

Informing indicated prevention: factors associated with the development of problematic cannabis use in young people

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Abstract

This research explores the relationship between risk factors associated with cannabis use in young people. This thesis addresses the assessment of cannabis use and its association with risk factors and implicit associations, and the suitability of these for targeting at-risk cannabis users, and how theories of drug instrumentalization and normalization frame cannabis use behaviour in young people in contact with drug services using a mixed-methods approach. Additionally, this research addresses the implications for indicated prevention and the targeting of young people considered at risk for developing problematic cannabis use behaviours.

This PhD reviews the scientific literature on cannabis use, with an emphasis on prevalence and use behaviours alongside associated risk and protective factors. Cannabis markets and potency, along with policy implications, are also explored. Furthermore, this PhD aims to understand how cannabis use behaviour assessment impacts on the identification of risk, and the subsequent implications for identifying those who might benefit from further support. Frequent, habitual cannabis users and their relationship with risk factors, including implicit cognitions, and use behaviour assessment are explored. Additionally, cannabis users in touch with drug services and their use behaviour are explored through frameworks of drug use instrumentalization and normalization. Lastly, the main findings of this dissertation are summarised and future research and policy implications are discussed.

This PhD illustrates the importance of cannabis use behaviour assessment in identifying young people at-risk for developing problematic use behaviours. This thesis provides evidence that suggests that psychopathology, and the over-instrumentalization of use as a self-medication, coping mechanism may be associated with the development of problematic use outcomes. These findings are contextualised within the current cultural and political environments in the United Kingdom and discussed in regards to their suitability for indicated prevention.

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List of abbreviations

ACMD	Advisory Council on the Misuse of Drugs
AMP	Affect Misattribution Procedure
ASI	Anxiety Sensitivity Index
AUDIT	Alcohol Use Disorders Identification Test
BAS	Gray's Behavioural Approach System
BIC	Bayesian Information Criterion Index
BPAQ	Buss and Perry Aggression Questionnaire
BSSS	Brief Sensation Seeking Scale
C-SDS	Cannabis version of Severity of Dependence Scale
CBD	Cannabidiol
CES-D	Center for Epidemiological Study of Depression Scale
CFC	Consideration of Future Consequences Scale
CUD	Cannabis Use Disorder
DSM	Diagnostic Statistical Manual of Mental Disorders
EM	Expectation Maximization
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
ESPAD	European School Survey Project on Alcohol and other Drugs
FAS	Family Affluence Scale
HBSC	Health Behavior in School-aged Children study
IAPS	International Affective Picture System
IAT	Implicit Association Test
ICD - 10	International Statistical Classification of Diseases and Related Health Problems, 10 th Revision
LPA	Latent Profile Analysis
M	Mean
MCQ	Marijuana Craving Questionnaire

MCQ-SF	Marijuana Craving Questionnaire (Short Form)
MEEQ	Marijuana Effect Expectancy Questionnaire
ML	Maximum Likelihood
MPS	Marijuana Problems Scale
NIDA	National Institute of Drug Abuse
SOA	Stimulus-Onset-Asynchrony
SC-IAT	Single Category Implicit Association Test
SD	Standard Deviation
SDS	Severity of Dependence Scale
SPSS	Statistical Analysis in Social Science
SRS	Sensitivity to Reward Scale
SSS	Sensation Seeking Scale
THC	Δ^9 -tetrahydrocannabinol
UK	United Kingdom
UNODC	United Nation Office on Drugs and Crime
VAS	Visual Analogue Scale
WCST	Wisconsin Card Sort Test
WHO	World Health Organization
ZPTI	Zimbardo Time Perspective Inventory

Chapter 1

Background and literature review

1.1 Introduction

The aim of this literature review is to understand important characteristics of cannabis use in young people, and its relationship to the development of prevention research efforts. The review provides a general overview; how the properties of cannabis might contribute to specific outcomes for users and how the current cannabis market influences these outcomes. Next, cannabis use behaviour (including epidemiology and prevalence estimates), both internationally and in the UK, and the potential problems associated with use will be discussed. Following this, a review of prevention research will be presented with a particular focus on indicated prevention. Finally, a review of the risk and protective factors associated with cannabis use and young people will be presented, specifically evaluating their usefulness in developing indicated prevention programs, as well as the theoretical underpinnings linking health behaviour and cannabis prevention.

1.2 Cannabis

Cannabis is obtained from the plant *Cannabis Sativa* and some of its subspecies, although debate regarding the taxonomy of cannabis amongst botanists still exists (see Watts, 2006). It is used in a variety of ways but is usually obtained from the dried leaves, stalks, flowers and seeds of the plant. Most commonly, the flowering tops or leaves of the plant are dried to prepare cannabis and it is smoked with a joint (often mixed with tobacco), pipe, or waterpipe; orally ingested (usually prepared in tea or a pastry); or inhaled using a vaporiser. Other ways of using cannabis include compressing the resin secreted from the plant to prepare *hashish*, or extracting the psychoactive component of the plant in oil to create *hash oil*. Cannabis is unsuitable for intravenous use due to its water-insolubility.

The cannabis plant produces unique chemicals known as cannabinoids along with approximately 500 other chemical compounds. Although over cannabinoids have been identified, the pharmacology of most of these substances is still unknown (Radwan et al., 2009). The most potent psychoactive agent and cannabinoid, and widely considered to be the most important when studying recreational use of cannabis, is Δ^9 -tetrahydrocannabinol (THC). THC is largely responsible for the intoxication (“high”) experienced when using cannabis and the majority of psychological and

physical effects (Iversen, 2000). High doses of THC produce hallucinogenic-like effects (Johns, 2001). Cannabidiol (CBD) is also considered to be an important cannabinoid when studying the effects of cannabis use due to its pharmacological antagonistic effect on THC (Pertwee, 2008). The antagonistic effect results because CBD is a sedative compound. The ratio of CBD to THC in the cannabis plant is significant in determining the level of psychoactivity experienced (Schubart et al., 2011; Potter, Clark, & Brown, 2008; Mechoulam & Parker, 2013). In addition to the cannabinoids and chemicals found in cannabis, smoke produced from a cannabis combustion (notwithstanding the products of mixing with tobacco directly) contains carbon monoxide and the same tars, irritants and carcinogens that are present in tobacco smoke, some of them in greater concentration (Ashton, 2001).

1.2.1 International data on cannabis use by young people

The Health Behaviour in School-aged Children study (HBSC) World Health Organization collaborative cross-national study provides comprehensive data on young people and their health behaviours. THE HBSC sample comprises school-aged children, aged 11, 13, and 15, from 43 countries in Europe and North America (although only 39 countries supplied suitable data for inclusion in the report) (Currie et al., 2012). This survey focuses on health inequalities specifically age, gender, geographical and socioeconomic dimensions. Questions on cannabis use were administered only to the 15 year-old age group, and not administered to students from Turkey due to cultural sensitivity. A minimum sample size of 1500 pupils was set; however most countries far exceeded these recommendations.

In addition to looking at prevalence, HBSC data looked specifically at health inequalities: age, sex, geography and family socioeconomic status. Health inequalities related to age were not included in cannabis related activity because only 15 year-old participants responded to questions relating to cannabis use. Socioeconomic status was evaluated using the Family Affluence Scale. The Family Affluence Scale (FAS) is a set of questions evaluating the material conditions of a young person's home (car ownership, bedroom occupancy, holidays and home computers), and was used due to its relative ease for young people to answer and its tendency to produce lesser missing data than other measures, such as parental occupation. The 2009/10 survey showed that the proportion of 15 year-olds across all HBSC countries who had used cannabis at least once during their lives was 17% (15% for females and 20% for males) and 13% reporting use in the last 30 days. Stark differences were reported in lifetime cannabis use of young people between countries, with as little as 3% reporting use in Romania and as much as 34% reporting use in Canada. A statistically

significant association between cannabis use and high family affluence was only shown in a few countries and mainly among boys; however, weekly cannabis smoking was more prevalent among boys and girls from low-affluence families in most countries, with a significant relationship demonstrated in 9 countries for boys and 13 for girls, while weekly smoking and family affluence was significantly positively associated only in Romania.

Respondents who had used cannabis at least once in their lives were placed into one of four categories: discontinued user (those who have used cannabis in their lifetime but not within the past 30 days or 12 months); experimenter (those who have used cannabis 1-2 times in the past 12 months); regular user (those who have used cannabis 3-39 times in the past 12 months); and heavy user (those who have used cannabis 40 or more times in the past 12 months). Of all HBSC respondents, 4 % were classified as discontinued users, 6% experimenters, 5% regular users and 2% heavy users. Additionally, results indicated higher prevalence of cannabis use among boys, with sex difference greater than 10% in some countries, including Lithuania, Poland and Switzerland (Currie et al., 2012). There were, however, substantial variations between countries and regions, attributed to cross-national differences in country wealth, perceived availability of cannabis, and perceived risk (Currie et al., 2012). In the UK, 9% of 15 year-olds reported using cannabis in the past 30 days and no sex differences were reported.

In addition to the international comparison provided by HBSC, many other studies have investigated the use of cannabis in the general population and its associations with psychosocial harm. In a systematic review of longitudinal, general population studies of cannabis use in young people and the corresponding psychosocial harms (including educational attainment, use of other drugs, anti-social behaviour, social problems) over 200 publications from 48 longitudinal studies were reviewed (MacLeod et al., 2004). Of the 16 studies considered to be of a 'higher methodological quality', 12 were conducted in the USA or Canada and one in the United Kingdom. The authors concluded that the evidence did not provide a strong support for a causal relationship between cannabis use by young people and psychosocial harm (MacLeod et al., 2004). Despite being consistently associated with reduced educational attainment, the use of other drugs, and a greater likelihood of problems with low age of initiation, cannabis was inconsistently associated with psychological problems and antisocial and other problematic behaviour. Three alternative explanations are given for the association between cannabis use by young people and psychosocial harm: reverse causation, in which cannabis use is a result of psychosocial factors; bias, in which the association found is a consequence of social methodology; and confounding factors, in which cannabis use is associated with other factors that are determinant of psychosocial harm.

More recently, a systematic review investigated whether cannabis could cause psychotic or affective symptoms beyond acute intoxication (Moore et al., 2007). Results indicated that lifetime cannabis use was associated with an increased risk of any psychotic outcome, and that this association demonstrated a dose-response relationship, with greater risk for those who more frequently use cannabis. Notably, the authors point out that although arguments linking early exposure to cannabis and increased risk of psychotic or affective symptoms, evidence does not support this and that the link may be, in fact, a result of more frequent exposure to cannabis opposed to a specific age group associated with increased vulnerability. This contributes to the growing evidence that suggests that although cannabis and psychosocial harms are linked, a causal relationship between use frequency and affective outcomes is unlikely to be determined at this time.

One of the greatest challenges in interpreting epidemiological cannabis data is discounting confounding, as adverse psychosocial outcomes and cannabis use are likely to share common predictive factors (Smith & Ebrahim, 2003; MacLeod et al., 2004). Furthermore, when looking at the relationship between specific affective psychotic outcomes, like schizophrenia, and cannabis use, a simple causal explanation is unlikely, as incidence of schizophrenia is associated with exposure to cannabis, yet as rates of cannabis have increased, the rates of schizophrenia have stabilized (MacLeod et al., 2004). In this regard, it has become increasingly apparent that simple measures of cannabis do not adequately describe the variations of use behaviour within the population. In order to parcel out the complexities of cannabis use and psychosocial outcomes, a more detailed measurement of cannabis use is required. As antecedents related to psychosocial outcomes and cannabis use are likely related and with a large proportion of the general population reporting at least experimental use, it is important to understand the ways in which use may be related to psychosocial outcomes, and when other antecedents may be more likely the root of these outcomes.

In addition to the epidemiology of cannabis use, it is important to note the prevalence of cannabis use disorders and the treatment seeking population as well. Cannabis dependence, or Cannabis use disorder, are controversial within the academic literature, with some researchers doubting the ability of cannabis to cause a withdrawal symptom, a prime element of other drug disorders, despite research into the endogenous cannabinoid system that suggests the potential for withdrawal mechanisms (Budney et al., 2004). Additionally, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), has added cannabis withdrawal to previous classifications of cannabis use disorder and cannabis abuse (American Psychiatric Association, 2013). In contrast, cannabis use is

viewed generally as an irregular and experimental activity that typically increases with use over adolescence (Coffey et al., 2000) before declining in the mid-20s (Chen & Kandel, 1995; Copeland & Swift, 2009).

1.2.2 Cannabis use in the United Kingdom

Cannabis is the most widely used illegal drug in the world with an estimate between 2.7 and 4.5 percent of the population aged 15-64 years having used cannabis (UNODC, 2014). Of particular concern is use by young people, with 17% of 15/16 year-olds in Europe reporting lifetime cannabis use (Hibell et al., 2012). In 2013-2014 in England and Wales, 29.2% of the general population (16-59 year-olds) reported lifetime cannabis use, and 10.4% of young people (16-24 year-olds) reported use in the last year (Home Office, 2015). This represents a trend in lowering rates of cannabis use by young people since 1999, when the Crime Survey of Britain and Wales reported 26.0% of young people using cannabis in the last year (Home Office, 2015). In 2013, over a quarter (26.8%) of treatment presentation in the UK were for cannabis, with the number of people entering structured drug treatment (including inpatient, outpatient and treatment through a GP) for the first time reporting cannabis as the primary drug representing 48.6% of admissions (Burton et al., 2014). Furthermore, of the 18,349 under 18s in the UK accessing specialist substance misuse services, 73% reported cannabis as the primary substance, more than any other drug including alcohol (Public Health England, 2015).

Prevalence data in the UK suggests that use by the general population has stabilised, if not declined, in recent years (Home Office, 2015; Burton et al., 2014). Despite this trend, cannabis is still the most commonly used illicit drug. Although the majority of cannabis users engage in recreational, experimental, and intermittent use, and are unlikely to develop dependence, they still may experience problematic use outcomes. In moving forward in reducing cannabis-related problems and harms, it is important to develop a better understanding the nuances of cannabis use behaviour and how it relates to use outcomes. Standard use measures, like frequency of use, do not provide a complex enough representation of use behaviour, and must be developed in order to unravel the relationship between use and affective and problematic outcomes.

