remained. Theme definitions were then compiled alongside supporting extracts.

## Results

The inductive thematic analysis led to the creation of four themes, each of which detail differential aspects of emotional experiences described by the participants in the present study. The themes were titled; 'The Tyranny of the Shoulds', 'Bias and the Persistence of Memory', 'Staring into the Void' and 'Emotive behavioral response'. Some overlap exists between the themes due to the complexity of participant experiences and will be discussed during the analysis.

Themes are presented in an order that reflects the nature of the theme itself. The first three themes explore different emotional clusters, starting with the experiences that were easiest for participants to rationalize and progressing to more challenging emotional experiences that were harder for participants to comprehend. The fourth and final theme is tied to how behavior changes during AHS influence further emotional experiences. Each theme is accompanied by a definition relating to the organizing factor and supporting extracts. See Figure 1 for a brief overview of themes.

## Themes

### *The Tyranny of the Shoulds*

The Tyranny of the Shoulds refers to emotional responses driven by intoxicated actions incongruent with a participant's internal belief/value. This aspect of AHS seemed to be a relatively automatic cognitive process, logical and easily understood by participants, although still provoking challenging emotional experiences. Across the theme participants expressed the notion that 'they should know better'. The theme consists of two subthemes, 'Bad Behavior' and 'Cyclic Relationship with Alcohol'.

#### *Bad Behavior*

Bad Behavior details common emotional responses and self-flagellating cognitions that occur because of the previous night of alcohol consumption. This was tied to a specific behavior or conversation that a participant may have had the previous evening that was unlikely to have occurred without intoxication. This also manifested in the guilt and regret participants expressed for wasting a day due to AHS or letting down a friend or family member.

Feelings of shame and self-flagellation were evident across the dataset and were encapsulated by Davina (22, female, employed) who described feelings of disbelief when having to confront intoxicated behaviors, *"I think if it's a super bad one I think you almost start to think like, 'ooh' like, I think you almost analyze the night before n think, 'I probably shouldn't've done that' or like 'what was I saying?' like if I was drunk 'oh what was I saying to that person?'"* The notion that time is valuable and that being hungover is a waste of time was frequently expressed across the interviews and was summarized by Alan (25, male, employed), *"I should be doing something more like with the weekend, I should be doing something productive or should be looking after myself more, I should be a bit healthy, I shouldn't be doing this anymore, I should be doing something a bit more proactive"*. Most participants echoed this sentiment and it was often suggested that binge drinking is not

indicative of adult behavior, explained by Grace (27, female, employed) here, *“I’ll look back and you know I’ll be like ‘I’m twenty-seven years old I can’t do this anymore, I’m not eighteen erm why did I do it?’”*

Negative repercussions were often expressed as deserved. If this was interpreted to have impacted other people then the negative emotional response would be exacerbated, illustrated by Davina (22, female, employed) who spoke of occasions when AHS would impact their relationship with family members, *“you actually start to put like your family second because you were an idiot n you drank too much”*

#### *Cyclic relationship with alcohol*

This subtheme provided insight into feelings of agitation in participants due to an accumulation of negative experiences over a long period of time. Participants expressed a desire to change long-term drinking behaviors to help alleviate AHS during future drinking episodes but often failed to implement such a change. The inability to break the cycle appeared tied to severe self-flagellation, diminished self-esteem and exasperation. These longer-term factors were described as more challenging than the short-term responses found in ‘Bad Behavior’. Participants explained difficult emotions and, in some cases, routines that revolved in some capacity around drinking. None of the participants reported ever having experienced alcohol related problems yet many spoke of significant difficulty in breaking a cycle that they had deemed harmful in some way.

Ellie (26, female, employed) encapsulated the impact of this cyclic relationship on their self-worth, *“Feelings of despair, worthlessness because I’ve done it several times, you then sort of like, [...] not blame, but you sort of like say ‘look what you’ve gone and done’, like you have this inner monologue of when you keep making those same mistakes through alcohol and then it’s just like ‘why have I done this again?’ and sort of those feelings of like that ‘you’re a fuck up’ kinda thing”*

These irritations stemmed from the simplicity of the cycle itself illustrated by Meghan (28, female, employed):

*“as an intelligent person I’d like to think that I should know [...] this is literally a constant cycle of- I’ll decide- I’ll say ‘I’ll drink one thing repetitively’ and then I won’t [...] then I feel like really angry at myself, I think the sense of anger is coming out a lot, I just feel annoyed, I feel annoyed that I know how to not get a hangover but yet repetitively do things to get it”*

Another example of this cycle was experienced by Jean (38, female, employed), who described a substantial impact on motivation for up-to two weeks after alcohol consumption:

*“It’s almost like my life revolves in fortnights, so it’s like I don’t drink for a couple of weeks or I drink and then for two weeks I’m useless, I’m not useless that’s a strong exaggeration but my mood is affected, the will to get up and do this stuff is completely different and then by the end of the two weeks it’s almost like it’s out of my system and I want exercise I want to do all the things I should be doing”*

### ***Bias and the Persistence of Memory***

Bias and the Persistence of Memory explores how the predominantly cognitive processes during AHS contribute to the emotions experienced. This includes the interpretation of memories from either the day of the hangover, the previous night of alcohol consumption or general life events. Central to this is the tendency for participants to interpret memories as negative, regardless of the nature of the memory. Participants reported patterns of rumination and paranoia and suggested that it was challenging to remaining rational during AHS. Participants described a 'magnification' effect which often drew dormant feelings to the forefront of consciousness. There was also a propensity for participants to speak nostalgically of the experience of camaraderie and AHS as a young adult. Although the role of camaraderie is discussed during the 'Emotive Behavioral Response' theme, it's noted absence and associated bittersweet interpretation was important to the present theme. It served as a reminder to some participants of what they no longer had.

