The University Of Sheffield.

Social and Environmental Influences on Recovery from Addiction

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A thesis submitted in partial fulfilment of the requirements for the award of Doctorate in Clinical Psychology (DClinPsy)

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The University of Sheffield

May 2022

Declaration

This thesis has not been submitted to any other institution, or for the purpose of obtaining any other qualifications.

Structure and Word Counts

Abstracts

Lay Summary: 499

Literature Review: 238

Empirical Study: 246

Literature Review

Excluding references and tables: 7848

Including references and tables: 16576

Empirical Study

Excluding references and tables: 7787

Including references and tables: 12487

Total Word Count

Excluding references and tables: 15635

Including references and tables: 29562

Lay Summary (Targeted Towards Research Participants)

Research into recovery from substance use disorders (SUDs) tends to focus on internal resources people use to help them recover, such as self-control or belief in their ability to succeed (coping self-efficacy). However, substance use occurs in a social context. This thesis aims to explore wider environmental and situational factors that affect individuals with SUDs recovery. Understanding the process of recovery is important as it could help develop more suitable and effective SUD interventions.

The first section of this thesis reviews research on whether substance use in friends, family, spouses and colleagues (called social network alcohol use) influences effectiveness of SUD treatment, during and after treatment. A systematic literature review was completed, searching four online databases for relevant studies. Thirty-four studies, with thirty-two independent datasets were included. Most samples (19) found that social network substance use worsened SUD intervention outcomes during and after treatment. Eight samples had mixed evidence for this link and five showed no or very little evidence. Limitations of the review are described alongside clinical implications and recommendations for future research in the full report.

New research suggests that situational strategies are important in recovery, regardless of individual level of self-control. If you are trying not to eat sugary foods, having access to them in your kitchen will make your task harder. Not buying them in the first place means you do not need to use self-control in the moment because the cues are not there to tempt you. This is what situational strategies are – making changes to your environment that limit your chances of using substances.

The second section of this thesis explored the role of situational strategies in recovery from alcohol use disorders (AUDs) and whether social network alcohol use, substance-free reinforcement (enjoyment and pleasure from activities without substances) and coping self-efficacy affect someone's use of situational strategies, regardless of their level of self-control.

An online survey was developed which included questions on demographics, situational strategies, substance-free reinforcement, coping self-efficacy, and negative urgency (a type of self-control). Two groups of participants were recruited, one who perceived themselves to be in recovery from an AUD for one year or more (43 people), and another who were heavy drinkers and whose drinking made them likely to be experiencing an AUD, although there was no attempt to formally diagnose this (63 people).

The results showed that situational strategies did not significantly differ between groups as expected. There was a significant difference in social network alcohol use between groups (those in recovery had less friends, family and colleagues who drank alcohol than heavy drinkers), but there were no significant differences in substance-free reinforcement or coping self-efficacy. However, within the participants in recovery, increased situational strategy use, coping self-efficacy, substance-free reinforcement and reduced negative urgency were significantly related to more stable recovery and predicted different aspects of it. Due to limitations of the research, these findings should be carefully interpreted. Clinical implications and recommendations for further research are described in the full report.

Acknowledgements

Firstly, I would like to thank those who supported the development of this project, particularly the ShARRP panel. I am so grateful for this resource. Thank you to each of you who took time to provide feedback and help share the advertisements when recruitment was tricky. Also, thank you to those who participated in the research, as without you, it could not have happened.

I would like to give thanks to my research supervisor, Professor Matt Field, whose knowledge and passion for research is inspiring. I have appreciated your clear, systematic way of thinking and rapid rate of response which has made this mammoth task seem much more achievable.

On a personal level, I want to thank everyone I have met throughout my career who believed in me and spurred me on to never give up on my dream of becoming a Clinical Psychologist, especially when times were particularly dark. I will be forever grateful for every one of you.

I would like to give a special mention to my two extraordinary sisters, Gemma and Georgia. You have been there for me, listened, and built me up through the toughest of days, even though you had no idea what I was talking about at times! There is no shadow of a doubt that I would not have made it to this point without you fighting my corner. There are no better friends than sisters and there are no better sisters than you two!

Finally, I want to thank the incredible trainee clinical psychologists I have had the privilege of meeting along the way (you know who you are!) who have provided so much support, solidarity, and compassion on this rollercoaster of a journey. I could not have done this with without you.

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Section One: Literature Review

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Abstract

Background: Social network alcohol use has been shown to impact alcohol use in individuals in the general population (Knox et al., 2019). There are a growing number of studies exploring the effect of social network substance use on substance use disorder (SUD) outcomes and this finding may extend to SUDs.

Objectives: This systematic review aimed to explore whether engagement in substance use among individuals in a person's social network affects (impedes or supports) response to treatment in adults with SUD and if so, whether these effects occur during treatment, after treatment or both.

Methods: A systematic review was conducted, protocol published at: https://osf.io/37qdy/?view_only=2615edc64896418dae2f5eb6267afd01. Four electronic databases were searched: Scopus, PsycINFO, CINAHL and Web of Science. Forward and backward citation searches occurred. A narrative synthesis was conducted on papers meeting all inclusion and no exclusion criteria. All papers were quality assessed.

Results: Thirty-four studies, with 32 independent samples were included in the narrative synthesis (reported N=19693). Three papers were rated as strong, 17 moderate and 14 weak quality. Of the independent samples (N=32), 19 showed that increased social network substance use impeded SUD treatment outcome, eight showed mixed evidence and five showed no or very limited evidence.

Conclusions: In most samples, social network substance use impeded substance use intervention outcomes by reducing participant abstinence or increasing participant substance use. All strong quality evidence fell in support of this link. Clinical implications and areas for future research are discussed.

Practitioner Points

1. Social network substance use impedes SUD treatment outcomes during and after various treatments (pharmacological, psychological, and mixed interventions).

2. SUD interventions should support clients to alter their social networks (reducing contact with substance users and adding abstinent individuals) and more systemic interventions where peers and family can engage in treatment together would allow for mutual benefit.

3. Further research is needed on the effects of social network substance use on peer support interventions alone, and long-term follow up research is needed to ensure the appropriateness of social network substance use change in SUD interventions long-term.

Keywords: Addiction, substance use disorder, social network substance use

Effects of Social Network Substance Use on Response to Treatment in Adults with Substance Use Disorders: A Systematic Review

Substance Use Disorders

The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association, 2013) specifies 11 criteria for substance use disorders (SUD) including taking larger amounts than intended, experiencing cravings and urges to use the substance, spending significant time acquiring, using or recovering from the substance, continuing to repeatedly use the substance despite difficulties this may bring (e.g. relationship issues, putting you in danger) and wanting to reduce or stop use but being unable to do so. A person experiencing at least two of these criteria with any of ten specified classes of substance in the past year meets criteria for a SUD, which can be classed as mild (meets 2-3 criteria), moderate (meets 4-5 criteria) or severe (meets 6+ criteria).

SUD Treatment

Reviews of SUD treatment demonstrate the wide variety of treatments available to individuals with SUDs (Douaihy et al., 2003; Jhanjee, 2014). Treatments can consist of pharmacological interventions (such as acamprosate for alcohol use disorder, opiate substitution treatment with methadone or nicotine replacement therapy) which have been shown to be effective (Douaihy et al., 2003). Psychological or psychosocial interventions are also offered, such as Cognitive Behaviour Therapy (CBT), motivational interviewing, cue exposure and response prevention (Jhanjee, 2014) as well as therapeutic communities and contingency management. Twelve-step approaches such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA) are also commonly used peer support interventions. For the purposes of this systematic review, any type of treatment or intervention will be considered, including pharmacological, psychological and peer support interventions.

Social Networks

Substance use behaviours occur in a social context, which is likely to affect the process of behaviour change in a person attempting to reduce their substance use. In the SUD literature, social support and social networks are terms which tend to be used synonymously, despite them having key differences. A person's social network is the people around them that they have relationships with, which may consist of friends, family, spouses, and colleagues (Cox, 2005). Social support is a broader concept covering what is offered by those individuals in a person's social network, which can be separated into various domains such as informational, concrete and emotional support (Schafer et al., 1981). Social support is likely important in assisting an individual in SUD treatment to succeed, and many studies have explored the relationship between social support and SUD outcomes. A recent systematic review found that positive social support networks can strengthen the benefits of medication treatments for opioid use disorder (Kumar et al., 2021). Despite these findings, an unanswered question remains regarding the impact of substance use *behaviour*, rather than support, among individuals in a participant's social network, on their response to SUD treatment. This is the focus of the current systematic review.

A recent systematic review showed that social network drinking impacted alcohol use in individuals in the general population (Knox et al., 2019). This may be explained by social learning theory, which proposes that behaviour is learnt through observing and imitating other people (Bandura et al., 1961; Bandura, 1977). Social learning theory may explain how substance use occurs initially in a social environment, but not necessarily how it continues and escalates into SUDs or how this affects attempts to change SUD behaviour. Therefore, this review aims to explore whether Knox et al. (2019)'s findings extend to those with SUDs in treatment and whether it affects their treatment outcome. There are a growing number of studies exploring the effect of social network substance use on SUD outcomes, but this has not been systematically reviewed and summarised across all substances and types of treatment. Therefore, this review aims to widen our

knowledge of the social determinants of recovery from addiction, which could have important implications for treatment.

Recovery from SUDs has long been portrayed as an internal identity change process, first described by Biernacki (1986). However, this individualistic view fails to account for the external social environment around a person. The social identity model of recovery (Best et al., 2016) proposes that recovery should be understood as a social process of identity change through changes in the social environment and related activities. Best et al. (2016) argued that changes to social networks influence recovery journeys. For example, by adding recovery focused groups or networks such as Alcoholics Anonymous to an individual with SUD's social environment, recovery-based values and norms are internalised and the recovery identity is established in the individual through social learning. Some treatments attempt to increase social support of clients in SUD treatment, such as family, couple or social network interventions as described in the drug misuse and dependence UK guidelines on clinical management (Clinical Guidelines on Drug Misuse and Dependence Update 2017 Independent Expert Working Group, 2017). Nonetheless, making changes to the social networks of individuals to include fewer substance users and more recovery focused individuals or groups, could be supplemented as an important ingredient in SUD intervention, to provide a better chance of a successful recovery.

Aims

This systematic review aimed to answer the following questions:

a) Does engagement in substance use among individuals in a person's social network affect response to treatment in adults with substance use disorder?

b) If so, does it impede or support response to treatment and do these effects occur during treatment, after treatment or both?

Methods

Protocol

A systematic review protocol was generated and finalised on 17th January 2022. It was then submitted to the Open Science Framework, where it was published on 24th January 2022. The protocol is available at https://osf.io/37qdy/?view_only=2615edc64896418dae2f5eb6267afd01.

Design

Before starting this systematic review, the Cochrane Database of Systematic Reviews was checked, and no systematic review has been completed which answers the specific questions posed by this review. A meta-analysis was deemed unsuitable as there was wide heterogeneity in the way outcomes were measured in studies due to complexity of defining recovery, as well as different types of intervention and different substances. Therefore, a narrative synthesis of the included studies was conducted as the most appropriate method based on the data, to explore the systematic review questions. Narrative synthesis is a method which implements a textual attempt to summarise the findings from the studies included in a systematic review (Popay et al., 2006). As included studies were not sufficiently similar to allow for meta-analysis, and narrative syntheses can cover various review questions (not only intervention effectiveness), a narrative synthesis was deemed a suitable method for this review.

Search Strategy

Four electronic databases were used to search the literature for this review: Scopus, PsycINFO, Web of Science and CINAHL. These databases were chosen to elicit breadth of psychological and health related research, as research into addiction spans these fields.

Search terms were generated by reviewing current literature reviews and research in the area. The addiction search terms were generated with reference to DSM terminology for SUDs from current and earlier versions, plus terms commonly used in the literature to describe specific SUDs e.g., “alcoholism”. The substances used as search terms were taken from the DSM-V categories of drugs that constitute SUDs. Search terms for social network substance use came from a systematic

review looking at social network analysis and alcohol use in the general population (Knox et al., 2019). The search terms for interventions came from reviews of interventions for substance use disorders (Douaihy et al., 2003; Jhanjee, 2014). Table 1 displays the search terms used. All terms were searched as keywords in each database. Subject headings were auto exploded in PsycINFO (see Appendix A for full strategies).

Following the screening process, citation searching was completed to identify further articles that the database searches may have missed. Reference lists of papers identified as appropriate for inclusion were hand searched and backwards citation searching was conducted.

Table 1

Search Terms

Concept	Search Terms
1. Addiction	Addict* OR dependen* OR "use disorder" OR misuse* OR "substance abuse" OR problem OR disorder OR alcoholic OR alcoholism
	AND
	alcohol OR nicotine OR tobacco OR smoking OR opiate OR heroin OR cocaine OR ecstasy OR stimulant* OR substance* OR narcotic* OR drinking OR opioid* OR opium OR cannabis OR hallucinogen* OR inhalant* OR sedative* OR hypnotic* OR anxiolytic*
AND	
2. Social network substance use	"social network" OR "social networks" OR "friendship network" OR "friendship networks" OR "peer network" OR "peer networks"
AND	
3. Treatment/intervention	Treatment OR intervention OR pharmaco* OR acamprosate OR methadone OR Naltrexone OR Buprenorphine OR "nicotine replacement therap*" OR bupropion OR varenicline OR Disulfiram
	OR psychosocial OR "cognitive behavio* therap*" OR "CBT" OR "cue exposure" OR "response prevention" OR "motivational interviewing" OR "motivation* enhancement" OR "contingency management" OR "therapeutic communit*"
	OR "peer support" OR "alcoholics anonymous" OR "narcotics anonymous" OR "12 step" OR "12-step" OR "twelve step"
AND	
4. Participant substance abuse/relapse status outcome	alcohol OR "alcohol use" OR drinking OR drug* OR "drug use" OR "substance use" OR smoking OR abstinence OR recovery OR relapse OR maintenance OR sober OR sobriety

Screening

Inclusion and exclusion criteria were chosen based on the review questions. The PICOS tool, designed for quantitative reviews, was used to specify inclusion and exclusion criteria (Methley et al., 2014). Table 2 displays the inclusion and exclusion criteria for this review. Articles were included if they met all inclusion criteria and no exclusion criteria.

Table 2

Inclusion and Exclusion Criteria Using the PICOS Tool (Methley et al., 2014)

PICOS domain	Inclusion criteria	Exclusion criteria
Participants/population	Adults (18+) with substance use disorder (including alcohol and nicotine) who are currently receiving any form of treatment intervention for their substance use disorder, or who have received such treatment in the past	Participants <18 years old Behavioural addictions e.g. problem gambling, gaming disorder (no consensus in DSM-V vs ICD-11) Participants have not made attempts to change behavior (through any form of intervention)
Intervention/exposure	Social network engagement in substance use	Studies which did not report social network substance use. Studies which did not explore the relationship between social network substance use, and participants substance use. Studies which only report attitudes to substance use in members of the social network, but do not measure substance use in members of the social network
Comparison/control	No comparison group required	No comparison group required
Outcome	Measure of participants' current substance use (frequency, quantity, abstinence status, relapse rates) or recovery (as defined by each paper e.g. abstinence, self-defined recovery status etc.)	No measure of participants current substance use or recovery
Study design	Any original published study providing empirical quantitative data Any year of publication, or location, if the full article is written in English.	Qualitative studies, secondary data e.g., literature reviews (primary data would be extracted from the original papers), papers not written in English. Grey literature

Behavioural addictions such as gambling, and gaming disorder were excluded from this systematic review. Currently, gaming disorder is not included in the DSM-V but is in the International Classification of Diseases version 11 (ICD-11; World Health Organisation, 2019). The DSM-V mentions internet gaming disorder in the recommendations for further research section. Due to the lack of consensus around gaming disorder in the DSM-V versus the ICD-11, it was excluded from this review. Additionally, behavioural addictions including gambling were excluded as it is possible that there may be differences in how social network behaviour (e.g., gaming or gambling) operates compared to substance use behaviour. Articles were excluded if they were not written in English. Grey literature was excluded as such work has not gone through the rigorous scientific checks required to be published in a peer-reviewed scientific journal. Articles were included if a measure of participants current substance use (frequency, quantity, abstinence status, relapse rates) or recovery was taken. It was recognised that as recovery is difficult to define, and is conceptualised in various ways, each paper may define recovery differently and measures may take the form of abstinence or self-defined recovery status for example.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA; Moher et al., 2009) were followed to support the article screening process. A PRISMA checklist for the systematic review was also completed (Appendix B). A sample of eight full-text papers were also screened by a second researcher to increase reliability of the screening process.

Quality Assessment

It is important to appraise the quality of research included in systematic reviews for bias and rigour to form unbiased conclusions. High quality studies will have minimised bias and error throughout the design, implementation, and analysis, so can be relied upon more confidently to make unbiased conclusions. The quality of evidence was assessed for each included paper and will be considered throughout the review. Poor quality research will be interpreted cautiously, bearing in mind the risk of bias.

The lead researcher assessed the quality of reviews using the Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies (Thomas et al., 2004; Appendix C). The EPHPP covers eight areas (selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity, analyses). Articles are rated as strong, moderate, or weak in the first six areas. A global rating of strong (no weak ratings), moderate (one weak rating) or weak (two or more weak ratings) is then generated. This tool was chosen because it covers all types of quantitative research, so could be used for all the papers included in the study. The EPHPP has demonstrated good content validity and construct validity (Thomas et al., 2004) and has fair inter-rater agreement for individual domains and excellent agreement for the final grade (Armijo-Olivo et al., 2012). A researcher independent to the project second coded 20% of the quality assessments. Disagreements were resolved via discussion.

Data Analysis

Data were extracted from all included studies by the lead researcher into Microsoft Excel and the key study characteristics were tabulated (Table 4). Key findings in relation to the review questions above were tabulated separately (Table 5). A narrative synthesis of all included studies was then conducted to summarise the key findings of the articles. The narrative synthesis was broken down into type of intervention as planned in the protocol as there were sufficient articles to do so, to explore similarities and differences across types of intervention.

Results

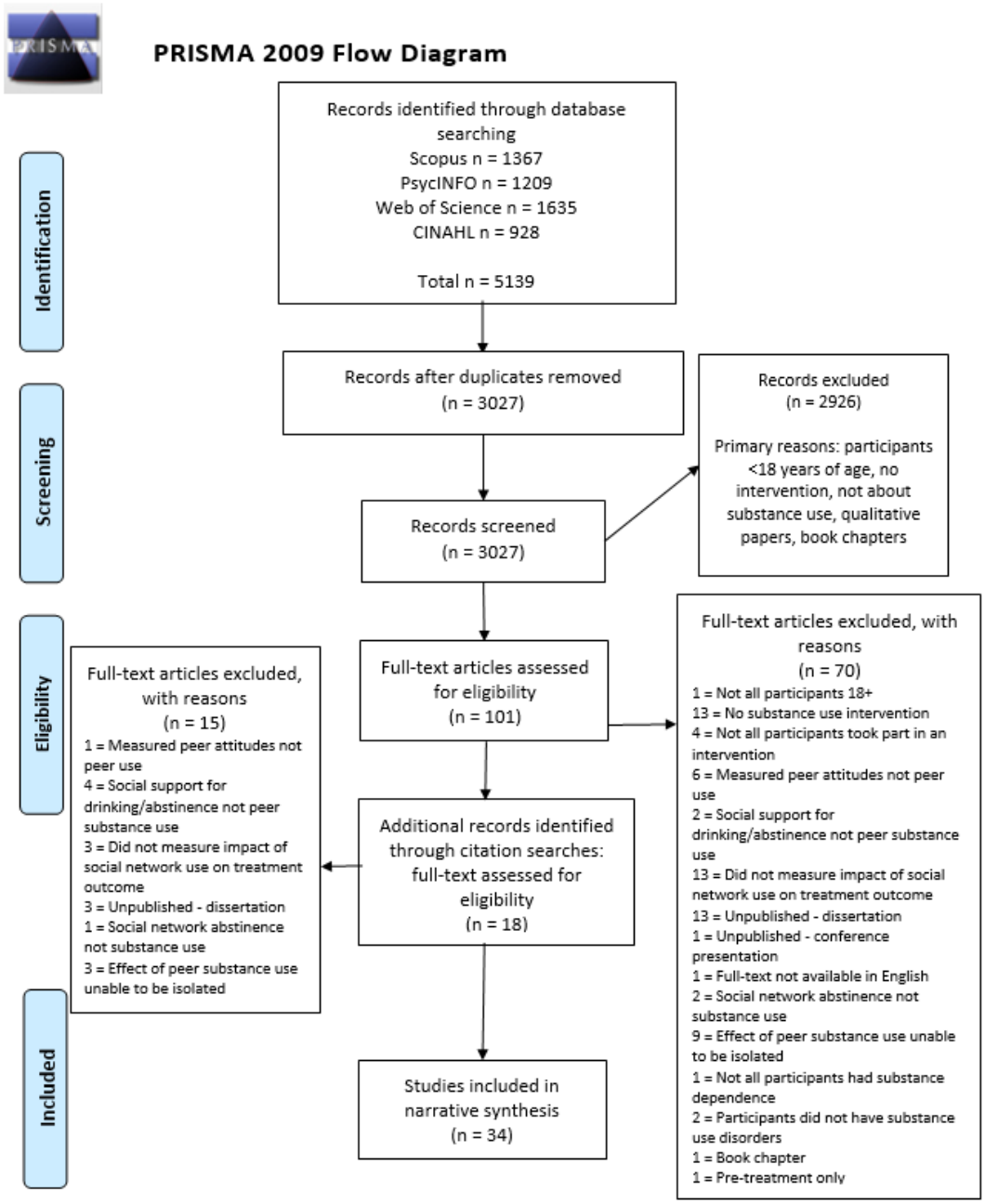
Data Screening

The final database searches were completed on 17th January 2022. Searching the databases yielded a total of 5139 papers. There were 3027 papers after removing duplicates. A total of 2926 papers were excluded after reviewing their titles and abstracts against the inclusion and exclusion criteria. Full-text articles of the remaining 101 papers were sourced and reviewed against the inclusion and exclusion criteria in more detail. Consequently, 70 of these papers were excluded. Forward and backward citation searching of relevant papers yielded an additional 18 papers

potentially appropriate for inclusion. The full text of these papers was reviewed and subjected to the inclusion and exclusion criteria. Fifteen of these were excluded. There was 100% agreement on whether the eight full-text papers also screened by a second researcher should be included or excluded based on the inclusion criteria. A total of 34 papers met all inclusion criteria and were included in the review. Figure 1 displays a PRISMA flow diagram of the search process.

Figure 1

A PRISMA Flow Diagram (Moher et al., 2009) Displaying the Flow of Data Through the Systematic Review



Characteristics of Studies

Data from studies was extracted by the lead researcher into a Microsoft Excel sheet designed for this review. There was a total of 34 studies included in the review, with three RCTs, one controlled clinical trial, 23 cohort studies and seven cross-sectional studies. Sample sizes ranged from 57 to 3589. Articles which described data from RCTs but were not the original RCTs themselves and were reporting data as observational studies were seen as such, so were rated as cohort or cross-sectional studies dependent on the design. Mean ages ranged from 20.4 to 49 years. Table 4 displays the characteristics of included studies.

Samples

There was a total of 34 papers included in the review, but some papers reported on the same sample. There was a total of 32 independent samples in the 34 papers. One RCT was described in two papers (Litt et al., 2007; Litt et al., 2015). Eddie & Kelly (2017) and Kelly et al. (2014) both reported on data from the same sample. For the purposes of the narrative synthesis, in order not to over credit the findings of results written up in multiple papers, each independent sample was treated as one overall finding.

Measures

Social Network Substance Use

The most frequently used questionnaire across the studies to measure substance use in the social network, was an alcohol specific measure called the Important People and Activities instrument (IPA; Clifford & Longabaugh, 1991). The IPA contains 11 indices: network size, size of daily network, importance of four most important people, drinking status of network, network drinking frequency, maximum drinks per drinking day in social network, percentage of heavy drinkers, percentage of abstainers and recovering alcoholics, most support for drinking among four most important people, least support for drinking among four most important people, average support for drinking among four most important people. Only articles which included indices specifically related to social network alcohol use in their statistical analyses were included as some

papers used an overall measure of all 11 domains which meant the impact of social network alcohol use could not be isolated.

Social network substance use, broader than just alcohol use, was measured by various other questionnaires. The Important People Drug and Alcohol interview (IPDA; Zywiak et al., 2009), which was adapted from the IPA, was used in some papers. Additionally, articles used other questionnaires, such as the Social Support Questionnaire (Sarason et al., 1983) but supplemented with questions about substance use of social network members. Egocentric Network Study Software called EgoNet (McCarty et al., 2007; available at sourceforge.net/projects/egonet) was used by some papers to explore the relationships in the social network.

Many articles did not use a validated questionnaire but asked participants questions in an interview about substance use behaviours of members of their social network (a variety of partner, friends, family and colleagues). Articles asked about social network members substance use in different ways, including frequency, amount, or whether the social network member drank alcohol or used substances in the presence of the participant.

Participant Substance Use or Recovery Outcome

Many of the papers used the Form-90 (Miller & Del Boca, 1994) to determine participants substance use or abstinence. Papers used different ways of categorising current substance use or abstinence using the Form-90, for example Percent Days Abstinent (PDA) or Percent Days Heavy Drinking (PDHD). Other papers used measures specific to the substance, such as the non-prescribed opioid use subscale in the Opiate Treatment Index (Darke et al., 1992) for opiate use or the Timeline Follow-Back method (Sobell & Sobell, 1995) for alcohol use. Total abstinence from alcohol and drugs was also used in two papers using the Addiction Severity Index (ASI; McLellan et al., 1992).

Some papers asked for self-reported substance use by participants within a specified duration. Some papers also confirmed self-reports medically (e.g., via urinalysis, carbon monoxide testing) or by reports from significant others.

Interventions

The papers involved a variety of substance use interventions including pharmacological, psychological and peer support interventions, or a combination of more than one.

Pharmacological

In terms of pharmacological interventions, various medications were prescribed across the papers. Methadone maintenance or opiate substitution treatment using LAAM (levo-alpha-acetyl-methadol) was described in eight papers. In two papers, smoking cessation was offered using burproprion or nicotine replacement via patch or lozenge. Naltrexone or acamprosate were also described for alcohol dependence in one paper.

Psychological

Several interventions which fell under the psychological interventions category were offered including packaged CBT, contingency management, integrated group therapy or drug counselling, social skills training, CBT, ego-strengthening/supportive therapy, motivational interviewing, and family therapy approaches. However, many of these were offered in conjunction with other interventions (peer support or pharmacological) across papers.

Peer Support

In terms of peer support interventions, twelve-step facilitation was offered including Alcoholics Anonymous, however all papers offering such interventions offered them in conjunction with other interventions. None of the included papers looked exclusively at peer support interventions. Therefore, the effects of social network substance use on substance use outcomes

from peer support interventions was not able to be isolated in the papers, so there was insufficient data to complete this section of the narrative synthesis as planned in the review protocol.

Mixed Treatment

Some interventions included a mixture of types of intervention and therefore could not be separated. For example, residential inpatient treatment facilities including 12-step approaches as well as motivational, cognitive behavioural and family therapy approaches (Eddie & Kelly, 2017). The Minnesota model was used in one paper (Witbrodt & Romelsjo, 2012) which consists of CBT, motivational interviewing and relapse prevention combined with 12-step facilitation. Therefore, a combined treatment category was generated for the narrative synthesis to include mixed interventions, which appeared in 19 papers.

Substances

The papers covered a variety of substances: nicotine, alcohol, cocaine, heroin or other opiates. Some papers explored any substance as defined by the participants. Fifteen papers explored alcohol dependence only. Three papers explored nicotine dependence. Seven explored heroin or opiates and one paper explored cocaine only. The remaining papers looked at a combination of substances.

Quality Assessment

The final ratings of all papers are shown in Table 3.