UK data collected for the European School Survey Project on Alcohol and other Drugs (ESPAD) was used to examine different use-clusters that emerge in heavy cannabis users (Miller and Plant, 2002). In the sample of 2641 UK school students aged 15-16 years, those who reported using cannabis more than 40 times (7.6% of the sample) were identified. Three clusters emerged among those identified as heavy cannabis users: antisocial (24.9%), unhappy (33.8%), and ordinary

(41.3%). The antisocial cluster was the smallest and reported relative ease in receiving money from their parents, a large group of friends, being male, and scored highest on levels of aggression against others, and thieving and destruction of property. The unhappy cluster found difficulty in obtaining money, caring, warmth or mental support from their parents; reported lax parental control and poor relationship and support from friends and parents; and had substantially lower levels of self-esteem and higher levels of depressed mood. Furthermore, they were generally dissatisfied with their own health and financial state. The final cluster, coined the 'ordinary' cluster, scored low on delinquency-aggression measures and had obedience to Society's rules. They also held a belief that life is stable and predictable. Although cross-sectional in design, these results highlight the different types of users and how this might influence the reasons for their use, and how they use. There are several potential hypotheses that may be derived: 1) the antisocial cluster is engaged in general deviant behaviour; 2) the unhappy cluster may engage in use as a form of self-medication or escapism; 3) the ordinary cluster may be engaging in typical use associated with young people and drug exploration. In acknowledging the different types of users, it becomes clear that looking at who uses, how they use, and why they use cannabis may inform researchers on the ways in which use outcomes may be reflected by use behaviour.

In another UK study looking at cannabis use, risk and protective factors and social functioning, results indicated, similarly to prevalence data, that a 24% of 14-16 year-olds in a sample of over 2000 students from 7 different state schools in London had used cannabis in their lifetime (Best et al., 2005). Additionally, those who had used cannabis were far more likely than their abstaining peers to have used, alcohol, tobacco and other drugs. Results indicated that of those who initiated cannabis use in the past 2 years, roughly 10% escalated to daily use, consistent with previous longitudinal data in Australia (Best et al., 2005; Coffey et al., 2000). However, when looking at cannabis use measures and risk and protective factors and social functioning, only time spent with friends involved in drug use indicated frequency of use. These results indicate that social functioning, particularly engaging in a network of friends that use drugs, is an important determinant of the frequency of cannabis use. Although this research highlights the importance of social networks and use behaviour, it does not provide a complete picture of the context within which this use is occurring. In the context of the previously discussed clusters of cannabis users, it would be useful to know whether these behaviours took place in instances of general drugs experimentation, delinquent behaviour, or as a coping mechanism for dealing with unhappiness. It is with this knowledge that we would be able to apply more detailed information for prevention work on how to prevent individuals from engaging in cannabis use that is likely to lead to problematic outcomes.

In a study of young people, alcohol and illicit drug use was measured in university students (mean age 20.9 years) (Webb et al., 1996). Cannabis was the most widely reported illicit drug used by students, with 20% of the sample reporting regular use (weekly or more often). This is higher than prevalence data among adults (aged 16-59 years) in the general population which report less than 10% last year use since 1996 (Burton et al., 2014), suggesting that university students may be more likely to engage in frequent use of cannabis than the general population. However, based on UK Focal Point prevalence data, it would appear that the majority of users would begin to discontinue or lessen their cannabis use between their mid-20s and 30s. A longitudinal analysis was conducted with UK dental students (with a medical student comparison group) examining their use of alcohol and illicit drugs (Newbury-Birch, Lowry & Kamali, 2002). Dental students responded to a questionnaire at the end of their second year, final year, and after a year of being a qualified dentist. In measuring current use of cannabis (although current use is not explicitly defined) 8% of dental students reported cannabis in their final year and 16% as dentists. Similarly, medical students reported 22% in the final year of their degree and 24% as Pre-Registration House Officers (PRHO). This longitudinal data provides insight into the cannabis use consumption by young people in university, and their transition into their professional career. This data suggests that current use of cannabis use may increase as they transition from student to the first years of employment. In keeping in mind UK prevalence data, it is likely that this stabilisation would deteriorate over time, unless there are specific mechanisms of use that are different for those in medical professions. More longitudinal analysis in the UK of how cannabis use evolves, prior to initiation, until later age (when cannabis use tends to taper off) would be helpful in ascertaining how and why users continue to engage in use when use by their peers tails off.

Some research has looked at the positive and negative experiences of heavy use, and aimed to differentiate between frequent use and problematic use (Hammersley & Leon, 2006). Investigating cannabis users in South East England, researchers interviewed (using extensive structured questionnaires) 172 university students who had used cannabis at least once in their lifetime, and used snowball sampling to recruit their participants. The researchers identified four groups based on their patterns of use: those who used casually and had no reason to control or manage their use; users who had deliberately given up using; users who regularly used, but saw this as largely positive, despite some negative effects; and users who bought cannabis regularly, but restricted their use based on the day of the week or due to other commitments (Hammersley & Leon, 2006). Most commonly, users reported that they titrated their use of cannabis, with 37% reporting 'I take a bit, get a bit high, take a bit more and so on for a few hours'; 35% reporting 'just take a little bit and get a bit high'; 19% 'quite a lot at once and got wasted for a few hours'; and 9%

‘kept on taking it until it was all gone or they had passed out’. Additionally, the authors suggest that dependence was not predictive of the extent of cannabis use, where cannabis dependence was assessed with questions regarding positive experiences of cannabis use to counterbalance questions regarding negative experiences. Although heavy users and those who reported daily/near-daily use of cannabis scored highest on levels of dependence, they still reported more positive than negative experiences. This study, however, did not include a standard measure of dependence, only the frequency of negative problems associated with use behaviour, which makes it difficult to compare this to other data exploring cannabis use behaviour.

Despite the limitations to this study, including a non-random sampling procedure, these results provide evidence that a more detailed understanding of the mechanisms of use behaviour are informative in explaining use outcomes. Additionally, the researchers highlight how concerns with negative experiences of cannabis may be warranted, but more so in an analogy with alcohol than other illicit drugs (Hammersley & Leon, 2006). Longitudinal analysis and understanding how the patterns of use and frequency of use, change over time, and how these changes affect use outcomes is needed. Furthermore, as this research was exploratory in nature, it is important to develop more research investigating the patterns of use, their mechanisms, and the prevalence and stability of these patterns within the population of young people.

1.2.3 Problems associated with cannabis use

Adolescent cannabis use is associated with a number of social, health and judicial problems. Adverse effects of cannabis include dependence disorder, increased risk of motor vehicle accidents, impaired respiratory function and cardiovascular disease, lower educational attainment, in addition to maladaptive adolescent psychosocial development and putative mental health problems with chronic use (Hall & Degenhardt, 2009; Lynskey et al., 2003; McGee et al, 2000; Fergusson et al., 2002). However, there are problems in determining causality of other cannabis related health problems, particularly pulmonary disorders, due to the high prevalence of concurrent tobacco use (Advisory Council on the Misuse of Drugs, 2008). Although not all use is dysfunctional, a high rate of young people initiate cannabis use at an early age and the increased number of cannabis-related treatment presentations indicate that preventative interventions need to focus not only on use initiation, but also targeting individuals most at-risk for abusing cannabis prior to use initiation, and decreasing cannabis use and associated problems among cannabis users who have yet to develop, but may be more susceptible to, developing dependence.

1.2.4 Cannabis potency

Cannabis potency is defined as the concentration (percentage) of cannabinoids in the cannabis plant, most commonly that of THC (Δ^9 -tetrahydrocannabinol). The percentage of THC is often considered to be the most important factor in determining the potency of cannabis due to its strong psychoactive effect. Although the THC content is most commonly used as a measure of cannabis potency, the psychoactive effect of cannabis may also depend on other cannabinoids, including cannabidiol (CBD) which has become increasingly important in recreational cannabis research due to its believed anti-psychotic properties, and other cannabinoids (i.e., cannabichromene, tetrahydrocannabivarin, cannabigerol) considered to have additive effects.

The plant variety (species), the part of the plant used, geographical origin, preparation for administration, and cultivation techniques are also major components in the determination of cannabis potency. Generally, cannabis and cannabis resin have between 2-8% THC content, while cannabis grown for fibre production (hemp) generally contains lower levels of THC (less than 0.3%) and higher levels of CBD compared to cannabis grown for recreational use (EMCDDA, 2008). The crossbreeding and genetic modification of cannabis has resulted in hybrid subspecies with higher levels of THC, with many of these hybrids originating from the Netherlands and the seeds readily available for purchase on the internet (Adams and Martin, 1996; Hall and Swift, 2000). The flowering tops ('buds') of cannabis have the highest THC content of the plant, followed by the leaves, stems, and seeds, while the cannabis preparations of hash oil generally have the highest THC content, followed by resin and herbal cannabis (McClaren et al., 2008). THC content degrades over time and the means by which cannabis is stored (airtight storage preserves the THC content) affects potency. Cultivation techniques, such as the growing of female plants in isolation so they are seedless ('sinsemilla', popularly referred to as 'skunk') producing higher levels of potency as fertilisation and seed production reduces THC level, also affect the potency of cannabis. In addition, the use of hydroponic or other methods facilitating the growth of cannabis indoors under artificial conditions yields higher concentrations of THC (Adams & Martin, 1996; Poulsen & Sutherland, 2000).

1.2.5 Cannabis potency trends

Recent political discussion and media coverage of cannabis potency has suggested that the THC concentration of cannabis is significantly higher than in previous years. These assertions, in addition to growing evidence that illustrates the potential increased likelihood of developing psychosis and psychotic symptoms as a result of high potency cannabis use, has led to increased interest and governmental funding for the appraisal of cannabis potency in the market. In the United States,

seizures of confiscated cannabis showed an increase of THC concentration levels from 2.0% in 1980 to 4.5% in 1997 (ElSohly, 2002), and 8.5% in 2006 (Office of National Drug Control Policy, 2007). However, data from New Zealand analysing seizures between 1976 and 1996 did not demonstrate an increase in cannabis potency (Poulsen & Sutherland, 2000). Although data measuring the potency of cannabis through seizures between 1997 and 2004 increased from 2.5% to 15%, this dramatic increase in potency could be explained by the large increase in proportion of seizures that were of cannabis buds between 2000 and 2004 (Licata et al., 2005). Evidence synthesised in reports by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) conclude that the potency of cannabis has not increased significantly over time and especially not at levels 10 times greater than in earlier years as some have suggested (Walters, 2002), with the exception of the Netherlands where cannabis potency has increased largely due to the production of domestic cannabis indoors (EMCDDA, 2004; EMCDDA, 2008). Data from the Netherlands indicates the THC content of cannabis has doubled between 2000 and 2004, but has since dropped off, with similar patterns being reported for hash (van Laar et al., 2007; Niesink et al., 2007). Samples measured in the Netherlands, however, were from 'coffee shops'-businesses that are permitted to sell small amounts of cannabis to the public-and were chosen based on their most popular sellers (generally sinsemilla), compared to police seizures used in other countries which contain a mixture of sinsemilla, buds, leaves, stems and seeds (Niesink et al., 2007).

1.2.6 Cannabis potency in the United Kingdom

In the United Kingdom, as part of the reclassification of cannabis, the Advisory Council on the Misuse of Drugs (ACMD) recommended research investigations to evaluate the different types of cannabis and their potencies in the market (ACMD, 2006). The average potency of herbal cannabis varied between 3% and 5% from 1975 to 1989 (Baker et al., 1980; Baker et al., 1982, EMCDDA, 2004), and increased from 8% to 13% between 1998 and 2004 (Eaton et al., 2005). Despite the suggestion that cannabis potency has increased in the UK, methodological issues such as inadequate or undisclosed sampling strategies, loose definitions of type of cannabis analysed, and lack of knowledge regarding cultivation techniques make it difficult to ascertain if and how these measured increases in cannabis are representative of the wider UK market (McClaren et al., 2008). More recent studies have attempted to measure the market share of types of herbal cannabis (imported herbal cannabis and 'sinsemilla') separately, due to their varying degrees of cannabis potency. In 2004/5, an investigation evaluating police seizures of five constabularies in England, with the majority being collected "on the street" with the remainder collected during property searches, found that sinsemilla accounted for 55% of samples seized, although considerable differences were found

among regions (Potter et al., 2008). Evidence also showed that herbal cannabis (median THC: 2.14%; median CBD: <.10%) and sinsemilla (median THC: 13.98%; median CBD: <.10%) had different cannabinoid profiles to cannabis resin (median THC: 3.54%; median CBD: 4.17%) especially with regards to CBD content (Potter et al., 2008). In 2008, police seizures collected from twenty-three police forces across England and Wales, with 80% of samples being collected “on the street”, found that herbal cannabis (81% sinsemilla; 3% traditional imported herbal cannabis) accounted for 80.8% of the sample, cannabis resin accounted for 15.3%, and the rest of the sample was found to be either indeterminate or not cannabis (Hardwick and King, 2008). The evidence demonstrates a further increase in the market share (55% to 81%) and potency (13.98% to 15.0%) of sinsemilla since 2004/5, and continued low levels of CBD content with 97% of herbal cannabis containing less than 0.1% (Hardwick and King, 2008). Similarly to results produced in 2004/5, significant regional variations in market share of herbal cannabis existed, and cannabis resin (median THC: 5.0%; mean CBD: 3.5%) had a much different cannabinoid profile compared to herbal cannabis (Hardwick & King, 2008).

1.2.7 Cannabis contamination

In addition to cannabis potency, interest and concern regarding the possible contamination of cannabis, in particular contamination caused by cultivation and storage (both naturally occurring contaminants, like fungi, and ‘unnatural’ products such as growth enhancers and pest control) and substances added for marketing purposes (for example, substances used to ‘bulk’ up the weights of the product), has increased in recent years (McLaren et al., 2008). Evidence from Australia shows that a sizeable portion (25%) the general population believes that hydroponic cannabis poses a greater potential health risk because of greater potency and contamination (StollzNow, 2006), while medicinal cannabis users tend to avoid hydroponic cannabis because of the perceived adverse side effects caused by contamination (Swift et al., 2005). Despite these documented concerns regarding the potential harmful effects of hydroponic cannabis, the perception that cannabis is a less harmful product than manufactured drugs such as amphetamines and heroin, and products such as cigarettes which contain chemicals and additives, because it is a ‘natural’ product persists (Hall & Nelson, 1995).

Naturally occurring moulds (*A. Flavus*), fungi (*Aspergillus*), and bacteria have been implicated in respiratory illness in cannabis users. *Aspergillus* is known to cause aspergillosis (a fatal lung disease), and an association between patients with compromised immune systems and the use of cannabis and the development of the disease was found (Denning et al., 1991; Marks et al., 1996). A study investigating the relationship between cannabis contamination with fungi and bacteria found

that 13 out of 14 cannabis samples contained fungi, the majority of cannabis smokers (13 of 23) were exposed to *Aspergillus*, while the only one of the controls (n =10) was exposed (Kagen et al., 1983). More recent investigations have supported the suggestion of cannabis contamination. One study found cannabis examples to be contaminated with mould, most commonly *Penicillium* (Verweij et al., 2000), while cannabis tested from coffee shops in a Dutch study found that cannabis contained levels of fungi and bacteria at levels considered to be unsafe for consumption (Hazekamp, 2006). Although evidence suggests that cannabis contamination exists, there is thus far no evidence that suggests the use of contaminated cannabis leads to disease in healthy individuals (McLaren et al., 2008). In addition to naturally occurring contaminants, concerns regarding the potential risks associated with pesticides and chemicals used in the cultivation of cannabis have been addressed (McLaren et al., 2008). Although strict guidelines are in place regarding the use of pesticides commercially and domestically (Australian Pesticides and Veterinary Medicines Authority, 2004), due to the illegal nature of cannabis production it is not known what products are used in cultivation, and what effects these pesticides may have on a product that is smoked (McLaren et al., 2008). There is little research on the contamination of cannabis from growth enhancers and pest controls, as well as the effects that these contaminations may have on people. A Dutch study found traces of pesticides in cannabis, but not at levels considered to be harmful to users (Niesink et al., 2006). Indoor-grown cannabis is perceived to be more contaminated with pesticides and growth enhancers than naturally grown cannabis (Swift et al., 2005; StollzNow, 2006), however there is no evidence to suggest the extent to which these claims exist (McLaren et al., 2008).