Rumination and the difficulty in remaining rational was evident across the interviews and this was particularly poignant for Patrick (29, male, employed). During the interview, they made it clear that they were susceptible to irrational thoughts regardless of alcohol, but this was intensified during AHS. Speaking of their feelings of 'humiliation' Patrick explains how they were impacted by rumination:

*"There was all of these thoughts and feelings I couldn't resolve until I went back to work and I was dreading going back to work even though ((pause)) like I could be, if I was rational with myself I could say, 'yeah these guys are just having a good time, it's just a good night, a fun night I've made a mistake on how much I drank maybe but apart from that its fine', but I couldn't, I couldn't shake these thoughts like 'everyone's gonna think I'm a weirdo'"*

A lingering sense of paranoia was described by Patrick, an effect that continued *"for a few days"* and was particularly distressing, *"I couldn't distract myself from it but I don't think it does much good, I think it just, I can't, I can't get answers that way, I can't"*. This desire to seek answers or explain

events and an inability to problem solve during AHS was common across the interviews. Participants regularly explained being caught in particularly distressing patterns of rumination. In the example above, Patrick was caught in this state for a weekend until they could break this cycle. The intensity of the thoughts and the relentless propensity for negative cognitions to repeat in the participants minds caused extremely challenging emotional experiences. Participants often used words such as 'dwell', 'obsess' or 'stew' to describe their experiences and it was clear that participants who found themselves caught in patterns of rumination also struggled to distract from this. A negative interpretation bias was evident, and participants explained that even if no negative behavior had occurred, some neutral or positive behavior that had occurred would be interpreted as negative. This was apparent for Scarlett (23, female, employed), *"even if I don't do anything embarrassing, even if it was just a conversation where I feel like I might've said something wrong you think about that and it always plays on my mind when I'm hungover [...] I try not to think about it as much as I can but it seems to be all that I can think about"*. This negative interpretation bias was not limited to thoughts of the previous night but extended to relationships, insecurities and quality of life. James (26, male, employed) encapsulated this, *"you might think about yourself like relationships or your weight or something else, or regards to your appearance will be a lot more increased"*. Participants expressed the idea that during AHS there was an increased likelihood for distressing thoughts or memories to arise that were otherwise dormant. In Olivia's (36, female, employed) case this could go back years, *"sometimes I will think about things that I've done years before that aren't connected at all and just 'oh like I need to dig a hole and get into it'"*.

Paranoia manifested itself in different ways for participants but was consistent across many of the interviews. Some participants described fear that the symptoms (physical or psychological) being experienced during AHS were too extreme or were lasting too long to have been induced purely by alcohol. This lead Steven (26, male, employed) to consider pursuing medical attention, *"I had felt really awful in terms of mood for about four days to the point where it seemed like it was more than a hangover [...] at the time it felt like 'oh this is a depression' or something like that, like an actual*

*thing that I should go to the doctors about. A few days later I felt totally fine so it seemed totally contained to the hangover".* Participants described that it was only in hindsight when AHS had subsided that it was possible to identify the experience as alcohol induced.

Nostalgia was often expressed by participants when describing their experiences of AHS. This was at times bittersweet, particularly when the absence of AHS camaraderie was identified. Ellie (26, female, employed) felt this particularly severely:

*"I'd get drunk quite often because I'd moved into a new flat with a friend from uni, so we would do that together, so we would be quite like- you'd have the camaraderie I think. But then this past year she's sort of been coupled up n I've been on my own quite a lot. So like occasionally I will just have a bottle of wine on my own in the house and it's fine but then there's been times where I've been out with other friends, but then because the next day the flats empty and I'm alone it's quite- like a lot of emotional hangovers have been happening"*

## ***Staring into the Void***

Staring into the Void explores troubling emotional experiences that were difficult or impossible for participants to explain. It attempts to capture the lingering notion described by participants that 'something isn't right' during AHS. Staring into the Void consists of two subthemes, 'The Under Toad' and 'The Hangover Blues'.

### *The Under Toad*

The Under Toad is a state of underlying uneasiness/anxiety. Participants described feelings of disquietude, dysphoria or malaise and complex emotion and cognitive responses such as dread. Accompanying these difficult experiential feelings was an increased likelihood of existential or catastrophic cognitions and the tendency to ask 'big' emotive questions during AHS. When participants spoke of these existential moments they tended to be detached from the previous night of intoxication. Participants expressed a lack of control over these feelings and explained that it was a case of waiting until the next day for them to diminish. It was often explained that when these feelings subsided, a state of confusion at what had been experienced ensued.

Heidi (27, female, employed) encapsulates how this negative state is experienced in their social group, *"we call it 'the doom', it's like the doom, it's like staring at the void kinda thing and I've not done anything bad but everything just seems so much more kind of erm catastrophic, like catastrophic thinking the next day, it's crazy"*

This notion of doom was echoed by Sophie (39, female, employed), *"I'll feel really kind of like almost like a sense of doom [...] you just feel like this general sense of anxiety [...] that kind of everything is not okay, you know when you have that sense of there's something not okay, there's something not okay but its nonspecific n then I'll be like 'what's not okay? What's not alright?'"*

For some participants, the increased propensity to think in an existential manner was overwhelming. Some thematic ties exist with 'Bias and the Persistence of Memory' in the sense that participants asked these 'big' questions with a negative interpretation bias. However, in the case of 'The Under Toad', this reflected feelings of disillusionment on a larger scale. Grace (27, female, employed) articulated the sense of futility they experience during AHS with a degree of jest, "*depending on the level of the hangover I'd start like reassessing my entire life*". When probed further about this Grace expressed experiencing unpleasant cognitions, "*just like questioning loads of things like, 'why am I even-', if I'm by myself like, 'why am I in the job that I'm in?', 'why do I live where I live?', 'why don't I have certain things?'*"

### *The Hangover Blues*

The Hangover Blues refers to a low mood state ranging from general sadness to symptoms more akin to a depressive episode. This could manifest in crying while hungover at events that would ordinarily not trouble participants, an experience that provoked bemusement. Some participants also referred to being in a state analogous to anhedonia, explaining that during AHS it was either extremely unlikely or impossible to experience positive emotion.