Table 3

Quality Assessment using the EPHHP Quality Assessment Tool (Thomas et al., 2004)

Paper	Selection Bias	Study Design	Confounders	Blinding	Data Collection Methods	Withdrawal and Dropouts	Global Rating
Bond et al. (2003)	Moderate	Moderate	Moderate	Moderate	Weak	Moderate	Moderate
Chong & Lopez (2008)	Moderate	Moderate	Moderate	Moderate	Strong	Weak	Moderate
Day et al. (2013)	Strong	Weak	Strong	Moderate	Strong	Moderate	Moderate
de Dios et al. (2013)	Weak	Weak	Weak	Moderate	Strong	Moderate	Weak
Eddie & Kelly (2017)	Moderate	Moderate	Strong	Moderate	Strong	Moderate	Strong
Ellis et al. (2004)	Moderate	Moderate	Strong	Moderate	Weak	Moderate	Moderate
Feng et al. (2018)	Strong	Weak	Strong	Moderate	Weak	Moderate	Weak
Goehl et al. (1993)	Moderate	Moderate	Weak	Moderate	Weak	Weak	Weak
Gogineni et al. (2001)	Moderate	Weak	Weak	Moderate	Weak	Moderate	Weak
Gordon & Zrull (1991)	Moderate	Moderate	Weak	Moderate	Weak	Strong	Weak
Gregoire & Snively (2001)	Weak	Weak	Weak	Moderate	Weak	Moderate	Weak
Havassy et al. (1991)	Moderate	Moderate	Moderate	Moderate	Weak	Strong	Moderate
Havassy et al. (1995)	Moderate	Moderate	Moderate	Moderate	Weak	Strong	Moderate
Japuntich et al. (2011)	Weak	Moderate	Moderate	Moderate	Weak	Weak	Weak
Karriker-Jaffe et al. (2020)	Moderate	Moderate	Strong	Moderate	Weak	Weak	Weak
Kelly et al. (2014)	Moderate	Moderate	Strong	Moderate	Strong	Moderate	Strong
Li et al. (2012)	Moderate	Weak	Strong	Weak	Weak	Moderate	Weak
Lions et al. (2014)	Moderate	Moderate	Moderate	Moderate	Weak	Weak	Weak
Litt et al. (2007)	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Litt et al. (2015)	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Litt et al. (2021)	Weak	Strong	Strong	Moderate	Strong	Moderate	Moderate
Longabaugh et al. (2010)	Moderate	Moderate	Moderate	Moderate	Strong	Weak	Moderate
McDonald et al. (2011)	Weak	Moderate	Weak	Moderate	Strong	Weak	Weak

Paper	Selection Bias	Study Design	Confounders	Blinding	Data Collection Methods	Withdrawal and Dropouts	Global Rating
Mericle et al. (2018)	Moderate	Moderate	Strong	Moderate	Weak	Moderate	Moderate
Mermelstein et al. (1986)	Weak	Strong	Strong	Moderate	Weak	Weak	Weak
Shen et al. (2018)	Moderate	Weak	Strong	Moderate	Weak	Moderate	Weak
Tracy et al. (2016)	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Wasserman et al. (2001)	Moderate	Moderate	Strong	Moderate	Weak	Strong	Moderate
Witbrodt & Kaskutas (2005)	Moderate	Moderate	Strong	Moderate	Weak	Strong	Moderate
Witbrodt & Romelsjo (2012)	Moderate	Moderate	Strong	Moderate	Weak	Moderate	Moderate
Witkiewitz et al. (2017)	Moderate	Moderate	Strong	Moderate	Strong	Weak	Moderate
Worley et al. (2014)	Moderate	Moderate	Strong	Moderate	Strong	Weak	Moderate
Worley et al. (2015)	Moderate	Moderate	Strong	Moderate	Weak	Weak	Weak
Zywiak et al. (2002)	Moderate	Moderate	Moderate	Moderate	Strong	Weak	Moderate

Studies in this review received all possible global ratings of weak (n = 14), moderate (n = 17) and strong (n = 3) study quality. Forty percent of the studies were assessed as weak, and few studies were considered strong quality evidence, so conclusions drawn throughout this review need to be cautiously interpreted. Common sources of bias included lack of validated and reliable measures, failing to control for potential confounding variables and low-quality designs (cross-sectional) which cannot infer causality. Papers demonstrating strong study quality (lower risk of bias) were given greater weighting in the narrative synthesis.

Table 4

Characteristics of Included Studies in the Systematic Review, Ordered Alphabetically by Author

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Bond et al. (2003)	USA	Cohort	Alcohol	927	38 (N.R.)	56	Public and private detoxification programs, private: inpatient, day hospital and outpatient, public: outpatient and residential facilities.	Abstinence at follow-ups: 90-day abstinence - whether the respondent had drank alcohol in the past 90 days (1 = abstinent, 0 = not)	How many of the individuals the participant has regular contact with "are heavy or problem drinkers"? Proportions of regular contacts who were heavy drinkers also calculated.
Chong & Lopez (2008)	USA	Cohort	Substance abuse	346	31.8 (7.6)	0	45-day residential substance abuse program	Relapse = any alcohol or drug use in 30 days preceding the follow up interviews	Asked "During 30 days before you came to Native American Connections, have you had problems with being around others who use alcohol or drugs?"
Day et al. (2013)	UK	Cross-sectional	Heroin dependence	118	35.5 (8.0)	73	Opiate substitution treatment	TOP - frequency and quantity of opiates, cocaine, and alcohol used in the 28 days prior to the interview.	IPDA interview - adapted from IPA. Key questions: use of opiates/cocaine (1–5, 1 = did use, now drug-free, 2 = nonuser, 3 = uses a little, 4 = uses a moderate amount, 5 = uses a lot). "How often does this person use opiates/cocaine?" (0–7, 0 = not in the past 6 months, 7 = daily).
de Dios et al. (2013)	USA	Cross sectional	Nicotine	151	40.5 (9.08)	49.7	Methadone maintenance program (data from ongoing RCT of varenicline, placebo, and combination NRT)	Tobacco use (daily number of cigarettes) and tobacco dependence as measured by the FTND	IPA up to 10 social network members smoking status (current smoker, former smoker, never a smoker).
Eddie & Kelly (2017)	USA	Cohort	Substance abuse	302	20.4 (1.6)	73.8	Residential inpatient treatment which included twelve-step, motivational, cognitive-behavioural, and family therapy approaches.	Form-90 percentage of days abstinent (PDA) from substances (excluding nicotine and caffeine)	Social Support Questionnaire (SSQ) plus alcohol and drug use and amount of contact with of up to 5 social network members. Peers with "regular use", "possible abuse", or "abuse" of alcohol and/or drugs = 'high-risk', "infrequent use", who "do not use", or "currently abstaining" = 'low-risk'.

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Ellis et al. (2004)	USA	Cohort	Substance abuse	1181	N.R.	0	Residential substance abuse treatment for women with children/postpartum women	Relapse = any use of alcohol or drugs (excluding nicotine)	Asked how often got drunk and used drugs with family members they saw at least once per week – translated into ever vs never dichotomies
Feng et al. (2018)	China	Cross-sectional	Opioid dependence	2446	N.R.	79.2	Methadone maintenance treatment	Self-reported heroin use in the seven days before assessment or most recent urine test positive.	Participants asked if any family members use heroin.
Goehl et al. (1993)	USA	Cohort	Substance abuse	70	35 (N.R.)	67	Methadone maintenance treatment program	Proportion of positive urine tests for one or more illicit substances across 3 months.	Problematic substance use in four closest social network members
Gogineni et al. (2001)	USA	Cross-sectional	Opioid dependence	252	40.3 (N.R)	56	Methadone maintenance program	Self-reported illicit injection drug use in the previous 6 months (1 = drug use, 0 = no drug use).	Asked whether live-in partner or spouse "drank heavily or used drugs" (yes/no) and "how many of the people that you spent time with used drugs"
Gordon & Zrull (1991)	USA	Prospective cohort	Alcohol	156	N.R.	54.5	28-day 12-step based inpatient treatment	Treatment outcome devised = abstinent, abstinent with slips, improved, or no change.	Pattison Psychosocial Inventory (Pattison & Pattison, 1981) -further questions added about the social network member's drinking with the participant.
Gregoire & Snively (2001)	USA	Cross-sectional	Substance dependence	59	33 (N.R)	0	Long-term residential substance abuse treatment service	Self-reported frequency of substance use in prior 30 days.	Living with anyone with a substance misuse problem.
Havassy et al. (1991)	USA	Cohort	Alcohol, opiate and nicotine	225	36.14 (7.01)	60	Smokers - outpatient smoking cessation, alcohol - inpatient 12-step programmes, opiate - methadone-assisted detox, inpatient 12-steps.	Relapse = 4+ days of use of the problem drug in the week prior to assessment, confirmed with urine or carbon monoxide screens.	Number of friends and relatives currently using the participants problem drug.
Havassy et al. (1995)	USA	Cohort	Cocaine	104	33.7 (6.3)	73.1	Inpatient chemical-dependency programs or intensive outpatient programs.	Self-reported cocaine use and urine toxicology screens	Number of friends and relatives currently using the participants problem drug.

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Japuntich et al. (2011)	USA	Cohort	Nicotine dependence	1504	44.7 (11.1)	41.8	Five combinations of bupropion, nicotine replacement (patches or lozenges) and a placebo.	Three cessation milestones (achieving initial abstinence, lapse risk, and lapse–relapse transition)	Assessed smoking of up to 10 people important to them. Number of smokers in the social network (including social smokers).
Karriker-Jaffe et al. (2020)	USA	Cohort	Alcohol dependence	722	38.6 (N.R.)	66	Public and private detoxification, residential, and outpatient alcohol and drug treatments	Alcohol dependence symptoms approximating the DSM-5 criteria for SUD up to 7-year follow-up.	Number of heavy drinkers in the social network
Kelly et al. (2014)	USA	Cohort	Alcohol dependence	302	20.4(1.6)	73.8	Residential treatment based on 12-steps, motivational enhancement, cognitive-behavioural and family therapy.	Form-90: Percent Days Abstinent from alcohol and illegal drugs; Percent Days Heavy Drinking during each time period since prior interview	Social Support Questionnaire (SSQ) modified to ask about five of their closest friends' substance (alcohol/drug) use status.
Li et al. (2012)	China	Cross sectional	Heroin dependence	176	N.R.	65.7	Methadone maintenance clinics	Self-reported heroin use in last 30 days confirmed with urine test.	Face-to-face survey - asked if they had any family members or friends who uses drugs.
Lions et al. (2014)	France	Prospective cohort	Opioid-dependence-DSM-IV	195, 158 at follow up	N.R. Median 33 years at baseline	84.8	Methadone treatment in specialised centres vs primary care	Non-prescribed opioid use in previous month - Opiate Treatment Index (Darke et al., 1992)	Participants asked how much time they had lived with someone who consumed heroin in the previous 6 months at enrolment and after 12 months.
Litt et al. (2007)	USA	RCT	Alcohol dependence or abuse (DSM-IV)	210	45 (11.4)	58	Outpatient: network support (NS), NS and contingency management (NS+CM), or case management (control).	Form-90, verified with post-treatment drug screen, breathalyser and collateral report.	Important People and Activities structured interview (IPA) Behavioural Support for Drinking - proportion of people in the social network classified as heavy drinkers
Litt et al. (2015)	USA	RCT	Alcohol dependence	210	45 (11.4)	58	Outpatient: network support (NS), NS and contingency management (NS+CM), or case management (control).	Drinking data using Form-90.	Important People and Activities structured interview (IPA). Behavioural Support for Drinking - proportion of people in the social network classified as heavy drinkers.

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Litt et al. (2021)	USA	RCT	Alcohol dependence (DSM-IV)	193	46(10.5)	65.8	Packaged CBT (manualised CBT coping skills-based treatment) vs NS treatment	Self-report alcohol use in the prior 24 hours.	IPA - drinking behaviour (frequency and quantity) of most important people in their social network, controlling for total size of social network.
Longabaugh et al. (2010)	USA	Cohort	Alcohol	1373	N.R. median = 44	69.1	Oral naltrexone or acamprosate alone and in combination, with brief medical management with or without a combined behavioural intervention.	Percentage days abstinent (PDA) and percentage heavy drinking days (PHDD)	IPI (created for this study from IPA) - drinking status and frequency of drinking of people who are important to the participant, who they have had contact with in the past 4 months.
McDonald et al. (2011)	USA	Cohort	SUDs and concurrent bipolar disorder	57	37.3 (10.6)	59.6	Integrated group therapy or standard group drug counselling for comorbid substance dependence and bipolar disorder.	Number (and mean) of days of drug use per month, from the ASI using the TLFB method.	IPI –substance use of maximum of 8 social network members over the last 3 months
Mericle et al. (2018)	USA	Prospective cohort	Alcohol	451	N.R.	52	Outpatient alcohol and drug treatment programs.	Past-year problem drinking- 2 out of 3 problem drinking criteria over prior 12 months.	How many of the people they have regular contact with (at least once every two weeks) were currently heavy and/or problem drinkers.
Mermelstein et al. (1986)	USA	Controlled clinical trial	Nicotine dependence	Study 1: 64 Study 2: 64	Study 1: 38.4 (11.6), Study 2: 38.8 (12.9)	Study 1: 42.1 Study 2: 50	Smoking cessation programme including cognitive behavioural relapse prevention.	Self-report smoking rate, at end of intervention verified by saliva, CO tests and significant other reports	Smoking history - Proportion of smokers in current household, friends and co-workers that smoke (5-point Likert scale from none to all).
Shen et al. (2018)	China	Cross-sectional	Heroin dependence	324	45.2 (5.9)	76.9	Methadone maintenance treatment program	Current drug use measures by urine test for opiate metabolites	In five closest people in social network, asked "does he/she sometimes join you while using drugs?" – Yes/No
Tracy et al. (2016)	USA	Cohort	Substance dependence	284	37.0 (10.8)	0	Residential outpatient women's substance abuse treatment	Self-reported substance use 12-months post treatment intake - yes/no	EgoNet software - number of substance using network members

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Wasserman et al. (2001)	USA	Cohort	Opioid dependence	128	45 (7.8)	55	Opioid maintenance treatment (OMT) using methadone or levo-alpha-acetyl-methadol	Current drug use - in last 7 days/ last 3-months at 3-month follow up	Perceived frequency of heroin, cocaine, marijuana, and alcohol use in people they lived with (max 6), intimate partners, up to 6 close friends/relatives.
Witbrodt & Kaskutas (2005)	USA	Cohort	Substance dependence (DSM-III-R)	302	41 (N.R.)	60	Hospital or community day treatment programs.	Total abstinence from alcohol and drugs using the Addiction Severity Index (ASI)	Of friends and family members with regular contact how many are abstinent vs heavy/problem drinkers or drug users
Witbrodt & Romelsjo (2012)	USA and Sweden	Cohort	Alcohol dependent DSM-IV for USA, ID-10 for Swedish	997 Swedish, 501 USA	N.R.	Swedish = 74.1, USA = 62.3	Swedish: social skills training, CBT and ego-strengthening/supportive therapy. USA: public/private programs of CBT, MI and relapse prevention with 12-steps	Drinking typology (moderate or heavy) based on Graduated Frequency Scale (GFS). Yearly drink volume was calculated.	Whether social network consisted of mostly substance abusers, both abusers and non-abusers, mostly non-abusers or no/very few contacts.
Witkiewitz et al. (2017)	USA and UK	Cohort	Alcohol dependence	3589	42.0 (10.7)	73	COMBINE (medication management/combined behavioral intervention). Project MATCH (CBT MET or TSF) and UKATT (MET orSBNT)	Self-reported weekly alcohol intake during treatment. Form-90 validated biologically or by collateral informants.	Important People and Activities (IPA) Inventory
Worley et al. (2014)	USA	Cohort	Alcohol or drug dependence + major depression	201	49 (7.67)	90	Modified group TSF for alcohol and drug use vs Integrated Cognitive-Behavioural Therapy (ICBT)	Percent days drinking (PDD) and using drugs (PDDRG) from the Timeline Follow-Back (TLFB) interview	Social Support Questionnaire (SSQ) - current alcohol and drug use of each social network member. Average network use, percent abstinent, and percent regularly drinking/ using.
Worley et al. (2015)	USA	Cohort	Alcohol dependence (DSM-IV)	1197	44(N.R)	69	Oral naltrexone or acamprosate alone and in combination, with brief medical management with or without a combined behavioural intervention.	Primary drinking outcome = percent heavy drinking days (PHDD) from the Form-90	Important People Inventory (IPI) at baseline prior to treatment assignment – drinking frequency and amount of contact with up to 10 individuals in contact over last 4 months.

Author (Year)	Country	Study design	Population	Sample size	Mean age (SD)	%male	Intervention	Outcome measure (s)	Social network substance use measure
Zywiak et al. (2002)	USA	Cohort	Alcohol	952	39(11)	72	Outpatient arm of Project MATCH (CBT, MET or TSF)	The Form-90: percentage of days abstinent, monthly volume and drinks per day.	IPA- drinking behaviour and frequency of people in the social network, percentage of heavy drinkers, abstainers and recovering alcoholics.

Note. Abbreviations: not reported (N.R.), Treatment Outcome Profile (TOP; Marsden et al., 2008), Important People Drug and Alcohol (IPDA; Zywiak et al., 2009), Important People and Activities (IPA; Clifford & Longabaugh, 1991), Randomised Controlled Trial (RCT), Nicotine Replacement Therapy (NRT), Fagerstrom Test for Nicotine Dependence (FTND; Heatherton et al., 1991), Social Support Questionnaire (SSQ; Sarason et al., 1983), Important People Inventory (IPI; Longabaugh et al., 2010), Addiction Severity Index (ASI; McLellan et al., 1992), Timeline Follow-Back (TLFB; (Sobell & Sobell, 1995)), Motivational Interviewing (MI), Graduated Frequency Scale (GFS; Greenfield, 2000), Cognitive Behavioural Therapy (CBT), Motivational Enhancement Therapy (MET), Twelve-Step Facilitation (TSF), Social Behaviour Network Therapy (SBNT).

Table 5

Main Results of Included Studies in the Systematic Review – Pharmacological Interventions, Ordered Alphabetically by Author

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Day et al. (2013)	Comparing those who used heroin in past 28 days to those who did not use heroin: significantly higher mean percentage of social network members with heavy opiate or cocaine users: U = 2025, p <.05, significantly higher mean number of network members using opiates/cocaine daily: U = 2080, p <.05, and significantly higher mean total frequency of drug use in the network: U = 2186, p<.01. A significantly higher percentage of the participants who used heroin reported contact with at least one opiate user in the previous six months compared to abstinent participants (Chi-square= 11.5, df = 1, p<.01). Social network substance use was a significant predictor of heroin use in past 28 days: B=1.24, Wald statistic =8.03, p<.01.	Yes	Moderate	During
de Dios et al. (2013)	Number of smokers in the social network was significantly positively associated with the number cigarettes per day (r=.239, p<.05). Nicotine dependence level and level of motivation to quit smoking were not significantly associated with smoking status of the social network.	Yes	Weak	During
Feng et al. (2018)	Logistic regression showed that the odds of concurrent heroin use among participants who had at least one heroin using family member was 1.59 (adjusted Odds ratio) times higher (95% C.I.= 1.17- 2.15) than participants without heroin using family members.	Yes	Weak	During

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Goehl et al. (1993)	Having at least one drug-using network member and proportion of positive urine tests were positively correlated (r = 0.36, p<.01). Participants with at least one closest social network substance user had a significantly higher percentage of positive urines than those with none (t(68)=-3.2, p<.002). Remained significant independent of time in treatment (F = 8.9, DF = 1, p < .004).	Yes	Weak	During
Gogineni et al. (2001)	Increased likelihood of injecting drugs was associated with having a live-in partner who injected drugs (Chi-square=23.33, p<.01). Participants with more drug using social network members were more likely to inject drugs than those with lower (t=-4.51, p<.01).	Yes	Weak	During
Japuntich et al. (2011)	Participants with more smokers in their social network (controlling for total social network size) were less likely to be abstinent at 6-month follow-up (though not significant after alpha correction). Proportion of smokers in the social network was not significantly associated with initial abstinence or lapse–relapse risk. In hierarchical regression analyses, the number of smokers in the social network was a significant predictor of lapse risk (HR=1.05, 95% CI= [1.01-1.09], p<.05).	Mixed	Weak	Both
Li et al. (2012)	Participants with at least one drug-using friend had significantly higher concurrent heroin use (p<.01) than participants with no drug-using friends, and the odds of concurrent heroin use in participants with at least one drug using friend were 2.88 times higher (p<.01). Such tests were not significant for having at least one family member who uses drug (p>.05).	Mixed	Weak	During
Lions et al. (2014)	Participants who lived with a drug user (OR=0.88 [3.24-24.93], p<.001) or had drug using friends (OR=4.00 [1.82-8.78], p<.001) in the previous six months, were more likely to be using opioids at 1-year follow up compared to those who didn't. Living with someone who used heroin at 1-year follow up was a significant predictor of opioid use at 1-year follow up (OR=12.77 [3.44-47.37], p<.001), and accounted for 21% of all participants reporting opioid use at 1-year follow up.	Yes	Weak	After
Shen et al. (2018)	MMT clients were more likely to use heroin while attending MMT if any member of their social network joined them in using drugs (AOR = 1.94, 95% CI = 1.04-3.63, p<.05).	Yes	Weak	During
Wasserman et al. (2001)	The number of social network cocaine users was significantly negatively related to cocaine abstinence (Chi-square=5.45, p<.05), but the number of social network heroin users did not relate to heroin abstinence when covariates were adjusted for (Chi-square=2.67, p>.05).	Mixed	Moderate	During
Worley et al. (2015)	During treatment, weekly drinker social network did not predict greater PHDD (b = 1.91, SE = 1.35, b = 0.06, p = .16) and increase time spent with social network drinkers did not significantly predict greater PHDD (b = 0.42, SE = 0.22, b = 0.03, p = .06). Weekly drinker social network (b = 4.12, SE =2.31, b = 0.12, p = .07) and time spent with social network drinkers (b = 0.01, SE = 0.01, b = 0.04, p = .11) did not predict PHDD during the follow-up.	No	Weak	Both

Note. Abbreviations: Degrees of freedom (DF), Confidence Interval (CI), Hierarchical Regression (HR), Odds Ratio (OR), Methadone Maintenance Treatment (MMT), Adjusted Odds Ratio (AOR), Percent Days Heavy Drinking (PHDD), Standard Error (SE).

Table 6

Main Results of Included Studies in the Systematic Review – Psychological Interventions, Ordered Alphabetically by Author

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Litt et al. (2021)	Participants were inclined to drink more alcohol on days when they saw social network members who drink, and the more hours spent with social network members while drinking showed stronger effects (β coefficients 0.40-0.66). Participants receiving PCBT were much more likely to drink as a function of time spent with social network drinkers than those offered NS. Greater reduction in associating with people who drink in NS treatment was positively associated with treatment outcome; adding non-drinkers to the social network, instead of reducing the number of drinkers was especially important.	Mixed	Moderate	Both
McDonald et al. (2011)	Number of social network substance users was significantly related to drug use over 15 months ($F(2, 56) = 8.16$, $p < .001$). Participants who reported two or more substance users in their social network had significantly more days of drug use than those with none ($t(24.1) = -3.40$, $p < .002$) or one ($t(29.3) = 3.03$, $p < .005$). Participants with multiple social network substance users at every assessment, had more drug use over 15 months than those who never or occasionally named multiple drug users ($F(2, 56) = 20.44$, $p < .001$).	Yes	Weak	After
Mermelstein et al. (1986)	Social network measures were mostly unrelated to outcomes. Study 1 - greater number of friends who smoked at pre-treatment in treatment failures ($M= 2.0$, $S.D. = 0.86$) than treatment successes ($M=1.6$, $S.D.= 0.79$), $t(62) = 2.08$, $p < .05$. Not replicated in Study 2. Social network measures unrelated to percentage rate. Tentatively suggested that friends who smoke may hinder smoking cessation, but not always.	No	Weak	Both
Worley et al. (2014)	Social network substance use predicted PDD and ($p < .05$) and PDDRG ($p < .05$) during 1-year follow up. Less substance use across the social network was associated with lower participant substance use following treatment. Rising average amount and proportion of social network drinking over time significantly predicted greater subsequent drinking.	Yes	Moderate	After

Note. Abbreviations: Packaged Cognitive Behavioural Therapy (PCBT), Network Support (NS), Mean (M), standard deviation (SD), percent days drinking (PDD), percent days using drugs (PDDRG).

Table 7

Main Results of Included Studies in the Systematic Review – Mixed Interventions, Ordered Alphabetically by Author

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Bond et al. (2003)	Percentage of heavy/problem drinkers in the social network were significant predictors of abstinence at 1- and 3-year follow-up. Participants who were abstinent at 1-year (OR=0.72, 95% CI = [0.63-0.85], p<.01) and 3-year (OR=0.92[0.86-0.99], p<.05) follow-ups were more likely to have less social network heavy or problem drinkers. A 10% increase in proportion of heavy or problem drinkers in an individual's social network (between 12 and 36 months) was associated with a 16% decrease in the odds of abstinence at 3-years.	Yes	Moderate	After
Chong & Lopez (2008)	Being around others who use alcohol or drugs in past 30 days significantly associated with alcohol (B=0.85, p<.01, OR=2.34 [1.51-3.63] (95% CI)) and drug (B=0.88, p<.01, OR=2.42 [1.51-3.89]) use at 12 month follow up.	Yes	Moderate	After
Eddie & Kelly (2017)	All Spearman's rho correlations between number of high-risk friends at 3, 6 and 12 months and PDA at 3, 6 and 12 month-follow up ranged between +/-0.20-0.44, all significant at p<.01. All Spearman's rho correlations between time spent with high-risk friends at 3, 6 and 12 months and PDA at 3, 6 and 12 month-follow up ranged between +/-0.20-0.47, all significant at p<.01. Therefore, increased amount of high-risk friends and time spent with high-risk friends was significantly related to lower PDA, and increased amount of low-risk friends and time spent with low-risk friends was significantly related to higher PDA (all p<.01).	Yes	Strong	After
Ellis et al. (2004)	Highly significant effect of participants spouse/significant other got drunk 2 or more times per month or used drugs in 6 months after the participants discharge on relapse in the 6-month period following discharge: Estimated effect=1.35, OR= 3.8 [1.7-8.6], chi square=10.72, p<.01.	Yes	Moderate	After
Gordon & Zrull (1991)	Number of family co-drinkers had an indirect negative effect on recovery. Participatory support from nondrinking co-workers explained 39.36% of the variance and was directly related to recovery.	Yes	Weak	After
Gregoire & Snively (2001)	Participants living with current substance users after treatment were more likely to be using substances (X^2 = 11.93, df = 1; p<.01), and had higher scores on the total substance use index (Z = –2.84, p<.01).	Yes	Weak	After
Havassy et al. (1991)	Participants with no drug users in their immediate social networks were at lower risk for relapse than those who had at least one drug user, but not significant at p<.01. The effect of drug use by close friends on relapse was not significant. Therefore, having friends using drugs did not predict relapse, though drug use among immediate network members did, but not significantly at p<.01.	Mixed	Moderate	After

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Havassy et al. (1995)	Having at least one cocaine user in participants immediate social network did not predict reduced abstinence (x^2 (1, n= 104) = 0.072, p>.05). For Caucasians, having no cocaine-using friends reduced relapse likelihood, but having no close friends at all raised risk of relapse (x^2 (2, n= 104) = 10.618, p<.01).	No	Moderate	After
Karriker-Jaffe et al. (2020)	Overall, up to seven year follow up, compared to individuals in stable recovery, individuals with high alcohol dependence symptoms post-treatment had more drinkers in their social network. Compared to relapsing individuals, individuals with high alcohol dependence symptoms post-treatment had significantly more drinkers in their social network. Individuals considered in stable recovery had social networks with the lowest number of drinkers.	Yes	Weak	After
Kelly et al. (2014)	Number of high-risk friends and low-risk friends were strong predictors of substance use outcome – high risk friends predicted increased PDHD and decreased PDA and low risk friends predicted decreased PDHD and increased PDA (high risk friends on PDA: B=0.344, SE=0.08, t=-3.42, p<.001 and PDHD: B=0.059, SE=0.018, t=3.33, p<.01).	Yes	Strong	After
Litt et al. (2007)	Increase in network behavioural support for drinking (number of heavy drinkers in the social network) was significantly, but weakly, negatively associated with PDA (r= -.19, p<.05, posttreatment, r = -.16, p<.05, 9 month follow up and not significant at 15 month follow up). Not significant for continuous abstinence at any time point. Change in amount of heavy drinkers in the social network did not predict treatment success, but increase in the number of non-drinkers in the social network from baseline to posttreatment did significantly predict this (B=0.22, SE = 0.18, Wald X^2= 2.02, p < .05). Adding just one non-drinking friend to the social network accounted for a 27% increase in the probability of being very successful (abstinence on at least 90% of days at all follow-ups).	Mixed	Moderate	After
Litt et al. (2015)	Behavioural support for drinking significantly affected PDA over time: B=-0.02, SE=0.13, p<.05 but did not significantly mediate the effect of gender on PDA over time B=0.001, Z=0.16, p>.05 Changes in number of close abstinent friends in the social network partially mediated NS treatment effects for men and women.	Mixed	Moderate	After
Longabaugh et al. (2010)	Frequency of social network drinking was consistently significantly negatively related to PDA during and after treatment, but not related to PHDD. Percentage of social network abstainers or heavy drinkers were not significantly related to PDA or PHDD.	Mixed	Moderate	After
Mericle et al. (2018)	Number of heavy drinkers in the network and problem drinking were significantly associated; increased number of social network drinkers were associated with increased continued problem drinking (OR=1.07, p<.05). Controlling for social network size, time, demographics and problem severity, each additional heavy/problem drinker in the social network increased the odds of problem drinking by 7%. Having at least one heavy drinker in the social network was associated with continued problem drinking at 12-month follow-up (OR=1.15, p<.05).	Yes	Moderate	After
Tracy et al. (2016)	Increased numbers of substance using social network members at 6-months after treatment were associated with an increased likelihood of substance use 12-months following treatment (OR = 1.08, 95% CI = 1.02, 1.14).	Yes	Strong	After

Author(s) (Publication Year)	Main results in relation to review question (including relevant statistics)	Relationship found?	Quality Assessment	Time
Witbrodt & Kaskutas (2005)	Relationship between proportion of heavy drinkers in the social network and total abstinence scores was not significant (p>.05) at any time point. In alcohol-dependent participants, a larger non-drinking social network significantly predicted abstinence but only at 6 months. In drug-dependent participants, a larger network of non-drinkers (not drug users) was associated with 12-month abstinence (not 6). Drug-dependent participants gained from having more people in their social network who did not use drugs (OR=1.1, p<.05).	No	Moderate	After
Witbrodt & Romelsjo (2012)	In the American participants, having a mostly non- substance abusing social network vs a mostly substance abusing social network significantly increased the odds for moderate drinking relative to heavy drinking (OR=0.35, p<.05), but not abstinence relative to heavy drinking (p>.05) at 1 year follow up, and neither were significant in the stepwise model. In the Swedish participants, having a social network of mostly non-abusers vs mostly abusers increased the odds for moderate drinking and abstinence, compared to heavy drinking at 1-year follow up (ORs=2.86 and 3.97, p<.01).	Mixed	Moderate	After
Witkiewitz et al. (2017)	Increased social network heavy drinkers were significant predictors of heavier drinking patterns. Participants with less social network heavy drinkers had a higher probability of low risk drinking during treatment. A higher percentage of heavy drinkers in the social network predicted a higher probability of persistent heavy drinking, versus low-risk drinking.	Yes	Moderate	During
Zywiak et al. (2002)	Non-significant correlations were found between drinking status of network, network drinking frequency, maximum drinks per day in network drinkers and percentage of heavy drinkers in network and drinking outcomes (percent days abstinent, monthly volume and drinks per drinking day) across all time points. None of the social network variables significantly predicted drinking during treatment. However, a larger percentage of abstainers and recovering alcoholics in the social network was associated with lower PDA and monthly volume after treatment, an effect which remained at 3 years posttreatment on PDA (PDA: r=-.10, p<.01, MV: r=-.10, p<.01).	No	Moderate	Both

Note. Abbreviations: Odds Ratio (OR), Confidence Interval (CI), Percent Days Abstinent (PDA), degrees of freedom (DF), Percent Days Heavy Drinking (PDHD), Standard Error (SE), Percent Heavy Drinking Days (PHDD), Important People and Activities (IPA), Monthly Volume (MV).