The use of substances to 'bulk up' the weight of cannabis or to make it appear more potent is cause for concern regarding the contamination of cannabis. In the United Kingdom, the Department of Health estimated that roughly 5-10% of cannabis seized between January and March 2007 was contaminated with glass beads (Department of Health, 2007). These glass beads were believed to be used to add bulk and to resemble the crystalline appearance of the THC-rich resin glands (McLaren et al., 2008). The corresponding public health alerts that were issued suggest that smoking contaminated cannabis could result in sore mouth, mouth ulcers, chesty persistent coughs and tightness in the chest (Department of Health, 2007), although it is unknown how many people were actually exposed to such products. Other reports have claimed that other substances such as phencyclidine and tobacco have been used to 'bulk up' cannabis (McPartland, 2002), but there has been no systematic research to support these claims.

1.2.8 Cannabis potency and market trends

The vast majority of research investigating high-potency cannabis and its effects on use outcomes is associated with drug-induced psychosis and mental health disorders, particularly schizoaffective disorders. A review of epidemiological studies looking at the causal link between cannabis and adults psychosis reported that use of cannabis yielded a twofold increase in likelihood of psychosis, and determined that a population level cessation of cannabis would lead to an 8% reduction in psychotic illness (assuming a causal relationship) (Arseneault et al., 2004). These results, however, should be interpreted with caution as the authors' point out that cannabis is not a direct causal link, but rather a part of a causal constellation of factors. Furthermore, results are reliant on data from a small group of individuals, and more extensive long-term, longitudinal studies are needed. Investigations of UK patients with first episode psychosis found that patients presenting a first episode psychosis were not more likely to have used cannabis compared to healthy controls, but were more likely to use cannabis more frequently and for a longer period of time (Di Forti et al., 2009; Di Forti et al., 2015). Furthermore, compared to controls, patients presenting first time psychosis reported a greater preference for using sinsemilla compared to herbal cannabis or resin (Di Forti et al., 2009; Di Forti et al., 2015). Daily users of high-potency cannabis, however, had earlier onset of first episode psychosis than those who never used cannabis (Di Forti et al., 2014). There are many limitations to this body of work, including: non-random recruitment that may have skewed towards mild cannabis users; inability to ascertain causality due to a cross-sectional design; confounding factors, including the use of cannabis to ameliorate psychotic symptoms; and use of self-reported cannabis use, especially the ability of participants to discern the type of cannabis they use, opposed to biological markers of use (Di Forti et al., 2009; Di Forti et al., 2014; Di Forti et al., 2015). Despite these limitations, this work highlights that differences in cannabis type, duration and frequency may lead to different outcomes for users.

A similar study was conducted in the Netherlands, which included the examination of the properties of the cannabis participants reported using because of the toleration of use in the Dutch market. Specifically, researchers asked participants which types of cannabis they usually consumed from a list provided by the Trimbos Institute (Niesink et al., 2007), thus verifying the concentration of THC and CBD in the type of products they reported with the participant's self-reported response. In this non-clinical, cross-sectional, web-based study, results indicated that use of cannabis with CBD present was inversely related to self-reported positive psychiatric symptoms, but not with negative or depressive psychiatric symptoms (Schubart et al., 2011). Despite demonstrating a small effect size, this provides further evidence of the antipsychotic properties of

CBD. The authors note that this small effect size (compared to previous studies including Zuardi et al., (2006)) may be because the concentration of CBD used for cannabis smoking is less compared to that of purified oral form (Schubart et al., 2011). In addition to similar studies, it is difficult to ascertain the causality of cannabis use and psychiatric symptoms, and longitudinal studies investigating how cannabis potency may affect psychiatric outcomes is needed. Nevertheless, this research further illustrates the need to develop further research investigating how the properties of cannabis influence use outcomes.

Although the majority of research investigating cannabis and the influence of cannabinoid properties on use outcomes focuses on psychiatric-related factors, some research has investigated its relationship with other factors. A recent study investigated the impact of cannabinoids, particularly THC and CBD, on memory impairment and psychological well-being (in addition to psychotic-like symptoms) (Morgan et al., 2012). Results indicated that higher levels of THC present were associated with higher levels of anxiety and depression, as well as greater memory impairment. Conversely, high levels of CBD were associated with lower psychosis-like symptoms, but only in recreational users (used less than 25 times per month). The use of biological markers determining the concentrations of CBD and THC found in participants provides the best indicator of cannabinoids present. However, because the mechanisms in which cannabinoids are deposited in hair are not well understood, in this study the presence of cannabinoids, opposed to the concentration of cannabinoids, was used. Despite the limitations of the biological testing, this study provides further evidence of an association between cannabis potency and psychiatric outcomes. More importantly, it illustrates that the association between cannabis potency and mental health factors, and that research looking at the effects of potency on behavioural outcomes and other factors is needed.

In unravelling the complicated constellation of factors associated with problematic cannabis use outcomes, it is increasingly apparent that looking more closely at cannabis type, duration and frequency in a more detailed manner may provide greater insight and help to inform drug prevention public health initiatives. As knowledge regarding cannabis, its properties, and the market continue to grow, researchers develop strategies for evaluating cannabis use behaviour. The varying cannabinoid concentrations in cannabis, as well as their availability both by country and regionally, may have an impact on outcomes of cannabis users. If cannabis users are in a country or region in which sinsemilla is a prominently distributed product, then there may be corresponding effects. Additionally, if users are seeking out and predominantly using sinsemilla, this could also have an effect on their cannabis use outcomes. It is therefore important for researchers to not only

evaluate the 'knowledge' of cannabis users, but how their knowledge of the cannabis and the market affects their decision making. Do cannabis users seek out sinsemilla because it helps them achieve their intended use experience? Are cannabis users making the decision to use sinsemilla despite possessing knowledge that it may have potentially negative mental health outcomes? How does cannabis knowledge influence consumption behaviour? Simple measures of frequency, like number of joints or days of use per week, do not adequately inform researchers of the use behaviour of cannabis users, and as a result provide very little insight into how the mechanisms of use are related to outcomes.

Although there are an increasing number of studies focusing on the relationship between cannabis use, drug-induced psychosis, and mental health disorders, it is important to note that these are not the only potential problematic outcomes associated with cannabis use. It is important to understand specifics of cannabis use, especially in frequent users, and how these factors correspond to both positive and negative outcomes. Understanding how the mechanisms of cannabis use behaviour relate to other problematic outcomes, like problems in relationships, finances, meeting commitments (school/work), is important. By comparison, in determining the consequences of alcohol consumption, there is a distinction between users who have a glass of wine an evening, and a person who drinks 10 units an evening; however, this type of distinction is not as apparent in cannabis research, where period prevalence of use is often used as a substitute for levels of use. As explored above, the type of cannabis, and the ratio of THC and CBD present in the species, and the way in which it is used is likely to have a great effect on outcomes in cannabis users. Additionally, it is important to understand the degree to which users are involved within their own use behaviour, and the degree to which their knowledge of the cannabis they use, the desired outcomes of their use, and their ability to negotiate between these two factors, play a role in their use outcomes. Furthermore, it is important to understand the contexts for which people are choosing to use cannabis, and how/why use is initiated and how this has affects their use outcomes.

1.3 Theoretical foundation

The social development model was the theoretical framework used to guide these studies and helped to understand the relationship between cannabis use outcomes and prevention interventions in young people. The social development model is an amalgamation of control theory (Hirschi, 1969) and social learning theory (Bandura, 1971), but for these studies the concept of instrumentalization of drug use was also considered (Müller and Schumann, 2011). The social development model emphasises the development of prosocial bonds to significant groups such as community (including peers) and family as a means of protection from the development of

maladaptive behaviours such as drug abuse (Hawkins et al., 1992). In addition, elements of other theories, including Problem Behavior Theory (Jessor, 1987), and theories implicating personality and interpersonal characteristics (Comeau et al., 2001; Howard et al., 1997) inform this research and subsequent factors believed to increase the susceptibility of cannabis related use and problems. The theoretical background describes antecedents and risk factors and their association with the development of substance use behaviours. Knowledge regarding risk and protective factors and their subsequent utility in predicting substance use (specifically cannabis) is paramount in designing and implementing prevention efforts. Furthermore, the theoretical background seeks to explain the association between risk and protective factors and substance use is critical in the development of such intervention efforts and how to target individuals who may be more likely to initiate or develop problematic use.

Previous research on cannabis use in the context of social development theory has supported the influence of peers and family factors on the initiation of cannabis use and the subsequent development of use trajectories and behaviours. Peer influence has been associated with substance use involvement at different stages of development (Windle, 2000; Brook et al., 2001); cannabis-using high school students with fewer cannabis-using friends were less likely than their peers to increase their cannabis use frequency six months later (White et al., 2006). Familial factors, including parental monitoring, are associated with use initiation, early substance use, and drug use disorders (Chilcoat & Anthony, 1996; Kosterman et al., 2000; Reinherz et al., 2003). Additionally, research has provided evidence that interpersonal and personality variables are important risk factors associated with cannabis initiation and use among young people, including: aggression (Reinherz et al., 2000; Unger et al., 2003), risk perception (von Sydow et al., 2002; McCambridge & Strang, 2004), and sensation seeking (Martin et al., 2002).

The consideration of instrumental drug use provides a framework for understanding non-addictive psychoactive drug use, including the use of cannabis (Müller & Schumann, 2011). This framework highlights that most people who are regular consumers of psychoactive drugs are not dependent and will never become dependent (O'Malley & Johnston, 2002). The concept of instrumental drug use suggests that there are specific mechanisms for which psychoactive drugs are indirectly used in order to achieve particular mental states such as improved social interaction; facilitated sexual behaviour; improved cognitive performance and counteracting fatigue; facilitated recovery from and coping with psychological stress; self-medication for mental problems; sensory curiosity; euphoria; hedonia, and high; and improved physical appearance and attractiveness (Müller & Schumann, 2011). Under this framework, there may be 'over-instrumentalization' of drug use,

which leads to increasing risk of transitioning to dependent and/or problematic use of drugs' (Müller & Schumann, 2011). Although frequency of use is often attributed to problematic outcomes of use and dependency (Coffey et al., 2003), under this framework the 'loss of control' over drug instrumentalization would contribute to the development of problematic or dependent use behaviours.

These theories were chosen in order to allow for the consideration of the fluidity of drugs use behaviour, and to reflect that use often matures and changes over time. Furthermore, the intersection of these theories provides context to use behaviour that is influenced by social relationships and personality constructs. Thus, although having peers who use cannabis may influence one's own use behaviour, it is important to also contextualize use behaviour, including how use is facilitated and the instrumentalization of use. Previous research has investigated the role of social relationships and personality constructs and their associations with cannabis use and other illicit drugs, but there is a paucity of work that has looked at these associations in the context of which use is administered using detailed analysis of the mechanisms of use.

1.4 Prevention

Prevention interventions seek to identify strategies that might avert the development of dysfunctional behaviour before it occurs. The identification of risk factors associated with an increased probability of developing the dysfunctional behaviour and protective factors that reduce the probability of the development of the dysfunctional behaviour are the key elements of prevention research. Once these factors have been identified, appropriate interventions can be devised to prevent the development of problematic use behaviours (Springer & Phillips, 2007). Universal intervention techniques dominate the realm of substance misuse prevention research. However, the majority of universal substance misuse interventions, including those focusing on cannabis, have been found to be ineffective, and those demonstrating promise in addressing substance misuse often require extensive time and financial commitments while yielding minimal results (Foxcroft et al., 2002; Gates et al., 2006). In contrast, indicated prevention is an individualised prevention approach that targets individuals at a higher risk for substance abuse or dependence later on in life and is considered to be the last point in prevention services for those at the border of developing substance use dependence. Although indicated services offer the highest probability of reaching those who are responsible for some of the greatest individual burdens on health, criminal justice and social services, and are at risk for the greatest individual harm due to substance abuse, little research exists that has investigated it. Indicated prevention is considered to be the most neglected prevention service among the three categories (universal, selective and

indicated) in the Institute of Medicine framework (Springer & Phillips, 2007). Limited funding, recruitment difficulty, high costs, and complexities of co-occurring problems are all factors considered to be barriers to indicated prevention implementation.

The Institute of Medicine (Springer & Phillips, 2007) concluded that where delivered indicated prevention strategies should: prevent progression to a dependence disorder (DSM-IV [currently DSM-V]); target harmful use and associated harms, not initiation of use; indicators of use should be more correlated with substance use compared to universal and selective interventions; a screening instrument should be used to identify at-risk individuals. Family, peer, or community level indicators are not suitable, and so screening tools should include individual indicators (e.g. school failure, involvement in the criminal justice system, health or mental health problems, violence or aggression, heavy alcohol use) (EMCDDA, 2009). In addition, best practice guidelines (which provides recommended, but not gold standard practice advice) suggest similar strategies and that indicated prevention should focus on those individuals with small, but detectable signs of substance abuse or similar behaviours; target individuals with high-risk indicators of substance abuse, but not dependence (according to diagnostic criteria); individuals must be identified prior to intervention; the aim of the intervention should not be to stop the initiation of use, but to prevent the progression to dependence and reduce the length and frequency of harmful use; indicators should contain a higher level of association with the targeted behaviour than selective interventions; and individual risk and protective factors need to be known in order to determine a specific intervention (NIDA, 1997).

Despite being an under researched field of substance misuse prevention, some indicated prevention interventions have shown promise. One study from the UK found that a single motivational interviewing session delivered to young (aged 16-20 years) drug users recruited by peers, especially those considered to be vulnerable or high-risk (defined as higher cannabis use frequency, men, those on benefits, those with psychosocial vulnerability) to be effective in reducing frequency of cannabis use at a 3 month follow-up (McCambridge & Strang, 2004). However, effect sizes diminished at one-year follow-up suggesting either a tapering off effect or spontaneous improvement in control subjects (McCambridge & Strang, 2005). Despite a lack of long-term effectiveness, this study suggested that indicated prevention targeting young people at a higher risk of developing cannabis use dependence has the potential to change behaviour, at least in the short-term.