There was a tendency for low mood states to linger long after physical symptoms had subsided, explained here by Steven (26, male, employed), "*although the physical effects might subside within a day, I can feel depressed for maybe like three days or four days*"

Participants explained feeling 'teary' either without good reason. Gemma (24, female, employed) explains having an emotional reaction that would never normally trouble them:

Gemma: "*I cried because I was that hungover. Like that is not like me at all, I'm not much of a crier, I'm not a very emotional person, I cried at Harry Potter [...] even though I've seen the film thousands*

*of times, that was a bad one [...] I think it's a lot of crying when I'm hungover [...] I wasn't bothered about anything, nothing had upset us in me personal life it was literally just that"*

Leah (21, female, student) described the inability to experience positivity that was echoed by many participants, *"when you're hungover you're not really susceptible to good mood [...] like it's not compatible"*

### ***Emotive Behavioral Response***

Emotive Behavioral Response focuses on behavioral responses to the negative symptoms of AHS.

How someone behaved, and the decisions that were made during AHS, interacted with the emotional and mood state of the drinker. Behavioral changes would either alleviate or exacerbate emotional discomfort. Participants tended to predominantly fall under behavioral patterns of one of the two subthemes titled, 'Disengaged and detached' and 'Proactive coping'.

#### *Disengaged, detached and vulnerable*

This subtheme centered around social withdrawal and the need to isolate oneself. Participants described being in a vulnerable state, emotionally fragile, with a need to feel comfortable. If participants were unable to withdraw, a variety of negative emotional reactions or mood states could occur. Further to this, if a participant was experiencing AHS differently to any peers that might have been present during the hangover, this could provoke a temporary dissonance within the relationship and trigger further negative emotions.

The desire to withdraw and isolate oneself from the outside world was a commonly reported reaction to the difficult symptoms participants had experienced. This comfort seeking behavior was akin to hibernation, where participants would retreat to a safe place, often a bed, until recovered. Participants often spoke of 'hiding' when describing this. Eric (35, male, employed) describes this avoidance, "*I kinda just want to sort of hide and not be noticed, feeling very self-conscious*".

Participants across the dataset often echoed the sentiment that the day 'needed to be over'.

Alongside this, participants described a need to be in a place that was their own, a desire for peace, predictability and security. Grace (27, female, employed) found themselves in a particularly difficult hangover state, some distance from home, with the daunting prospect of a long journey back:

*"I just like needed that journey to end, it was awful like I could- I struggled to even get dressed in the morning, I was like 'I'm gonna cancel my train and just stay in [city]' [...] just needed to get home into my own bed like in my own space"*

Together with the desire to 'hibernate', participants repeatedly expressed the need to be alone in order to help process negative emotions. The suggestion was that being around other people would impair the recovery process, as the nature of this state was personal and private, as expressed by Zoe (23, female, employed), *"sometimes I would wanna just be alone with my thoughts, like if I'm having like negative- like if I'm having those sorts of thoughts I wouldn't want someone else to be there"*

Participants spoke of an emotional fragility that made normal experiences more challenging. This fragility inhibited risk taking behavior by negatively impacting a participant's confidence. Alan (25, male, employed) encapsulates this below:

*"I wouldn't wanna do something where there could be a negative thing, where there could be rejection or anything like that, I'd rather just be on my own for a while [...] most of the time like today for example, if I ask someone to do something n they said no I wouldn't be too fussed, I'd be like, 'okay I'll find someone else to do-' but if on those days ((pause)) I wouldn't want that back, I wouldn't want that sort of even if they had a good reason I'd just be like 'oh why are they doing that?' And I'd probably overthink it"*

### *Proactive coping*

This subtheme details a series of behaviors that saw certain participants seek human interaction or adopt a strategy to alleviate the negative symptoms of AHS. In contrast to the patterns of isolation and 'hibernation' described in 'Disengaged, Detached and Vulnerable', participants who described having a social group who exhibited similar symptoms reported drawing comfort in this shared

experience, often describing feelings of camaraderie. Some participants described a catharsis from being able to talk through negative emotions, moods or cognitions that were being experienced during AHS. Participants also used tools such as mindfulness, yoga, meditations and being kind to oneself as ways to promote emotional relief.

Olivia (36, female, employed) spoke of the respite they experienced from AHS symptomatic congruence, *“because you’ve got it in common you’re kinda talking about it, I suppose it might slightly bring us closer together because you do sort of share things”*. This was echoed by Jean (38, female, employed) in terms of romantic relationships, *“when you’re both hungover it sometimes enhances relationships, like the drink- having a drink, having a laugh together, being able to like reminisce about the night before”*.

Participants used coping mechanisms that had been adopted in day-to-day life to help manage the cognitions and emotions that were being experienced during AHS. Eric (35, male, employed) used meditative practices to remain mindful of his thoughts and feelings during AHS:

*“I do try to meditate to try to stop-, not stop, just recognize what I’m thinking and where I am, so typically if I’m in bed and I’m trying to sleep I might erm yeah meditate or just do something to erm to try to change my thought stream towards something which I’m looking forward to”*

## Discussion

Through collecting data from a healthy adult sample, the present study explored some examples of how emotion can manifest during AHS. AHS is known for its heterogeneity of symptoms (Prat et al., 2009) and the experiences described by participants corroborated this. An array of negative emotions were commonly described by participants including guilt, shame, dread, anger and regret. Emotions appeared to cluster, allowing for the conceptualization of four themes; 'The Tyranny of the Shoulds', 'Bias and the Persistence of Memory', 'Staring into the Void' and 'Emotive Behavioral Response'. Each theme had distinct organizing factors or constructs (behavior, cognition and mood) - see Figure 1, although elements of each theme overlapped at points due to the complexity of the experiences described by participants. Together, the themes helped answer the research question, 'Are certain emotions particularly connected to alcohol hangover syndrome?'