Results from Pharmacological Interventions

Eleven papers with 11 independent samples explored the relationship between social network substance use and treatment outcome related specifically to pharmacological interventions (Table 5). While other papers also included pharmacological interventions, pharmacotherapy was provided in addition to other treatments and the effect on the pharmacological treatment alone could not be isolated in the analyses and therefore are reported under mixed interventions. Across these 11 studies, nine were assessed as weak quality evidence and two (Day et al., 2013 and Wasserman et al., 2001) were assessed as moderate. Therefore, all conclusions drawn in this section need to be interpreted cautiously due to risk of bias across studies. The results of pharmacological interventions are separated by substance below as different pharmacological interventions were used specifically for different substances.

Heroin

Eight papers explored opiate substitution treatment, almost exclusively methadone maintenance treatment (MMT). Five papers showed evidence for a relationship between social network substance use and MMT outcomes during treatment and one during follow up. Two papers had mixed results.

During Intervention. Social network substance use was found to be a significant predictor of heroin use during treatment (Day et al., 2013 and Goehl et al., 1993). Participants who reported having more drug using social network members were more likely to inject drugs during treatment than those with less (Gogineni et al., 2001). The odds of concurrent heroin use among participants who had at least one heroin using family member was 1.59 times higher than participants without heroin using family members (Feng et al., 2018). However, Li et al. (2012) found mixed results depending on the type of relationship. During MMT, concurrent heroin use in participants with at least one substance-using friend was significantly higher than participants who had no substance-using friends, but this effect was not significant for family members substance use.

Having a substance using live-in partner was shown to increase the likelihood of injecting substances during MMT (Gogineni et al., 2001). In addition, there was evidence to suggest that a social network member joining the participant when using drugs was associated with an increased likelihood of concurrent heroin use during MMT (Shen et al., 2018).

One paper which explored opioid maintenance through methadone or levo-alpha-acetyl-methadol (LAAM), had mixed results (Wasserman et al., 2001). Having fewer drug users in the social network at baseline predicted cocaine abstinence, but not opiate abstinence 3 months later. The number of social network heroin users did not relate to heroin abstinence when covariates were adjusted for. The number of social network cocaine users, however, was significantly negatively related to cocaine abstinence.

Following Intervention. Additionally, there was some evidence exploring the effects after treatment. Participants who had drug using friends or lived with a substance user in the previous six months were more likely to be using non-prescribed opioids at one year follow up (Lions et al., 2014).

Alcohol

One paper explored the effect of social network alcohol use on outcome of pharmacological interventions for alcohol dependence (naltrexone, acamprosate). During treatment, weekly drinker network did not predict greater PHDD and increased time spent with social network drinkers had a threshold but nonsignificant association with greater PHDD. Similarly, weekly drinker social network and time spent with social network drinkers did not predict PHDD during the follow-up phase (Worley et al., 2015). This paper was assessed as weak quality, therefore a firm conclusion is unable to be drawn specifically on the impact of social network alcohol use on pharmacological intervention outcomes for alcohol use disorder. More high-quality research is needed in this area to be able to make such conclusions.

Nicotine

Two papers explored pharmacological interventions for cigarette use, which consisted of bupropion, varenicline, and nicotine replacement therapy via lozenge or patches. The number of smokers in the social network was significantly positively associated with number cigarettes per day in one study (de Dios et al., 2013).

The second paper had mixed results. Participants with more smokers in their social network (controlling for total social network size) were less likely to be abstinent at 6-month follow-up, but this was not significant after alpha correction. The proportion of smokers in the social network was not significantly associated with initial abstinence or lapse–relapse risk, but the number of smokers in the social network was a significant predictor of lapse risk (Japuntich et al., 2011).

Results from Psychological Interventions

Four papers with four independent samples explored the relationship between social network substance use and psychological intervention outcomes (Table 6). Some papers included psychological interventions in combination with other interventions so the effect on the psychological interventions alone could not be isolated in the analyses and are therefore reported under combined interventions.

Two papers provided evidence of an effect of social network substance use on participant substance use outcome following treatment. McDonald et al. (2011) covered integrated group therapy versus standard drug counselling for clients with substance dependence and bipolar disorder. Number of substance users in a participant's social network was related to participant substance use over 15 months; the more social network substance users, the higher the participants substance use was during and after treatment in the 1-year follow up period. Worley et al. (2014) offered outpatient group psychotherapy for substance use disorders and major depression (as defined by the DSM-IV) or standard drug counselling. Social network substance use predicted percent days drinking (PDD) and percent days using drugs (PDDRG) during the 1-year follow up.

Less substance use across the social network was associated with lower participant substance use following treatment. Rising average amount and proportion of social network drinking over time significantly predicted greater subsequent drinking. Both papers were assessed as moderate quality.

One study showed mixed outcomes dependent on treatment group. Litt et al. (2021) explored packaged cognitive behavioural therapy (PCBT) versus a network support (NS) treatment. Participants were inclined to drink more alcohol on days when they saw social network members who drink, and the more hours spent with social network members while drinking showed stronger effects. However, effects varied across treatment. Participants receiving PCBT were much more likely to drink as a function of time spent with social network drinkers than those offered NS. This paper was assessed as moderate quality.

One study exploring a psychologically based smoking cessation group intervention including cognitive behavioural relapse prevention found limited evidence to support an impact of social network smoking on smoking outcome (Mermelstein et al., 1986). Social network measures were mostly unrelated to smoking outcomes. In their first study, a greater number of friends who smoked at pre-treatment was found in treatment failures compared to treatment successes, but this was not replicated in the second study. Social network smoking was unrelated to participant smoking rate up to 3 months posttreatment. The authors argue that their results tentatively suggest that friends who smoke may hinder smoking cessation, but not always. However, this was one paper which was assessed as weak quality and therefore a firm conclusion cannot be drawn on the impact of social network smoking on psychological smoking cessation intervention outcomes. More high-quality research is needed in this area to make such conclusions.

Results from Mixed Interventions

Nineteen papers with 17 independent samples explored the relationship between social network substance use and outcomes of interventions that included more than one category from pharmacological, psychological and peer support interventions (Table 7).

During Intervention

One study explored the relationship between social network substance use and participant substance use outcome during treatment and found support for this link. Increased social network heavy drinkers were significant predictors of heavier drinking patterns during treatment. A higher percentage of heavy drinkers in the social network predicted a higher probability of persistent heavy drinking, versus low-risk drinking (Witkiewitz et al., 2017). This study was assessed as moderate quality.

After Intervention

Ten studies with nine independent samples showed that social network substance use affected substance use outcomes after treatment. Participants who were abstinent at 1-year and 3-year follow-ups were more likely to have a lower percentage of contacts who were heavy or problem drinkers in one study (Bond et al., 2003). A 10% increase in proportion of an individual's social network who were heavy or problem drinkers (between 12 and 36 months) was associated with a 16% decrease in the odds of abstinence at 3-years (Bond et al., 2003). Similarly, being around others who use alcohol or drugs in the prior 30 days was significantly associated with participant alcohol and drug use at 1-year follow up (Chong & Lopez, 2008). A further paper found a highly significant effect of participants spouse or significant other 'got drunk' two or more times a month or used drugs in the 6 months after the participants discharge on relapse in the 6-month period following discharge (Ellis et al., 2004). A further study showed that the number of co-drinkers in participants family had an indirect negative effect on recovery (Gordon & Zrull, 1991). A study looking at women's substance use treatment, found that participants who were living with current substance users after treatment were more likely to be using substances, and had higher scores on the total substance use index (Gregoire & Snively, 2001). Increased numbers of substance using social network members at 6-months after treatment were associated with an increased likelihood of substance use 12-months following treatment (Tracy et al., 2016). Having at least one

heavy drinker in the social network was associated with continued problem drinking at 1-year follow-up (Mericle et al., 2018). A significant independent association between number of heavy drinkers in the social network and problem drinking was found in a study which showed that each additional heavy/problem drinker in the social network increased the odds of problem drinking by 7%, controlling for covariates (Mericle et al., 2018). In two papers describing one independent sample (Eddie & Kelly, 2017; Kelly et al., 2014), the number of high-risk friends and low-risk friends were found to be strong predictors of substance use outcome. Greater number of high-risk friends was associated with lower percent days abstinent (PDA) and higher percent days heavy drinking (PDHD). Additionally, increased time spent with high-risk friends was associated with lower PDA. A long-term follow-up study, following clients for 7 years after discharge from treatment (Karriker-Jaffe et al., 2020), found that compared to participants in stable recovery, participants with high alcohol dependence symptoms post-treatment had more drinkers in their social network, and those considered in stable recovery had social networks with the lowest number of drinkers. Of these ten papers, two (both reporting on sample sample) were assessed as strong, four moderate and three weak quality.

Five papers with four independent samples reported mixed findings for the relationship between social network substance use and participant substance use outcome after treatment. An increase in proportion of heavy drinkers in the social network was significantly, but weakly, negatively associated with PDA, but not continuous abstinence, up to 9-months post-treatment. Change in number of heavy drinkers in the social network did not predict treatment success status. However, an increase in the number of non-drinkers in the social network from baseline to posttreatment did significantly predict treatment success (Litt et al., 2007). Adding just one non-drinking friend to the social network accounted for a 27% increase in the probability of being very successful (reported abstinence on at least 90% of days at all follow-ups; Litt et al., 2007; Litt et al., 2015). Another study found that participants with no drug users in their immediate social networks were at lower risk for relapse than those who had at least one drug user, but this was not significant

at p<.01. The effect of drug use by close friends on relapse was not significant. Therefore, having friends using drugs did not predict relapse, though drug use among immediate network members did, but not significantly at p<.01 (Havassy et al., 1991). Frequency of social network drinking was consistently and significantly negatively related to PDA during and after treatment in one study (Longabaugh et al., 2010), but it was not significantly related to PHDD. Percentage of social network abstainers and heavy drinkers were unrelated to either measure of drinking (Longabaugh et al., 2010). In a Swedish sample, having a social network comprised mostly of non-substance abusers versus mostly substance abusers increased the odds for both moderate drinking and abstinence, compared to heavy drinking at one year follow up (Witbrodt & Romelsjo, 2012). But in their US sample, this effect was found for moderate drinking relative to heavy drinking, but not abstinence relative to heavy drinking. All these papers were assessed as moderate quality.

Three papers with independent samples found very little or no evidence of a relationship between social network substance use and participant substance use outcome. The relationship between proportion of heavy drinkers in the social network and total abstinence scores was not significant (p>0.05) at any time point up to 12-month follow-up in one study (Witbrodt & Kaskutas, 2005). Similarly, having a cocaine user in the immediate network did not predict less abstinence 6 months after treatment (Havassy et al., 1995). Non-significant correlations were found between IPA indices directly related to social network substance use (drinking status of network, network drinking frequency, maximum drinks per day in network drinkers and percentage of heavy drinkers in network) and drinking outcomes (percent days abstinent, monthly volume and drinks per drinking day) in one study (Zywiak et al., 2002). All three of these papers were assessed as moderate quality evidence.

Discussion

Summary of the Research

This systematic review aimed to answer the following questions:

a) Does engagement in substance use among individuals in a person's social network affect response to treatment in adults with substance use disorder?

b) If so, does it impede or support response to treatment and do these effects occur during treatment, after treatment or both?

Overall, despite the quality of evidence being mostly moderate or weak across all papers, most studies demonstrated that social network substance use impedes substance use treatment outcomes (during and after intervention). All papers assessed as strong quality found evidence in support of this relationship, and none of the papers which found little or no evidence for the relationship were assessed as strong quality. Therefore, globally across types of intervention and substance, it is concluded that social network substance use does negatively affect treatment outcome, by impeding participant abstinence or increasing participant substance use. The evidence for this link after treatment was stronger than during treatment. While evidence fell in favour of this link during treatment, the methodological quality of such studies was generally poor so this finding cannot be asserted as confidently.

Across the total of 32 independent samples (described in 34 papers), 19 found evidence that social network substance use impeded substance use treatment outcomes. Of these 19 papers, 10 (52.6%) were classified as weak, seven (36.8%) as moderate and two as strong (10.5%) quality evidence.

Eight samples showed at least some, but mixed, evidence that social network substance use led to worse substance use treatment outcomes. These papers found different results depending on different treatment outcomes (Japuntich et al., 2011; Longabaugh et al., 2010; Litt et al., 2007; Litt et al., 2015), social network relationships (Li et al., 2012; Havassy et al., 1991), substance

(Wasserman et al., 2001), country of participants (Witbrodt & Romelsjo, 2012) or intervention (Litt et al., 2021). Additionally, two samples showed greater support for a link between increased abstinent social network members and improved treatment outcomes (Litt et al., 2007; Litt et al., 2015 and Litt et al., 2021). Two (25%) of these eight papers were assessed as weak, six (75%) as moderate and none as strong quality evidence.

Five samples showed no or very limited evidence in support of a relationship between social network substance use and substance use treatment outcome. Two (40%) of these papers were assessed as weak, three as moderate (60%) and none as strong quality evidence.

Considering all 32 samples, nine (28.1%) explored effects during treatment, 18 (56.3%) after and five (15.6%) both during and after. Of the five samples which did not exclusively consider during or after treatment, but spanned both, none completely supported a link between social network substance use and substance use outcomes, two had mixed results and three did not support the link. Two (40%) of these were assessed as moderate quality and three (60%) weak.

Of the nine samples that explored effects during treatment, seven (77.8%) suggested that social network substance use impedes substance use outcomes, two (22.2%) provided mixed results and none found no evidence for this link. Three (33.3%) were assessed as moderate and six (66.7%) weak quality, with no papers in this section rated as strong quality. Therefore, although the papers suggest that there is a detrimental link between social network substance use and treatment outcome during treatment, this conclusion should be cautiously interpreted due to risk of bias in the studies.

Of the 18 samples exploring effects after treatment, 12 (66.7%) provided evidence to suggest that social network substance use negatively impacted substance use outcomes, four (22.2%) gave mixed results and two found no evidence for this link (11.1%). Two (11.1%) were assessed as strong quality, 11 (61.1%) moderate and five (27.8%) weak, reflecting the highest quality evidence across these studies, meaning there is more confidence in conclusions drawn in such papers. All the strong quality evidence fell in this section and there was no strong quality

evidence against the relationship. Therefore, it is fairly confidently concluded that social network substance use impedes treatment outcomes after treatment.

The strongest evidence that social network substance use impeded substance use outcomes in people with SUDS fell within the mixed intervention category, consisting of blended approaches to substance use intervention such as the Minnesota Model or residential inpatient treatment facilities including twelve-step approaches and cognitive behavioural and family therapy approaches. Therefore, it can be more confidently asserted that social network substance use does impede substance use treatment outcomes in this area. There were only four studies exclusively covering psychological interventions which tended to involve samples with comorbid conditions such as bipolar disorder. Given that there was a small amount of evidence with high heterogeneity, it was difficult to form specific conclusions and more evidence is needed in this area. While most studies were in favour of social network substance use impeding substance use treatment outcomes for pharmacological treatment specifically, the quality of evidence in these studies was particularly weak, so this interpretation needs to be treated cautiously.

Participants with substance users in their social networks are likely exposed to substance related cues more frequently which could explain the review findings. Individuals with SUDs are found to be more susceptible to substance use when presented with substance use related stimuli and show attentional bias towards such cues (Baker et al., 1986; Siegel, 1979). Many relapses are reported to occur under conditions where participants are in the presence of other people using the substance or in environments where the substance is readily available (Marlatt, 1996; O'Connell et al., 2011). Such behaviour has been described to occur through a process of classical conditioning (Tiffany, 1995). Stimuli such as substance use paraphernalia become conditioned stimuli through being paired with rewarding effects of substance use, and over time elicit a conditioned response which can include subjective craving or substance use behaviour. Research has consistently shown that participants with SUDs experience cravings when exposed to substance related cues (Carter & Tiffany, 1999). Additionally, literature on drug expectancy shows that perceived availability of a

substance triggers increased cravings compared to when there is no anticipation that the substance will be able to be used (Wertz & Sayette, 2001). Cue exposure and drug expectancy can explain the pathway to substance use in a person with an SUD presented with substance use cues. Substance use cues increase perceived expectation of the substance being available, which increases cravings and subsequent likelihood of substance use. On the other hand, it has been proposed that the presence of a substance related cue can increase levels of negative affect, such as frustration at being unable to use the substance (Jędras et al., 2013), or shame about cravings (Witkiewitz et al., 2013), which can also increase craving. By this logic, those with more abstinent social networks would be exposed to fewer substance use cues and therefore subjective craving and substance use behaviour is less likely to be triggered. Indeed, this was supported by some studies in this review (Litt et al., 2007; Litt et al., 2015; Litt et al., 2021; Witbrodt & Kaskutas, 2005; Worley et al., 2014) which found that increases in abstinent social network members were significant predictors of success status of treatment, and one study found that an increase of one non-drinking friend led to a 27% increase in the probability of treatment being considered very successful (Litt et al., 2007).

Additionally, social norms and conformity could explain poorer SUD treatment outcomes in participants with many people in their social network who use substances. Conformity can be described as succumbing to pressures of a group (Crutchfield, 1955). These pressures can be explicit or implicit and can include group norms, which are informal rules adopted by a group which all group members behave according to (Feldman, 1984). Social norms which support substance use have been shown to be important predictors of increased substance use in adolescents in colleges (Lewis & Clemens, 2011; White et al., 2019) and adults in workplaces (Frone & Brown, 2010). Therefore, say a person is engaged in a friendship group of heavy drinkers. Drinking alcohol and going to pubs may be a social norm and expectation of the group. This would make it more difficult for the person to stop using alcohol, due to the overt or covert pressure to conform and fear of losing their social relationships if they did not.

Strengths and Limitations

This systematic review had several strengths including the pre-registration of a protocol and using PRISMA guidelines to follow best practice. The review was assessed against the guidelines (Appendix B) and all applicable criteria were met. To access as much appropriate research as possible, this review used four different databases, with no limits on time. Forward and backward citation searching also increased confidence that all relevant papers were identified. In addition, due to research occurring in various countries, with various diagnostic systems and older versions of the DSM, the reviewers were inclusive with regards to the SUD inclusion criteria, so that relevant papers were not missed. The review also used a detailed quality assessment, and the quality assessment process was supported by a second independent reviewer assessing 20% of papers to improve reliability.

This systematic review also had some limitations. Across papers, most evidence was assessed as moderate or weak quality. Due to excluding grey literature, publication bias may exist within this review and may have exaggerated the link between social network substance use and substance use outcome. Similarly, excluding articles not written in English could have impacted the findings as findings may have been exclusive to papers written in English. A sample of eight full-text papers were screened by a second researcher to increase reliability of the screening process, however this was only a small proportion and further involving a second reviewer would have increased reliability and rigour of this systematic review. Finally, data extraction was completed by one researcher only and adding a second researcher extracting and confirming data would have made this process more reliable and less prone to human error.

What this Review Adds to the Literature

Social network drinking has been shown to increase alcohol use in individuals in the general population, independent of treatment contexts (Knox et al., 2019). This review extends these findings past alcohol, to individuals with SUDs in treatment, suggesting that social network

substance use also increases participant substance use throughout treatment and beyond. Additionally, this review extends Kumar et al., (2021)'s finding that social network support strengthens medication outcomes for opioid use disorders. Homing in on the results from pharmacological interventions for opiates in this review, findings suggested that substance use in the social network led to increased risk of the participant engaging in opiate use during treatment, and some evidence that this effect remains after treatment (up to 12 months). Taking the findings of these two reviews together suggests that a social network that is both supportive in the participants treatment and low in substance use would lead to better pharmacological treatment outcomes for opiates. However, this review extends past opiates and pharmacological interventions, and suggests that social network substance use impedes treatment outcomes for several types of substance (such as alcohol, opiates, nicotine, cocaine) and types of intervention (pharmacological, psychological and mixed interventions including peer support). Therefore, a social network engaging in substance use is detrimental for treatment outcomes regardless of substance or treatment type.

Clinical Implications

This review suggests that SUD treatments should not view an individual in isolation and manage only internal cravings, triggers and mood states which may elicit substance use. Treatments should also consider the environmental context around a person, specifically the social network, and the impact this can have in treatment and recovery.

A clear clinical implication from this review would be ensuring substance use interventions support the client to alter their social networks, by reducing contact with substance users, adding abstinent individuals to their social network, or offering more systemic interventions where peers and family can engage in treatment together to allow for mutual benefit. An interesting finding in three papers was that it was particularly important to add non-drinkers to the network, rather than reducing the number of drinkers (Litt et al., 2007; Litt et al., 2015; Litt et al., 2021). This suggests

that changing a clients' social network in both ways (increasing non-users and decreasing substance users) may be a useful target for intervention.

Areas for Future Research

No papers explored the effects of social network substance use on peer support interventions exclusively, which meant it was not possible to separate out effects for just peer support. Future research should aim to address this gap in the literature by exploring effects of social network substance use on peer support interventions to elucidate whether conclusions in this review hold for peer support interventions offered in isolation. Similarly, there were limited papers on psychological interventions alone, so further research in this area would also be beneficial.

Recovery from SUDs is a lifelong journey (Laudet et al., 2002) and many individuals describe themselves as in recovery after several years of abstinence (Laudet et al., 2007), suggesting the need for long-term maintenance. However, most papers had maximum follow-up periods of one year, with only one paper extending beyond three years. More high-quality, long-term follow up data is needed to provide further evidence to decipher whether the conclusions made in this review are sustained long-term.

Across studies in this review, social network substance use was measured differently, even in articles using the same instrument such as the IPA. Various relationships (family, friends, live-in partners, colleagues) as well as measures (frequency counts of users or amount of substance use, percentage of participants "heavy drinkers" which was defined differently in different studies) were taken across studies. What remains unanswered is whether any of these can explain the relationship found. For example, is the overall number of people in a social network who use substances, or total amount of substance use among all members of the social network more detrimental to treatment outcomes? This area could also be further explored in future research.

Conclusion

After weighing up the data, this systematic review provides sufficient evidence to conclude that the extent of substance use within a person with a SUD's social network has an influence on their treatment outcome and recovery. Globally, across substance and type of intervention, increased substance use in the social network leads to increased substance use behaviours and decreased abstinence scores both during and after intervention. Further high-quality long-term research is needed to explore this effect over time.

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Appendices

Appendix A

Full Search Strategies

Scopus

(TITLE-ABS-KEY (addict* OR dependen* OR "use disorder" OR misuse* OR "substance abuse" OR problem OR disorder OR alcoholic OR alcoholism) AND TITLE-ABS-KEY (alcohol OR nicotine OR tobacco OR smoking OR opiate OR heroin OR cocaine OR ecstasy OR stimulant* OR substance* OR narcotic* OR drinking OR opioid* OR opium OR cannabis OR hallucinogen* OR inhalant* OR sedative* OR hypnotic* OR anxiolytic*) AND TITLE-ABS-KEY ("social network" OR "social networks" OR "friendship network" OR "friendship networks" OR "peer network" OR "peer networks") AND TITLE-ABS-KEY (treatment OR intervention OR pharmaco* OR acamprosate OR methadone OR naltrexone OR buprenorphine OR "nicotine replacement therap*" OR bupropion OR varenicline OR disulfiram OR psychosocial OR "cognitive behavio* therap*" OR "CBT" OR "cue exposure" OR "response prevention" OR "motivational interviewing" OR "motivation* enhancement" OR "contingency management" OR "therapeutic communit*" OR "peer support" OR "alcoholics anonymous" OR "narcotics anonymous" OR "12 step" OR "12-step" OR "twelve step") AND TITLE-ABS-KEY (alcohol OR "alcohol use" OR drinking OR drug* OR "drug use" OR "substance use" OR smoking OR abstinence OR recovery OR relapse OR maintenance OR sober OR sobriety))

PsycINFO

1. exp Addiction/ or addict*.mp.
2. dependen*.mp.
3. "substance use disorder"/
4. "use disorder".mp.
5. misuse*.mp.
6. "substance abuse".mp. or exp Drug Abuse/
7. problem.mp.
8. disorder.mp.
9. alcoholic.mp.
10. alcoholism.mp. or exp Alcoholism/
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12. alcohol.mp.
13. exp Nicotine/ or nicotine.mp.