Preliminary investigations using an indicated prevention approach have focused on targeting personality risk factors for substance misuse (Conrod et al., 2000a; Conrod et al., 2000b; Conrod et al., 2006; Conrod, Castellanos, & Mackie, 2008). In particular, the personality factors of sensation seeking, trait anxiety, anxiety sensitivity and hopelessness have been targeted in indicated prevention interventions that seek to prolong use initiation and decrease propensity for problematic use. One personality-based targeted intervention in the UK comprised two 90 minute manual-driven group sessions led by a counsellor and co-facilitator, and prevented the growth of binge drinking behaviour among sensation seeking adolescents (mean age 14) compared to a control group (no intervention) (Conrod et al., 2006). Additionally, evidence from personality-targeted indicated prevention intervention suggested that matching participants to interventions based on their personality, and the cannabis-use motivations that are predicted by such personality factors, are more effective in reducing frequency and severity of problematic alcohol and drug use (cannabis) compared to motivational control interventions (Conrod et al., 2000). These results suggest that screening for use motivation and tailoring interventions based on these motivations is one direction in which prevention research should proceed. Although the majority of indicated preventions using targeted personality interventions have focused predominantly on alcohol use and binge drinking, other research has shown that high anxiety sensitivity predicted conformity motives for cannabis use (Comeau et al., 2001). Thus, personality-targeted brief interventions may look to focus on the high anxiety sensitivity as a motivational predictor for cannabis use and seek to design targeted interventions surrounding this personality construct.

Despite the promise of targeting individual risk and protective factors to create more individualised approaches to preventing harmful substance misuse, the intervention models used have typically been based on traditional intervention techniques such as motivational interviewing (e.g. McCambridge & Strang, 2004), family based (e.g. Kamon et al., 2005), cognitive therapy (e.g. Zonneville-Bender et al., 2007) and school-based programmes (e.g. Conrod, Constellanos-Ryan & Strang, 2010; Conrod et al., 2013)). Additionally, indicated prevention research has tended to rely largely on traditional modes for enrolling population groups most at-risk for developing substance misuse problems and dependence (although see Palmgreen et al., 2002 who used television advertisements with targeted content to recruit high sensation seekers). Attention to creating more individualised approaches to preventing harmful substance misuse needs to not only focus on creating innovative ways to design interventions for high-risk populations, but also in developing innovative ways in recruiting and reaching target populations. One innovative indicated prevention strategy in schools has used personality-targeted interventions to match high risk individuals with individualised interventions based on anticipated motivations for use based on personality profiles

(Conrod et al., 2006). Implementation of similar innovative techniques in community settings, especially utilising existing public health frameworks and systems, is needed.

1.5 Policy context

In response to disparities in health outcomes and expectancies around drug use, the UK government has published its Drugs Strategy and subsequent annual reports detailing plans for reducing health inequalities (Home Office, 2010). The key principles of the current UK Drugs Strategy are to reduce demand, restrict supply and build recovery, which will be measured by the reduction of illicit drug use and its harms, and increasing the number of individuals recovering from dependence (Home Office, 2010). Unlike previous strategies employed by the UK government, this strategy focuses not only on eliminating harms related to drug use, but providing opportunities to choose recovery. Furthermore, approaches will be oriented towards locally designed and delivered services. The most recent update on the UK Drugs Strategy emphasises the continued use of universal and targeted approaches to reducing drug demand (Home Office, 2015). Indicated prevention provides a more individualised approach of preventative medicine and the utilisation of local services allow for services to be designed and delivered based on the specific vulnerabilities and needs of communities. Although targeted approaches around vulnerable youth (particularly around resilience across the life course and parental drinking), men who have sex with men, and the identification of vulnerable young people and their subsequent referral to local services, the types of services, particularly around indicated approaches to the identification and dissemination of targeted prevention, are not specifically addressed (Home Office, 2015). The types of targeted approaches used by local services, thus, are up to the discretion of the communities themselves. Thus, research exploring targeted approaches to drug prevention is needed to provide local communities with resources to deliver the most suitable targeted prevention interventions.

1.6 Mixed Methods Approach

This PhD employed a mixed-methods approach, using both quantitative and qualitative methodologies to answer the research questions posited in this thesis. Quantitative research utilises statistical and mathematical techniques to investigate observable phenomena in an attempt to generalise to a larger population, while qualitative traditionally asks broad questions to identify themes and patterns exclusive to the population used in the study. The first two studies of this thesis employ quantitative methodologies to ascertain the relationship between risk factors associated with cannabis use outcomes. The use of quantitative methods is important for the identification of factors that may be suitable for targeting in an indicated prevention intervention.

Additionally, the third study of this PhD employed qualitative methods in order to contextualize and explore the relationship identified in the previous studies. This was critical in order to identify and explore the nuances of this relationship and the suitability for the previously identified risk factors for indicated prevention efforts. Thus, the research methods used are informed by the research questions, and the research objectives in this piece of work are best met by the use of both quantitative and qualitative methods.

The utilisation of mixed methods has been discussed in the academic literature (Bryman, 2007; Bardley & Bishop, 2015). One of the main issues in mixed-methods research is the importance of integration of research techniques and findings to be mutually enlightening, and similarly, mixed methods research is weakened by the lack of integration of data. In this thesis work, each study were designed, implemented and informed by a consistent understanding of previous literature (through the literature review) and the emerging findings of studies. As a result, the most suitable methods were chosen based on the research objectives and emerging evidence. Thus, although findings were not concurrently analysed due to time available for the PhD, the studies were informed by consistent objectives and research questions.

1.7 Conclusions

Indicated prevention is a tool for which public health interventions can target individuals with specific vulnerabilities to developing problematic use outcomes. This technique provides an opportunity for a cost-effective way to deliver interventions. In contrast to universal interventions which are targeted at the entire population regardless of level of risk, this allows interventions to focus specifically on the mechanisms which are most likely to lead to problematic outcomes. Although this provides an opportunity for public health to focus on the most vulnerable population groups, it is first important that researchers understand the mechanisms of use between cannabis use and risk and protective factors. Many of the risk and protective factors associated with cannabis use have numerous confounding factors and it is important before designing indicated interventions that these factors are, in fact, strong predictors of problematic use, and that the mechanisms of use that predict use outcomes are understood so interventions targeting these individuals can be developed. This literature provides a review of the cannabis and prevention, and highlights the need for more investigative work informing indicated prevention efforts. This PhD will investigate the relationship between risk factors and their linkages with cannabis, and how understanding this relationship may provide an understanding of how indicated interventions for young people and cannabis use can be designed and delivered.

Chapter 2

Cannabis use measures and associated risk factors

2.1 Introduction

Prevention science research seeks to avert the development of dysfunctional use behaviour before it occurs. The identification of risk factors associated with an increased probability of developing the dysfunctional behaviour and protective factors that reduce the probability of the development of the dysfunctional behaviour are the key elements of prevention research. Once these factors have been identified, appropriate interventions can be devised to prevent the development of problematic use behaviours.

The majority of focus on cannabis prevention work has been on the initiation of cannabis use and abstinence (Porath-Waller, Beasley & Beirness, 2010; Norberg, Kezelman, & Lim-Howe, 2013). Although cannabis use in the United Kingdom has decreased in recent years, the prevalence of recent and frequent cannabis use is still the greatest amongst all illicit drugs (Burton et al., 2014). Although prevention work seeks to prevent the initiation of cannabis use, it also works to prevent cannabis users from graduating to dependent and/or problematic use. It is therefore important to understand whether or not the risk and protective factors associated with cannabis initiation are similar to other cannabis use outcomes, including frequency and self-reported cannabis use-related problems.

A multitude of risk and protective factors have been implicated in the development of cannabis and other drug-related behaviours. Although there is a complicated web of factors associated with the development of drug-related and cannabis, this research focuses specifically on factors that are most suitable for community and school-based interventions. Thus, factors that are appropriate for large-scale screening and amenable to change are considered.

This research has two main objectives:

- 1) To assess outcome measures of cannabis use and how they are predicted by risk and protective factors, and the feasibility of developing indicated prevention efforts based on these factors.

- 2) To assess how sub-clinical levels of psychopathology affect use outcomes, and if this is an appropriate avenue for future indicated prevention work.

In assessing the first research objective, it is important to differentiate the relationship between frequency and problematic outcomes in order to better understand how these two outcomes interact. In alignment with the drugs as instruments framework (see section 1.2), we cannot make the assumption that the frequency of use is directly related to problems associated with cannabis use. Rather, the over-instrumentalization of drugs and lack of control regarding use precedes problematic outcomes. Thus, although users of drugs may be considered recreational, infrequent users, these individuals, if they are engaging in abusive or 'binge' use, may still experience problematic use outcomes, even if these problematic outcomes are not considered as indicators of dependence. It is important that these individuals are not discounted when assessing and estimating prevalence of problematic users, and that interventions designed to prevent problematic use would be appropriate and available for this population. Furthermore, it is necessary in defining interventions to assess which individuals are most likely to have problematic outcomes due to their use, and not just the individuals who are susceptible of progressing to dependent use. In looking at young people, it is of importance to note that while many young people acutely engage in problematic alcohol behaviours, both delinquent and hazardous, most of these people will not advance to dependent use, yet these individuals may still benefit from targeted interventions (Johnstone et al., 1996; Zakrajsek & Shope, 2006; McCambridge, McAlaney & Rowe, 2011). This same approach needs to be adopted for cannabis and other drug use behaviour (Sargent et al., 2010; Conrod, Castellanos-Ryan & Strang, 2010).

In the second research question, sub-clinical levels of psychopathology and its relationship with cannabis use outcome are investigated. The reasoning for this is two-fold: 1) psychopathology is one of the factors most attributed to cannabis and other drug use outcomes (Moore et al., 2007); and 2) the comorbidity of mental health and problematic drug use is a great public health concern (Jané - Liopis & Matytsina, 2006). Depression, anxiety, and aggression have all been linked to cannabis and other drug use behaviour (Crippa et al., 2009; Ostrowsky, 2011; Lev-Ran et al., 2013). The direction of causality amongst psychopathology and drug use is often presented with conflicting theories. Some suggest that psychopathology leads to increased drug use, while others purpose that drug use leads to increased levels of psychopathology (Harris & Edlund, 2005; van Laar et al., 2007; Schneider, 2008; Degenhardt et al., 2013). It is likely that there is a bi-directional relationship between psychopathology and drug use, where one factor exacerbates the condition of the other (McGee et al., 2000; Ferdinand et al., 2005; Pacek, Martins & Crum, 2013). Thus, psychopathology would be an

appropriate risk factor for the development of indicated prevention in potentially curbing the development of both problematic cannabis use and mental health outcomes.

2.2 Risk and protective factors associated with drug use

Research has identified numerous risk and protective factors associated with the use of licit and illicit substances including, but not limited to: genetics (Lynskey et al., 2002; Verweij et al., 2010), sex and sexuality (Guxens et al., 2007; Corliss et al., 2010), age (Young et al., 2002; Beckett et al., 2004; Ljubotina et al., 2004; Palmer et al., 2009), life events (Turner & Lloyd, 2003), self-esteem (Hoffman & Cerbone, 2002; Bitancourt et al., 2016), impulsivity/sensation seeking (Martin et al., 2002; Crawford et al., 2003), mental health disorders (Höfler et al., 1999; Hoffman and Cerbone, 2002; Ilomaki, 2004), early onset of substance use (Höfler et al., 1999; von Sydow et al., 2002), drug-related attitudes and cognitions (von Sydow et al., 2002; McCambridge & Strang, 2004), aggression (Reinherz et al., 2002; Unger et al., 2001), family structure (Reinherz et al., 2002; Lynskey et al., 2002), parental monitoring (Case and Haines, 2003; Wu et al., 2004), peer behaviour and use (Höfler et al., 1999; von Sydow et al., 2002; Beckett et al., 2004), social norms (Kosterman et al., 2000), educational performance (Hallfors et al., 2002), socio-economic status (Höfler et al., 1999; Reinherz et al., 2002; Poulton et al., 2002); and drug availability (von Sydow et al., 2002). The large number of factors associated with substance misuse has led to difficulties for researchers and public health practitioners to identify which are most predictive of harmful outcomes or are most suitable for targeting through intervention. Furthermore, each factor is also likely to be differentially amenable to change through intervention (e.g. sex is resistant to change, parental monitoring is easier to change, whilst improving socio-economic status is difficult but amenable to change through long term policy investment), and the effect of changing the indicator on drug use behaviour also varies. As the majority of this area of research has been conducted in international populations (typically the USA) it is also important that the transferability of existing findings is investigated. Research is therefore needed that not only identifies amenable factors but that also assesses whether they may be targeted through local (or national) health service structures and systems.

The risk and protective factors at the forefront of this PhD research are impulsivity/sensation seeking, aggression/externalising behaviours, anxiety sensitivity, depression/depressive symptoms, and risk perception/time perspective. For these factors, there is an emerging body of literature examining their relationship with substance use behaviours (Windle & Wiesner, 2004; Bonn-Miller et al., 2007; Comeau et al., 2001; Hampson et al., 2008; Korhonen et al., 2008; Kilmer et al., 2007). Evidence from indicated prevention research also suggests that targeting these factors may provide an effective means of recruiting participants into interventions,

(e.g. Palmgreen et al., 2001), and such interventions may also be effective at reducing substance use in young people of previous indicated prevention interventions targeting these factors (Conrod et al., 2006; Conrod et al., 2010; McCambridge & Strang, 2004; Zonneville-Bender, 2007).

2.2.1 Genetic factors associated with cannabis use

Genetic factors associated with cannabis use are largely unsuitable for indicated prevention, although interventions targeting phenotypes, specifically looking at the interaction of genes and the influence of environmental factors may be suitable for future prevention work. However, in assessing which risk and protective factors are suitable to interventions, it is important to assess the degree to which genetic factors contribute to use behaviour and outcomes. A recent meta-analysis of environmental, such as family environment, parental style, prenatal influences, socio-economic status, and genetic factors associated with cannabis use evaluated the links between cannabis initiation and dependence in twin studies by sex (Verweij et al., 2010). This study presented findings into three categories: genetic factors; factors from a shared environment; and environmental factors not shared by twin pairs. As with most attempts to amalgamate multiple studies of cannabis use, there was a lack of consistency with the measurement of problematic cannabis use in the primary studies used for analysis. For this study, problematic cannabis was 'operationally defined' as having 'one or more symptoms of abuse or dependence in their lifetime' as defined by the primary authors, although most used the DSM-IV (Verweij et al., 2010). For males, genetic factors contributed the most to models explaining both initiation of use and problematic use, while shared and unshared environmental factors contributed significantly to the model, but to a lesser extent. For females, the results showed a strong association between genetic factors and problematic cannabis use, and shared environmental factors and initiation of cannabis use. These results indicate that both cannabis initiation and problematic use are heritable, although the strong contributions of shared and unshared environmental factors suggest that non-genetic factors play a substantial role. A particular insight of this meta-analysis is the importance these factors may play at different points in cannabis use trajectories. For females, the extent to which environmental factors contributed to initiation of use and biological factors to problematic use suggested that use initiation is more strongly related to availability of cannabis and the use by peers. Additionally, this would suggest that the biological factors related to cannabis may be more important in understanding the development of problematic use outcomes. In developing cannabis use interventions, it is important to note that for females, in particular, initiation of use may be a critical point of intervention, and environmental factors associated with initiation of use may be most suitable in designing targeted prevention.