Contrary to research suggesting that AHS occurred less frequently with age following a binge drinking episode (Tolstrup et al., 2014), the participants of the present study universally expressed that hangovers had become considerably more difficult, both emotionally and physiologically. How participants socially interacted during AHS played a central role in the emotional experiences described by participants. Many participants expressed that the social dynamics of friendship groups had changed with time. Nostalgia was often evident when participants articulated how AHS had been experienced in the past, how social camaraderie in late-teens/early twenties made the experience acceptable and even positive at times. As participants aged, this camaraderie had wilted or disappeared altogether, leaving participants alone to cope with the experience. It was often expressed that the shared experience of negative AHS symptoms had made things easier in the past and the notable absence of AHS camaraderie was difficult for some participants. It may be the case that if the physiological symptoms of AHS grow more severe with age it may become more difficult to socially interact with others, limiting the opportunities alcohol consumers have to experience

camaraderie.

Not all participants had lost this social camaraderie during AHS however. The small number of participants who benefitted from currently having a social group with members that experienced similar negative symptoms of AHS generally described milder emotional distress, supporting the earlier research exploring the role of alcohol and drinking identity in a social context (Fjær, 2012; Scott, Shucksmith, Baker, & Kaner, 2017). Being able to experience a congruence among peers during AHS meant that participants could alleviate suffering and allowed space for positivity, something that was mostly lacking in participants who experienced AHS alone. This reflects the finding in younger adults that negative emotions during AHS could be dealt with socially through storytelling telling and teasing (Fjær, 2015), suggesting the practice may be just as beneficial for adults as well as student drinkers. This is supported by research demonstrating the importance of social support systems as a protective mechanism to help people through difficult experiences (Cohen & Wills, 1985).

Nostalgia may be triggered by a psychological threat as a mechanism to restore wellbeing. Threats include low mood (Wildschut, Sedikides, Arndt, & Routledge, 2006), loneliness (Zhou, Sedikides, Wildschut, & Gao, 2008) and a sense of meaningless (Routledge et al., 2011) all of which were described by participants in the present study. The role of nostalgia during AHS appeared bittersweet, with participants recurrently describing feelings of sadness at what was now missing from their experience of AHS and sometimes from life in general.

The act of rumination was a key cognitive and behavioral element to how numerous participants experienced emotions during AHS. Many participants also described being without distraction, which provided extended periods of time to 'dwell'. The consequence of extended periods of rumination appeared tied to the emotions of sadness and shame. Rumination has been shown to be related to both depressive and anxiety symptoms (Nolen-Hoeksema, 2000) and individuals prone to rumination have been demonstrated to more frequently use alcohol to cope with difficult emotional

experiences (Nolen-Hoeksema & Harrell, 2002). It may be the case that participants who described difficult cycles of rumination during AHS are already prone to this behavior. Therefore, AHS may simply be aggravating the problem due to the amount of time a sufferer can spend alone and without distraction.

Rumination has also been shown to heighten negative interpretation bias (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998) and impair problem solving (Lyubomirsky, Tucker, Caldwell, & Berg, 1999). Participants reported negatively interpreting memories associated with the night before and often struggled to stop ruminating. This may go some way in explaining why participants were describing affective disturbance that lasted considerably longer than 24 hours.

Whether participants were prone to rumination is impossible to tell from the present study, as no measures were included to ascertain this. The response styles theory (Nolen-Hoeksema, 1991) suggests that rumination enhances the impact of low mood on cognition, increasing the likelihood that people will use negative thoughts and memories to try to understand their current state. As low mood has been widely associated with AHS (McKinney & Coyle, 2006; Swift & Davidson, 1998; Verster, 2008), it may be the case that the negative interpretation of events is in part due to low mood, and when the mood eventually subsides alcohol consumers can reevaluate memories from a more neutral perspective. This was often the case in the present study, with participants describing a post hangover realization that whatever event was interpreted negatively was considerably less undesirable than appraised during AHS. Tackling negative interpretation bias has been considered for the treatment of depressive disorders, being described as a “cognitive vaccine” (Holmes, Lang, & Shah, 2009). If an interpretation bias modification could be applied to those suffering from AHS, a positive change in cognition could potentially create a domino effect behaviorally, emotionally and physically, in line with the principles of cognitive behavioral therapy (Hollon & Beck, 1994). It is important to highlight that any self-help intervention aimed at alleviating challenging cognitions would need to be simple and easy enough for someone in an impaired state to complete, perhaps

learnt while an individual is not suffering from AHS and then applied during. It is also essential to consider the moral implications of any intervention as it could potentially promote problematic drinking habits.

The interactions between nostalgia, negative interpretation bias and rumination together appear key to many negative emotional experiences during AHS. As nostalgia has been demonstrated to be more often positive than negative (Sedikides, Wildschut, Arndt, & Routledge, 2008) it may be the case that the negative interpretation bias experienced during AHS creates a 'grass-is-greener' comparative effect. The negative emotions experienced are interpreted as more severe in comparison with the nostalgic memories of AHS during youth, as unpleasant memories tend to fade faster than positive memories, described as the fading affect bias (Walker, Skowronski, & Thompson, 2003). In this sense, negative interpretation bias and patterns of rumination may be distorting the usually positive function of nostalgia.

Participants experiencing unexplainable emotions associated with the 'Staring into the Void theme' are challenging to interpret. It may be the case that complex experiential feelings such as dread are caused by different factors to those preceding guilt or regret. Dread, a complex amalgamation of emotion (fear) and related cognitions is a particularly negative emotional experience generally associated with an impending event or decision to be made (Harris, 2012). What became apparent in the present study is that these difficult emotional responses were being experienced seemingly without cause and were considerably challenging for participants.

### ***Limitations, implications for practice and future research***

A strength of the study was its use of an adult sample, with participants predominantly in employment from various professional sectors as opposed to a sample of student drinkers. This allowed for a broad exploration of experience building upon studies that investigated AHS in young adults or teenagers (Fjær, 2012, 2014, 2015). The current study highlights dimensions of AHS that have not been documented elsewhere, and offers supporting construct and ecological validity to existing and established quantitative research on the role of regret, notably guilt and shame in alcohol use (Patock-Peckham, Canning, & Leeman, 2018); while also extending the existing concept of the 'hangover war story' – a narrative concerning the severity of symptoms from the 'worst hangover ever' (Shorter et al., 2017).