14. tobacco.mp.
15. smoking.mp.
16. exp Opiates/ or opiate.mp.
17. exp Heroin/ or heroin.mp.
18. exp Cocaine/ or cocaine.mp.
19. ecstasy.mp.
20. stimulant*.mp.
21. substance*.mp.
22. narcotic*.mp.
23. drinking.mp.
24. opioid*.mp.
25. opium.mp.
26. exp Cannabis/ or cannabis.mp.
27. exp Hallucinogenic Drugs/ or hallucinogen*.mp.
28. inhalant*.mp.
29. sedative*.mp.
30. hypnotic*.mp.
31. anxiolytic*.mp.
32. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31
33. 11 and 32
34. "social network".mp.
35. "social networks".mp.
36. "friendship network".mp.
37. "friendship networks".mp.
38. exp Peer Relations/ or "peer network".mp.
39. "peer networks".mp.
40. 34 or 35 or 36 or 37 or 38 or 39
41. treatment.mp. or exp Treatment/
42. intervention.mp. or exp Intervention/
43. pharmaco*.mp.
44. acamprosate.mp. or exp Acamprosate/

45. exp Methadone/ or methadone.mp.

46. naltrexone.mp. or exp Naltrexone/

47. buprenorphine.mp. or exp Buprenorphine/

48. "nicotine replacement therap*".mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]

49. exp Bupropion/ or bupropion.mp.

50. varenicline.mp.

51. disulfiram.mp. or exp Disulfiram/

52. psychosocial.mp.

53. exp Cognitive Behavior Therapy/ or "cognitive behavio* therapy".mp.

54. CBT.mp.

55. "cue exposure".mp.

56. "response prevention".mp.

57. exp Motivational Interviewing/ or "motivational interviewing".mp.

58. "motivation* enhancement".mp.

59. "contingency management".mp. or exp Contingency Management/

60. "therapeutic communit*".mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]

61. "peer support".mp.

62. alcoholics anonymous.mp. or exp Alcoholics Anonymous/

63. narcotics anonymous.mp.

64. exp Twelve Step Programs/ or "12 step".mp.

65. 12-step.mp.

66. "twelve step".mp.

67. 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66

68. alcohol.mp.

69. "alcohol use".mp.

70. drinking.mp.

71. drug*.mp.

72. "drug use".mp.

73. "substance use".mp.

74. smoking.mp.

75. exp Drug Abstinence/ or abstinence.mp.

76. recovery.mp.

77. relapse.mp.

78. maintenance.mp.

79. sober.mp.

80. sobriety.mp. or exp Sobriety/

81. 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80

82. 33 and 40 and 67 and 81

CINAHL

TX (Addict* OR dependen* OR “use disorder” OR misuse* OR “substance abuse” OR problem OR disorder OR alcoholic OR alcoholism) AND TX (alcohol OR nicotine OR tobacco OR smoking OR opiate OR heroin OR cocaine OR ecstasy OR stimulant* OR substance* OR narcotic* OR drinking OR opioid* OR opium OR cannabis OR hallucinogen* OR inhalant* OR sedative* OR hypnotic* OR anxiolytic*) AND TX ("social network” OR "social networks" OR “friendship network” OR “friendship networks” OR “peer network” OR “peer networks”) AND TX (Treatment OR intervention OR pharmaco* OR acamprosate OR methadone OR Naltrexone OR Buprenorphine OR “nicotine replacement therap*” OR bupropion OR varenicline OR Disulfiram OR psychosocial OR “cognitive behavio* therap*” OR “CBT” OR “cue exposure” OR “response prevention” OR “motivational interviewing” OR “motivation* enhancement” OR “contingency management” OR “therapeutic communit*” OR “peer support” OR “alcoholics anonymous” OR “narcotics anonymous” OR “12 step” OR “12-step” OR “twelve step”) AND TX (alcohol OR “alcohol use” OR drinking OR drug* OR “drug use” OR “substance use” OR smoking OR abstinence OR recovery OR relapse OR maintenance OR sober OR sobriety)

Web of Science

Addict* OR dependen* OR “use disorder” OR misuse* OR “substance abuse” OR problem OR disorder OR alcoholic OR alcoholism (Topic) and alcohol OR nicotine OR tobacco OR smoking OR opiate OR heroin OR cocaine OR ecstasy OR stimulant* OR substance* OR narcotic* OR drinking OR opioid* OR opium OR cannabis OR hallucinogen* OR inhalant* OR sedative* OR hypnotic* OR anxiolytic* (Topic) and “social network” OR "social networks" OR “friendship network” OR “friendship networks” OR “peer network” OR “peer networks” (Topic) and Treatment OR intervention OR pharmaco* OR acamprosate OR methadone OR Naltrexone OR Buprenorphine OR “nicotine replacement therap*” OR bupropion OR varenicline OR Disulfiram OR psychosocial OR “cognitive behavio* therap*” OR “CBT” OR “cue exposure” OR “response prevention” OR “motivational interviewing” OR “motivation* enhancement” OR “contingency management” OR “therapeutic communit*” OR “peer support” OR “alcoholics anonymous” OR “narcotics anonymous” OR “12 step” OR “12-step” OR “twelve step” (Topic) and alcohol OR “alcohol use” OR drinking OR drug* OR “drug use” OR “substance use” OR smoking OR abstinence OR recovery OR relapse OR maintenance OR sober OR sobriety (Topic)

Appendix B

PRISMA Checklist

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1 and 7
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-6
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	6 and 9
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	7
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	9
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	7-8 and 10
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	8 and 51-54
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	9-11

Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	11
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	11
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Study level, 15-18
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n/a
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n/a

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	41
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	10-11
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	19-24
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	15-18
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	24-29
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n/a
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			

Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	37-39
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	41
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	39-43
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	n/a

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097 For more information, visit: **www.prisma-statement.org**.

Appendix C

EPHPP Tool and Guidelines

EPHPP tool and guidelines have been removed to ensure conformance with copyright legislation.

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Section Two: Empirical Study

The Role of Self-control and Situational Strategies in Recovery from Addiction

Abstract

Aims: This study aimed to explore the role of situational strategies in recovery from alcohol use disorders (AUD). It hypothesised that people in recovery would use more situational strategies than heavy drinkers, assumed likely to have at least a mild AUD. Substance-free reinforcement, social network alcohol density and coping self-efficacy were hypothesised to mediate the relationship between preventive coping (reflecting situational strategies) and recovery.

Methods: A cross-sectional between groups design. Participants in recovery from AUD (N=43) and heavy drinkers (N=63) completed an online survey including demographics and measures of situational strategies (preventive coping), substance-free reinforcement, social network alcohol use, coping self-efficacy and negative urgency (a facet of self-control). T-tests and Mann-Whitney U tests examined between groups differences. Mediation analyses occurred across all participants and within the recovery sample. Correlations and regressions explored relationships between recovery and independent variables.

Results: Hypothesised group differences in preventive coping (reflecting situational strategies), substance-free reinforcement and coping self-efficacy were not found, but social network alcohol density was significantly lower in the recovery group. No mediation of preventive coping on recovery occurred. Within the recovery group, correlations and regressions showed that increased preventive coping, coping self-efficacy, substance-free reinforcement and reduced negative urgency were related to greater stability of recovery and predicted different aspects of it.

Conclusions: Social network alcohol density distinguishes individuals in recovery from heavy drinkers. Preventive coping, substance-free reinforcement, coping self-efficacy and negative urgency are important correlates of the stability of recovery. Clinical implications and methodological issues are discussed.

Practitioner Points

1. Heavy drinkers, assumed to have at least mild AUDs, had higher social network alcohol density than individuals in recovery.

2. Increased preventive coping, coping self-efficacy, substance-free reinforcement and reduced negative urgency were related to greater stability of recovery.

3. Reducing the proportion of social network alcohol use and increasing substance-free reinforcement should increase AUD treatment effectiveness and chances of stable recovery.

4. Further research is needed to bolster these findings and extend to other SUDs and/or behavioural addictions.

Keywords: Addiction, alcohol use disorders, dependence, recovery, heavy drinkers, situational strategies, preventive coping, social network substance use, substance-free reinforcement, coping self-efficacy, self-control

The Role of Self-control and Situational Strategies in Recovery from Addiction

Substance Use Disorders (SUDs)

Substance Use Disorders (SUDs) are defined by the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-V; American Psychiatric Association, 2013) by 11 criteria including taking larger amounts of the substance than intended, experiencing cravings and urges to use the substance, spending significant time acquiring, using, or recovering from the substance, repeated use despite associated difficulties (e.g., relationship troubles) and being unable to reduce or stop use. A person experiencing at least two of these criteria in the past year meets criteria for a SUD, which are classed as mild (meets 2-3 criteria), moderate (meets 4-5 criteria) or severe (meets 6+ criteria). Previous diagnostic manuals used different terminology. The fourth edition of the DSM (4th ed.; DSM–IV-TR; American Psychiatric Association, 2000) specified alcohol abuse and dependence. The International Classification of Diseases (10th ed.; ICD-10; World Health Organisation, 1993) used the term dependence, reflecting strong urges to take substances with the substance becoming highly prioritised over other activities which were previously more highly valued. The term SUD will be used throughout this study, which includes individuals who would have been termed substance dependent or abusing by earlier diagnostic manuals.

SUDs, and AUDs specifically, are associated with many health conditions including cancers, heart disease, stroke, liver damage, accidental injury, and mental health difficulties including mood and anxiety disorders (Rehm, 2011; Schulte & Hser, 2014). AUDs also have a large economic impact on society. Public Health England estimated the economic cost of alcohol misuse in England as £21-52 billion (Public Health England, 2016). Globally, alcohol use was the seventh highest risk factor for deaths and disability-adjusted-life-years in 2016 (Griswold et al., 2018) and a recent meta-analysis estimated the economic cost of alcohol consumption as 2.6% of the gross domestic product (Manthey et al., 2021).

Recovery

Individuals with SUDs have been described as difficult to treat long-term as relapse rates are high (Sinha, 2011) and epidemiology studies report modest rates of long-term recovery. Sheedy & Whitter (2009)'s review of studies of recovery prevalence argues that 58% sustain stable recovery. A systematic review and meta-analysis showed that the remission rate from SUDs was between 35.0% and 54.4% (Fleury et al., 2016). However, recovery from SUDs is challenging to define, and definitions vary from complete abstinence (Steindler, 1998) to it depending on the individual's narrative and definition of recovery (Kaskutas et al., 2014).

Nevertheless, individuals with SUDs can recover spontaneously without intervention, often termed 'natural recovery' (Granfield & Cloud, 1999). Lee Robins' seminal studies shed light on why this may occur. Robins studied veterans on their return from Vietnam in 1971 (Robins et al., 1974; Robins et al., 1975). Heroin was inexpensive, pure, and readily accessible in Vietnam then. Forty-three percent of veterans reported using opiates in Vietnam and 20% experienced heroin dependence. In the 8-12 months after their return home, only 10% reported trying heroin again, 2% reported using heroin more than weekly for over a month and <1% reported becoming readdicted. Three years later, 2% were addicted to heroin. Robins' studies propose that substance dependence can occur, and end, primarily based on situational, social, and contextual factors (availability, price, social norms, and life circumstances).

Self-control

Addiction literature has long focused on internal processes involved in addiction and recovery rather than contextual and environmental factors. A key construct proposed to predict recovery from addiction is self-control, defined as the ability to be in charge of your behaviour, inhibit impulses, and choose the long-term positive outcome over short-term gain (American Psychiatric Association, n.d.). Deficits in self-control are highlighted in theories of substance

dependence (Lyvers, 2000; Kwako et al., 2015). Foddy & Savulescu (2010)'s willpower view argues that addiction involves a willpower (or impulse inhibition) deficit as the individual knows the damage substance use is doing but cannot stop. They argue that pleasure likely motivates individuals with SUDs above anything else, so they struggle to exert self-control.

Many theories of self-control focus on impulse inhibition; however, alternative perspectives have been proposed. Gottfredson & Hirschi's (1990) self-control theory suggests that people with high self-control are particularly good at identifying risks and benefits of their behaviour and altering their environment to allow them to achieve long-term goals. Similarly, Fujita (2011) argues that self-control is more than the effortful inhibition of impulses, and psychologists should take a wider perspective on defining self-control. Duckworth et al. (2016) argue for the process model of self-control, that manipulating our surroundings to our advantage is a highly effective form of self-control because it limits the chances of needing to employ impulse inhibition strategies in the moment in response to a cue (e.g., a substance). Therefore, environmental manipulation may have the greatest benefit when internal impulse control strategies are inadequate.

Situational Strategies

Snoek et al. (2016) conducted a longitudinal qualitative study of the development and view of self-control in individuals with SUDs. Sixty-nine individuals in SUD treatment were interviewed. Most participants self-reported high willpower, contrary to the willpower view. The number of strategies participants used, and how strongly they endorsed them, differentiated those in stable recovery from those who remained addicted. Strategies described included: changing living environment, social identity changes via changes to social network, or getting a substance-free partner. Snoek et al. (2016) provides the first evidence that self-generated situational strategies underlie SUD recovery, and argue that using situational strategies, which circumvent the need for willpower, are more significant for recovery than willpower itself. These findings reflect the wider

self-control literature above (Duckworth et al., 2016; Fujita, 2011) and warrant further exploration to develop our understanding of recovery from SUDs.

Mediators of Recovery

Self-efficacy

Self-efficacy refers to an individual's belief in their likelihood of success in a situation, through their belief in their ability to implement a plan of action (Bandura, 1977). Within addiction research, a strong relationship between self-efficacy and substance use outcomes after various treatments has been demonstrated (Adamson et al., 2009). Self-efficacy has also been shown to mediate SUD treatment effects (LaChance et al., 2009), so is likely to be a mediator of recovery.

Social Network Substance Use

Much substance use occurs in a social context (see Moos, 2006) and substance use behaviour can be learnt through observing and imitating other people (social learning theory, Bandura et al., 1961; Bandura, 1977). An individual's social network reflects people they have relationships with, such as friends, family, spouses, and colleagues (Cox, 2005). Social network alcohol density refers to the amount of alcohol use in the social network (Levitt et al., 2020). A systematic review showed that social network drinking increased individuals' alcohol use in the general population (Knox et al., 2019). In AUD populations, individuals with more social network substance use show decreased odds of abstinence after alcohol treatments (Bond et al., 2003). Social network alcohol use is therefore proposed as an important factor involved in recovery from AUDs.

Substance-free Reinforcement

Behavioural economics proposes that SUDs occur when the reinforcing value of the substance is higher than all alternative available reinforcers (Bickel et al., 2014). Substance-free

reinforcement is reinforcement gained by social, occupational, and recreational activities unrelated to substance use. Acuff et al. (2019)'s systematic review showed that increases in substance-free reinforcement were associated with abstinence from substance use following various treatments, for alcohol use (Murphy et al., 2005), cocaine dependence (Rogers et al., 2008) and smoking (Schnoll et al., 2016). Consequently, substance-free reinforcement is proposed as an important factor in recovery from SUDs.

Rationale for this Research

Research suggests that typically, recovery happens when an individual has an increase in alternative substance-free opportunities for reinforcement, increased acknowledgement of costs of addiction, alters their social networks to limit contact with other substance users, and improves the use of strategies to manage their substance use urges or impulses (Tucker et al., 1994; McIntosh & McKeganey, 2000). Such strategies have been assumed to be internal self-control strategies for resisting temptation via response inhibition, but Snoek et al. (2016)'s qualitative research suggests that those strategies are situational. However, this is yet to be explored quantitatively. Therefore, this research seeks to address this gap in the literature using quantitative methods.

Self-control in terms of impulse inhibition represents the internal drivers of recovery, whereas the focus of this study is external, situational factors. Therefore, negative urgency (a facet of impulse control characterised by the tendency to act rashly under extreme negative emotions, most highly correlated with drinking problems and alcohol dependence (Coskunpinar et al., 2013)) was included as a covariate in this research.

This research focuses on alcohol use, as AUD is the most prevalent SUD (Merikangas & McClair, 2012; Glantz et al., 2020), so would contribute meaningful data to clinical practice that could benefit many people. It was also the most practical sample to recruit within the research parameters (time, resource, limited incentives) due to the prevalence of alcohol use.

Aim

To quantitatively study the role of situational strategies in recovery from AUDs in a sample of participants in recovery from AUDs, compared to a sample of individuals in the general population who drink over the recommended amount of alcohol (referred to as "heavy drinkers"), who were likely (and assumed) to have AUDs at the mild end of the spectrum.

Hypotheses

The experimental hypotheses were:

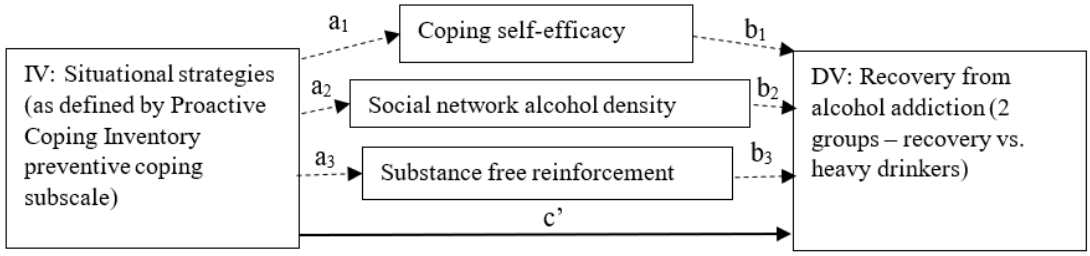
1. Participants in the recovery group will use more situational strategies to avoid alcohol use (so score higher on the preventive coping subscale of the Proactive Coping Inventory (PCI; Greenglass et al., 1999)) compared to those in the heavy drinkers group.
2. Participants in the recovery group will have higher confidence in their ability to use adaptive coping strategies (so score higher on the Coping Self-Efficacy Scale (CSES, Chesney et al., 2006) compared to the heavy drinkers group.
3. Participants in the recovery group will have higher substance-free reinforcement than the heavy drinkers group, assessed by an adapted version of the Activity Level Questionnaire (ALQ, Meshesha et al., 2020).
4. Participants in the recovery group will have lower social network alcohol density, measured by the Brief Alcohol Social Density Assessment (BASDA, Fortune et al., 2013), compared to the heavy drinkers.
5. An exploratory hypothesis is proposed that coping self-efficacy, social network alcohol density and substance-free reinforcement will mediate the relationship between situational strategy use and recovery, but any one of these mediators could explain most of the effect (Figure 1). Exploratory analyses will also explore relationships between these constructs and

Substance Use Recovery Evaluator (SURE, Neale et al., 2016) total score and subscales in the recovery group.

6. The mediating effects described in hypothesis five will remain significant after statistically controlling for individual differences in a domain of self-control known as negative urgency (measured by UPPS-P negative urgency subscale, Whiteside & Lynam, 2001).

Figure 1

A Diagrammatic Interpretation of the Hypothesised Mediation Effects



Note. Abbreviations: IV = independent variable, DV = dependent variable, a and b = coefficients per mediator reflecting indirect effect paths, c' = direct effect.

Methods

Design

This cross-sectional, between groups study used quantitative methods to compare groups on situational strategy use (measured through preventive coping) and explored potential mediators of that anticipated group difference (substance-free reinforcement, social network addiction density and self-efficacy). Data collection began in March 2021.

Procedure

Service User Involvement

The Sheffield Addiction Recovery Research Panel (ShARRP) is a Patient and Public Involvement (PPI) panel who review potential addiction research, comprised of individuals with experience of dependent substance use and their partners or family. The proposed research was presented at two ShARRP meetings. Feedback was gained on feasibility of recruitment for the

recovery sample including acceptability of completing measures independently online (due to covid-19). No specific concerns related to individuals in recovery completing the measures online were raised. The panel argued that a £5 incentive should be offered as this is average remuneration for similar research. Unfortunately, this request for incentivisation was declined by the DClinPsy research committee, and the ShARRP shared that recruitment may struggle as a result. The ShARPP also provided feedback on the accessibility and acceptability of questionnaires and participant facing information.

Recruitment

For the recovery group, an invitation to participate (Appendix A) was circulated within community recovery organisations with the assistance of ShARRP and on relevant pages and groups on social media (Facebook, Twitter and Reddit).

Recruitment for the heavy drinkers sample consisted of a volunteer sample of adults who self-reported drinking over the recommended government guidelines of alcohol (more than 14 units a week; Department of Health, 2016). A separate invitation to participate (Appendix B) was shared on social media (Facebook, Twitter and Reddit). The University of Sheffield volunteers mailing list was also used to recruit for this group.

Survey

Participants completed an online survey, hosted on Qualtrics. An information sheet which differed across groups was presented first (Appendix C). A consent form followed, and participants virtually signed their agreement if they wished to participate (Appendix D). The questionnaires were then presented in a random order to combat fatigue effects. Three attention checks were dispersed throughout. Debrief information followed (Appendix F). Then participants could enter a prize draw to win one of two £25 Amazon vouchers, by providing their email address.

Participants

Recovery group inclusion criteria were adults 18 years+, who consider themselves in recovery from an alcohol problem ("alcoholism", alcohol dependence, or alcohol use disorder) for one year or longer. Recovery has been categorised into early (<1 year), sustained (1-5 years) and stable recovery (>5 years; Betty Ford Institute, 2007). Specifying five years in recovery would be restrictive and make recruitment difficult. A minimum of one year is a relatively commonly used cut-off to describe recovery (e.g., Spinelli & Thyer, 2017), and added variability in stability of recovery to help test the experimental hypotheses.

Heavy drinkers group inclusion criteria were adults 18 years+, who drink more than 14 units of alcohol per week. People who drink more than 14 units a week are at increased risk of alcohol-related harm (Department of Health, 2016) and likely to meet several DSM-V SUD criteria e.g., drinking more than intended, hazardous use and experiencing tolerance. A higher cut off was considered, or a screening stage to assess alcohol use severity before inviting participants to take part, with measures such as the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992; Saunders et al., 1993), Michigan Alcoholism Screening Test (MAST; Selzer, 1971) or CAGE (Cut, Annoyed, Guilty, Eye) Questionnaire (Ewing, 1984). Concerns regarding likelihood of recruitment without incentives prevented this. Therefore, the inclusion criteria of more than 14 units was chosen to ensure recruitment of a reasonably sized sample, while retaining enough alcohol use to presumably reflect at least the less severe end of AUDs, without attempting to diagnose this.

Exclusion criteria for both groups were individuals under age 18, currently undergoing a detoxification program and who were intoxicated at the time of accessing the survey.

Ethical Considerations

Ethical approval was gained from the University of Sheffield research ethics committee (Appendix F). An information sheet containing information required for participants to provide

informed consent was provided. A significant percentage of individuals with SUDs have capacity to provide informed consent for research and unless the individual is experiencing advanced cognitive impairment, acute withdrawal or intoxication, capacity to consent should be assumed (Morán-Sánchez et al., 2016). Participants were asked not to participate if they were currently intoxicated, otherwise capacity to consent was assumed.

Participants were informed that participation is voluntary, and they could withdraw by closing their browser. Participant numbers ensured confidentiality and anonymity. Vouchers were used for the prize draw to reduce potential harm from cash incentives for individuals who use substances. Debrief information included helplines should any distress have arisen or if participants wanted support regarding their substance use. A data management plan ensured data was managed and stored in line with GDPR (Appendix G).

Measures

Participants in both groups completed the same measures (Appendix H).

Demographics

A socio-demographics questionnaire was developed based on the UK Life in Recovery Survey (Best et al., 2015), a large-scale survey exploring individuals' lifelong experiences of SUD recovery. Information was gathered on various aspects including gender, age, location, education, and health.

Recovery

Recovery was measured using the Substance Use Recovery Evaluator (SURE, Neale et al., 2016), a 26 item self-report outcome measure. Twenty-one items are scored on a 5-point Likert scale. Five items are not scored but designed for participants to consider their recovery priorities. The scale has five factors: substance use, self-care, relationships, material resources and outlook on

life. The SURE demonstrates high internal consistency (Chronbach's alpha 0.92) and test-retest reliability. The SURE showed appropriate discriminant validity and concurrent convergent validity as the five factors positively correlated with a quality-of-life measure (WHOQOL-BREF; Skevington et al., 2004) and the Assessment of Recovery Capital (ARC; Groshkova et al., 2013) subscale scores. People who self-identify as in recovery score significantly higher on the measure than those who do not, or are unsure (Neale et al., 2016).

Situational Strategies

As Snoek et al., (2016) was the first to describe situational strategies in recovery qualitatively, a quantitative measure which maps onto this construct was sought. The Proactive Coping Inventory (PCI, Greenglass et al., 1999) is a 55 item self-report questionnaire containing seven subscales: proactive coping, preventive coping, reflective coping, strategic planning, instrumental support seeking, emotional support seeking and avoidance coping. The PCI subscales show high internal consistency (Cronbach alphas from .71-.85), and its factorial validity and homogeneity has been verified (Greenglass et al., 1999). The PCI preventive coping subscale (PCI-PC) measures foreseeing potential challenges and introducing strategies to manage situations before they arise. Research exploring situational aspects in coping responses to stressful experiences around ageing used the PCI-PC (Ouwehand et al., 2006), and argued that the PCI-PC accurately captures the tendency to prevent potentially challenging situations before they fully develop, which is also what situational strategies refer to. Therefore, just the preventive coping subscale (PCI-PC) was administered as it maps most closely onto the construct of situational strategies.

Self-control

The Urgency, Premeditation (lack of), Perseverance (lack of), Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (UPPS-P, Whiteside & Lynam, 2001) is a 59-item self-report measure of impulsive behaviour with five factors: negative urgency, positive urgency, lack of

premeditation, lack of perseverance and sensation seeking. The UPPS-P has been psychometrically validated and shows good test-retest reliability (Weafer et al., 2013). The 12-item negative urgency (tendency to act rashly under extreme negative emotions) subscale (UPPSP-NU) was administered to decrease participant burden, as this facet of self-control it is most highly correlated with drinking problems and alcohol dependence (Coskunpinar et al., 2013).

Coping Self-Efficacy

The Coping Self-Efficacy Scale (CSES, Chesney et al., 2006) measures an individual's confidence to use positive coping strategies in challenging circumstances. The CSES's psychometric properties have been assessed (Chesney et al., 2006; Cunningham et al., 2020). A 13-item version was revealed by exploratory and confirmatory factor analyses. Test-retest correlation coefficients were strong (.40 -.80) and convergent and divergent validity were demonstrated by partial correlations with the Ways of Coping (Folkman & Lazarus, 1988). The 13-item version was administered to measure coping self-efficacy and reduce participant burden.

Substance-free Reinforcement

A modified version of the Activity Level Questionnaire (ALQ; Meshesha et al., 2020) was administered to measure substance-free reinforcement. The substance-free version of the ALQ was used; participants were asked to rate the frequency in the past 30 days and enjoyment of 17 types of activity when they had not used alcohol, on 5-point Likert scales. The ALQ demonstrates good internal consistency (Meshehsa et al., 2020). The measure was adapted for the covid-19 pandemic. Activities that were possible under local government restrictions were added first, then a message followed explaining that some activities that follow may not have been possible due to covid-19, but due rapidly changing restrictions all questions will be asked, and the remaining items followed.

Social Network Alcohol Density

The 20-item Brief Alcohol Social Density Assessment (BASDA; Fortune et al., 2013) was administered to measure social network alcohol use. Four closest non-biological relatives in the individuals' social network are rated on quantity and frequency of alcohol use. The BASDA has very good internal reliability for each individual social network member (α's = .88−.90) and an average (α = .90; MacKillop et al., 2013).

Data Analysis

Data were analysed using IBM SPSS (Version 26). Descriptive statistics for the demographic data and IVs were calculated. Differences between groups on the demographic variables were examined with Chi-squared or independent samples t-tests.

Mann-Whitney U tests were conducted to explore group differences (recovery vs heavy drinkers) in situational strategies (measured by PCI-PC), substance-free reinforcement (ALQ), social network alcohol density (BASDA), negative urgency (UPPSP-NU) and recovery (SURE, and each SURE subscale) due to skewed distributions. An independent samples t-test measured group difference in coping-self efficacy (CSES) as this was normally distributed. To ensure any null findings were not due to limited statistical power, Bayesian Mann-Whitney-U or independent samples t-tests were conducted on Jeffreys's Amazing Statistics Program (JASP) v0.16.1. (Goss-Sampson 2022) for each of these analyses. Given the results of these primary analyses, a subgroup analysis was conducted using a subgroup of the heavy drinkers as the comparison group, which is described in the results section.

As situational strategies (measured by PCI-PC) was the key variable of interest, a logistic regression was conducted with PCI-PC as the predictor and group as the outcome variable. An exploratory multiple mediation analysis with bootstrapping was conducted to explore the proposed mediation model, controlling for negative urgency.