2.2.2 Mental health and cannabis

Substantial research focus has been placed on the relationship between cannabis and psychotic and affective mental health outcomes (Moore et al., 2007; Degenhardt et al., 2013; Lev-Ran et al., 2013). Despite these efforts, the relationship between mental health and cannabis remains unclear (Moore et al., 2007). One of the main difficulties in unravelling the relationship between mental health outcomes and cannabis use is elucidating causality (McLaren et al., 2011). Despite frequent assertions of comorbidity and correlation between mental health factors and cannabis use outcomes, paradoxical theories of self-medication hypothesis and cannabis use as a contributing factor to the development of mental health outcomes have been frequently demonstrated and refuted in the literature (Lazereck et al., 2012). Furthermore, there are considerable difficulties in ascertaining cannabis use outcomes and the suitability of frequency and dependence as appropriate measures (Zeisser et al., 2012; van der Pol et al., 2013b; Hughes et al., 2014). The measurement of amount of cannabis use specifically is difficult due to complexities of use sharing in cannabis culture and the variability in cannabis content, including the percentage of THC present. Despite the limitations of current research on the relationship between mental health and cannabis, considerable progress has been made in understanding this relationship.

The association between cannabis use and mental health outcomes and disorders has been well documented. Heavy use of cannabis is associated with the onset of acute psychotic episodes for those without previous history of psychotic symptoms and the exacerbation of symptoms for those with established psychosis (Linszen, Dingemans, & Lenoir, 1994; van Os et al., 2002; van Os et al., 2009). The relationship between affective mental health disorders and cannabis use is more equivocal, although research suggests that depressed individuals are more likely to use cannabis, and that use associated with an increased likelihood of anxiety, depression and suicide attempts (Johns, 2001). In a systematic review of longitudinal studies of cannabis and mental health disorders, a consistent increase in incidence of psychotic mental health outcomes, independent of acute intoxication, was found in addition to a dose-response effect with risk of incidence increasing from 40% to 50-200% for heavy using participants (Moore et al., 2007). While the relationship between psychotic mental health outcomes and cannabis was consistent, the link between cannabis use and affective mental health outcomes, including anxiety and depression, was less strong.

A cohort study in Australia that followed adolescent students (aged 14-15 years-old) for 7 years found an association between frequent cannabis use and the development of anxiety and depression (Patton et al., 2002). While 60% of participants had used cannabis by the age of 20, as frequency of cannabis use increased so did the prevalence of anxiety and depression. This effect

was particularly strong for female participants, with female daily users of cannabis having an over fivefold increase in odds of anxiety or depression than in non-users. In this sample, no prospective relationship between anxiety and depression in adolescence and later frequent cannabis use was found, repudiating the self-medication hypothesis and suggesting that pharmacological or psychosocial mechanisms underlie the relationship between cannabis and mental health.

Although the self-medication hypothesis has been disputed in the development of anxious and depressive affective disorders, evidence supported that cannabis is used as a means of self-medication for aggression (Arendt et al., 2007). In a sample of cannabis dependent (ICD-10 criteria) young adults (aged 16-30 years), participants that reported problems controlling violent behaviour tended to use cannabis to decrease aggression and suspiciousness, and for relaxation, despite reacting with more aggression when intoxicated. This study had several limitations, including the use of a crude measure of aggression as the recurrent tendency to either harm people physically and the retrospective evaluation of behaviour. Despite these limitations, these results suggest self-medication of aggression. In addition, this study investigated the relationship between depression, cannabis dependence and the self-medication hypothesis. Results indicated that depressive participants did not retroactively self-report happiness or euphoria after acute cannabis use; suggesting that self-medicating for depression by the use of cannabis is unlikely, consistent with previous research (Degenhardt, Hall & Lynskey, 2003).

The relationship between cannabis and mental health is complex and similar factors are associated with the development of both the initiation of cannabis use and the development of mental health problems. The direction of causality is contentious, but most assertions suggest that cannabis use generally predisposes the development of mental health disorders (Richardson, 2010). However, the complexities of reviewing such research are highlighted by one longitudinal study following adolescents (aged 15 years-old) until early adulthood (aged 21 years-old) that indicated that mental disorders at the age of 15 led to a small, but significant elevated risk of cannabis use at the age of 18, while cannabis use at age 18 led to an elevated risk of a mental disorder at age 21 (McGee et al., 2000). Realistically, there are likely to be several different pathways and trajectories relating to cannabis use and mental health disorders, and it may be that there is a bi-directional relationship between cannabis and mental health.

2.2.3 Anxiety sensitivity

Although correlated and similar to trait anxiety, anxiety sensitivity is a conceptually and distinct construct (McNally & Eke, 1996). Anxiety sensitivity corresponds to a specific fear of anxiety-related

bodily sensations as a result of a fear that such sensations will lead to negative outcomes such as physical illness, social embarrassment or loss of mental control (Reiss et al., 1986), while trait anxiety refers to the tendency to react anxiously to potentially anxiety provoking stimuli. Anxiety sensitivity is believed to be related to cannabis use, particularly for individuals for whom coping is a motivation for cannabis use (Bonn-Miller et al., 2007). Anxiety sensitivity is considered to be a malleable trait in psychosocial interventions, meaning that interventions targeting anxiety sensitivity could change cannabis use, or other substance use outcomes (Otto & Reilly-Harrington, 1999; Smits et al., 2008). Interventions that have decreased anxiety sensitivity, such as moderate-intensity exercise, have been shown to decrease levels of anxiety sensitivity as well as decreased motivations to use cannabis for coping reasons (Smits et al., 2011). This evidence supports the need to further investigate how the reduction of anxiety sensitivity through moderate-intensity exercise as a potential intervention tool for reducing cannabis problems.

Other research has investigated the potential links between anxiety sensitivity and cannabis, and its potential for public health interventions. The Substance Use Risk Profile Scale is an instrument used to assess four distinct, independent personality traits (anxiety sensitivity, hopelessness, sensation seeking, and impulsivity) believed to be associated with problematic substance use (Krank et al., 2011). In one study of Dutch adolescents, results indicated that hopelessness and sensation seeking were strongly associated with using alcohol, cannabis and tobacco, while high anxiety sensitivity individuals were less likely to use alcohol at a younger age (Malmberg et al., 2010). It is important to note that this research focused specifically on age of onset, and suggested only that hopelessness and sensation seeking individuals are more likely to engage in use at a younger age. This is not surprising considering characteristics of sensation seeking and hopelessness would be more likely to coincide with engaging in deviant or hedonic behaviour. It is likely that anxiety sensitivity would not be associated with the initiation of use, but that it may affect use outcomes if one begins to use cannabis. An analysis of the role of anxiety sensitivity and cannabis use and how it influences use behaviour across the course of use trajectory is needed. For example, individuals with high levels of anxiety sensitivity are likely to engage in substance use to relieve negative affective states, while high sensation seeking individuals are more likely to engage in use for the positive hedonic effects (Brunelle et al., 2004; Conrad, Pihl & Vassileva, 1998). Thus, while individuals with high anxiety sensitivity may not have an earlier age of onset for cannabis use, they still may be more likely to develop problematic use outcomes. Research looking at the effects of internalising behaviour (anxiety, depression, and suicidal tendencies) and externalizing behaviour (hyperactivity, aggression) and cannabis dependence symptoms found that high levels of internalising behaviour problems were associated with high number of dependence

problems, regardless of the coping motive level (Fox et al., 2011). The mechanisms for this relationship were different than hypothesised. The researchers predicted that experiencing higher levels of internalising behaviours would result in levels of negative consequences that exceeded predictor variables; however, using cannabis to cope with negative affects was most problematic for users without internalising behaviours (Fox et al., 2011). The mechanisms between anxiety sensitivity and cannabis use in young people still need considerable more research to untangle the web of factors underlying the relationship; however, the linkages between anxiety sensitivity and the development of cannabis use problems as well it's malleability in an intervention setting suggest that this may be a suitable construct for indicated prevention.

2.2.4 Aggression and problem behaviour

Aggression and problem behaviour have been shown to be major risks factors for drug use. The self-medication hypothesis postulates that individuals who experience negative emotional stress tend to seek out specific substances in order to assuage specific symptoms (Khantzian, 1985). In a study of clinically dependent cannabis users in Denmark, for example, evidence suggested that cannabis use could be used as a means of self-medication for controlling aggression and problem behaviour, defined as difficulty in controlling violent behaviour (Arendt et al., 2007). Furthermore, evidence suggests that cannabis use, in moderate to high doses, is linked with the suppression of aggressive behaviour (Hoaken & Stewart, 2003). Although the self-medication theory refers specifically to controlling violent behaviour, the research in this PhD intends to focus on both violent and non-violent behaviour and distinguish these from anger and aggression. This will provide a more appropriate and inclusive measure of aggression suitable for a general population sample.

Research has investigated how the relationship between cannabis and aggression was mediated in a clinical sample of young people (under 26 years-old) with first-episode psychosis (Harris et al., 2010). The results indicated that patients who exhibited physically aggressive behaviour were more likely to be regular users of cannabis. Although it is not clear whether or not cannabis use is a direct cause of violent/aggressive behaviour, or if confounding factors of personality type and deviant behaviour are the cause (Harris et al., 2010). The authors propose that a potential mechanism for which cannabis may increase aggressive behaviour is the effect of 'go-no go' functions on the brain which play a role in the ability to inhibit behaviour (Harris et al., 2010). The self-medication hypothesis would suggest that using cannabis may serve to inhibit violent or aggressive behaviour, and that cannabis is unlikely to cause aggressive or violent behaviour, which is supported within the literature (Abel, 1977). It is important, however, to understand if aggression is a suitable construct for targeting individuals who are likely to become

problematic users of cannabis, or whether aggression is linked to other confounding factors that are associated with problematic cannabis use outcomes.

2.2.5 Depression

Psychopathology, particularly depression, has been implicated in the development of cannabis use and related problems (Degenhardt, Hall & Lynskey, 2003; Degengardt et al., 2013). There are three main theories in research regarding the relationship between cannabis and psychopathology, including depression: a causal link of cannabis increasing the risk of psychopathology (cannabis causing depression); reverse causation where cannabis use is caused or influenced by psychopathology (depression causing cannabis); and the association between cannabis and psychopathology is due to other factors (confounding factors increase the risk of both cannabis use and depression), like socioeconomic status and personality factors, and the measured association is due to confounding factors and other bias (Johns, 2001; Arseneault et al., 2004; Macleod et al., 2004; Arendt et al., 2007). A study of cannabis-dependent young people (under 30 years-old) looked to investigate the self-medication hypothesis for depression and aggression (Arendt et al., 2007). Results indicated that while there did not appear to be evidence supporting the self-medication hypothesis and cannabis and depression, those with reported depressive symptoms were more likely to report lifetime history of problems (Arendt et al., 2007). Furthermore, prior depression was associated with less positive effect outcomes reported while under the influence of cannabis (Arendt et al., 2007). Thus, although evidence suggests that depression may not be used to assuage depressive symptoms, depressive symptoms may lead to less positive cannabis use outcomes and in turn problematic use.

A review of the evidence exploring the association between cannabis use and depression found that heavy cannabis use and depression were correlated, and that longitudinal data suggests that heavy cannabis use may increase depressive symptoms in some users (Degenhardt, Hall & Lynskey, 2003). Furthermore, as evidenced by longitudinal studies, the authors highlight that early onset regular or problematic cannabis use is associated with later onset of depression. This is likely because a) cannabis causes changes in neurotransmitter systems that lead to a more depressed mood, or b) that effects of cannabis use are socially mediated, whereas reduced educational attainment, unemployment and crime, and other factors associated with regular and problematic cannabis use lead to depressive symptoms (Degenhardt, Hall & Lynskey, 2003). This evidence suggests that there may be a bidirectional relationship between cannabis and depression, whereas

some early onset and subsequent regular cannabis use may lead to depressive symptoms, and depressive symptoms may lead to more problematic use outcomes in others.

In an effort to better understand the mechanisms that underlie the association between depression and cannabis, research has examined those factors that may mediate this relationship. In one study of University undergraduates, researchers investigated how distress and discomfort intolerance mediates the relationship between depression and cannabis use and related problems (Simons & Gaher, 2005). Discomfort intolerance assesses the ability to tolerate physical states of discomfort, and distress intolerance is the ability to tolerate negative and physical sensations, which have been previously linked to substance misuse (Simons & Gaher, 2005). The results indicated that distress intolerance was associated with problematic cannabis use, including cannabis problems and cannabis frequency (Buckner, Keough, & Schmidt, 2007). Discomfort intolerance mediated the relationship between cannabis and depression whereby individuals with a greater capacity to tolerate discomfort were more likely to have cannabis-related problems (Buckner, Keough, & Schmidt, 2007). This research also suggested that distress intolerance may act as a protective factor for cannabis use for individuals less able to tolerate negative physical sensations, like some of those produced during cannabis intoxication, resulting in them being less likely to use cannabis (Buckner, Keough, & Schmidt, 2007). These results provide an interesting contribution to the vast literature of depression and cannabis. It appears that depression and cannabis have a bidirectional relationship, and it is likely that there are many confounding factors, thus it is difficult to ascertain how strong the association between cannabis and depression. Furthermore, evidence that discomfort intolerance may mediate this relationship suggests that those less able to tolerate bodily sensation are less likely to use cannabis, and that the role of discomfort in those with greater levels of depression may serve as a protective factor.

2.2.6 Sensation seeking

Sensation seeking is a personality trait characterised by the need to seek novel experiences and intense sensations, including activities involving danger or risk, and having the willingness to take risks to have such experiences. The relationship between sensation seeking and drug use has been reported in various populations. Research investigating sensation seeking is largely based on the work of Zuckerman (see, for example: Zuckerman 1979, 1988, 1994). This work defines sensation seeking as a personality trait in which individuals seek varied, novel, complex, and intense sensations and experiences which are sought despite associated physical, social, legal and financial risks. Indicated prevention interventions based on this theoretical conception of sensation seeking

have been shown to be effective in delaying onset of substance use among high risk, vulnerable youth with elevated trait sensation seeking (Conrod et al., 2006; Conrod et al., 2010). Sensation seeking has been implicated in the development of alcohol misuse behaviours, particularly heavy episodic drinking, and targeted interventions delivered to younger adolescents (mean age 14 years-old) have proven effective in delaying initiation and reducing harmful use (Conrod et al., 2000; Conrod et al., 2006).