The present study offers strong ecological validity to the study of AHS. The amount of alcohol that can be administered in a quantitative study must adhere to strict ethical guidelines (Dolinsky & Babor, 1997) meaning it is unlikely to reflect naturalistic binge drinking quantities of alcohol. Participants in the present study spoke of considerable alcohol intake during binge drinking episodes that could not be replicated in a laboratory setting. Using semi structured interviews allowed for the documentation of vivid descriptions of real life hangovers that would otherwise remain unchronicled. The insight provided by this study could be used as a starting point to incorporate more comprehensive dimensions of emotion to empirical definitions of AHS. A caveat to this however is that it is not possible from the study to say categorically that the emotions that participants discussed were due to AHS and not a response to intoxicated actions. Although the interviewer attempted to keep participants focused on the emotional reaction during AHS, rather than the experience of heavy drinking in general, it is possible that the memory of these events become interwoven in the participants' minds. The aforementioned ethical considerations and the behavioral changes that often occur during intoxication means that it is very challenging to study AHS in isolation.

Participants who suffer from more severe hangovers are unlikely to attend a laboratory-based study. Nonresponse bias exists in alcohol research (Kypri et al., 2004) and quantitative research is not equipped to have captured the experiences described in the present study. Participants described patterns of thinking and behavior that at times resembled psychological symptoms akin to common mental health problems such as anxiety disorders and depression. Those seeking to alleviate distressing symptoms of AHS are likely to be advised to change their drinking habits, however in a society geared toward alcohol consumption, social pressures may make it difficult to change this behavior. Participants in this study discussed alcohol consumption and AHS as a cycle that was extremely difficult to break.

The study was not without its limitations. Limited consideration was given to the impact of other drugs. Alcohol use, particularly binge drinking, may occur alongside the consumption of a variety of psychoactive substances (Measham & Brain, 2005) which are likely to exhibit substantive emotion and mood effects the following day (Ashton, 2001; Breiter et al., 1997; Parrott & Lasky, 1998). Future research should incorporate a series of questions regarding present and historical substance use to establish any possible interactions that may impact an individual's experience of emotion during AHS.

Volunteer bias also means that the experiences of the present sample are not necessarily reflective of all alcohol consumers. The study sought individuals that experienced negative emotions and/or mood states after drinking and therefore any claims of generalizability need to be carefully considered. Although the findings do not necessarily apply to all sufferers of AHS, the study is particularly valuable in that it explores the experiences of participants that are significantly impacted on an emotional level, sometimes for days at a time, which to the present researcher's knowledge, hasn't been investigated before. As AHS is a construct that exists on a continuum of severity, it is important to understand the full scope of AHS experiences.

The sample was also female skewed, although research on whether sex differences exist in how AHS is experienced is conflicted. Some studies have shown no significant difference between the sexes (Harburg, Gunn, Gleiberman, DiFranceisco, & Schork, 1993; Howland et al., 2008) while other research has demonstrated hangover intensity for women as significantly higher than that of men (Verster, Van Duin, Volkerts, Schreuder, & Verbaten, 2003). This conflict in the literature makes it difficult to ascertain how a female skewed sample might impact the generalizability of the present findings. A further consideration is that due to time constraints, the lead author of the study was responsible for the collection, coding and summarising of the data. Overall summaries of the data were then discussed with another member of the research team. Future studies in this area should utilize more than one coder to reduce researcher bias and increase objectivity (Armstrong, Gosling, Weinman, & Marteau, 1997).

Recall bias may also be present, as the participants discussed experiences that occurred at various points in the past. A methodological approach that could address this in future research is ecological momentary assessment (EMA) (Shiffman, Stone, & Hufford, 2008). EMA allows the recording of immediate participant experience including mood and behaviour (Burke et al., 2017). A longitudinal study employing smart phone technology to enable participants to record subjective emotion & mood states during AHS may be particularly beneficial in understanding how emotion is experienced. This would place relatively little strain on potential participants who may otherwise be put off by attending laboratory studies due to the severity of AHS symptoms and would add to the findings of the present study. This would also capture data regarding the frequency of alcohol consumption, adding a statistical element to the analysis that could be valuable.

## **Conclusion**

The present study documented a diverse range of distressing emotions connected to AHS including guilt, shame, dread, anger and regret. Rumination, negative interpretation bias, nostalgia, self-flagellation, isolation, camaraderie (or lack of), existential angst and catastrophic thinking were important in how participants described their emotional experiences. Four themes were created to account for differential aspects of the emotional experiences during AHS titled; 'The Tyranny of the Shoulds', 'Bias and the Persistence of Memory', 'Staring into the Void' and 'Emotive behavioral response'. The study adds ecologically valid data from healthy UK alcohol consumers to AHS research, a syndrome that is under-researched, poorly defined, costly and ubiquitous among alcohol consumers.