The multiple mediation analysis was replicated with the recovery group data, with scores on the SURE as a continuous outcome variable. In the recovery group data, Spearman's rho correlations were calculated to explore relationships between IVs and SURE scores, and exploratory linear regressions examined predictors of recovery stability.

Power Calculations

G*Power for independent samples t-tests was used to estimate required sample size, as this research was primarily interested in how situational strategies differs between people in recovery versus heavy drinkers. As there is no previous quantitative research into situational strategies in recovery, a "medium" effect size (d = 0.5) was chosen (Cohen, 1988). With a standard alpha of 0.05, a total sample size of 102 would be required to reach 80% power. G*Power for logistic regression was used to estimate sample size required for the mediation analysis using a "medium" effect size (d = 0.5) according to Cohen's conventions (Cohen, 1988). With a standard alpha of 0.05, a total sample size of 55 would be required to reach 80% power. However, 55 seemed too small for the proposed analysis, compared to guidance from the literature (Bujang et al., 2018). Therefore, a minimum of 102 participants were recruited, so the primary analysis was sufficiently powered so that useful data could be contributed regarding the primary research question. As the mediation analysis was exploratory, achieved power for further analyses was calculated post-hoc.

Results

Descriptive statistics are presented, followed by results per experimental hypothesis. Further exploratory analysis on the recovery group data follow, ending with a subgroup analysis.

Descriptive Statistics

Overall, 211 people accessed the survey, 103 in the heavy drinkers group and 108 in the recovery group. Thirty-nine participants in the heavy drinkers group and 64 in the recovery group

withdrew by closing their browser. Hence, 62.14% in the heavy drinkers group and 40.74% in the recovery group finished the survey.

Participants' ages ranged from 18 to 79. The mean age was 36.63. Age did not significantly differ between groups (U=1269, z =-.55, p=.582). 54.72% of the sample were female, 43.40% male, 0.94% transgender, 0.94% agender.

Group differences in demographic variables were explored (Table 1). Compared to the heavy drinkers group, the recovery group had a significantly higher percentage of: females ($X^2(3)=11.43$, p=.010), participants in America ($X^2(10)=29.66$, p=.001), participants who had ever received mental health support ($X^2(2)=16.33$, p<.001) and currently ($X^2(2)=21.47$, p<.001). The recovery group had a significantly lower proportion of students ($X^2(7)=19.41$, p<.01) and White British participants ($X^2(7)=15.32$, p=.032).

Table 1

Descriptive Statistics for Demographic Variables per Group and Overall Sample and Tests of Group Difference

	Recovery Group (N=43)		Heavy Drinkers Group (N=63)		Total Sample (N = 106)		
Demographic Variable	N	%	N	%	Total N	Total %	Group difference
Ethnicity							
Asian	0	0.00	5	7.94	5	4.72	$X^2(7)=15.32$, p=.032
Black British	0	0.00	3	4.76	3	2.83	
Mixed Race	2	4.65	0	0.00	2	1.89	
Other, please specify:	1	2.33	1	1.59	2	1.89	
Prefer not to say	1	2.33	1	1.59	2	1.89	
White British	25	58.14	46	73.02	71	66.98	
White European	10	23.26	5	7.94	15	14.15	
White Irish	4	9.30	2	3.17	6	5.66	
Gender							
Female	31	72.09	27	42.86	58	54.72	$X^2(3)=11.43$, p=.010
Male	11	25.58	35	55.56	46	43.40	
Other	0	0.00	1	1.59	1	0.94	
Transgender	1	2.33	0	0.00	1	0.94	

	Recovery Group (N=43)		Heavy Drinkers Group (N=63)		Total Sample (N = 106)		
Demographic Variable	N	%	N	%	Total N	Total %	Group difference
Employment							
Employed Full time	25	58.14	33	52.38	58	54.72	$X^2(7)=19.41$, p=.007
Employed part time	3	6.98	4	6.35	7	6.60	
Other	4	9.30	1	1.59	5	4.72	
Prefer not to say	1	2.33	0	0.00	1	0.94	
Retired	0	0.00	5	7.94	5	4.72	
Student	4	9.30	19	30.16	23	21.70	
Unemployed	5	11.63	1	1.59	6	5.66	
Volunteer	1	2.33	0	0.00	1	0.94	
Location							
Australia	1	2.33	0	0.00	1	0.94	$X^2(10)=29.66$, p=.001
Canada	0	0.00	1	1.59	1	0.94	
Czech Republic	0	0.00	1	1.59	1	0.94	
Finland	1	2.33	0	0.00	1	0.94	
Ireland	1	2.33	0	0.00	1	0.94	
Netherlands	1	2.33	0	0.00	1	0.94	
New Zealand	1	2.33	0	0.00	1	0.94	
Philippines	0	0.00	1	1.59	1	0.94	
United Kingdom of Great Britain and Northern Ireland	24	55.81	58	92.06	82	77.36	
United States of America	13	30.23	1	1.59	14	13.21	
Missing data	1	2.33	1	1.59	2	1.89	
Housing							
Homeless	1	2.33	0	0.00	1	0.94	$X^2(5)=5.26$, p=.385
Other	1	2.33	1	1.59	2	1.89	
Privately owned	16	37.21	30	47.62	46	43.40	
Rented – long term/stable	19	44.19	18	28.57	37	34.91	
Rented – short term/temporary	5	11.63	13	20.63	18	16.98	
Shared	1	2.33	1	1.59	2	1.89	
Education							
A or AS level	8	18.60	14	22.22	22	20.75	$X^2(7)=9.16$, p=.241
Apprenticeship	1	2.33	0	0.00	1	0.94	
Doctorate	4	9.30	11	17.46	15	14.15	
GCSE or O Level	3	6.98	3	4.76	6	5.66	
Masters degree	12	27.91	16	25.40	28	26.42	
NVQ	3	6.98	0	0.00	3	2.83	
No formal qualifications	1	2.33	0	0.00	1	0.94	
Undergraduate degree	11	25.58	19	30.16	30	28.30	
Setting							
Rural area	1	2.33	0	0.00	1	0.94	$X^2(3)=3.25$, p=.355
Rural town	9	20.93	8	12.70	17	16.04	
Suburban	16	37.21	23	36.51	39	36.79	
Urban	17	39.53	32	50.79	49	46.23	

	Recovery Group (N=43)		Heavy Drinkers Group (N=63)		Total Sample (N = 106)		
Demographic Variable	N	%	N	%	Total N	Total %	Group difference
Relationship Status							
Divorced or separated	3	6.98	3	4.76	6	5.66	$X^2(4)=6.44$, p=.169
In a relationship but not cohabiting	3	6.98	9	14.29	12	11.32	
Married or cohabiting	21	48.84	37	58.73	58	54.72	
Not in a relationship	16	37.21	12	19.05	28	26.42	
Prefer not to say	0	0.00	2	3.17	2	1.89	
Income							
Below £10000	5	11.63	10	15.87	15	14.15	$X^2(5)=4.29$, p=.523
£10001-20000	3	6.98	7	11.11	10	9.43	
£20001-30000	4	9.30	10	15.87	14	13.21	
£30001-40000	8	18.60	5	7.94	13	12.26	
Above £40000	20	46.51	26	41.27	46	43.40	
Prefer not to say	3	6.98	5	7.94	8	7.55	
Children							
No	31	72.09	43	68.25	74	69.81	$X^2(1)=.18$, p=.672
Yes	12	27.91	20	31.75	32	30.19	
Physical Health							
Excellent	2	4.65	7	11.11	9	8.49	$X^2(4)=2.28$, p=.684
Fair	9	20.93	14	22.22	23	21.70	
Good	20	46.51	22	34.92	42	39.62	
Poor	2	4.65	3	4.76	5	4.72	
Very Good	10	23.26	17	26.98	27	25.47	
Medical Help for Physical Health							
No	28	65.12	49	77.88	77	72.64	$X^2(1)=2.06$, p=.151
Yes	15	34.88	14	22.22	29	27.36	
Mental Health							
Excellent	2	4.65	5	7.94	7	6.60	$X^2(4)=5.50$, p=.239
Fair	7	16.28	21	33.33	28	26.42	
Good	16	37.21	18	28.57	34	32.08	
Poor	8	18.60	6	9.52	14	13.21	
Very Good	10	23.26	13	20.63	23	21.70	
Mental Health Help Ever							
No	6	13.95	32	50.79	38	35.85	$X^2(2)=16.33$, p<.001
Prefer not to say	0	0.00	1	1.59	1	0.94	
Yes	37	86.05	30	47.62	67	63.21	
Mental Health Help Currently							
No	17	39.53	22	34.92	39	36.79	$X^2(2)=21.47$, p<.001
Yes	20	46.51	8	12.70	28	26.42	
N/a	6	13.95	33	52.38	39	36.79	

Data Cleaning

Data were cleaned in preparation for formal analysis. Two participants (one per group) were excluded for failing two or more attention checks. Participants who failed one attention check (N=2 recovery, N=3 heavy drinkers) were retained to allow for human error. There was no missing data as the force response option had been used in Qualtrics. Two outliers were identified (z-score >|3.29|), one in each of the SURE relationships and material resources subscales, which were mean replaced. Normality was assessed by exploring histograms, Q-Q plots, skew and kurtosis values and Kolmogorov-Smirnov and Shapiro-Wilk tests (Appendix I). PCI-PC, SURE (and all subscales), ALQ, BASDA and UPPSP-NU violated the assumption of normality for parametric tests, so nonparametric tests were used. CSES was normally distributed, so parametric tests were used. Table 2 displays descriptive statistics for the IVs and between group tests.

Table 2

Means, Standard Deviations and Medians for the Independent Variables by Group and Overall Sample and Tests of Between Group Difference

Variable	Recovery Group (N=43)	Heavy Drinkers Group (N=63)	Overall Sample (N=106)	Group Difference
PCI-PC (max score = 40)				
Mean	30.58	29.83	30.13	U=1267, z = -.56,
SD	5.55	6.08	5.85	p=.573, r=-.56,
Median	31.00	31.00	31.00	BF_{01}=4.36
CSES (max score = 130)				t(104)=-.92, p=.343, =.09, BF_{01}=3.28
Mean	69.12	73.38	71.65	
SD	23.96	22.95	23.35	
Median	70.00	73.00	71.50	
ALQ (max score = 136)				U=1191, z= -1.05, p=.293, r=-.10,
Mean	83.60	78.71	80.70	BF_{01}=3.40
SD	27.46	27.73	27.60	
Median	87.00	79.00	81.50	

Variable	Recovery Group (N=43)	Heavy Drinkers Group (N=63)	Overall Sample (N=106)	Group Difference
BASDA (max score = 36)				
Mean	15.26	19.29	17.65	U=960, z= 2.54,
SD	9.06	6.86	8.04	p=.011, r=-.25,
Median	17.00	20.00	18.00	BF_{01}=.25
UPSPP-NU (max score = 48)				U=985.5, z = -2.38, p=.017, r=-.23, BF_{01}=0.22.
Mean	32.21	28.00	29.71	
SD	7.80	7.09	7.64	
Median	31.00	29.00	29.00	
SURE (max score = 63)				U=1225, z = -.84, p=.404, r=-.08,
Mean	54.19	52.79	53.36	BF_{01}=3.76
SD	6.55	7.58	7.18	
Median	56.00	54.00	54.50	
SURE Drinking and Drugs (max score = 18)				U=1048, z = -2.08, r=-.20, p=.037, BF_{01}=1.33
Mean	16.42	15.46	15.85	
SD	2.45	2.73	2.63	
Median	18.00	16.00	17.00	
SURE Self-care (max score = 15)				U=1333.5, z = -.14, p=.892, r=-.01, BF_{01}= 4.62
Mean	11.30	11.37	11.34	
SD	2.66	2.55	2.59	
Median	11.00	11.00	11.00	
SURE Relationships (max score = 12)				U=1344, z = -.08, p=.940, r=-.01, BF_{01}= 4.60
Mean	10.77	10.71	10.73	
SD	1.78	1.81	1.79	
Median	12.00	12.00	12.00	
SURE Material Resources (max score = 9)				U=1317.5, z = -.29, p=.775, r=-.03, BF_{01}=4.26
Mean	8.37	8.31	8.33	
SD	0.98	1.17	1.09	
Median	9.00	9.00	9.00	
SURE Outlook on Life (max score = 9)				U=1264, z = -.61, p=.544, r=-.06, BF_{01}=4.12
Mean	7.33	7.14	7.22	
SD	2.00	1.97	1.98	
Median	8.00	8.00	8.00	

Note. Abbreviations: SD = standard deviation, PCI-PC = Proactive Coping Inventory Preventive Coping subscale, a measure of preventive coping reflecting situational strategy use, CSES = coping self-efficacy scale, a measure of coping self-efficacy, ALQ = Activity Level Questionnaire, a measure of substance-free reinforcement, BASDA = Brief Alcohol Social Density Assessment, a measure of social network alcohol use, UPSPP-NU = Urgency, Premeditation (lack of), Perseverance (lack of), Sensation Seeking, Positive Urgency, Impulsive Behavior Scale, Negative Urgency subscale, a measure of negative urgency, SURE = Substance Use Recovery Evaluator, a measure of recovery.

Hypothesis One – Situational Strategies

A Mann-Whitney U test was conducted with the IV group (with two levels, recovery or heavy drinkers) and PCI-PC score as the dependent variable (DV). This was not significant: U=1267, z=-.56, p=.573, r=-.56. The Bayes factor (BF_{01}=4.36) reflected substantial evidence in favour of the null hypothesis compared to the alternative hypothesis according to Wagenmakers et al. (2011). A logistic regression was performed to see if PCI-PC score could predict group membership, but this was not significant ($X^2(1)$=.43, p=.511) and correctly predicted 59.4% of cases.

Hypothesis Two – Coping Self-efficacy

An independent samples t-test was conducted with the IV group (recovery or heavy drinkers) and CSES as the DV. This was not significant: t(104)=-.92, p=.343, r=.09. The Bayes factor (BF_{01}=3.28) reflected substantial evidence in favour of the null hypothesis compared to the alternative hypothesis.

Hypothesis Three – Substance-free Reinforcement

A Mann-Whitney-U test was conducted with the IV group (recovery or heavy drinkers) and ALQ as the DV. This was not significant: U=1191, z=-1.05, p=.293, r=-.10. The Bayes factor

(BF_{01}=3.40) reflected substantial evidence in favour of the null hypothesis compared to the alternative hypothesis.

Hypothesis Four – Social Network Alcohol Density

A Mann-Whitney U test was conducted with the IV group (recovery or heavy drinkers) and BASDA as the DV, which was significant, U=960, z= 2.54, p=.011, r=-.25. The recovery group (Mdn = 17) had significantly lower social network alcohol density compared to the heavy drinkers group (Mdn = 20). The Bayes factor (BF_{01}=.25) provided substantial evidence in favour of the alternative hypothesis compared to the null hypothesis.

Hypotheses Five and Six – Impulse Inhibition and the Mediation Model

A Mann-Whitney U test was conducted with the IV group (recovery or heavy drinkers) and UPPSP-NU as the DV. Negative urgency significantly differed between groups: U=985.5, z =-2.38, p=.017, r=-.23. The recovery group were significantly higher in negative urgency (Mdn = 31) than the heavy drinkers group (Mdn = 29). The Bayes factor (BF_{01}=0.22) provided substantial evidence in favour of the alternative hypothesis compared to the null hypothesis. To address hypothesis five, the mediation analysis entered UPPSP-NU as a covariate to control for individual differences in negative urgency.

Mediation Analyses

Multicollinearity was not identified as none of the IVs were highly correlated with each other (r_s>0.8). Heteroscedasticity was assessed via scatterplots of the residuals and was not identified. The SPSS PROCESS Macro model 4 was used to complete a bootstrapped mediation analysis. The IV was preventive coping (PCI-PC) and DV was group (recovery or heavy drinkers), the three proposed mediators were coping self-efficacy (CSES), social network alcohol density (BASDA) and substance-free reinforcement (ALQ), and UPPSP-NU was entered as a covariate.

The direct effect of PCI-PC on group was not significant, B=-.05, SE=.04, p=.275. The total indirect effect of PCI-PC on group was not significant, B=-.03, SE=.02, 95% CI=-.09 - .01. None of the indirect effects were significant (Table 3).

Table 3

Summary of Indirect Effects for Mediation Analysis (N=106)

Variable	B	SE B	95% CI
BASDA	-.0137	.0144	-.0502 - .0052
CSES	-.0017	.0085	-.0254 - .0097
ALQ	-.0128	.0144	-.0468 - .0108

This analysis shows that there was no mediation occurring. However, the final logistic regression model for the outcome group was significant ModelLL(5)=17.52, p=.004, and explained 20.56% of the variance in group (Nagelkerke R^2=.2056). There was a significant effect of BASDA on group, B=.06, SE=.03, z(5)= 2.13, p=.033. BASDA was not related to PCI-PC, which was confirmed by the non-significant regression model with BASDA as the outcome (p=.149) and the effect of PCI-PC on BASDA was not significant B=-.21, SE=.14, t(2,103)=-1.50, p=.136. Therefore, BASDA is not a mediator of PCI-PC on group but predicts group directly. There was also a significant direct effect of UPPSP-NU on group, B=-.10, SE=.04, z(5)=-2.60, p=.009.

Recovery Group Analysis

Spearman's rho correlations were undertaken with SURE overall and subscale scores for each of the IVs in the recovery group data (Table 4). Greater stability of recovery overall was associated with higher levels of preventive coping (r_s=.33), coping self-efficacy (r_s=.54), substance-free reinforcement (r_s=.47) and lower levels of negative urgency (r_s=-.42). Increased self-care

(SURE subscale) was significantly associated with higher coping self-efficacy (r_s=.33), substance-free reinforcement (r_s=.39) and lower negative urgency (r_s=-.42). Increased outlook on life (SURE subscale) was significantly associated with higher preventive coping (r_s=.32), coping self-efficacy (r_s=.64) and substance-free reinforcement, (r_s=.38) and lower negative urgency (r_s=-.39).

Table 4

Spearmans Rho Correlations Between SURE Scores and Other Variables in the Recovery Sample (N=43)

Variable	SURE		SURE Drinking and drug use		SURE Self-care		SURE Relationships		SURE Material resources		SURE Outlook on life	
	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p	r_s	p
PCI-PC 4	.33*	.029	.04	.797	.23	.134	.11	.499	.29	.060	.32*	.037
CSES	.54***	<.001	.25	.105	.33*	.032	.26	.092	.16	.299	.64***	<.001
ALQ	.47**	.001	.24	.124	.39**	.009	.29	.063	.24	.129	.38*	.013
BASDA	.08	.603	-.05	.747	.12	.449	.06	.692	.01	.964	.03	.834
UPPSP-NU	-.42**	.005	-.14	.364	-.42**	.005	.03	.853	-.12	.458	-.39**	.009

Note. * = correlation is significant at the 0.05 level (2-tailed), ** = correlation is significant at the 0.01 level (2-tailed), *** = correlation is significant at the 0.001 level (2-tailed).

Due to the likelihood of variability of recovery, the mediation analysis was repeated on the recovery group data using SURE overall score as a continuous outcome variable. The direct effect of PCI-PC on SURE was not significant B=.16, SE=.17, p=.336. The total effect of PCI-PC on SURE was not significant B=.15, SE=.10, 95% CI= -.09 - .32. None of the indirect effects for CSES, ALQ or BASDA were significant (Table 5).

Table 5

Summary of Indirect Effects for Recovery Group Mediation Analysis (N=43)

Variable	B	SE B	95% CI
CSES	.0768	.0636	-.0378 - .2132
ALQ	.0842	.0729	-.0599 - .2281
BASDA	-.0091	.0463	-.1458 - .0434

According to the analysis, no mediation occurred. However, the overall regression model for the outcome SURE was significant F(5,37)=4.46, p=.003, and predicted 37.61% of variance in SURE scores (R^2=.3761). There was a significant effect of ALQ on SURE, B=.07, t(5,37)=2.22, SE=.03, p=.033. ALQ was not related to PCI-PC, which was confirmed by the non-significant regression model with ALQ as the outcome (p=.361) and the effect of PCI-PC on ALQ was non-significant B=1.15, SE=.80, p=.160. Therefore, ALQ is not a mediator of PCI-PC on SURE score but predicts SURE directly. Among participants in recovery, higher substance-free reinforcement was positively correlated with overall stability of recovery, as measured by SURE total score.

Supplementary Analyses

Recovery is multifaceted, so it was important to explore relationships between variables and individual factors of recovery, in addition to the overall score. Further supplementary regressions were undertaken with IVs that significantly correlated with SURE subscales in the recovery group, to further explore the relationship between these variables and find the most significant predictors.

Multiple Linear Regressions

SURE Self-Care Regression. A multiple regression was performed with SURE self-care score as the DV and CSES, ALQ and UPPSP-NU as IVs (Table 6). Taken together, CSES, ALQ

and UPPSP-NU significantly predicted SURE self-care scores, F(3,39)=5.88, p=.002 and explained 25.9% of the variance in SURE self-care (Adjusted R^2=.259). ALQ and UPPSP-NU were significant individual predictors of SURE self-care score, t(39)=2.76, p=.009 and t(39)=-2.55, p=.015 respectively. As ALQ increased and UPPSP-NU decreased, SURE self-care score increased. Squaring the semi-partial correlations showed that 13.40% and 11.49% of the variance in SURE self-care was accounted for by the unique contributions of ALQ and UPPSP-NU respectively.

Table 6

Summary of Multiple Regression Analysis for Variables Predicting SURE Self-care Score in the Recovery Group (N=43)

Variable	B	SE B	β	p
CSES	.003	.018	.023	.887
ALQ	.037	.013	.378**	.009
UPPSP-NU	-.138	.054	-.405*	.015

Note. Adjusted R^2=.259, *=p<.05, **=p<.01

SURE Outlook on Life Regression. A multiple regression was performed with SURE outlook on life as the DV and PCI-PC, ALQ, CSES and UPPSP-NU as IVs (Table 7). Taken together, PCI-PC, CSES, ALQ and UPPSP-NU significantly predicted SURE outlook on life scores, F(4,38)= 5.75, p=.001, and explained 31.1% of the variance in SURE outlook on life. CSES was the only significant individual predictor t(38)=2.90, p=.006 showing that as CSES increased, SURE outlook on life increased. Squaring the semi-partial correlation showed that 13.84% of the variance in SURE outlook on life was accounted for by the unique contribution of CSES. However, the scatterplot of the residuals suggested that the assumption of homoscedasticity had been somewhat violated for this analysis, meaning it needs to be cautiously interpreted.

Table 7

Summary of Multiple Regression Analysis for Variables Predicting SURE Outlook on Life Score in the Recovery Group (N=43)

Variable	B	SE B	β	p
PCI-PC	.036	.051	.101	.476
CSES	.038	.013	.459**	.006
ALQ	.013	.010	.180	.187
UPPSP-NU	-.021	.040	-.083	.596

Note. Adjusted R^2=.311, **=p<.01

Supplementary Subgroup Analysis

A Mann-Whitney U-test was conducted with the IV group (recovery or heavy drinkers) and SURE score as the DV. This test was not significant: U=1225, z=-.84, p=.404, r=-.08, BF_{01}=3.76. Examining the SURE subscales, Mann-Whitney U tests showed a significant difference between group on the drinking and drug use subscale, U=1048, z=-2.08, r=-.20, p=.037, BF_{01}=1.33, which was higher in the heavy drinkers (Mdn = 18) than the recovery group (Mdn = 16). There were no significant differences between group on any of the other SURE subscales (self-care: U=1333.5, z=-.14, p=.892, r=-.01, BF_{01}= 4.62, relationships: U=1344, z=-.08, p=.940, r=-.01, BF_{01}= 4.60, material resources: U=1317.5, z=-.29, p=.775, r=-.03, BF_{01}=4.26, outlook on life: U=1264, z=-.61, p=.544, r=-.06, BF_{01}=4.12).

The two groups did not differ on overall SURE as expected, suggesting that while the control sample drank more alcohol than is recommended, they featured less problematic drinking than anticipated. Given this lack of difference between the two groups, and observation that the heavy drinkers group tended to report few problems associated with their drinking, the between groups analyses were repeated with the recovery sample versus a subgroup of participants in the

heavy drinkers group, to capture individuals more likely to experience more alcohol dependence symptoms. The subgroup consisted of the lowest scoring third of participants in the heavy drinkers group (N=21) on the SURE drinking and drug use subscale, as lower scores indicate more substance use. The SURE drinking and drug use was negatively skewed, so a conservative third ensured a reasonable level of problematic substance use while maintaining a sufficient sample size for a meaningful analysis. Group comparisons for PCI-PC, CSES and ALQ remained non-significant (effect sizes r=-.21, .09, -.21 respectively) as per the initial analysis which provides confidence that null findings were not due to the control sample not being dependent enough (Appendix I).

In the original analysis, BASDA and UPPSP-NU significantly differed between groups. In this subgroup analysis neither did (effect sizes r=-.23 and -.09, Appendix I), though BASDA was approaching significance (p=.062). These results offer an indication regarding these variables, but it is possible that they may be type II errors due to limited power so must be cautiously interpreted. The mediation model was not repeated as power would be very low, making the analysis meaningless.

Power Analysis

A post-hoc power calculation was undertaken for the between groups tests. Given an alpha of 0.05, medium effect size of 0.5 (Cohen, 1988) and sample size of 106, power achieved was 0.81 which is above the recommended threshold of 0.8 (Cohen, 1988;1992). When this power analysis was repeated for the subgroup analysis (N=64), power achieved was 0.40, meaning the subgroup results cannot be strongly relied upon.

For the mediation analyses, given an alpha of 0.05, medium effect size of f^2=0.15 (Cohen, 1988), sample size of 106 and five predictors (IV:PCI-PC, mediators: BASDA, CSES, ALQ, covariate: UPPSP-NU), achieved power was 0.87 which is above the recommended threshold of 0.8

(Cohen, 1988). This power analysis was repeated for the exploratory mediation analysis on the recovery group data (N=43). Power achieved was 0.40, meaning this analysis needs to be interpreted cautiously as may be subject to Type II error.

Discussion

This research aimed to quantitatively explore the role of situational strategies in recovery from AUDs. Hypotheses one to four proposed that the recovery group would have significantly higher situational strategy use (PCI-PC), coping self-efficacy, substance-free reinforcement, and lower social network alcohol density than the heavy drinkers group, respectively. The between-groups analyses did not provide evidence to support hypotheses one to three, so each of these hypotheses were rejected. The corresponding Bayes factors provided substantial evidence in favour of the null hypotheses compared to the alternative hypotheses, so it is reasonable to assume that the null hypotheses were not incorrectly accepted due to inadequate statistical power. The between groups analyses provided evidence to reject null hypothesis four, therefore hypothesis four was accepted. Hypotheses five and six were rejected as the mediation analyses did not support the proposed mediation model, though social network alcohol density directly predicted group membership. The mediation analyses on the recovery group data only also did not support the proposed mediation model, but substance-free reinforcement directly predicted stability of recovery.

Based on the literature demonstrating that self-efficacy predicts treatment outcome (Adamson et al., 2009) including occurrence (Stephens et al., 1995), quantity (Maisto et al., 2000) and frequency (Greenfield et al., 2000) of substance use after SUD treatment, and is a mediator of treatment effect (Litt et al., 2005: LaChance et al., 2009), it was expected that participants in recovery would have higher self-efficacy compared to participants who were currently drinking heavily and likely to meet diagnostic criteria for AUD. However, participants did not have to have undertaken SUD intervention in this study. Much self-efficacy research explores short-term

treatment outcomes (e.g., up to 12 months, Allsop et al., 2000) whereas if participants had engaged in an intervention, it may have occurred years previously, which could account for the different results, as long-term effects have not been established.

The finding that substance-free reinforcement did not distinguish between groups was surprising as behavioural economics theory proposes that substance misuse is more likely in environments without alternative reinforcers to substances (Bickel et al., 2014; Higgins et al., 2004) and SUD treatments that increase substance-free reinforcement demonstrate positive outcomes (Rogers et al., 2008), suggesting substance-free reinforcement is important in intervention success. However, substance-free reinforcement directly predicted stability of recovery in the recovery group, which is more in line with this literature.