In order to better conceptualise the ways in which sensation seeking may be linked to drug use, a study investigated the relationship between several factors, including sensation seeking, and motivations for alcohol, tobacco and cannabis use (Comeau et al., 2001). Based on Cooper's (1994) model of motivations for drinking (conformity, enhancement, coping, and social), the authors investigated how different risk and protective factors associated with use contributed to different motivations for use. Previous researchers have utilised Cooper's model with cannabis use and found that coping and enhancement motivations led to increased frequency of use, while conformist motivations led to more problematic use outcomes (Simons et al., 1998). In the sample of over 500 adolescents, personality factors associated with cannabis use motivations were only significant for conformity motivations, and anxiety sensitivity was an independent, significant predictor. The authors suggest that anxiety sensitivity and its link with cannabis use are based on the anxiolytic effects of the drug and the anxiety related to social encounters (Comeau et al., 2001). The authors did not find an association between sensation seeking and enhancement motivations for cannabis use, despite previous research; however, the authors suggest that although sensation seeking may not be associated with enhancement motivations, it is possible that sensation seeking is linked to expansion motives, or experiential awareness (Comeau et al., 2001).

Another study investigating the genetic and environmental risk factors associated with cannabis use in twins, specifically looked at risk-taking and sensation seeking characteristics. Opposed to using the commonly used Zuckerman Sensation Seeking Scale, a seven-item scale, still representative of the Zuckerman scale, addressing risky behaviours (including: birth control use, sexual promiscuity, riding a motorcycle, seat belt use) was used. No associations were found between the risk-taking behaviours, suggesting that there was not a unitary concept of risk-taking. Results suggested that the amount of variance in cannabis use attributed to sensation seeking differed greatly by the four traits examined (risk-taking attitude, riding a motorcycle, seat belt use, and sexual promiscuity). Furthermore, results indicated that although genetic factors are associated with variation in cannabis use, these genetic factors are not associated with risk-taking behaviours (Miles et al., 2001).

Despite contradictory evidence linking cannabis and sensation seeking personality characteristics, it may be that sensation seeking is in fact mediated by other factors associated with cannabis use outcomes. In a study examining the relationship between early sensation seeking in children (during 4th and 5th grade of elementary school) and cannabis use during adolescents (during 11th and 12th grade), early sensation seeking was found to be linked to adolescent cannabis use (Hampson et al., 2008). Furthermore, path analysis showed that early sensation seeking leading to adolescent cannabis use was mediated through affiliation with deviant peers. This suggests that sensation seeking influenced cannabis use as a result of sensation seeking leading to motivation to associate with deviant peers (Hampson et al., 2008). In addition to looking at sensation seeking and deviant peer associations with cannabis, researchers have also investigated the relationship between parental monitoring, sensation seeking and cannabis. Results from a study of college students found that while sensation seeking was associated with alcohol and cannabis dependence, parental monitoring (as measured by parental monitoring during last year of high school) was only associated with alcohol dependence (Kaynak et al., 2013).

In addition to the relationship between sensation seeking and cannabis use outcomes, the relationship between sensation seeking, cannabis, and substance use prevention campaigns has been a topic of importance for public health researchers. Researchers evaluated the effect of the National Drug Control Policy's Marijuana Initiative Campaign (USA) on young people and found that high sensation seekers decreased their cannabis use in the past 30 days as a result of the campaign (Palmgreen et al., 2007). Additionally, positive cannabis attitudes and beliefs for high sensation seekers were significantly reduced (Palmgreen et al., 2007). The authors suggest the effectiveness of this campaign was due to using 'dramatic negative consequence' messages, and although this may be useful in preventing use initiation, it is important to consider whether this tool would be useful in preventing problematic cannabis use and dependence.

Sensation seeking has also been evaluated as a moderator of the effects of peer influences, consistency with personal aspirations, and perceived harm and cannabis use. Results indicated that peer pressure and perceived peer cannabis use had little effect on low sensation seekers, while having a much greater effect on high sensation seekers (Slater, 2003). Additionally, aspirations inconsistent with cannabis use were a protective factor for high sensation seekers. These results provide implications for prevention and provide further evidence that high sensation seekers are at an increased risk for cannabis use, and that understanding the mechanisms associated, including the influence of peer behaviour, may be useful in designing targeted interventions.

2.2.7 Impulsivity

Impulsivity is a personality trait which can be characterised by the degree to which one has behavioural disinhibition. Impulsivity can manifest in various ways, including performing an act or making a choice without considering the potential consequences of the action. Impulsive personality traits are highly prevalent amongst substance-using individuals and have been discussed as both a risk factor and a consequence for substance abuse (de Wit, 2009). There are three major hypotheses regarding the relationship between drug use and impulsivity: 1) high levels of impulsivity lead to drug use, 2) the use of drugs increases impulsivity, and 3) impulsivity and drug use are related to a common factor(s) (Perry & Carroll, 2008).

Acutely, cannabis use has been associated with the impairment of impulsivity when light users received a high dose of THC (McDonald et al., 2003), and on a task of inhibition by intoxicated, chronic cannabis users (Ramaekers et al., 2006). These results suggest that acute cannabis use supports impulsive behaviour and influence inhibition of maladaptive responses (Crean, Crane, & Mason, 2011). Long-term effects of cannabis on impulsivity are less certain. The Stroop Test and the Wisconsin Card Sort Test (WCST) have been used to assess the relationship between impulsivity and cannabis use, with both demonstrating different results. The Stroop Test has consistently demonstrated no difference between cannabis users and controls (Lyons et al., 2004; Pope et al., 2001, 2002, 2003; Verdejo-Garcia et al., 2005), while studies using the WCST have largely produced significant differences between cannabis users and controls (Bolla et al., 2002; Pope et al., 2001, 2002, 2003). It has been suggested that the results are due to differences in the abilities necessary to perform the tasks, implicating concept formation, planning, and sequencing as potential facets of impulsivity impaired by long-term chronic use of cannabis (Crean, Crane & Mason, 2011). In addition to acute and chronic users of cannabis, recreational cannabis users were found to have impulsivity traits, impulsive decision-making, and behavioural disinhibition linked to consumption patterns (Moreno et al., 2012). This research suggests that the progression from recreational drug use to chronic drug abuse may be mediated by impulsive traits, and that trait impulsivity, as described by the impulsive endophenotype, may be considered as a risk factor (Ersche et al., 2010).

A review of impulsivity and substance use disorders supports the theory that impulsivity precedes the development of substance use disorders (Verdejo-Garcia et al., 2008). Despite this finding, the authors caution that impulsivity is often not a specific predictor of substance use disorders, but rather 'a shared risk factor for multiple clinical manifestations and disorders' (Verdejo-Garcia et al., 2008). Impulsivity is a highly complex behaviour construct, and there appears to be a

moderate heritability (Eysenck, 1993). It is therefore important for future research to identify and deconstruct the genetic risk factors associated with impulsivity and their dimensions (Verdejo-Garcia et al., 2008). In understanding how to deliver indicated interventions, it is crucial to understand impulsivity and how it relates to other factors associated with the development of cannabis problems.

2.2.8 Risk perception and time perspective

The perception of risk is closely associated with beliefs about negative consequences of behaviour; however, because of the attention given to the concept of risk it merits separate treatment. Risk perception concerns beliefs about the severity of consequences associated with performing a specific behaviour, and the probability of those consequences occurring. The Health Belief Model suggests that perceived risk is a key determinant in the decision-making process for health related behaviours (Pechmann, 2001). In a social environment where it is often believed that cannabis-related behaviour is less stigmatised than other drug behaviour, it is hypothesised that the greater lifetime use and heavier, more problematic use result from the lack of perceived risk of cannabis use. Furthermore, evidence suggests that perceived risk and the potential consequences of cannabis use act as a protective factor for use initiation, and that for heavy cannabis users the perceived risk and potential consequences of use are not congruent to their actual experiences (Kilmer et al., 2007).

In a similar vein to risk perception, time perspective is a non-conscious process by which social and personal experiences are allocated to temporal categories, or time frames, and work to give order, coherence and meaning to those events (Zimbardo and Boyd, 1999). It is hypothesised that the ways in which these experiences are assigned influences the ways in which people make judgements and greatly inform the decision-making process. Time perspective identifies five different types of temporal categories: Past Negative, Present Hedonistic, Future, Past Positive, and Present Fatalistic. Studies using this construct in health research have found, for example, that those with a high present orientation, both hedonistic and fatalistic, were more sexually active and less likely to use alternate methods of reducing HIV exposure than future oriented peers (Rothspan & Read, 1996). When considering cannabis use, a person with a Future-orientated time perspective and high perceived risks of cannabis use might be less likely to report use. Alternatively, a person with a present oriented time perspective with lower perceived risk of cannabis use might be more likely to report use.

Previous research investigating time perspective has shown Future time perspective as a protective factor for cannabis use (Keough, Zimbardo, & Boyd, 1999; Wills, Sandy & Yaeger, 2001). In order to better understand the relationship between time perspective and drug use, researchers investigated how Future time perspective mediated the role of general drug-oriented perception in French adolescents (Apostolidis et al., 2006a). Results indicated that Future time perspective had a negative relationship with reported cannabis use as frequently evidenced in the literature, and furthermore that drug-oriented perception may play a mediating role in this relationship (Apostolidis et al., 2006a). This suggests that the relationship between Future time perspective and cannabis may be indirect, and that Future time perspective may actually be mediated by an individual's drug perception.

Another French study investigated the links between cannabis use, risk perception and time perspective (Apostolidis et al., 2006b). This study sought to examine the link between cannabis use and time perspective, explore the relationship between cannabis use, risk perception, and time perspective, and lastly to test whether time perspective moderates the link between cannabis use and risk perception (Apostolidis et al., 2006b). Risk perception was measured by evaluating self-reported perceived outcomes of cannabis use with two factors: 'risk relativization' and 'risk approval'. 'Risk relativization' emphasises the benefits associated with cannabis and rejects the risks, while 'risk approval' associated with 'hard drug-taker' behaviours. Results showed that higher future time perspective scores were associated with lower reported cannabis use, while higher scores of Present Hedonistic time perspective were associated with higher reported cannabis use. Cannabis users were more likely to emphasise the 'risk relativization' dimension than non-users, while non-users were more likely to emphasise the 'risk approval' dimension than users. Furthermore, regression analysis showed that there was a negative association between the level of cannabis consumption and perceived risks. Time perspective was also shown to moderate the relationship between risk perception and cannabis use. Specifically, the results supported the hypothesis that time perspective intervenes between high levels of cannabis use and a risk denial view; it is likely that the moderating effect differs by the temporal frame. Although this provides evidence that risk perception and time perspective are linked in their association with cannabis use, the cross-sectional design of this study does not allow us to make any causal explanations. Furthermore, it provides evidence that the socio-cognitive factors associated with cannabis use are a complex web of mechanisms and research that seeks to unravel how these factors work and interact is necessary to understanding how to design prevention measures.

To further understand these mechanisms, researchers sought to understand the relationship between time perspective and substance use, and how desire for control moderated that relationship (Fieulain & Martinez, 2010). This provided support for a relationship between Future time perspective and Present Hedonistic time perspective and substance use outcomes. However, this research also provides further evidence that while Present Hedonistic time perspective is a risk factor and future time perspective is a protective factor for substance use, this is dependent on whether there is also strong desire for control. Thus, the desire for control component can be associated as a risk factor (Present Hedonistic time perspective) or a protective factor (Future time perspective). Although this research focused on composite measures of substance use, it illustrated that the relationship between the mechanisms associated with cannabis use can provide a greater understanding of use behaviour and how prevention should aim to prevent problematic and dependent use.

2.2.10 Cannabis effect expectancies

Cannabis effect expectancies are a construct used to measure the anticipated outcomes of use associated with cannabis. Predominantly, the Marijuana Effect Expectancies Questionnaire (MEEQ) (Aarons et al., 2001) has been used to evaluate six lower order scales: Cognitive and Behavioural Impairment, Relaxation and Tension Reduction, Social and Sexual Facilitation, Perceptual and Cognitive Enhancement, Global Negative Effects, and Craving and Physical Effects, along with two high order scales: Positive and Negative expectancies. Cannabis effect expectancies may provide a better understanding to the mechanisms that underpin use behaviour, as evidence suggests that those with higher positive expectancies engage in more frequent use, while those with more negative expectancies behave conversely (Simons & Arens, 2007). Research indicates that changes in cannabis expectancies are associated with cannabis intentions, which in turn may lead to a greater likelihood of initiating or intensifying use behaviours (Skenderian et al., 2008).

Research investigating the relationship between anxiety and cannabis problems has looked at the potential link with cannabis expectancies. In a sample of undergraduate students, there was an association between high negative expectancies surrounding cannabis use and problematic outcomes (Buckner & Schmidt, 2008). Due to the cross-sectional nature of this study, it is not possible to derive causality whereby having negative beliefs leads to negative outcomes, or those who have negative outcomes begin to expect them. Additionally, when looking specifically at social anxiety associated with cannabis use and expectancies, those with higher social anxiety and greater impairment expectancies were more likely to use cannabis. This may suggest that those with social

anxiety intend to use cannabis to alleviate uncomfortableness with social situations. A further study was conducted, looking specifically at individuals determined to meet the clinical diagnosis for Social Anxiety Disorder (Buckner & Schmidt, 2009). Results indicated that Social Anxiety Disorder was the only depressive or anxiety disorder related to cannabis problems, and that negative expectancies of use (Cognitive and Behavioural Impairment, and Global Negative Effects expectancies) were related (Buckner & Schmidt, 2009). These results suggest that while negative affect may be a risk for problematic cannabis use outcomes, it is important to understand the mechanisms that underlie this risk and that it may in fact be that specific types of negative affect are associated with cannabis problems, as this evidence suggests Social Anxiety Disorder may be one of them (Buckner & Schmidt, 2009).

In addition to Social Anxiety Disorder, cannabis expectancies have been hypothesised to mediate the relationship between cannabis use outcomes and other risk factors. A study investigated the role of cannabis expectancies and how they mediated the relationship between impulsive personality style and cannabis based on the 'acquired preparedness model' (Vangsness et al., 2005). Results indicated having negative cannabis expectancies partially mediated the relationship between impulsivity and cannabis use; participants with higher levels of impulsivity had lower negative expectancies, and in turn, used cannabis more frequently (Vangsness et al., 2005).

2.3 Methodology

The first phase of this research programme was developed to determine what factors were associated with cannabis use, and more specifically, cannabis dependence and related problems in young people aged 18-25 years-old. The results of this study are intended to inform indicated prevention efforts for those young people with increased propensity for developing cannabis dependency and related problems.