Figure 1. Themes, organizing factors and subthemes

Theme name	Subthemes	Organizing concept	Key features	
The Tyranny of the Shoulds	Bad behavior	Cyclic relationship with alcohol	A behavior (or lack of behavior) clashing with an internal value causing a negative emotional reaction	Guilt, shame, frustration, self-flagellation
Bias and the Persistence of Memory	-	-	Predominantly cognitive aspects that further impact emotional experiences during AHS	Anxiety, paranoia, rumination, negative interpretation bias, shame, nostalgia
Staring into the Void	The Under Toad	The Hangover Blues	Hard-to-explain negative emotions or mood states	Anxiety, low mood, dread, catastrophic cognitions, existential cognitions
Emotive Behavioral Response	Disengaged, detached and vulnerable	Proactive coping	Behavioral responses to AHS cause further emotional experiences	Emotional fragility, isolation, comfort-seeking, camaraderie

## References

- Al-Shawaf, L., Conroy-Beam, D., Asao, K., & Buss, D. M. (2016). Human emotions: An evolutionary psychological perspective. *Emotion Review*, *8*(2), 173-186.
- Ashton, C. H. (2001). Pharmacology and effects of cannabis: a brief review. *The British Journal of Psychiatry*, *178*(2), 101-106.
- Armstrong, D., Gosling, A., Weinman, J., & Marteau, T. (1997). The place of inter-rater reliability in qualitative research: an empirical study. *Sociology*, *31*(3), 597-606.
- Bailey, C., Andrews, N., McKnight, A., Hughes, J., & Little, H. (2000). Prolonged changes in neurochemistry of dopamine neurones after chronic ethanol consumption. *Pharmacology Biochemistry and Behavior*, *66*(1), 153-161.
- Barnett, N. P., Merrill, J. E., Kahler, C. W., & Colby, S. M. (2015). Negative evaluations of negative alcohol consequences lead to subsequent reductions in alcohol use. *Psychology of Addictive Behaviors*, *29*(4), 992-1002.
- Beck, A. T. (1970). Cognitive therapy: Nature and relation to behavior therapy. *Behavior therapy*, *1*(2), 184-200.
- Beedie, C., Terry, P., & Lane, A. (2005). Distinctions between emotion and mood. *Cognition & Emotion*, *19*(6), 847-878.
- Bobier, C. A. (2017). Deflating Moods. *Southwest Philosophy Review*, *33*(1), 25-32.
- Boileau, I., Assaad, J. M., Pihl, R. O., Benkelfat, C., Leyton, M., Diksic, M., . . . Dagher, A. (2003). Alcohol promotes dopamine release in the human nucleus accumbens. *Synapse*, *49*(4), 226-231.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, *3*(2), 77-101.
- Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. London, England: Sage.
- Breiter, H. C., Gollub, R. L., Weisskoff, R. M., Kennedy, D. N., Makris, N., Berke, J. D., . . . Riorden, J. P. (1997). Acute effects of cocaine on human brain activity and emotion. *Neuron*, *19*(3), 591-611.
- Burke, L. E., Shiffman, S., Music, E., Styn, M. A., Kriska, A., Smailagic, A., . . . French, B. (2017). Ecological momentary assessment in behavioral research: addressing technological and human participant challenges. *Journal of medical Internet research*, *19*(3).
- Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clinical psychology review*, *26*(1), 17-31.
- Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological bulletin*, *125*(3), 367-383.
- Calder, I. (1997). Hangovers. *BMJ: British Medical Journal*, *314*(7073), 2.
- Calonne, D. S. (2003). *Charles Bukowski: Sunlight Here I Am: Interviews and Encounters 1963-1993*: Northville, Michigan, Sun Dog Press.
- Clark, D. M. (2011). Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: the IAPT experience. *International review of psychiatry*, *23*(4), 318-327.
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological bulletin*, *98*(2), 310.
- Crofton, J. (1987). Extent and costs of alcohol problems in employment: a review of British data. *Alcohol and alcoholism*, *22*(4), 321-325.
- Cunningham, J. A. (2012). Comparison of two internet-based interventions for problem drinkers: randomized controlled trial. *Journal of medical Internet research*, *14*(4).
- Curtin, J. J., Patrick, C. J., Lang, A. R., Cacioppo, J. T., & Birbaumer, N. (2001). Alcohol affects emotion through cognition. *Psychological Science*, *12*(6), 527-531.
- Darwin, C. (1872/1965). *The expression of the emotions in man and animals* (Vol. 526): University of Chicago Press (Original work published 1872).

- Davis, M. A. (2009). Understanding the relationship between mood and creativity: A meta-analysis. *Organizational behavior and human decision processes*, 108(1), 25-38.
- Dietler, M. (2006). Alcohol: Anthropological/archaeological perspectives. *Annu. Rev. Anthropol.*, 35, 229-249.
- Dolan, R. J. (2002). Emotion, cognition, and behavior. *science*, 298(5596), 1191-1194.
- Dolinsky, Z. S., & Babor, T. F. (1997). Ethical, scientific and clinical issues in ethanol administration research involving alcoholics as human subjects. *Addiction*, 92(9), 1087-1098.
- Ekman, P., Friesen, W. V., & Ellsworth, P. (1972). *Emotion in the human face: Guidelines for research and an integration of findings*. New York: Pergamon.
- Ellis, A. (1958). Rational psychotherapy. *The Journal of general psychology*, 59(1), 35-49.
- Fjær, E. G. (2012). The day after drinking: Interaction during hangovers among young Norwegian adults. *Journal of Youth Studies*, 15(8), 995-1010.
- Fjær, E. G. (2014). Making sense of a multitude of (immoral)'intoxicating stories'. *International Journal of Drug Policy*, 25(3), 353.
- Fjær, E. G. (2015). Moral Emotions the Day After Drinking. *Contemporary Drug Problems*, 42(4), 299-313.
- Frijda, N. H. (2009). *Mood* (D. Sander & K. R. Scherer Eds.). Oxford, England: Oxford University Press.
- Frijda, N. H., & Davidson, R. J. (1994). *Varieties of affect: Emotions and episodes, moods, and sentiments*. USA: Oxford University Press US.
- Gendron, M. (2010). Defining emotion: A brief history. *Emotion Review*, 2(4), 371-372.
- Gruber, R., & Cassoff, J. (2014). The interplay between sleep and emotion regulation: conceptual framework empirical evidence and future directions. *Current psychiatry reports*, 16(11), 500.
- Harburg, E., Davis, D., Cummings, K. M., & Gunn, R. (1981). Negative affect, alcohol consumption and hangover symptoms among normal drinkers in a small community. *Journal of Studies on Alcohol*, 42(11), 998-1012.
- Harburg, E., Gunn, R., Gleiberman, L., DiFranceisco, W., & Schork, A. (1993). Psychosocial factors, alcohol use, and hangover signs among social drinkers: a reappraisal. *Journal of Clinical Epidemiology*, 46(5), 413-422.
- Harris, C. R. (2012). Feelings of dread and intertemporal choice. *Journal of Behavioral Decision Making*, 25(1), 13-28.
- Hollon, S. D., & Beck, A. T. (1994). *Cognitive and cognitive-behavioral therapies* (S. D. Bergin & S. L. Garfield Eds.). Oxford, England: John Wiley.
- Holmes, E. A., Lang, T. J., & Shah, D. M. (2009). Developing interpretation bias modification as a "cognitive vaccine" for depressed mood: imagining positive events makes you feel better than thinking about them verbally. *Journal of Abnormal Psychology*, 118(1), 76.
- Howland, J., Rohsenow, D. J., Allensworth-Davies, D., Almeida, A., Minsky, S. J., Arnedt, J. T., & Hermos, J. (2008). The incidence and severity of hangover the morning after moderate alcohol intoxication. *Addiction*, 103(5), 758-765.
- Inoue, K., Fukunaga, M., Kiriya, T., & Komura, S. (1984). Accumulation of Acetaldehyde in Alcohol-Sensitive Japanese: Relation to Ethanol and Acetaldehyde Oxidizing Capacity. *Alcoholism: Clinical and Experimental Research*, 8(3), 319-322.
- Izard, C. E. (2010). The many meanings/aspects of emotion: Definitions, functions, activation, and regulation. *Emotion Review*, 2(4), 363-370.
- Jayawardena, R., Thejani, T., Ranasinghe, P., Fernando, D., & Verster, J. C. (2017). Interventions for treatment and/or prevention of alcohol hangover: Systematic review. *Human Psychopharmacology: Clinical and Experimental*.
- Jefferson, G. (2004). Glossary of transcript symbols with an introduction. *Pragmatics and Beyond New Series*, 125, 13-34.
- Kanai, R., & Rees, G. (2011). The structural basis of inter-individual differences in human behaviour and cognition. *Nature reviews neuroscience*, 12(4), 231-242.