The finding that social network alcohol density was significantly lower in the recovery group compared to the heavy drinkers group is consistent with established literature demonstrating the deleterious effect of social network substance use on treatment outcomes (Bond et al., 2003) and that individuals who achieve stable recovery post-treatment have lower social network alcohol use compared to those with dependence symptoms post-treatment (Karriker-Jaffe et al., 2020). It is possible that some individuals with SUDs may find themselves within a social network involving a high proportion of substance use, without necessarily choosing those individuals to be part of their social network, such as blood relatives. Such circumstances may influence an individual to engage in substance use or struggle to reduce their substance use due to implicit or explicit social norms (Feldman, 1984) around substance use and conforming to the pressures of their social network. However, it is also possible that individuals with SUDs may actively seek out relationships with other individuals who use substances for reasons such as kinship, sense of safety, or protection. Either or both explanations may apply depending on the individual and their circumstances. Despite predicting group membership, social network alcohol density did not significantly correlate with SURE in the recovery sample, suggesting that it can distinguish a person in recovery from a heavy

drinker, but is not related to stability of recovery. While not an experimental hypothesis, the recovery group had significantly higher negative urgency (lower impulse control) than the heavy drinkers, opposing the willpower view (Foddy & Savulescu, 2010). This implies that impulse control may not be as important in recovery from SUDs as research suggests.

This research offers interesting findings on the process of recovery from AUDs. The results show there is lots of variability among people in recovery. Increased preventive coping, coping self-efficacy, substance-free reinforcement and lower negative urgency were significantly related to greater stability of recovery. Additional relationships were uncovered when exploring SURE subscales, which reveals how different constructs predict different aspects of recovery. These novel findings for AUDs are broadly supported by the literature on recovery from SUDs. Self-efficacy has been shown to predict SUD recovery (Kelly & Greene, 2014), though this relationship was mediated by recovery motivation. Resistance to impulsivity, and self-regulation, were positively related to length of abstinence of participants in recovery houses (Ferrari et al., 2009). Recovery from SUDs has been demonstrated when access to substance-free rewarding activities increases (Tucker et al., 2002), specifically in smokers (Schnoll et al., 2016).

Situational strategy use is a novel research area in recovery from SUDs with only one quantitative paper. The between group results were unexpected in light of Snoek et al. (2016)'s findings, but methodological issues need to be considered and further research is required. The recovery group analysis provided some support for Snoek et al. (2016)'s finding that situational strategies underlie recovery as preventive coping was significantly associated with stability of recovery, but there was no evidence to suggest that situational strategies are more important than impulse control in recovery, as negative urgency was also associated with stability of recovery with a larger correlation coefficient.

Strengths and Limitations

This research has many strengths. To the researcher's knowledge, it is the first quantitative research to explore situational strategies in recovery from AUDs. Therefore, this novel research adds to the evidence base and our understanding of recovery, with important clinical implications. Attention checks increased the reliability of the data and reduced fatigue effects. Statistical methods used were rigorous, completing power calculations and supplementing inferential statistics with Bayesian statistics to thoroughly test the hypotheses. PPI through the ShARRP allowed service user voices to be heard, adding credibility to the research.

This research also has several limitations. The groups were not distinct on the SURE as expected. The mean overall SURE score in the recovery sample (54.19) was higher than the self-identified recovery sample (45.2) in Neale et al. (2016), suggesting that participants were more stable in their recovery in the current study. This offers confidence that the recovery group did consist of individuals in recovery. However, most participants in the heavy drinkers sample scored at the higher end of the drinking and drug use subscale. The median score on this subscale for the heavy drinkers group was 16 with a mean of 15.46 (max score=18). Higher scores on this subscale reflect lower levels of use. Although participants drank above the UK recommended drinking guidelines, meaning they were drinking at a harmful level, their low scores on this subscale suggest relatively unproblematic substance use, reflecting the less severe end of dependent alcohol use. This potential explanation for the null between group findings was mitigated by the subgroup analysis but conclusions were hard to rely upon due to limited power. Nevertheless, the SURE is not designed to quantify substance use problems in individuals not in recovery. Therefore, supplementing the SURE with a validated measure of alcohol use, such as the AUDIT, or dependence severity, such as the Severity of Dependence Scale (SDS; Gossop et al., 1995), MAST or CAGE Questionnaire would have helped discern whether the participants reflected dependence as a comparison group, and is recommended for future research.

It has been argued that mediation analysis should not be completed in the absence of a direct effect because of the belief that mediation cannot occur without one (Apodaca & Longabaugh, 2009). Statistically speaking, mediation can occur without total or overall effects (Kenny & Judd, 2014) and O'Rourke & MacKinnon (2018) argue that there is rationale to conduct mediation analyses, regardless of total or overall effect, specifically in alcohol treatment research, as it allows the potential to better understand the mechanisms involved. As this analysis was exploratory, with the aim of learning more about the process of recovery in a new area, it was deemed appropriate to complete the mediation analyses despite the lack of direct effects.

The volunteer samples likely introduced bias. Participants who volunteer for research can differ from the target population, particularly with confidential or personal research topics such as substance use or sexual behaviour (Strassberg & Lowe, 1995). Online completion reduced inclusivity by preventing participation from those without access to internet or devices, or those who cannot read. Despite attempting to mitigate this by seeking feedback from the ShARRP, the completion rate in the recovery group was low, which could reflect lower acceptability or difficulties completing the questionnaires.

The covid-19 pandemic occurred throughout data collection, which reduced the validity of the ALQ. Essential public health measures such as lockdowns and physical distancing meant that the availability of substance-free reinforcement was suddenly significantly limited. Additionally, economic impacts of the pandemic such as job losses affected individuals' availability to source alternative substance-free reinforcement which may have led to increased substance use globally and in individuals with SUDs (Acuff et al., 2021). Therefore, it must be held in mind that the findings of this research (especially related to substance-free reinforcement) occurred during this unique time, and it would be helpful to repeat post-pandemic to see if the results hold.

Finally, the mediation analysis on the recovery group data (N=43), and the subgroup analyses (N=64) were underpowered. Due to timeframe, practical constraints, lack of incentives and exhausting all avenues of recruitment, it was not possible to recruit further participants, meaning results need to be carefully interpreted.

Areas for Future Research

Future research should repeat this work with stricter inclusion criteria reflective of dependence for the comparison group. It may be that the proposed between group effects do occur, but in comparison to people with SUDs, as this was not specified in the current study. Individuals with SUDs are a difficult population to reach for research purposes, due to power differentials and stigma (Cook & Larson, 2021). It was not possible to recruit individuals with SUDs for this research due to the time restraints and lack of incentives. Including a measure of current substance use in addition to a recovery measure would also be recommended. It would be beneficial to expand this research to other substances (e.g., opiates, stimulants, nicotine) and addictions (e.g., gambling) to further explore this sparse field of research.

Clinical Implications

This research has important clinical implications. If the process of recovery from SUDs can be better understood and supported by intervention, the lives of individuals with SUDs could be improved, and the economic burden reduced. This research suggests that treatment for AUDs should focus on contextual and environmental factors, in addition to internal resources such as self-control and self-efficacy. For example, Cognitive Behavioural Therapy (CBT) is an evidence-based treatment for SUDs, focusing on changing thoughts and behaviours related to the substance (McHugh et al., 2010). This offers limited recognition of the contextual and environmental factors which may play a role. While CBT shows good outcomes (Magill et al., 2019), they are improved when combined with other interventions (e.g., pharmacological) or other types of care (Irvin et al.,

1999; Magill & Ray, 2009; Ray et al., 2020). This research provides some suggestion that supplementing individualistic treatments with interventions that consider contextual and environmental factors would likely be beneficial. Specifically, reducing social network alcohol use may be an important target for intervention, as people in recovery have lower social network alcohol use than those who drink heavily. This research supports McKay (2016)'s argument that increasing substance-free reinforcement should be included in interventions to increase chances of stable recovery.

Conclusion

In conclusion, the primary hypothesised group difference in preventive coping (reflecting situational strategies) was not found and no mediation occurred. Group differences in substance-free reinforcement and coping self-efficacy were not found, but people in recovery had lower social network alcohol density than heavy drinkers. Supplementary analysis with the recovery group data showed that increased preventive coping, coping self-efficacy, substance-free reinforcement and reduced negative urgency were related to greater stability of recovery and predicted different aspects of it. These findings need to be carefully interpreted considering the methodological weaknesses discussed but shed some light on a narrowly explored area of research.

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Appendices

Contents

Appendix A

Invitation to Participate: Recovery Group

ONLINE STUDY – PARTICIPANTS NEEDED

"The Role of Self-control and Strategies in Recovery from Addiction"

What is this research about?

We are conducting research to understand the process of recovery from addiction. We are interested in how people learn to avoid temptation and choose to spend their time, and how these decisions might support people to recover from addiction.

In order to do this research, we want to compare people who are in recovery from addiction with other people who drink alcohol regularly.

Who can take part?

Please **only** take part if:

- You consider yourself to be in recovery from an alcohol problem ("alcoholism", or alcohol dependence, or alcohol use disorder) for one year or longer.
- You have access to a laptop or desktop computer with internet access to enable you to take part in this research.

Please **do not** take part if:

- You are under 18 years old
- You are currently undergoing a detoxification programme
- You are currently intoxicated as this may affect your ability to give informed consent

What will it involve?

You will be asked to complete some questionnaires online. This should take approximately 20-30 minutes. You will first be asked some questions about your circumstances. Additional questions will ask about various topics such as your alcohol and drug use and that of your close friends, how you spend your time, and how you manage your mood and are able to resist temptation.

Responses will be kept strictly confidential and participation will be anonymous. At the end of the study, you can choose to be entered into a prize draw to win one of two £25 Amazon vouchers for completing the study. If would like to take part, please scan the Qualtrics QR code below to access the survey.

Researcher Contact details

Laura Ames (Trainee Clinical Psychologist) – lames2@sheffield.ac.uk

Supervised by Prof. Matt Field, matt.field@sheffield.ac.uk

Appendix B

Invitation to Participate: Heavy Drinkers Group

ONLINE STUDY – PARTICIPANTS NEEDED

"The Role of Self-control and Strategies in Recovery from Addiction"

What is this research about?

We are conducting research to understand the process of recovery from addiction. We are interested in how people learn to avoid temptation and choose to spend their time, and how these decisions might support people to recover from addiction.

In order to do this research, we want to compare people who are in recovery from addiction with other people who drink alcohol regularly.

Am I eligible to take part?

Please **only** take part if:

- You typically drink more than 14 units of alcohol per week (this is equivalent to about 6 pints of beer or cider, one and a half bottles of wine, or 14 measures of spirits).
- You have access to a computer, tablet or smartphone with internet access to enable you to complete the online questionnaires.

Please **do not** take part if:

- You are under 18 years old
- You are currently undergoing a detoxification programme
- You are currently intoxicated as this may affect your ability to give informed consent
- You consider yourself to be in recovery from an alcohol problem ("alcoholism", or alcohol dependence, or alcohol use disorder).

What will it involve?

You will be asked to complete some questionnaires online. This should take approximately 20-30 minutes. You will first be asked some questions about your circumstances. Additional questions will ask about various topics such as your alcohol and drug use and that of your close friends, how you spend your time, and how you manage your mood and are able to resist temptation.

Responses will be kept strictly confidential and participation will be anonymous. At the end of the study, you can choose to be entered into a prize draw to win one of two £25 Amazon vouchers for completing the study. If would like to take part, please scan the Qualtrics QR code below to access the survey.

Researcher Contact details

Laura Ames (Trainee Clinical Psychologist), lames2@sheffield.ac.uk
Supervised by Prof. Matt Field, matt.field@sheffield.ac.uk

Appendix C

Participant Information Sheets

Recovery Group

Participant Information Sheet

Research Project Title: The Role of Self-control and Strategies in Recovery from Addiction

Researchers: Laura Ames (Trainee Clinical Psychologist), Professor Matt Field

You are being invited to take part in this research project. Before you decide if you would like to take part in this research, it is important that you understand what it will involve and why this research is taking place. Please read the following information carefully and take time to consider whether or not you would like to take part in this research, discussing with others if you would like. If you have any questions, if you want any more information or if there is anything you are unsure of, please contact the lead researcher via email (Laura Ames, lames2@sheffield.ac.uk) before continuing.

Why is this research taking place?

We are conducting research to understand the process of recovery from addiction. We are interested in how people learn to avoid temptation and choose to spend their time, and how these decisions might support people to recover from addiction. In order to do this research, we want to compare people who are in recovery from addiction with other people who drink alcohol regularly.

This research is being conducted as part of a Doctorate in Clinical Psychology (DClinPsy) training programme at the University of Sheffield.

Why have I been chosen?

You have been chosen to take part as you may consider yourself to be in recovery from an alcohol problem ("alcoholism", or alcohol dependence, or alcohol use disorder). Please only take part if you consider yourself to be in recovery from an alcohol problem for one year or longer.

Please **do not** take part if you are under 18 years old, are currently undergoing a detoxification programme or are currently intoxicated as this may affect your ability to give informed consent.

Do I have to take part?

You do not have to take part. Participation is voluntary, so it is entirely up to you whether you decide to take part or not. If you decide you would like to take part, you will be asked to confirm your consent. You can withdraw at any time before you have completed the questionnaires by closing your website browser, in which case your responses will not be stored. Once you get to the end of the questionnaires and submit your responses, your

data will be anonymised, and it will no longer be possible for you to withdraw your responses.

What will taking part involve?

You will be asked to complete some questionnaires online. This should take approximately 20-30 minutes. You will first be asked some questions about your circumstances. Additional questions will ask about various topics such as your alcohol and drug use and that of your close friends, how you spend your time, and how you manage your mood and are able to resist temptation.

What are the possible disadvantages and risks of taking part?

Answering some of the questions in this study may make you concerned about your drinking or drug use. Remember that you can withdraw from the study by closing your browser window if this happens. You can also contact your GP or Healthcare provider for advice and support for cutting down on alcohol can be found here: https://www.nhs.uk/live-well/alcohol-support/tips-on-cutting-down-alcohol/.

What are the possible benefits of taking part?

At the end of the study you can choose whether you would like to be entered into a prize draw to win one of two £25 Amazon vouchers to thank you for your time spent completing this research. Whilst there are not immediate benefits for all people participating in the project, it is hoped that this work will lead to better support for people who have alcohol or drug problems.

How will my data be kept confidential and who is the data controller?

This research will take place online and there will be no way of tracing your responses back to you. All the information will be kept strictly confidential and you will not be identifiable in any report or publication that comes from this research. Only the research team will be able to access your data, and it will not be shared with anyone else. The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

If you decide you would like to enter the prize draw, you will be asked to provide an email address in order for us to be able to get the vouchers to the two winners, which will be sent electronically. It is entirely your choice whether or not you would like to be entered into the prize draw. Email addresses will be stored separately from the research data, meaning that your responses cannot be traced to your email address. Prize draw winners will also be asked to sign a form to confirm they have received the voucher. This form will be saved in a secure file as a digital copy for at least 6 years after the end of the project, accessible by University finance and administrative staff only, for reference if a financial audit is required. Once the vouchers have been received and signed receipts have been returned, email addresses will be deleted.

What is the legal process for processing my personal data?

According to data protection legislation, under the General Data Protection Regulation (GDPR), we are required to inform you that the legal basis we are applying in order to process your personal data is that ‘processing is necessary for the performance of a task

carried out in the public interest' (Article 6(1)(e)). As we will be collecting some data that is defined in the legislation as more sensitive (we will ask you questions about your ethnicity and sexual activity), we also need to let you know that we are applying the following condition in law: that the use of your data is necessary 'for archiving purposes in the public interest, scientific research purposes or statistical purposes' (9(2)(j)).

What will happen to the data collected and the results of the research?

The results from this research will be submitted as part of the lead researcher's doctoral thesis in May 2022. As your data will be anonymised, you will not be identifiable in this report. If you would like a copy of the results after this, you can contact the researcher. The study may also be published in a scientific journal. Data will be stored in an anonymous format indefinitely after the project is completed.

It is likely that other researchers may find that the data collected in this research project would be useful in answering future research questions. Therefore, anonymised questionnaire responses will be deposited in the Open Science Framework data depository so that it can be used for future research and learning.

Who has ethically reviewed this research?

This research has been reviewed and approved by The University of Sheffield's Ethics Review Procedure, as administered by the Department of Psychology Research Ethics Committee.

What if you are unhappy with the research or would like to make a complaint?

If you would like to make a complaint about this project, in the first instance you should contact the lead researcher (Laura Ames, lames2@sheffield.ac.uk). If you do not feel that your complaint has been dealt with appropriately you can contact the lead researcher's supervisor, Professor Matt Field on matt.field@sheffield.ac.uk. If you feel that your complaint has not been handled to your satisfaction following this, you can contact. Prof Elizabeth Milne, Head of Department at psy-hod@sheffield.ac.uk or Dr.Robert Schmidt & Dr Jilly Gibson-Miller, Joint chairs of the Psychology Department Ethics Subcommittee on psy-ethics@sheffield.ac.uk. If the complaint relates to how your personal data has been handled, information about how to raise a complaint can be found in the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Contact information

This research is being conducted as part of Laura Ames' (Trainee Clinical Psychologist) doctoral training. If you have any questions, or would like any further information, you can contact Laura via email at lames2@sheffield.ac.uk. Alternatively, you can email a.sinha@sheffield.ac.uk or leave a telephone message with Amrit Sinha, Research Support Officer on: 0114222 6650 and he will ask the trainee to contact you.

Thank you for taking the time to read this information.

Heavy Drinkers Group

The University Of Sheffield.

Participant Information Sheet

Research Project Title: The Role of Self-control and Strategies in Recovery from Addiction

Researchers: Laura Ames (Trainee Clinical Psychologist), Professor Matt Field

You are being invited to take part in this research project. Before you decide if you would like to take part in this research, it is important that you understand what it will involve and why this research is taking place. Please read the following information carefully and take time to consider whether or not you would like to take part in this research, discussing with others if you would like. If you have any questions, if you want any more information or if there is anything you are unsure of, please contact the lead researcher via email (Laura Ames, lames2@sheffield.ac.uk) before continuing.

Why is this research taking place?

We are conducting research to understand the process of recovery from addiction. We are interested in how people learn to avoid temptation and choose to spend their time, and how these decisions might support people to recover from addiction. In order to do this research, we want to compare people who are in recovery from addiction with other people who drink alcohol regularly.

This research is being conducted as part of a Doctorate in Clinical Psychology (DClinPsy) training programme at the University of Sheffield.

Why have I been chosen?

You have been chosen to take part as you drink alcohol regularly. Please only take part if you typically drink more than 14 units of alcohol per week (this is equivalent to about 6 pints of beer or cider, one and a half bottles of wine, or 14 measures of spirits). We will be recruiting approximately 50 other people in this category.

Please **do not** take part if you are under 18 years old, are currently undergoing a detoxification programme or are currently intoxicated as this may affect your ability to give informed consent. Please do not take part if you consider yourself to be in recovery from an alcohol problem (“alcoholism”, or alcohol dependence, or alcohol use disorder).

Do I have to take part?

You do not have to take part. Participation is voluntary, so it is entirely up to you whether you decide to take part or not. If you decide you would like to take part, you will be asked to confirm your consent. You can withdraw at any time before you have completed the questionnaires by closing your website browser, in which case your responses will not be stored. Once you get to the end of the questionnaires and submit your responses, your data will be anonymised, and it will no longer be possible for you to withdraw your responses.

What will taking part involve?

You will be asked to complete some questionnaires online. This should take approximately 20-30 minutes. You will first be asked some questions about your circumstances. Additional questions will ask about various topics such as your alcohol and drug use and that of your close friends, how you spend your time, and how you manage your mood and are able to resist temptation.

What are the possible disadvantages and risks of taking part?

Answering some of the questions in this study may make you concerned about your drinking or drug use. Remember that you can withdraw from the study by closing your browser window if this happens. You can also contact your GP or Healthcare provider for advice and support for cutting down on alcohol can be found here: https://www.nhs.uk/live-well/alcohol-support/tips-on-cutting-down-alcohol/.

What are the possible benefits of taking part?

At the end of the study you can choose whether you would like to be entered into a prize draw to win one of two £25 Amazon vouchers to thank you for your time spent completing this research. Whilst there are not immediate benefits for all people participating in the project, it is hoped that this work will lead to better support for people who have alcohol or drug problems.

How will my data be kept confidential and who is the data controller?

This research will take place online and there will be no way of tracing your responses back to you. All the information will be kept strictly confidential and you will not be identifiable in any report or publication that comes from this research. Only the research team will be able to access your data, and it will not be shared with anyone else. The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

If you decide you would like to enter the prize draw, you will be asked to provide an email address in order for us to be able to get the vouchers to the two winners, which will be sent electronically. It is entirely your choice whether or not you would like to be entered into the prize draw. Email addresses will be stored separately from the research data, meaning that your responses cannot be traced to your email address. Prize draw winners will also be asked to sign a form to confirm they have received the voucher. This form will be saved in a secure file as a digital copy for at least 6 years after the end of the project, accessible by University finance and administrative staff only, for reference if a financial audit is required. Once the vouchers have been received and signed receipts have been returned, email addresses will be deleted.

What is the legal process for processing my personal data?

According to data protection legislation, under the General Data Protection Regulation (GDPR), we are required to inform you that the legal basis we are applying in order to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). As we will be collecting some data that is defined in the legislation as more sensitive (we will ask you questions about your ethnicity and sexual activity), we also need to let you know that we are applying the following

condition in law: that the use of your data is necessary 'for archiving purposes in the public interest, scientific research purposes or statistical purposes' (9(2)(j)).

What will happen to the data collected and the results of the research?

The results from this research will be submitted as part of the lead researcher's doctoral thesis in May 2022. As your data will be anonymised, you will not be identifiable in this report. If you would like a copy of the results after this, you can contact the researcher. The study may also be published in a scientific journal. Data will be stored in an anonymous format indefinitely after the project is completed.

It is likely that other researchers may find that the data collected in this research project would be useful in answering future research questions. Therefore, anonymised questionnaire responses will be deposited in the Open Science Framework data depository so that it can be used for future research and learning.

Who has ethically reviewed this research?

This research has been reviewed and approved by The University of Sheffield's Ethics Review Procedure, as administered by the Department of Psychology Research Ethics Committee.

What if you are unhappy with the research or would like to make a complaint?

If you would like to make a complaint about this project, in the first instance you should contact the lead researcher (Laura Ames, lames2@sheffield.ac.uk). If you do not feel that your complaint has been dealt with appropriately you can contact the lead researcher's supervisor, Professor Matt Field on matt.field@sheffield.ac.uk. If you feel that your complaint has not been handled to your satisfaction following this, you can contact. Prof Elizabeth Milne, Head of Department at psy-hod@sheffield.ac.uk or Dr.Robert Schmidt & Dr Jilly Gibson-Miller, Joint chairs of the Psychology Department Ethics Subcommittee on psy-ethics@sheffield.ac.uk. If the complaint relates to how your personal data has been handled, information about how to raise a complaint can be found in the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Contact information

This research is being conducted as part of Laura Ames' (Trainee Clinical Psychologist) doctoral training. If you have any questions, or would like any further information, you can contact Laura via email at lames2@sheffield.ac.uk. Alternatively, you can email a.sinha@sheffield.ac.uk or leave a telephone message with Amrit Sinha, Research Support Officer on: 0114222 6650 and he will ask the trainee to contact you.

Thank you for taking the time to read this information.

Appendix D

Participant Consent Form

The University Of Sheffield.

Participant Consent Form

Research Project Title: The Role of Self-control and Strategies in Recovery from Addiction

Researchers: Laura Ames, Prof. Matt Field

1. I confirm that I have read and understood the project information sheet. Please only take part in the research if you have read this information and understand what taking part will involve.	Yes	No
2. I have been given the opportunity to ask questions about the project.	Yes	No
3. I agree to take part in the project. I understand that taking part in the project will include completing a series of questionnaires, which will include questions about my alcohol and drug use. I understand that this information will be kept confidential and anonymous and there will be no way of tracing this information back to me. I understand it will take approximately 20-30 minutes to complete.	Yes	No
4. I understand that participation in this research is voluntary and that I can withdraw at any time before I have completed the questionnaires by closing my browser window, without the need to give a reason. There will be no consequences if I choose to withdraw. I understand that once I submit my responses, they will be anonymised so it will no longer be possible to withdraw my responses.	Yes	No
5. I understand that any personal details such as name, phone number and address will not be recorded.	Yes	No
6. I understand and agree that other authorised researchers will have access to my anonymised responses after the research project is complete.	Yes	No
7. I understand that I will be offered the opportunity to enter into a prize draw for 1 of 2 £25 Amazon vouchers at the end of the study for taking part. I understand that I will need to provide an email address in order for the voucher to be sent to the winners electronically, but that email addresses will be stored separately to the research data and therefore cannot be traced to my responses.	Yes	No
8. I agree to take part in this research and understand that the data I provide will be used as part of a Doctorate in Clinical Psychology (DClinPsy) thesis and therefore may be published. I understand and agree that other authorised researchers may use my data in publications, reports and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	Yes	No

9. I give permission for my anonymised questionnaire responses to be deposited in the Open Science Framework data depository so that it can be used for future research and learning.	Yes	No

Contact details for further information

Lead Researcher: Laura Ames (Trainee Clinical Psychologist), University of Sheffield, email: lames2@sheffield.ac.uk

Research supervisor: Professor Matt Field, University of Sheffield, email: matt.field@sheffield.ac.uk

Appendix E

Debrief Information

"The Role of Self-control and Strategies in Recovery from Addiction"

Participant Debrief Information

Thank you for taking the time to complete this study. We are investigating how people who are in recovery from addiction are able to maintain their recovery. Specifically, we are interested in ways that people might plan their daily activities rather than relying on "willpower" in order to maintain their recovery. To answer this question, we compared a group of people who are in recovery from addiction with a comparison group of people who drink alcohol regularly.

We hope that understanding the process of recovery from addiction will lead to better support for people who have alcohol or drug problems. If you have any further questions or any concerns, please get in touch via the details at the bottom of this page.

If you have experienced any emotional or psychological distress because of the issues raised during this survey, you can contact the following services below for support and advice if necessary. If you are concerned about your drinking, we are not qualified to offer advice regarding this. However, we recommend that you seek further information and advice from the following sources:

- Samaritans – call 116 123 (24 hours a day, 365 days a year) or email jo@samaritans.org. Samaritans provide free confidential support for anyone experiencing emotional or psychological difficulties or distress of any kind.

- Drinkline - 0300 123 1110 (weekdays 9am to 8pm, weekends 11am to 4pm). This is the national alcohol helpline. If you're worried about your own or someone else's drinking, you can call this free helpline in complete confidence.

- Advice on cutting down on alcohol can be found at https://www.nhs.uk/live-well/alcohol-support/tips-on-cutting-down-alcohol/.

- Your GP or healthcare provider.

Contacts

If you have any questions or concerns with respect to this study, please contact:

Laura Ames (Trainee Clinical Psychologist), email: lames2@sheffield.ac.uk

You can also contact the researcher supervising this project:

Professor Matt Field, email: matt.field@sheffield.ac.uk

Appendix F

Ethical Approval

The University Of Sheffield.

Downloaded: 08/01/2021
Approved: 08/01/2021

Laura Ames
Registration number: 190218054
Psychology
Programme: Doctorate in Clinical Psychology

Dear Laura

PROJECT TITLE: The Role of Self-Control and Strategies in Recovery from Addiction
APPLICATION: Reference Number 037291

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 08/01/2021 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 037291 (form submission date: 07/01/2021); (expected project end date: 31/05/2022).
- Participant information sheet 1085602 version 1 (15/12/2020).
- Participant information sheet 1085601 version 1 (15/12/2020).
- Participant consent form 1085603 version 1 (15/12/2020).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Following Amendment on 16.08.21

The University Of Sheffield.

Downloaded: 23/08/2021
Approved: 08/01/2021

Laura Ames
Registration number: 190218054
Psychology
Programme: Doctorate in Clinical Psychology

Dear Laura

PROJECT TITLE: The Role of Self-Control and Strategies in Recovery from Addiction
APPLICATION: Reference Number 037291

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 08/01/2021 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 037291 (form submission date: 07/01/2021); (expected project end date: 31/05/2022).
- Participant information sheet 1085602 version 1 (15/12/2020).
- Participant information sheet 1085601 version 1 (15/12/2020).
- Participant consent form 1085603 version 1 (15/12/2020).