2.3.1 Method

An online questionnaire was used to assess the association between cannabis use and related personality, mental health and drug-related factors. The online survey was made available by Bristol Online Surveys and was completed anonymously. The sample consisted of undergraduate students recruited through psychology courses, with additional participants recruited from online forums, including Blue Light and Drugs-Forum. Participants had to be between the ages of 18-25 years-old, have no current clinical diagnosis of an affective disorder, or be in receipt of drug treatment to take part. Participants completed a battery of self-report measures via an online questionnaire, including: the Severity of Dependence (SDS) scale (Martin et al., 2006); AUDIT (Saunders et al., 1993); Marijuana

Effect Expectancy Questionnaire (MEEQ) (Aarons et al., 2001); Fagerström test of Nicotine Dependence (Heatherton et al., 1991); Brief Sensation Seeking Scale (Zuckerman, Eysenck & Eysenck, 1978; Hoyle et al., 2002); Impulsivity (Sensitivity to Reward) (Torrubia et al., 2001); Depressive Symptomatology (Radloff, 1991); Impulsivity (Consideration of Future Consequences) (Strathman et al., 1994); Anxiety Sensitivity Index (Taylor et al., 2007); Aggression Questionnaire (Buss & Perry, 1992); Time Perspective (Zimbardo & Boyd, 1999); Marijuana Problems (Stephens, Roffman & Curtin, 2000; Simons & Carey, 2002). The overall questionnaire took approximately 30 minutes to complete.

2.3.2 Ethical consideration

Participants were asked to report their substance use history and other sensitive information to the researchers through the online questionnaire. On the participants information sheet, which was included on the online system, it explicitly stated that confidentiality would be maintained. Participants provided their consent electronically, which followed the presentation of the study information sheet. All research documents included information regarding local services and helplines/websites that provide help and information on substance use issues. All study procedures were approved by the Liverpool John Moores University Ethics Board. No adverse effects were reported.

2.3.3 Statistical analysis

Demographic, personality, mental health, and drug-related scores were calculated from questionnaires using SPSS (v. 18.0+). Firstly, to assess the main hypotheses, multiple regression analyses were performed to analyse the relationship between the aforementioned constructs and cannabis outcome measures. Multiple regression analyses were chosen because of its predictive validity for analysing the relationship between independent variables with multiple dependent variables. Dependent variables were chosen based on previous research, and because all were previously found to be associated with drug use behaviour, and so a backwards approach was employed. This approach allowed for an understanding of how risk factors related to cannabis use were related to assessments of cannabis use behaviour. Secondly, Latent Profile Analysis (LPA) was conducted using the software package Latent Gold Version 4.5 (Vermunt & Magidson, 2005). Latent Profile Analysis is a statistical technique that identifies similar groups based on observations and/or responses to questionnaires and other instruments. Using this approach, distinct classes of individuals were identified which were expected to be similar to one another with respect to the relationship between the variables of interest, but different from individuals in other classes. For this analysis, measures of aggression, anxiety and depressive symptomatology were used as indicators of

latent classes. The number of classes was determined using several indices. The statistical measure of fit used was the Bayesian Information Criterion Index (BIC); lower BIC numbers indicate a better fitting model. However, the number of classes was ultimately determined by a combination of factors in addition to the BIC, including the average classification probabilities, research questions, parsimony, theoretical justification, and substantive interpretability (Bauer & Curran, 2003). Latent Gold allows formulation of a model in which the class distribution (class size) is allowed to differ between groups by using a random-effects approach rather than by estimating a separate set of class sizes for each group, as is done in a traditional multiple-group analysis. Class membership is automatically determined by Latent Gold using model based posterior membership probabilities estimated by maximum likelihood (ML) methods. Latent Gold uses the EM (Expectation Maximization) algorithm for dealing with ML estimation with missing data (McLachlan & Krishnan, 2008). Classes were then characterised on covariates in SPSS (v. 18.0) using ANOVA (Tukey's post hoc) and multinomial logistic regression analyses, assessing the likelihood of membership to one class compared to another. ANOVA analysis was used to compare mean scores between groups, while multiple logistic regressions analyses were used the predictive validity of dependent variables to group membership. Statistical significance was set at $p < 0.05$ for all analyses.

2.3.4 Participants

The sample consisted of 414 (41.8% female) participants, the majority of whom were students (91.2%) and from the United Kingdom (57.2%). Psychology students ($\approx 22.2\%$) studying at Liverpool John Moores University received course credit for their participation, while all other participants received nothing. The mean age was 20.30 years-old (range = 18-25, SD = 2.69). The racial and ethnic composition of the sample comprised 90.3% White, 3.6% Mixed Race, 1.7% Asian British, 1.9% Asian, 1.0% Black, and 1.4% other. The Alcohol Use Disorders Identification Test (AUDIT) was used as a brief screening instrument to identify harmful and hazardous drinking. Using a diagnostic cut-off of 11, 157 (37.9%) of those who had used alcohol were considered to be at risk for hazardous and harmful drinking (Fleming, Barry & Macdonald, 1991). Mean AUDIT score were slightly lower to those of other studies on UK university students due to the inclusion of non-University students (Atwell, Duka & Abraham, 2011; Moreira, Oskrochi, & Foxcroft, 2012). Recruited participants were given the web address for an online questionnaire to complete in their own time.

Table 1. Drug statistics (alcohol, tobacco and cannabis). (N = 414)					
	M (SD)*				
<i>Alcohol</i>					
Age of initiation (Years) (N = 398)	14.54 (1.99)				
AUDIT score (N = 376)	9.97 (5.76)				
Above diagnostic cut-off (%)	157 (37.9)				
<i>Tobacco</i>					
Age of initiation (Years) (N = 317)	14.86 (2.36)				
Fagerström nicotine dependence (N = 140)	1.61 (2.13)				
<i>Cannabis</i>					
Age of initiation (Years) (N = 297)	15.78 (3.48)				
Lifetime cannabis use (%)	Never	Lifetime	Past year	Past month	
	103 (24.9)	311 (75.1)	261 (63.0)	199 (48.1)	
Cannabis use frequency (%)	Never	Less than monthly	Monthly	Weekly	Daily
	127 (30.7)	90 (21.7)	33 (8.0)	80 (19.3)	84 (20.3)
SDS (N = 239)	2.02 (2.53)				
Above diagnostic cut-off (%)	52 (21.8)				
Cannabis problems index (N = 311)	1.82 (2.77)				

*M(SD) unit of measurement unless otherwise noted

Table 2. Use of drugs other than cannabis. (N = 414)				
	Never	Lifetime	Past year	Past Month
Ecstasy (%)	246 (59.4)	168 (50.6)	112 (27)	49 (11.8)
Heroin (%)	382 (92.3)	32 (7.6)	16 (3.8)	8 (1.9)
Cocaine (%)	282 (68.1)	132 (31.8)	80 (19.3)	31 (7.5)
Hallucinogens (%)	248 (59.9)	166 (40.0)	139 (33.5)	71 (17.1)
Ketamine (%)	346 (83.6)	68 (16.4)	48 (11.6)	16 (3.9)
Legal Highs (%)	286 (69.1)	128 (30.9)	81 (19.5)	42 (10.1)
Salvia Divinorum (%)	301 (72.7)	113 (27.3)	51 (12.3)	10 (2.4)
Amphetamines (%)	289 (69.8)	125 (30.2)	88 (21.3)	50 (12.1)
Anabolic Steroids (%)	403 (97.3)	11 (2.6)	3 (0.7)	1 (0.2)

2.3.5 Measures

Multiple questionnaires were evaluated for inclusion in the final research instrument. Use within the wider research, suitability for the sample population, theoretical underpinnings, length and statistical measures, such as reliability were considered. When available and appropriate, shorter versions of questionnaires were chosen.

2.3.5.1 Anxiety Sensitivity-III (ASI-3))

The ASI-3 is an adaption of the Anxiety Sensitivity Index, which applies multidimensionality to previously used indexes, adding subscales of cognitive, social, and physical anxiety sensitivity to the construct (Anxiety Sensitivity Index; Reiss et al., 1986; Taylor et al., 2007). It is an 18-item scale that assesses three different components of anxiety sensitivity: Cognitive, Physical and Social. The scale shows good reliability and validity in non-clinical populations and shows improved psychometric properties compared to the original Anxiety Sensitivity Index (Taylor et al., 2007). The scale has good reliability in the current sample ($\alpha = .89$).

2.3.5.2 Buss and Perry Aggression Questionnaire (BPAQ)

The BPAQ is a 29-item questionnaire that assesses four factors of aggression: verbal, physical, anger and hostility (Buss and Perry, 1992). For the purposes of this investigation, only the verbal, physical and anger factors of the scale questionnaire were assessed., Hostility is less considered in studies of aggression and more associated with indirect forms of aggression (Archer & Webb, 2006).

2.3.5.3 Center for Epidemiological Study of Depression Scale (CES-D)

The CES-D is a 20-item self-report scale designed to measure depressive symptomatology in non-clinical populations (Radloff, 1991). The scale has been previously shown to have good reliability in young people (Radloff, 1991). The scale showed good reliability in the current sample ($\alpha = .92$).

2.3.5.4 Consideration of Future Consequences (CFC)

The CFC scale measures the extent to which individuals consider the future implications of their immediate behaviours and the degree to which they are influenced by these potential outcomes (Strathman et al., 1994). The scale consists of 12 statements in which participants indicate on a 5-point Likert scale the extent to which the item is characteristic of them. The Cronbach's alpha for the current sample was poor ($\alpha = .37$).

2.3.5.5 Sensitivity to Reward Scale (SRS)

The SRS was extracted from the longer Sensitivity to Punishment and Sensitivity to Reward Questionnaire and measures the dimension of impulsive personality based on Gray's Behavioural Approach System (Torrubia et al., 2001). The scale showed good reliability in the current sample ($\alpha = .77$). The 24-item scale describes situations in which people would adopt approach behaviours to obtain a reward.

2.3.5.6 Zimbardo Time Perspective Inventory (ZTPI)

Time perspective is an inventory of the dimension of time construction, specifically the cognitive processes that organise human experience into past, present, and future temporal frames (Zimbardo & Boyd, 1999). The 56-item questionnaire examines 5 dimensions of time perspective: Past Negative ($\alpha = .83$), Present Hedonistic ($\alpha = .82$), Future ($\alpha = .69$), Past Positive ($\alpha = .62$), Present Fatalistic ($\alpha = .71$). The test has acceptable internal consistency and test-retest reliability. The scale showed good reliability in the current sample ($\alpha = .76$).

2.3.5.7 Zuckerman's Brief Sensation Seeking Scale

The Brief Sensation Seeking Scale is an 8-item scale adapted from the 40-item Sensation Seeking Scale-V (Zuckerman, Eysenck, & Eysenck, 1978; Hoyle et al., 2002). The brief measure of sensation seeking maintains suitable internal consistency in young people and is a strong predictor of intention to try cannabis in young people (Hoyle et al., 2002). The scale showed good reliability in the current sample ($\alpha = .81$).

2.3.5.8 Marijuana Effect Expectancies Questionnaire (MEEQ)

The Marijuana Effect Expectancy Questionnaire (MEEQ) is a 48-item list of expectations regarding the effects of cannabis use (Aarons et al., 2001). The questionnaire was developed to be used by those with and without cannabis use histories. The scale is comprised of six lower order scales: Cognitive and Behavioural Impairment ($\alpha = .81$), Relaxation and Tension Reduction ($\alpha = .82$), Social and Sexual Facilitation ($\alpha = .61$), Perceptual and Cognitive Enhancement ($\alpha = .70$), Global Negative Effects ($\alpha = .89$), and Craving and Physical Effects ($\alpha = .75$).

2.3.5.9 Cannabis-related problems

Cannabis-related problems were measured using a cannabis problems index, a list of 17 items derived from the 19-item Marijuana Problems Scale (MPS) (Stephens, Roffman & Curtin, 2000). Participants were first asked whether or not they experienced a problem in the past 90 days (e.g. legal problems; difficulty sleeping), and then were asked if this problem was caused or worsened due to cannabis use. Two items from the original scale (“feel bad about your use”; “withdrawal symptoms”) were eliminated due to their reference to specific drug use. The removal of specific references to drugs was to ensure that it would be a suitable questionnaire for both users and nonusers of cannabis; additionally, we sought to measure how cannabis influences general problems. The scale in the current sample had good reliability ($\alpha = .86$).

2.3.5.10 Cannabis and other substance use

Cannabis frequency was assessed by asking, “How often do you think you use cannabis?” on a 9-point Likert scale (‘never’, ‘1-2 times a year’, ‘6 times a year’, ‘once per month’, ‘twice per month’, ‘once per week’, ‘3 times per week’, ‘5 times per week’, ‘everyday’). Results were adapted to a 5-point scale of ‘never’, ‘less than monthly’, ‘monthly’, ‘weekly’, and ‘daily’ use of cannabis as to be comparable UK prevalence data (Burton et al., 2014). Use of other substances was determined by use of a bespoke measure which has been used in previous studies (for example: Sumnall et al., 2004).

Table 3. Cannabis risk factors. (N = 414)		
<i>Personality factors</i>		<i>M (SD)</i>
Sensation seeking		2.21 (0.75)
Impulsivity (SRS)		0.49 (0.18)
Impulsivity (CFC) (N= 413)		3.04 (0.38)
ZPTI	Past Negative	3.13; (0.76)
	Past Positive	3.38 (0.57)
	Present Hedonistic	3.53 (0.55)
	Present Fatalistic	2.69 (0.65)
	Future	3.18 (0.50)
<i>Drug-related factors</i>		
MEEQ	Cognitive Behavioural Impairment	31.69 (7.34)
	Relaxation and Tension Reduction	27.94 (6.08)
	Social and Sexual Facilitation	27.21 (5.49)
	Perceptual and Cognitive Enhancement	25.43 (5.31)
	Global Negative Effects	19.95 (7.73)
	Craving and Physical Effects	22.08 (4.30)
<i>Mental health factors</i>		
ASI-3	Cognitive	3.19 (4.56)
	Physical	3.50 (4.00)
	Social	7.05 (5.10)
	Total	13.74 (11.10)
BPAQ (N = 399)	Anger	16.17 (5.97)
	Physical	21.36 (7.70)
	Verbal	15.34 (4.37)
	Total	53.05 (14.48)
CES-D		17.15 (11.09)

2.4 Results

2.4.1 Regression analyses

2.4.1.1 Cannabis use

In the present sample, 311 (75.1%) reported lifetime cannabis use, 261 (63.0%) reported last year cannabis use, and 199 (48.1%) reported last month use, while the remaining sample (103; 24.9%) reported lifetime abstinence from cannabis.

2.4.1.2 Relationship between lifetime cannabis use and personality, drug-related and mental health factors

Multiple regression analysis was performed to examine the relationship between lifetime cannabis use and personality, drug-related and mental health factors. In this analysis, the dependent outcome variable was whether cannabis had ever been used in their lifetime. Using a stepwise approach (backwards method), the predictor variables and sex were entered into the model. The final model accounted for 46.2% of the variance in lifetime cannabis use and was a significant fit of the data ($F(5, 392) = 67.41, p < .001$). The adjusted R^2 (.455) showed little shrinkage, indicating that the model would generalise well. Drug-related cognitions, specifically two subscales from the Marijuana Effect Expectancies Questionnaire (MEEQ) were found to be highly correlated with lifetime cannabis use; MEEQ (Global and Negative Effects) were negatively correlated with lifetime use ($\beta = -0.627, p < .001$), and MEEQ (Craving and Physical Effects) ($\beta = 0.277, p < .001$) were positively associated with lifetime use of cannabis. Additionally, aggression was significantly associated with lifetime cannabis use ($\beta = 0.119, p < .001$). Anxiety sensitivity and MEEQ (Sexual and Social Facilitation) were also included in the model, but were only marginally significant.