- Kim, D.-J., Kim, W., Yoon, S.-J., Choi, B.-M., Kim, J.-S., Go, H. J., . . . Jeong, J. (2003). Effects of alcohol hangover on cytokine production in healthy subjects. *Alcohol, 31*(3), 167-170.
- Kypri, K., Stephenson, S., & Langley, J. (2004). Assessment of nonresponse bias in an internet survey of alcohol use. *Alcoholism: Clinical and Experimental Research, 28*(4), 630-634.
- Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research, 37*(2), 284-291.
- Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. *American psychologist, 37*(9), 1019.
- LeMarquand, D., Pihl, R. O., & Benkelfat, C. (1994). Serotonin and alcohol intake, abuse, and dependence: clinical evidence. *Biological psychiatry, 36*(5), 326-337.
- Leventhal, H., & Scherer, K. (1987). The relationship of emotion to cognition: A functional approach to a semantic controversy. *Cognition and emotion, 1*(1), 3-28.
- Lyubomirsky, S., Caldwell, N. D., & Nolen-Hoeksema, S. (1998). Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories. *Journal of personality and social psychology, 75*(1), 166.
- Lyubomirsky, S., Tucker, K. L., Caldwell, N. D., & Berg, K. (1999). Why ruminators are poor problem solvers: clues from the phenomenology of dysphoric rumination. *Journal of personality and social psychology, 77*(5), 1041.
- Mallett, K. A., Bachrach, R. L., & Turrisi, R. (2008). Are all negative consequences truly negative? Assessing variations among college students' perceptions of alcohol related consequences. *Addictive Behaviors, 33*(10), 1375-1381.
- McIntosh, C., & Chick, J. (2004). Alcohol and the nervous system. *Journal of Neurology, Neurosurgery & Psychiatry, 75*, 16-21.
- McKinney, A. (2010). A review of the next day effects of alcohol on subjective mood ratings. *Current drug abuse reviews, 3*(2), 88-91.
- McKinney, A., & Coyle, K. (2006). Alcohol hangover effects on measures of affect the morning after a normal night's drinking. *Alcohol and alcoholism, 41*(1), 54-60.
- Measham, F., & Brain, K. (2005). 'Binge' drinking, British alcohol policy and the new culture of intoxication. *Crime, media, culture, 1*(3), 262-283.
- Merrill, J.E., Rosen, R.K., Walker, S., & Carey, K.B. (2018). A qualitative examination of contextual influences on negative alcohol consequence evaluations among young adult drinkers. *Psychology of Addictive Behaviors, 32*, 29-39.
- Mitchell, J. M., O'Neil, J. P., Janabi, M., Marks, S. M., Jagust, W. J., & Fields, H. L. (2012). Alcohol consumption induces endogenous opioid release in the human orbitofrontal cortex and nucleus accumbens. *Science translational medicine, 4*(116), 116ra116.
- Molbak, M., Schou, A., & Tolstrup, J. (2017). Alcohol Hangover and Risk of Drinking Problems and Alcohol Use Disorder: A Systematic Review. *J Alcohol Drug Depend, 5*(255), 2.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*(4), 569.
- Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*(3), 504.
- Nolen-Hoeksema, S., & Harrell, Z. A. (2002). Rumination, depression, and alcohol use: Tests of gender differences. *Journal of Cognitive Psychotherapy, 16*(4), 391-403.
- Office for National Statistics. (2017). *Adult drinking habits in Great Britain: 2005 to 2016*. United Kingdom: Office for National Statistics.
- Ozawa, S., Kamiya, H., & Tsuzuki, K. (1998). Glutamate receptors in the mammalian central nervous system. *Progress in neurobiology, 54*(5), 581-618.
- Parrott, A. C., & Lasky, J. (1998). Ecstasy (MDMA) effects upon mood and cognition: before, during and after a Saturday night dance. *Psychopharmacology, 139*(3), 261-268.