The following amendments to this application have been approved:

- Amendment approved: 16/08/2021

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix G

Data Management Plan

The Role of Self-Control and Strategies in Recovery from Addiction

A Data Management Plan created using DMPonline

Creators: Laura Ames, Matt Field

Affiliation: The University of Sheffield

Template: The University of Sheffield Postgraduate Research DMP

Last modified: 22-11-2020

The Role of Self-Control and Strategies in Recovery from Addiction

Defining your data

- **What data will you collect or create during the project?**
- **How will the data be collected or created, and over what time period?**
- **What formats will your digital data be in?**
- **Approximately how much digital data will be generated during the project?**
- **Are you using pre-existing datasets? Give details if possible, including conditions of use**

Data will be quantitative in nature, and collected via questionnaires with multiple choice options administered on Qualtrics, an online survey platform. There will be no paper data, digital only. All data will be collected during the project (no pre-existing data will be used).

Participants responses will be anonymised by Qualtrics. There will be no personally identifying information recorded. Data will be extracted from Qualtrics in csv filetype, as well as analysed in SPSS.

There will be approximately 100 participants taking part in the study and therefore data will be extracted from each participant. There will be approximately 125 responses per participant across all questionnaires administered (approx 12KB), therefore there will be a total of approximately 12500 data points (approx 120KB).

Once downloaded, data will be saved on the secure University of Sheffield UniDrive in clearly marked, password protected folders, which only the trainee and project supervisor can access. A consistent version control strategy will be used to keep track of data within this folder.

Looking after your data

- **How will you make data easier to understand and use? *(e.g. creating a README file)***
- **Where will you store digital and physical data during the project?**
- **How will you name and organise your data files?**
- **How will you ensure data is backed up? *(e.g. using* University research data storage*)***
- **How often will you check your backup files? *(e.g. on backup, at set intervals)***
- **Will you use extra security precautions for any of your digital or physical data? *(e.g. for sensitive and/or personal data)***

Data will be stored on the secure University of Sheffield UniDrive during this project, no hard copies will be created. This is a secure, routinely backed up service which is protected from corruption and allows both trainee and supervisor to access the data securely.

A readme file will be generated to include information about each variable and interpretation guidelines, and information about file naming conventions.

Clear titles will be used to refer to data, which will include a date in yyyymmdd format and version number.

Data will be stored in clearly marked, password protected folders, which only the trainee and project supervisor can access.

Data will be stored within the UniDrive and backed up as frequently as possible, at a minimum weekly.

Archiving your data

- **What data will be archived (stored on a long-term basis) at the end of the project?**
- **How long will the data be stored for? *(e.g. standard TUoS retention period of 10 years)***
- **Where will the archive be stored? *(e.g. subject-specific repository, or* ORDA*)***
- **Who will archive the data? *(e.g. you, or your supervisor)***
- **If you plan to use storage other than a repository, who will be responsible for the data?**

All data will be archived by the trainee and stored on the Open Science Framework. If the storage capacity proves insufficient then data will be stored on the University of Sheffield Online Research Data (ORDA). As per the University of Sheffield guidance, data will be registered in the University of Sheffield research data repository ORDA, even if the data files are deposited in OSF. Data will be retained indefinitely on OSF after completion of the project.

Sharing your data

- **How will you make your data available outside the research group after the project?** ***(e.g. through data repository, or access on request via data availability statement)***
- **Will you make all of your data available, or are there reasons you can't do this?** ***(e.g. personal data, commercial or legal restrictions, very large datasets)***
- **How might you make more of your data available?** ***(e.g. anonymisation, participant consent, analysed data only)***
- **What licence might you attach to your data to say how it can be reused and shared?**

All data will be openly accessible and available through the Clinical Psychology Department at the University of Sheffield, to conform with open science principles and as it is fully anonymised. The data will be made freely available on the Open Science Framework, allowing anyone access without the need to request permission.

Implementing your plan

- **Who is responsible for making sure the plan is followed?** ***(e.g. you, your supervisor)***
- **How often will the plan be reviewed and updated?** ***(e.g. if the project changes, yearly)***
- **What actions have you identified from the rest of this plan?** ***(e.g. selecting a repository, requesting University research data storage)***

The trainee (Laura Ames) has overall responsibility for ensuring the plan is implemented, with support from the supervisor where required.

The plan will be reviewed yearly until the thesis is submitted (at which point it will no longer be reviewed), and will be changed only if there are changes to the project which would affect data collection or storage.

Appendix H

Copies of all Questionnaires Administered to Participants on Qualtrics

Socio-demographics Questionnaire

Questionnaire has been removed to ensure conformance with copyright legislation.

Questionnaire has been removed to ensure conformance with copyright legislation.

Questionnaire has been removed to ensure conformance with copyright legislation.

Proactive Coping Inventory (PCI; Greenglass et al., 1999) - Preventive Coping Subscale

PCI:PC questionnaire has been removed to ensure conformance with copyright legislation.

Substance Use Recovery Evaluator (SURE, Neale et al., 2016)

SURE questionnaire has been removed to ensure conformance with copyright legislation.

SURE questionnaire has been removed to ensure conformance with copyright legislation.

SURE questionnaire has been removed to ensure conformance with copyright legislation.

Coping Self-Efficacy Scale (CSES, Chesney et al., 2006)

CSES questionnaire has been removed to ensure conformance with copyright legislation.

A modified version of the Activity Level Questionnaire (Meshesha et al., 2020)

ALQ questionnaire has been removed to ensure conformance with copyright legislation.

ALQ questionnaire has been removed to ensure conformance with copyright legislation.

Brief Alcohol Social Density Assessment (BASDA, Fortune et al., 2013)

BASDA questionnaire has been removed to ensure conformance with copyright legislation.

Urgency, Premeditation (lack of), Perseverance (lack of), Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (UPPS-P, Whiteside & Lynam, 2001) - Negative Urgency subscale

UPPS-P questionnaire has been removed to ensure conformance with copyright legislation.

Appendix I

Additional Statistical Details

Kurtosis and Skew Values, Tests of Normality and Q-Q Plots for the Independent Variables, Supplementary Subgroup Analyses and Effect Size Calculations

Variable		Statistic	Std. Error
PCI	Skewness	-0.305	0.235
	Kurtosis	-0.413	0.465
SURE	Skewness	-0.739	0.235
	Kurtosis	0.03	0.465
CSES	Skewness	0.08	0.235
	Kurtosis	-0.597	0.465
ALQ	Skewness	0.448	0.235
	Kurtosis	1.368	0.465
BASDA	Skewness	0.167	0.235
	Kurtosis	1.122	0.465
UPPSP-NU	Skewness	-0.085	0.235
	Kurtosis	-0.214	0.465
SURE Drinking and Drugs	Skewness	-1.074	0.235
	Kurtosis	0.057	0.465
SURE Self-care	Skewness	-0.326	0.235
	Kurtosis	-0.705	0.465
SURE Relationships	Skewness	-1.242	0.235
	Kurtosis	0.307	0.465
SURE Material Resources	Skewness	-1.504	0.235
	Kurtosis	1.225	0.465
SURE Outlook on life	Skewness	-0.814	0.235
	Kurtosis	-0.558	0.465

Tests of Normality

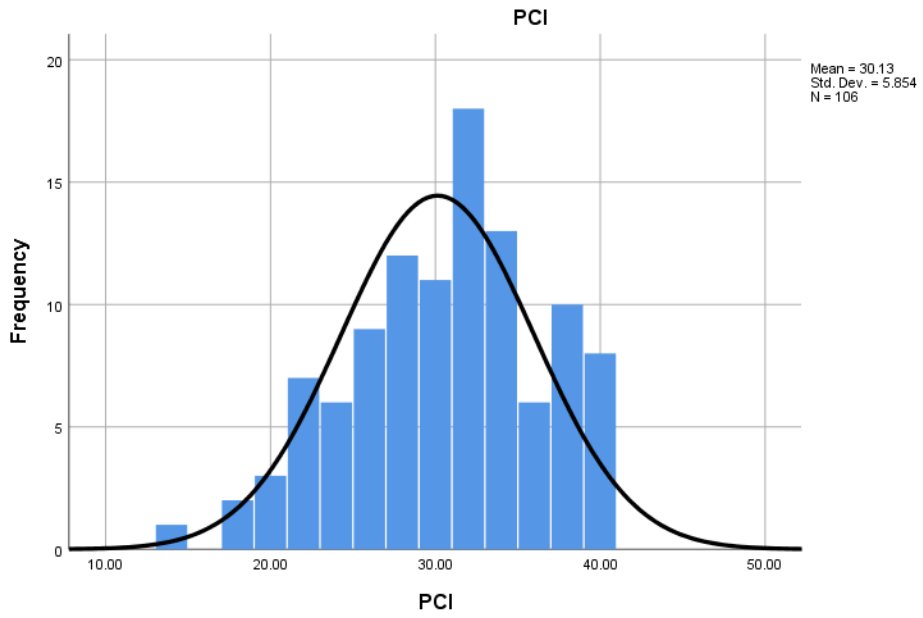
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PCI	.087	106	.045	.979	106	.083
SURE	.125	106	.000	.943	106	.000
CSES	.055	106	.200*	.987	106	.405
ALQ	.071	106	.200*	.973	106	.030
BASDA	.102	106	.009	.961	106	.003

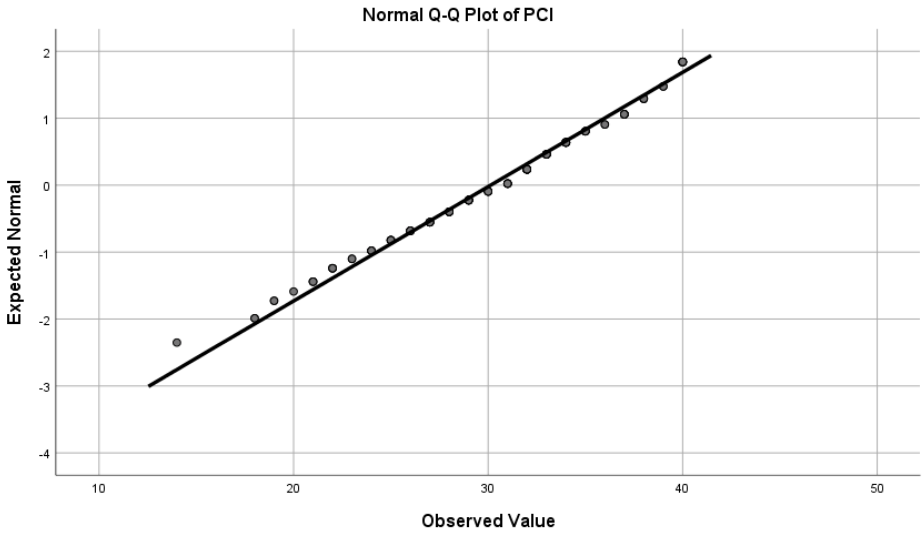
UPPSP	.097	106	.015	.984	106	.252
SURE_Drinkinganddruguse	.253	106	.000	.797	106	.000
SURE_Selfcare	.098	106	.014	.945	106	.000
SURE_Relationships	.327	106	.000	.732	106	.000
SURE_Materialresources	.399	106	.000	.659	106	.000
SURE_Outlookonlife	.232	106	.000	.825	106	.000

*. This is a lower bound of the true significance.

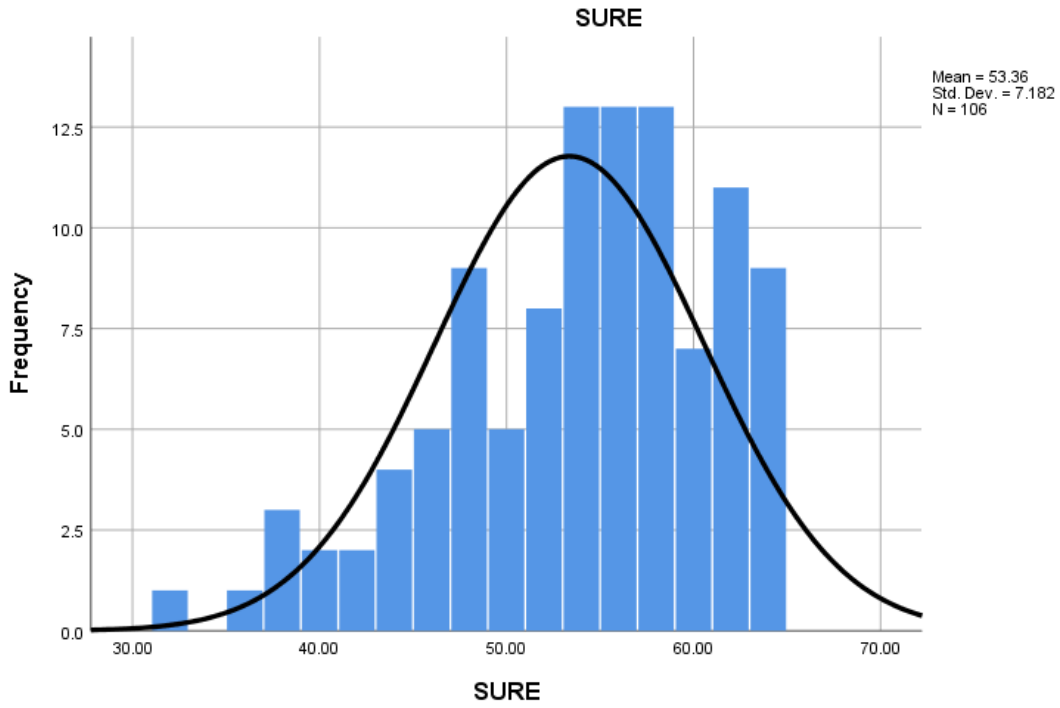
a. Lilliefors Significance Correction

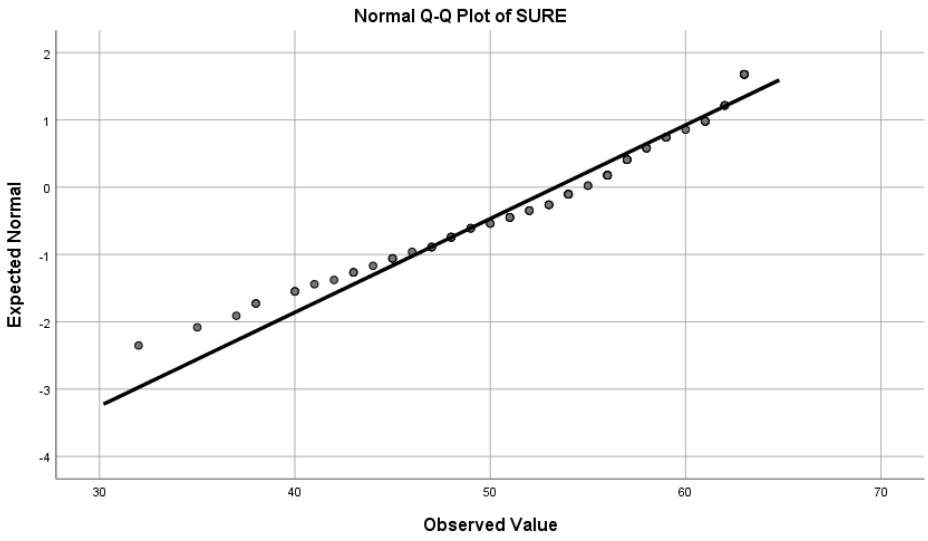
PCI-PC



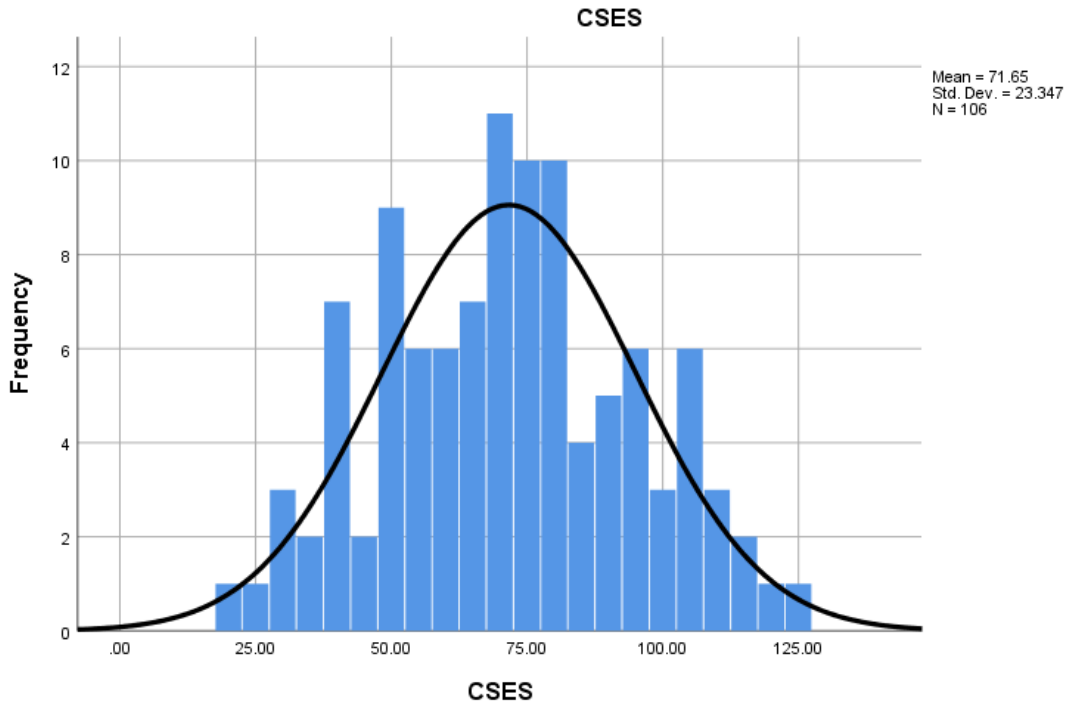


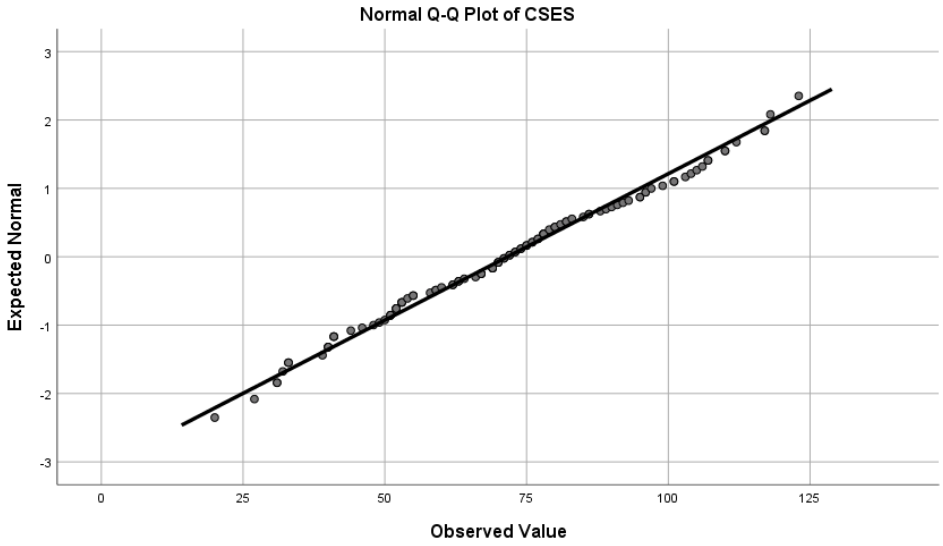
SURE


SURE
Mean = 53.36
Std. Dev. = 7.182
N = 106
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
30.00
40.00
50.00
60.00
70.00
SURE

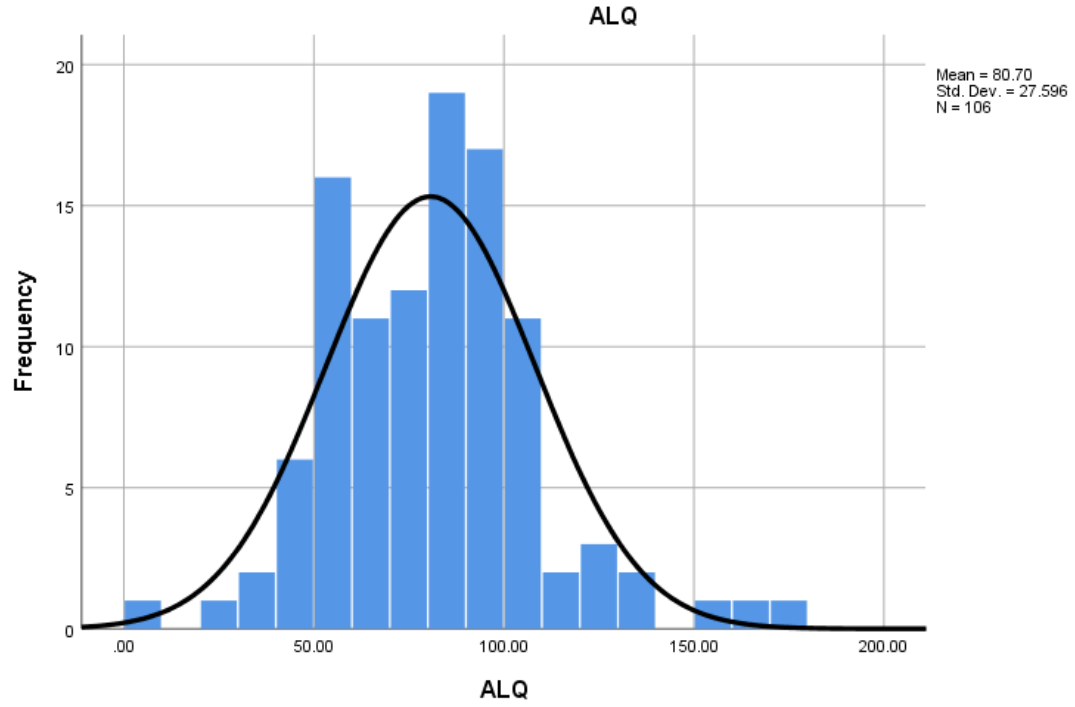

Normal Q-Q Plot of SURE
Expected Normal
2
1
0
-1
-2
-3
-4
30
40
50
60
70
Observed Value

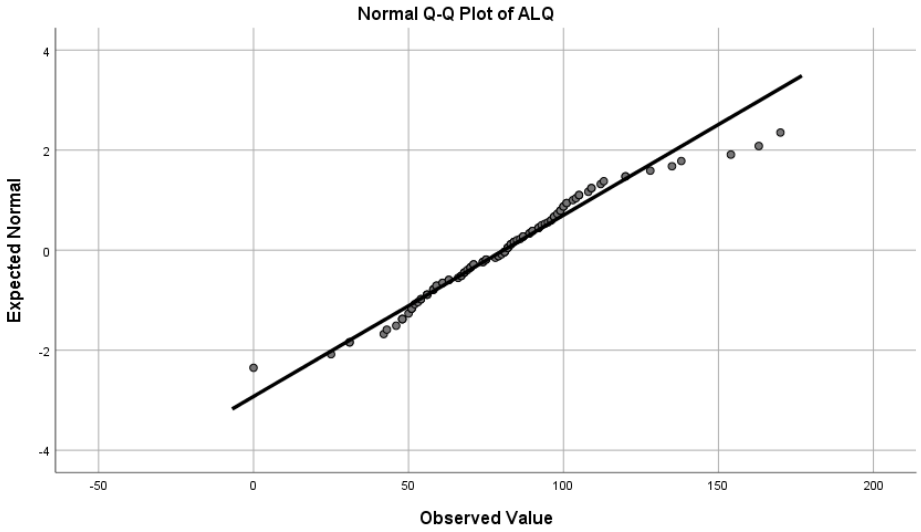
CSES


CSES
Mean = 71.65
Std. Dev. = 23.347
N = 106
Frequency
0
2
4
6
8
10
12
.00
25.00
50.00
75.00
100.00
125.00
CSES

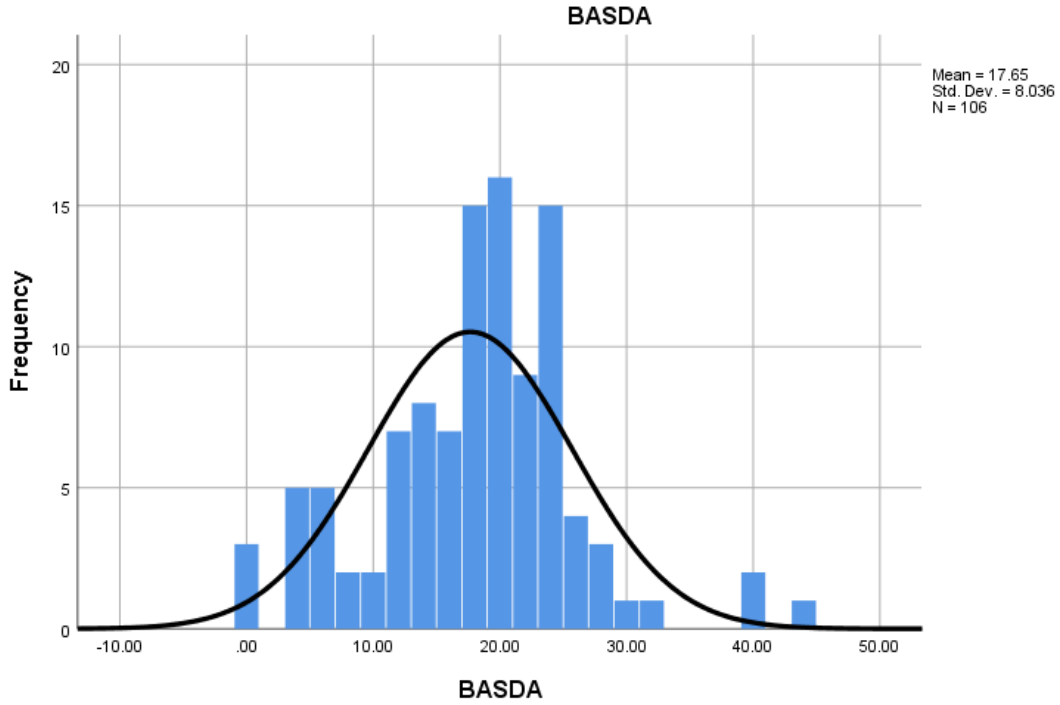

Normal Q-Q Plot of CSES
Expected Normal
3
2
1
0
-1
-2
-3
0
25
50
75
100
125
Observed Value

ALQ


ALQ
Mean = 80.70
Std. Dev. = 27.596
N = 106
Frequency
20
15
10
5
0
.00
50.00
100.00
150.00
200.00
ALQ


Normal Q-Q Plot of ALQ
Expected Normal
4
2
0
-2
-4
-50
0
50
100
150
200
Observed Value