- Patock-Peckham, J. A., Canning, J. R., & Leeman, R. F. (2018). Shame is bad and guilt is good: an examination of the impaired control over drinking pathway to alcohol use and related problems. *Personality and Individual Differences, 121*, 62-66.
- Patrick, C. H. (1952). *Alcohol, culture and society*. Durham, NC: Duke University Press.
- Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature reviews neuroscience, 9*(2), 148-158.
- Plutchik, R. (1980). *Emotion: A psychoevolutionary synthesis*. United Kingdom: Longman Higher Education.
- Prat, G., Adan, A., & Sánchez-Turet, M. (2009). Alcohol hangover: a critical review of explanatory factors. *Hum Psychopharmacol, 24*(4), 259-267.
- Routledge, C., Arndt, J., Wildschut, T., Sedikides, C., Hart, C. M., Juhl, J., . . . Schlotz, W. (2011). The past makes the present meaningful: nostalgia as an existential resource. *Journal of personality and social psychology, 101*(3), 638.
- Ruhé, H. G., Mason, N. S., & Schene, A. H. (2007). Mood is indirectly related to serotonin, norepinephrine and dopamine levels in humans: a meta-analysis of monoamine depletion studies. *Molecular psychiatry, 12*(4), 331-359.
- Sandelowski, M. (2008). Theoretical saturation. *The Sage encyclopedia of qualitative methods, 1*, 875-876.
- Scott, S., Shucksmith, J., Baker, R., & Kaner, E. (2017). 'hidden Habitus': a qualitative study of socio-ecological influences on drinking practices and social identity in mid-adolescence. *International journal of environmental research and public health, 14*(6), 611.
- Sedikides, C., Wildschut, T., Arndt, J., & Routledge, C. (2008). Nostalgia: Past, present, and future. *Current Directions in Psychological Science, 17*(5), 304-307.
- Sher, K. J., & Grekin, E. R. (2007). *Alcohol and Affect Regulation*. New York: Guildford Press.
- Sher, L. (1997). The placebo effect on mood and behavior: the role of the endogenous opioid system. *Medical hypotheses, 48*(4), 347-349.
- Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annu. Rev. Clin. Psychol., 4*, 1-32.
- Shorter, G. W., Murphy, M., & Cunningham, J. A. (2017). Understanding the hangover experience in Canadian adults: A latent class analysis of hangover symptom patterns and their alcohol-related correlates. *Drugs: education, prevention and policy, 24*(2), 189-196.
- Single, E., Robson, L., Xie, X., & Rehm, J. (1998). The economic costs of alcohol, tobacco and illicit drugs in Canada, 1992. *Addiction, 93*(7), 991-1006.
- Stan, A. D., Schirda, C. V., Bertocci, M. A., Bebeko, G. M., Kronhaus, D. M., Aslam, H. A., . . . Pollock, M. H. (2014). Glutamate and GABA contributions to medial prefrontal cortical activity to emotion: implications for mood disorders. *Psychiatry Research: Neuroimaging, 223*(3), 253-260.
- Swift, R., & Davidson, D. (1998). Alcohol hangover. *Alcohol Health Res World, 22*, 54-60.
- Tolstrup, J. S., Stephens, R., & Grønbaek, M. (2014). Does the severity of hangovers decline with age? Survey of the incidence of hangover in different age groups. *Alcoholism: Clinical and Experimental Research, 38*(2), 466-470.
- Valenzuela, C. F. (1997). Alcohol and neurotransmitter interactions. *Alcohol Research and Health, 21*(2), 144.
- Verster, J. C. (2008). The alcohol hangover—a puzzling phenomenon. *Alcohol and alcoholism, 43*(2), 124-126.
- Verster, J. C., Lantman, M. V. S., van de Loo, A. J., & Mackus, M. (2017). Development of a definition for the alcohol hangover: consumer descriptions and expert consensus. *Current drug abuse reviews*.
- Verster, J. C., Van Duin, D., Volkerts, E. R., Schreuder, A. H., & Verbaten, M. N. (2003). Alcohol hangover effects on memory functioning and vigilance performance after an evening of binge drinking. *Neuropsychopharmacology, 28*(4), 740.

- Walker, W. R., Skowronski, J. J., & Thompson, C. P. (2003). Life is pleasant--and memory helps to keep it that way! *Review of General Psychology*, 7(2), 203.
- Watanabe, M., Maemura, K., Kanbara, K., Tamayama, T., & Hayasaki, H. (2002). GABA and GABA receptors in the central nervous system and other organs. *International review of cytology*, 213, 1-47.
- Weidman, A. C., Steckler, C. M., & Tracy, J. L. (2017). The jingle and jangle of emotion assessment: Imprecise measurement, casual scale usage, and conceptual fuzziness in emotion research. *Emotion*, 17(2), 267.
- Weight, F., Aguayo, L., White, G., Lovinger, D., & Peoples, R. (1991). GABA-and glutamate-gated ion channels as molecular sites of alcohol and anesthetic action. *Advances in biochemical psychopharmacology*, 47, 335-347.
- White, H. R., & Ray, A. E. (2013). Differential evaluations of alcohol-related consequences among emerging adults. *Prevention Science*, 15(1) 115-124.
- Wierzbicka, A. (1992). Defining emotion concepts. *Cognitive science*, 16(4), 539-581.
- Wiese, J. G., Shlipak, M. G., & Browner, W. S. (2000). The alcohol hangover. *Annals of internal medicine*, 132(11), 897-902.
- Wildschut, T., Sedikides, C., Arndt, J., & Routledge, C. (2006). *Nostalgia: Content, triggers, functions*. *Journal of Personality and Social*. Paper presented at the Social Psychology.
- Wood, M. D., & Sher, K. J. (2000). Risks of alcohol consumption in laboratory studies involving human research participants. *Psychology of addictive behaviors*, 14(4), 328.
- Zhou, X., Sedikides, C., Wildschut, T., & Gao, D.-G. (2008). Counteracting loneliness: On the restorative function of nostalgia. *Psychological Science*, 19(10), 1023-1029.

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