BASDA


BASDA
Mean = 17.65
Std. Dev. = 8.036
N = 106
Frequency
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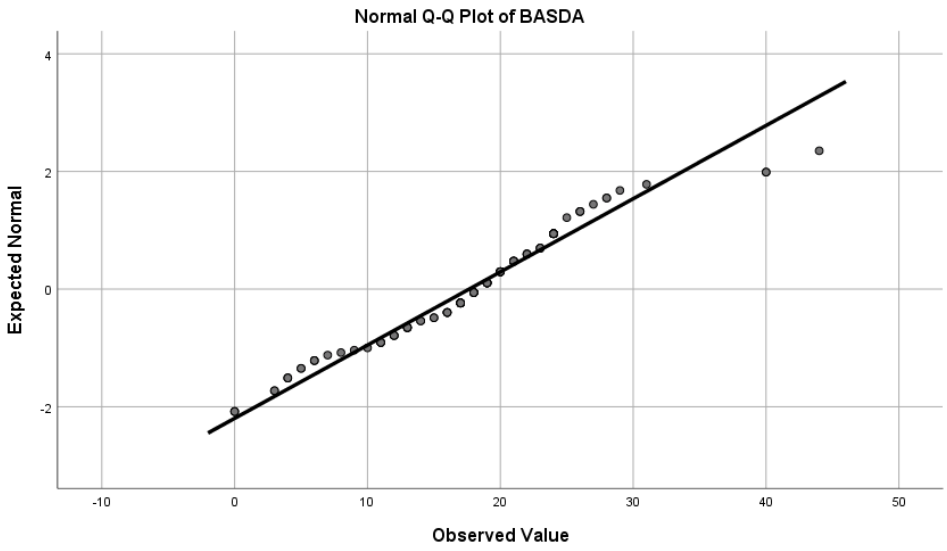
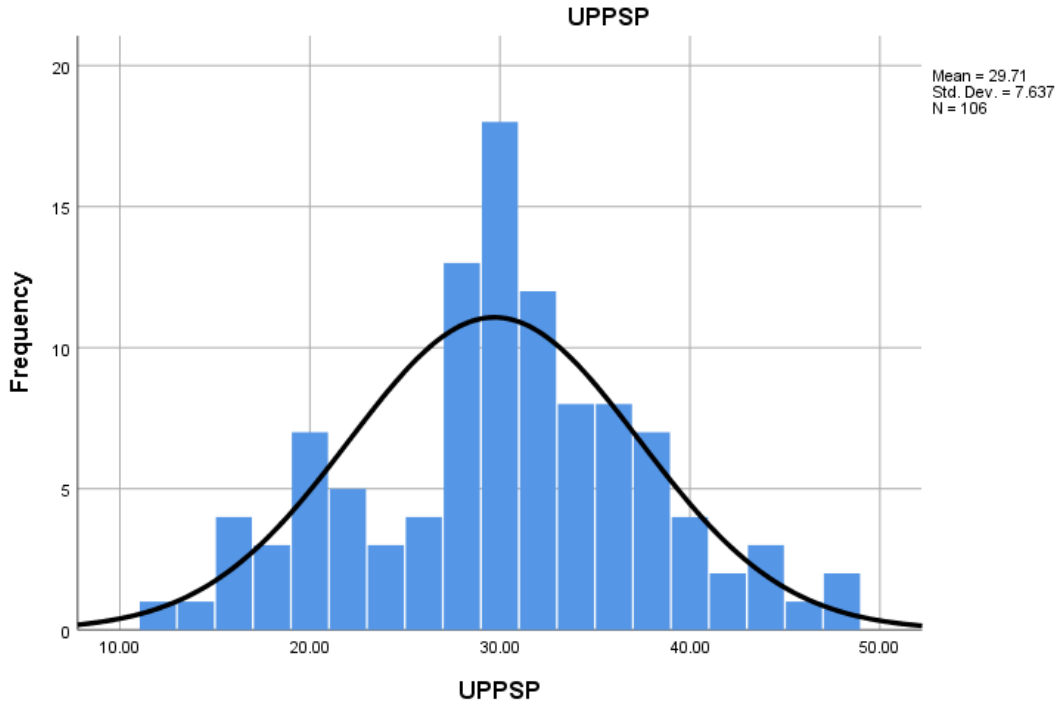
15
10
5
0
-10.00
.00
10.00
20.00
30.00
40.00
50.00
BASDA


Normal Q-Q Plot of BASDA
Expected Normal
4
2
0
-2
-10
0
10
20
30
40
50
Observed Value

UPPSP-NU


UPPSP
Mean = 29.71
Std. Dev. = 7.637
N = 106
Frequency
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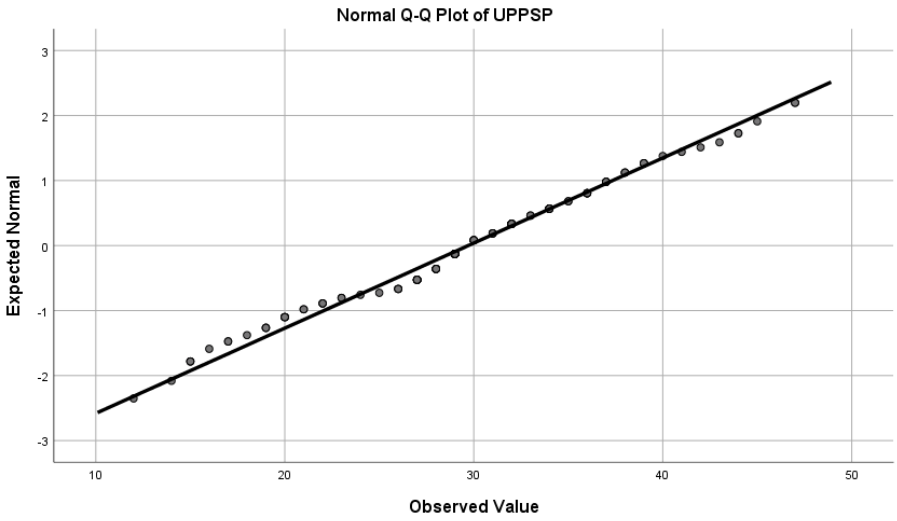
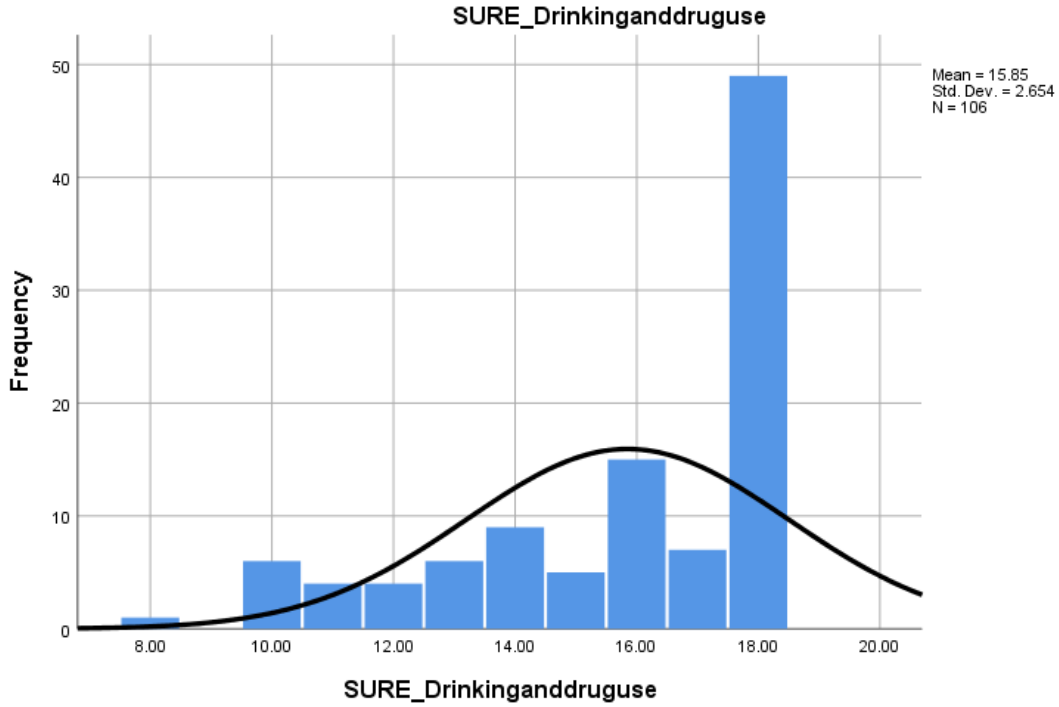
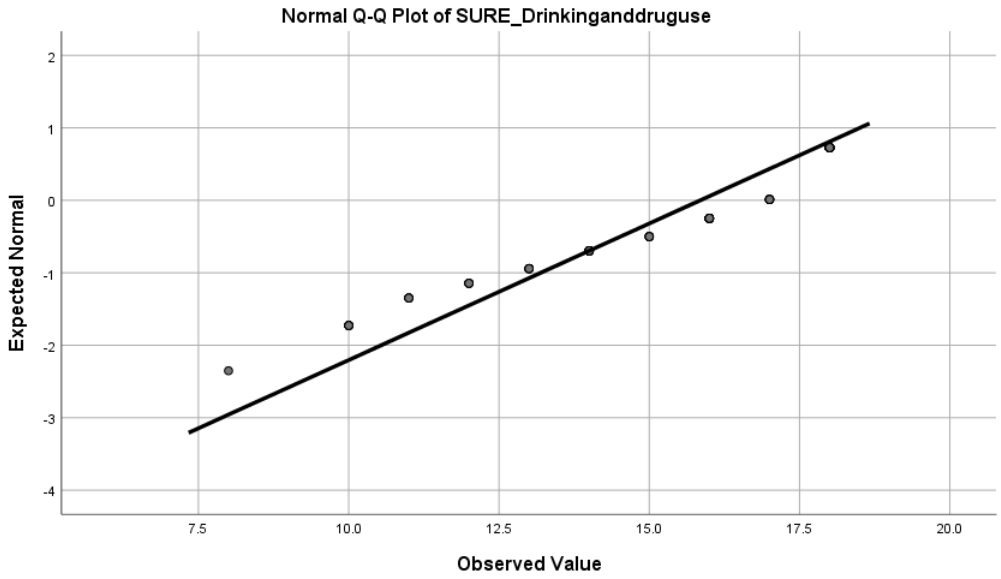
15
10
5
0
10.00
20.00
30.00
40.00
50.00
UPPSP

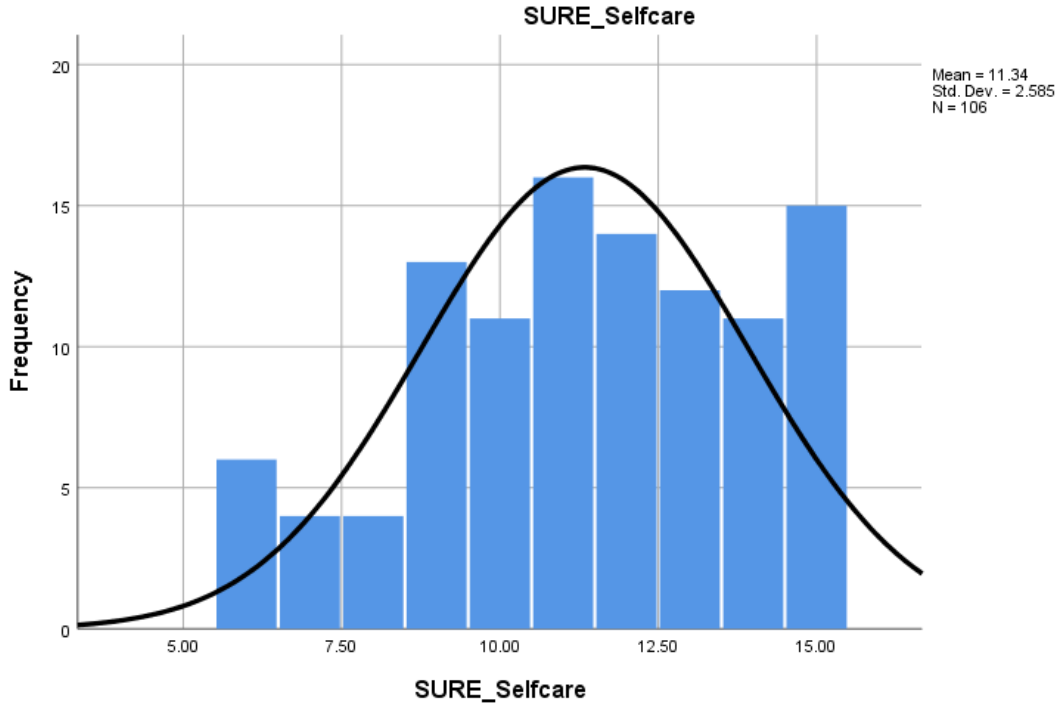

Normal Q-Q Plot of UPPSP
Expected Normal
3
2
1
0
-1
-2
-3
10
20
30
40
50
Observed Value

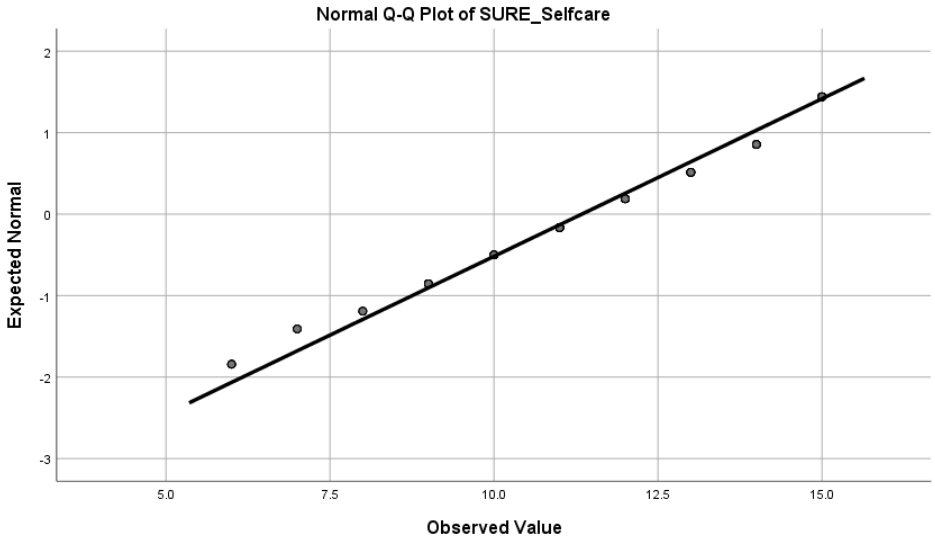
SURE Drinking and Drug Use Subscale



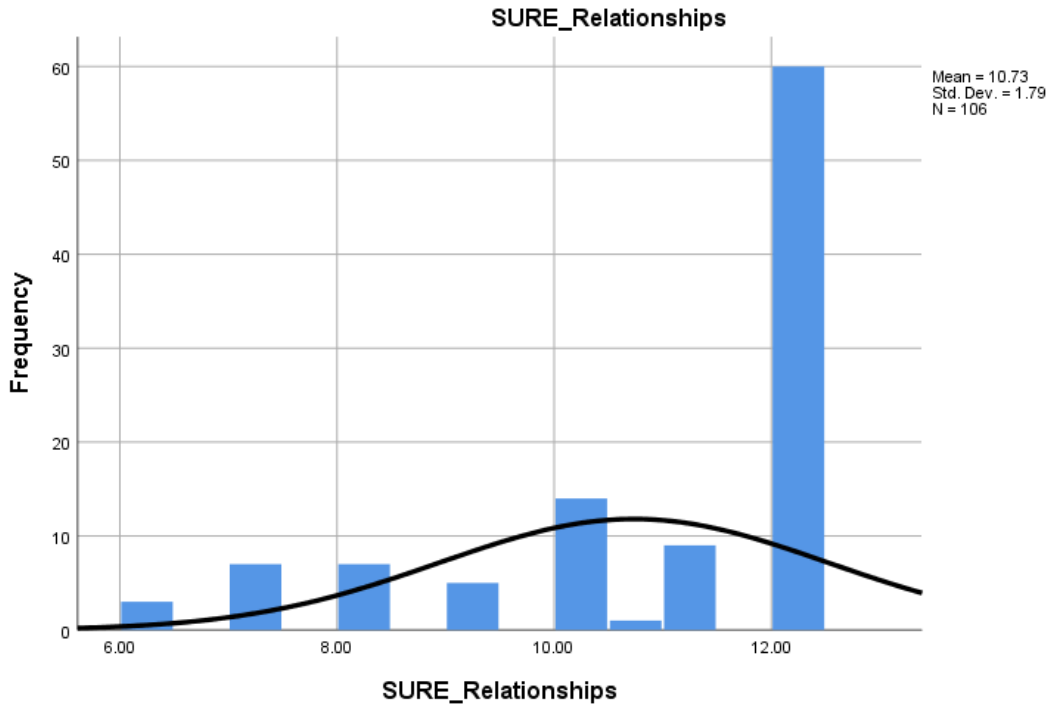


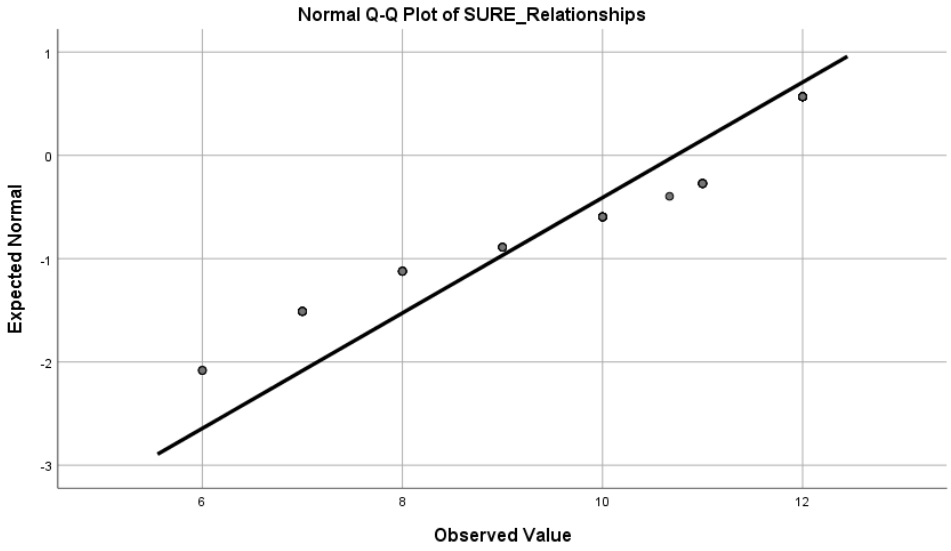
SURE Self-care Subscale



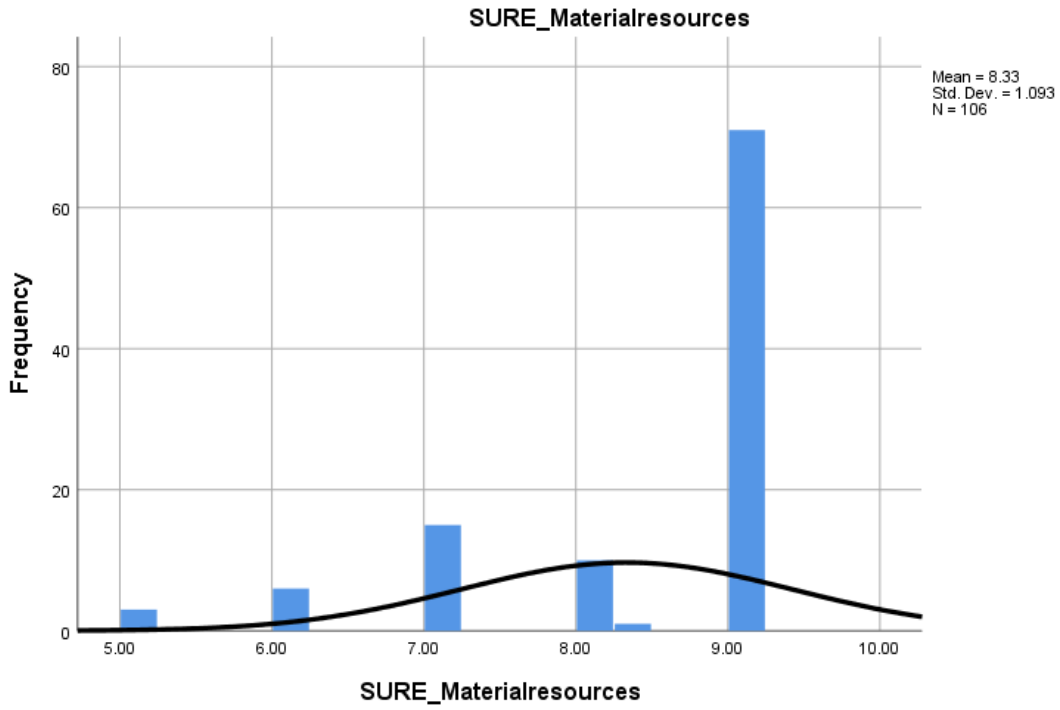


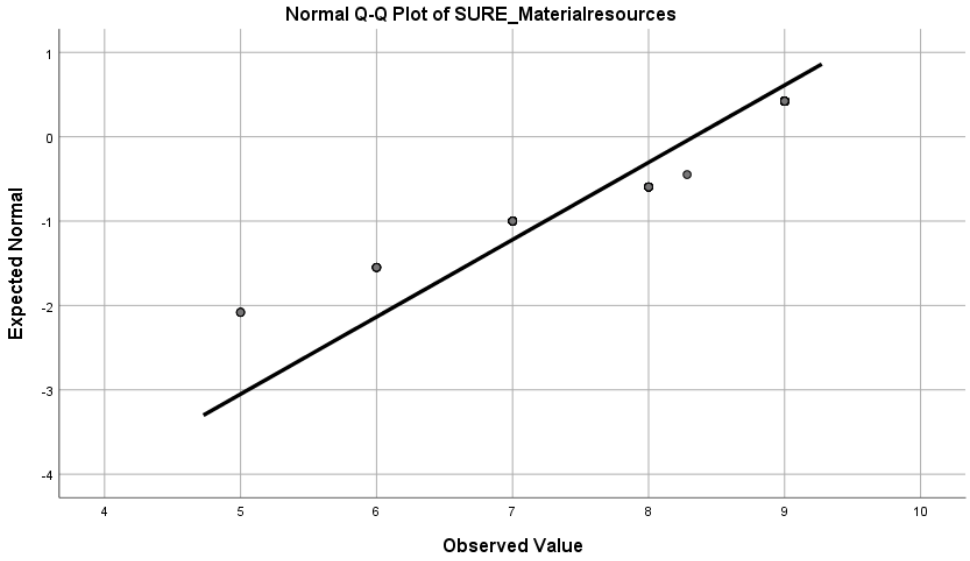
SURE Relationships Subscale



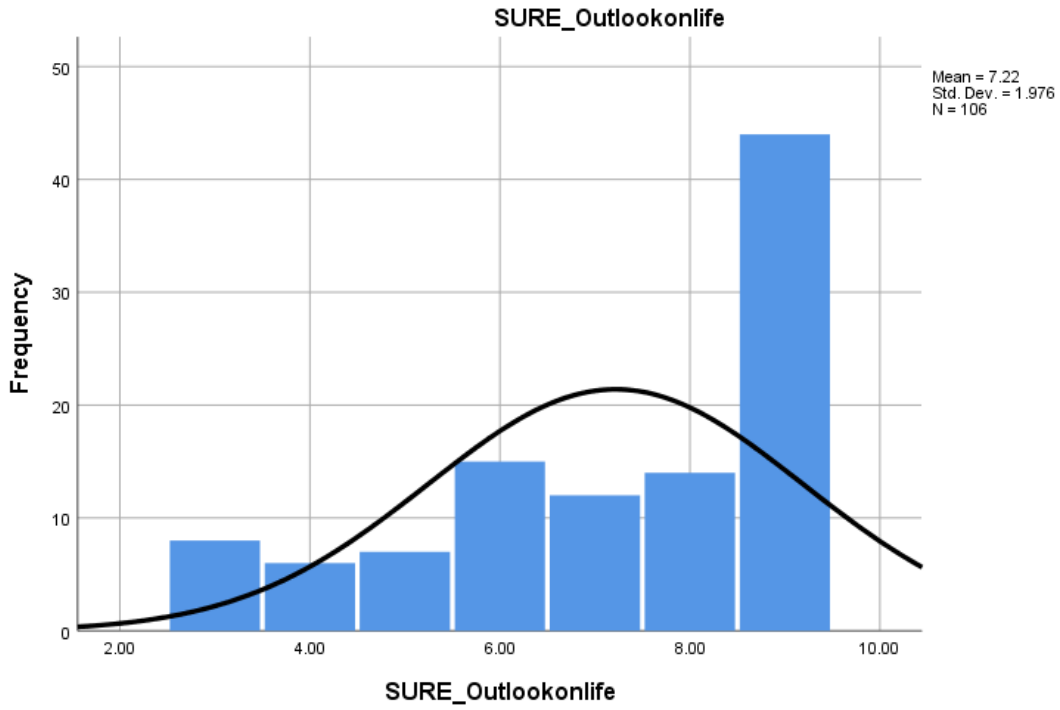


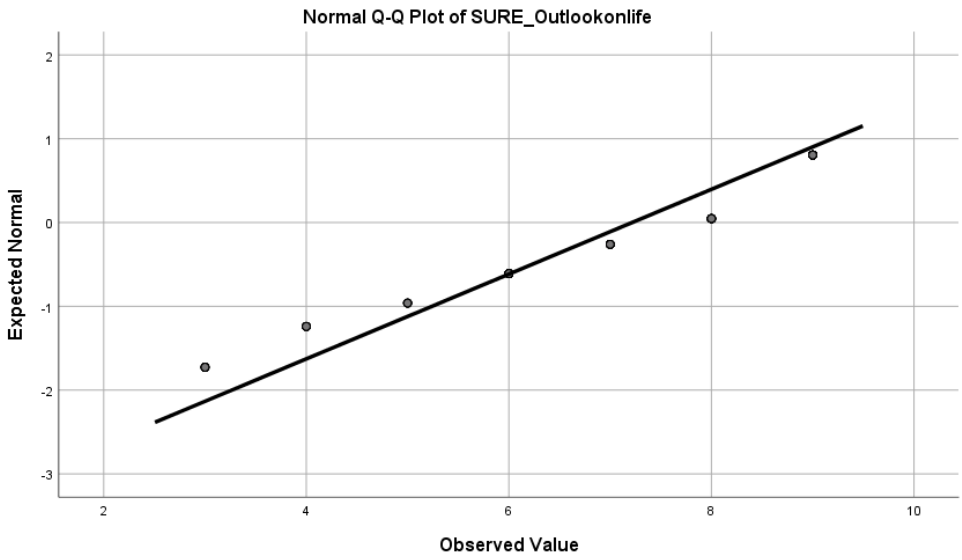
SURE Material Resources Subscale





SURE Outlook on Life Subscale





Subgroup Analysis (N=64) – Recovery Sample N=43, Heavy Drinkers Subgroup N=21

Tests of Difference Between Groups

	PCI	SURE	ALQ	BASDA	UPPSP	SURE_Drinkinganddruguse	SURE_Selfcare	SURE_Relationships	SURE_Materialresources	SURE_Outlookonlife
Mann-Whitney U	336.500	209.000	333.000	321.000	399.500	97.000	386.000	357.500	424.000	345.500
Wilcoxon W	567.500	440.000	564.000	1267.000	630.500	328.000	617.000	588.500	655.000	576.500
Z	-1.647	-3.472	-1.695	-1.869	-.746	-5.243	-.944	-1.441	-.454	-1.575
Asymp. Sig. (2-tailed)	.100	.001	.090	.062	.456	.000	.345	.150	.650	.115

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
CSES	Equal variances assumed	.625	.432	.516	62	.607	3.16390	6.12812	-9.08603	15.41383
	Equal variances not assumed			.541	45.047	.591	3.16390	5.84545	-8.60910	14.93690

Effect Size Calculations

t-tests	t	df	t+df	t/(d+tf)	|t/(d+tf)|	r= sqrt|t/(d+tf)|
CSES	-0.923	104	103.077	-0.00895	0.008954	0.0946281
CSES subgroup	0.516	62	62.516	0.008254	0.008254	0.0908509

Mann Whitney Us	Z	N	sqrt N	r = (=Z/sqrtN)	Size
PCI-PC	-0.564	106	10.29563	-0.564	Large
PCI-PC subgroup	-1.647	64	8	-0.20588	Small
SURE	-0.835	106	10.29563	-0.08108	
SURE subgroup	-3.472	64	8	-0.43402	Medium
ALQ	-1.052	106	10.29563	-0.1022	Small
ALQ subgroup	-1.695	64	8	-0.21186	Small
BASDA	-2.543	106	10.29563	-0.24699	Small
BASDA subgroup	-1.869	64	8	-0.23361	Small
UPPSP-NU	-2.378	106	10.29563	-0.23101	Small
UPPSP-NU subgroup	-0.746	64	8	-0.0932	
SURE drinking and drugs	-2.082	106	10.29563	-0.20225	Small
SURE drinking and drugs subgroup	-5.243	64	8	-0.65533	Large
SURE self-care	-0.136	106	10.29563	-0.01322	
SURE self-care subgroup	-0.944	64	8	-0.11796	Small
SURE relationships	-0.075	106	10.29563	-0.00727	
SURE relationships subgroup	-1.441	64	8	-0.18011	Small
SURE material resources	-0.285	106	10.29563	-0.02772	
SURE material resources subgroup	-0.454	64	8	-0.05675	
SURE outlook on life	-0.607	106	10.29563	-0.05893	
SURE outlook on life subgroup	-1.575	64	8	-0.19684	