Table 4. Model summary for regression of lifetime cannabis use. (N = 414)			
	<i>B</i>	<i>SE b</i>	β
Final model			
Constant	0.758	0.127	
Aggression	0.004	0.001	0.119**
Anxiety sensitivity	0.003	0.002	0.066#
MEEQ (Craving and Physical Effects)	0.028	0.004	0.277***
MEEQ (Global and Negative Effects)	-0.035	0.002	-0.627***
MEEQ (Sexual and Social Facilitation)	-0.005	0.003	-0.066#

Note. $R^2 = .462$. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

2.4.1.3 Cannabis use frequency

Cannabis Use Frequency was initially measured on a 9-point Likert Scale (never; 1-2 times per year; 6 times per year; once per month; twice per month; 3 times per week; 5 times per week; everyday) . The initial responses were found to be too few per response category and the measure was recalculated on a 5-point Likert Scale in accordance with pravelance data measurement: Never, Less Than Monthly, Monthly, Weekly, or Daily. In the present samlpe, 127 (30.7%) reported never using cannabis, 127 (21.7%) reported less than montly use, 33 (8.0%) reported montly use, 80 (19.3%) reportedly weekly use, and 84 (20.3%) reported daily use.

2.4.1.4 Relationship between cannabis use frequency and personality, drug-related and mental health factors

Multiple regression analysis was performed to examine the relationship between frequency of cannabis use and personality, drug-related and mental health factors. The analysis was performed only on participants that indicated that they had used cannabis in their lifetime. Using a stepwise approach (backwards method), the predictor variables and sex were entered into the model. The final model accounted for 53.3% of the variance in cannabis use frequency and is a significant fit of the data ($F(5, 293) = 66.861$, $p < .001$). The adjusted R^2 (.525) showed little shrinkage, indicating that the model woud generalise well. Two subscales of drug-related cognitions significantly predicted frequency of cannabis use. MEEQ (Perceptual and Cognitive Enhancement) was positively correlated with frequency ($\beta = 0.232$, $p < .001$), while MEEQ (Global and Negative Effects) was

negatively correlated ($\beta = -0.434$, $p < .001$). Sensation seeking was negatively correlated with with cannabis use frequency ($\beta = -0.114$, $p < .01$). Anxiety sensitivity (ASI-3) was positively associated with cannabis use frequency ($\beta = .089$, $p < .05$).

Table 5. Model summary for regression of cannabis frequency. (N=299)

	<i>b</i>	<i>SE b</i>	β
Final model			
Constant	2.249	0.420	
Sex	0.852	0.118	0.311***
Anxiety sensitivity	0.011	0.005	0.089*
MEEQ (Global and Negative Effects)	-0.097	0.100	-0.434***
MEEQ (Perceptual and Cognitive Enhancement)	0.064	0.011	0.232***
Sensation seeking	-0.223	0.082	-0.114**

Note. $R^2 = 0.533$. # $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$.

2.4.1.5 Cannabis use problems index

The Cannabis use problems index is a 17-item scale adapted from the Marijuana Problems Index (Stephens et al., 2000) to assess problems associated with the use of cannabis. Participants were first asked whether or not they had experienced the problem within the last six months, and then were asked if the problem was caused or worsened by the use of cannabis. Of those participants who reported lifetime use of cannabis, 49.8% reported no associated problems from their cannabis use ($M = 1.82$; $SD = 2.77$).

2.4.1.6 Relationship between cannabis problems and personality, drug-related and mental health factors

A multiple regression analysis was used to explore the relationship between problems associated with cannabis use and personality, drug-related and mental health factors. The analysis was performed only on participants that indicated that they had used cannabis in their lifetime. Using a stepwise approach (backwards method), the predictor variables, cannabis use frequency and sex were entered into the model. The final model accounted for 34.3% of the variance in cannabis use frequency and is a significant fit of the data ($F(6, 292) = 15.813$, $p < .001$). The adjusted R^2 (.343) show a small amount of shrinkage, indicating that the model would generalise reasonably well.

Frequency of cannabis use was a significant predictor of cannabis-related problems ($\beta = 0.446$, $p < .001$). The Cognitive Behavioural Impairment ($\beta = 0.158$, $p < .01$) and the Global Negative Effects ($\beta = 0.173$, $p < .05$) subscales of the MEEQ were positively correlated with use problems. Of the mental health factors, ASI-3 ($\beta = 0.180$, $p < .001$) was found to be positively correlated with self-report cannabis problems. The Impulsivity (Sensitivity to Reward) ($\beta = 0.128$, $p < .05$) was positively associated with cannabis use related problems, while ZPTI (Future time perspective) ($\beta = -0.113$, $p < .05$) was negatively associated

Table 6. Model summary for regression of cannabis problems. (N = 299)			
	<i>b</i>	<i>SE b</i>	β
Final model			
Constant	-3.519	1.241	
Sex	0.815	0.304	0.151**
Anxiety sensitivity	0.043	0.012	0.180***
ZPTI (Future)	-0.612	0.262	-0.113*
Impulsivity (SRS)	1.971	0.776	0.128*
MEEQ (Global and Negative Effects)	0.076	0.030	0.173*
MEEQ (Cognitive Behavioural Impairment)	0.061	0.023	0.158**
Cannabis frequency	0.0876	0.129	0.446***

Note. $R^2 = .343$. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

2.4.1.7 Severity of dependence

The Severity of Dependence Scale (SDS) is a brief 5-item scale used to assess the psychological aspects of dependence experienced by users of illicit drugs (Gossip et al., 1995). In a sample of adolescent cannabis users in Australia, the diagnostic cut-off point for cannabis dependence was determined to be a score of 4 (Martin et al., 2006). The severity of dependence scale was only completed by participants who reported using cannabis in past 3 months. The severity of dependence scale ($M=2.02$; $SD = 2.53$) included 52 respondents (21.8% of those who responded) who had used cannabis and were above the threshold for cannabis dependence.

2.4.1.8 Relationship between severity of dependence and personality, drug-related and mental health factors

A multiple regression analysis was used to explore the relationship between problems associated with severity of dependence and personality, drug-related and mental health factors. The analysis was performed only in those participants that indicated that they had used cannabis in their lifetime. Using a stepwise approach (backwards method), the predictor variables and sex were entered into the model. The final model accounted for 26.6% of the variance in cannabis use frequency and was a significant fit of the data ($F(8, 220) = 9.957, p < .001$). The adjusted R^2 (.239) showed a small amount of shrinkage, indicating that the model would generalise reasonably well. Sex was a significant predictor of severity of dependence ($\beta = 0.234, p < .001$). The Perceptual and Cognitive Enhancement ($\beta = 0.153, p < .05$) and the Cognitive Behavioural Impairment ($\beta = 0.332, p < .001$) subscales of the MEEQ were positively correlated with use severity of dependence, while the Social and Sexual Facilitation subscale ($\beta = -0.242, p < .001$) was negatively correlated. Of the mental health factors, anxiety ($\beta = 0.187, p < .001$) was positively correlated with dependence, while depression ($\beta = -0.167, p < .05$) was negatively correlated. Time perspective (Past Negative) was retained in the model, but was not a significant predictor of severity of dependence.

Table 7. Model summary for regression of severity of dependence. (N = 116)

	<i>b</i>	<i>SE b</i>	B
Final Model			
Constant	-3.712	1.237	
Sex	1.220	0.311	0.234***
Anxiety	0.044	0.016	0.187**
ZPTI (Past Negative)	0.438	0.244	0.137#
MEEQ (Global and Negative Effects)	1.905	0.930	0.129*
MEEQ (Perceptual and Cognitive Enhancement)	0.076	0.033	0.153*
MEEQ (Cognitive Behavioural Impairment)	0.177	0.037	0.332***
MEEQ (Social and Sexual Facilitation)	-0.110	0.031	-0.242***
Depression	0.040	0.018	-0.167*

Note. $R^2 = 0.266$ for Final Model. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. $^{\wedge}p = 0.13$.

2.4.2 Latent Profile Analysis

A three class model was identified as the best solution (BIC = 9104.44; $R^2 = 0.58$; entropy $R^2 = 0.60$), representing a moderate model of the classifications. Class demographics are shown in Table 8. Class 1 (*Moderate Psychopathology*) represented the largest proportion of the sample (37.7%). This group had a moderate level of psychopathology compared to the other clusters. Class 2 (*High Psychopathology*) (32.1%) included individuals with the highest levels of psychopathology. Class 3 (*Low Psychopathology*) (28.8%) represented the smallest group and the lowest level of psychopathology.

Table 8. Demographics and psychopathology by cluster. (N=399)			
Variable	Moderate Cluster (n = 156)	High Cluster (n = 128)	Low Cluster (n = 115)
Age (M, SD)	20.23 (2.84)	20.43 (2.72)	20.33 (2.29)
Female (%)	42.3	43.0	42.6
White (%)	91.3	85.2	94.2
Student (%)	84.0	82.8	81.7
Aggression (M, SD)	55.41 (12.93)	58.92 (15.95)	43.30 (8.88)
Anxiety sensitivity (M, SD)	12.49 (23.52)	23.52 (12.58)	4.73 (2.89)
Depressive symptomology (M, SD)	14.63 (4.88)	29.00 (10.83)	7.82 (3.52)

Table 9. Fit statistics and entropy for latent profile analysis.						
Classes	LL	Parameters	BIC	Wald	P-Value	Entropy
1	-4683.0559	6	9402.0455	NA	NA	NA
2	-4524.9839	13	9127.8242	2.0339	p = .15	.7098
3	-4492.3286	20	9104.4364	2.5119	p = .28	.6205
4	-4479.4672	27	9120.6364	5.6218	p = .13	.6421
5	-4470.9212	34	9145.4671	65.6603	p ≤ .001	.6835
6	-4459.9542	41	9165.4558	56.2694	P ≤ .001	.6697

2.4.3 ANOVA

Using ANOVA, all of the identified clusters significantly differed on two of the corresponding determinants of psychopathology group, anxiety sensitivity and depressive symptomatology; however, there were no significant difference in level of aggression between the medium and high psychopathology groups. In identifying differences in cannabis use outcomes, clusters differed with respect to cannabis problems ($F(2, 388) = 7.60, p < .001$), but not cannabis use frequency ($F(2, 398) = 0.20, p = ns$). As shown in Table 11, classes differed on measures of impulsivity, Sensitivity to Reward and Consideration of Future Consequences scales, MEEQ Cognitive and Behavioural Impairment and Present Fatalistic, Present Hedonistic, Past Negative, and Past Positive dimensions of time perspective were all found to be significantly related to psychopathology. Tukey's post hoc showed that the low psychopathology group reported significantly lower scores on the MEEQ (Cognitive and Behavioural Impairment) subscale of cannabis expectancies and dimensions of impulsivity (Sensitivity to Reward and Consideration of Future Consequences) compared to the moderate and high psychopathology group. There were significant differences amongst all three clusters on Past Negative and Present Fatalistic time perspective, with higher psychopathology indicating higher scores.

Table 10. Multivariate ANOVA results between psychopathology and cannabis frequency and related problems, cannabis expectancies and time perspective.

	Moderate M (SD)	High M (SD)	Low M (SD)	F
Cannabis frequency	1.71 (1.56) ^a	1.80 (1.56) ^a	1.81 (1.54) ^a	0.20
Cannabis problems	1.35 (2.52) ^a	1.96 (2.89)	0.74 (1.55) ^a	7.60***
MEEQ (Cognitive and Behavioural Impairment)	32.43 (7.22) ^a	32.85 (6.42) ^a	29.84 (7.95)	6.21**
MEEQ (Relaxation and Social Tension)	28.30 (6.19) ^a	27.95 (6.29) ^a	27.71 (6.08) ^a	0.32
MEEQ (Social and Sexual Facilitation)	27.29 (5.82) ^a	27.27 (5.38) ^a	27.28 (5.12) ^a	0.00
MEEQ (Perceptual and Cognitive Enhancement)	25.77 (5.36) ^a	25.73 (5.23) ^a	24.77 (5.25) ^a	1.40
MEEQ (Global Negative Effects)	20.26 (7.84) ^a	20.73 (6.88) ^a	18.50 (8.33) ^a	2.83
MEEQ (Craving and Physical Effects)	21.78 (4.46) ^a	22.44 (4.23) ^a	22.03 (4.27) ^a	0.80
ZPTI (Past Negative)	3.15 (0.64)	3.68 (0.64)	2.57 (0.58)	96.00***
ZPTI (Present Hedonistic)	3.58 (0.53) ^a	3.59 (0.53) ^a	3.42 (0.59) ^a	3.68*
ZPTI (Future)	3.18 (0.48) ^a	3.10 (0.53) ^a	3.18 (0.50) ^a	3.01
ZPTI (Past Positive)	3.40 (0.58) ^a	3.28 (0.62) ^a	3.46 (0.57) ^a	3.34*
ZPTI (Present Fatalistic)	2.67 (0.60)	2.95 (0.64)	2.45 (0.64)	19.25***
Impulsivity (SRS)	0.51 (0.17) ^a	0.56 (0.20) ^a	0.40 (0.14)	28.47***
Impulsivity (CFC)	3.09 (0.38) ^a	3.09 (0.36) ^a	2.92 (0.38)	8.78***
Sensation seeking	2.19 (0.74) ^a	2.14 (0.76) ^a	2.34 (0.73) ^a	2.46
Aggression	55.41 (12.93) ^a	58.92 (15.95) ^a	43.30 (8.88)	47.80***
Anxiety sensitivity	12.49 (23.52)	23.52 (12.58)	4.73 (2.89)	159.80***
Depressive symptomology	14.63 (4.88)	29.00 (10.83)	7.82 (3.52)	286.89***

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

^a Means not significantly different from one another ($p \leq .01$).

2.4.4 Multinomial Logistic Regression

Multinomial logistic regression was used to predict class membership on the basis of cannabis expectancies, frequency and problems, and personality and time perspective factors. These results are shown in Tables 12, 13, and 14. Compared to members of the low psychopathology group (cluster 3), membership of Class 2 (moderate psychopathology) was significantly predicted by greater cannabis expectancies Cognitive and Behavioural Impairment (OR = 1.07; 95%CI: 1.02-1.12), cannabis expectancies Craving and Physical Effects (OR = 0.88; 95%CI: 0.82-0.95); impulsivity (Sensitivity to Reward) (OR = 134.35; 95%CI: 21.06-860.82); and Past Negative time perspective (OR = 4.05; 95%CI: 2.58-6.37).

Compared with the low psychopathology class, membership of the high psychopathology was significantly predicted by higher levels of time perspective Past Negative (OR = 14.66; 95%CI: 8.34-25.69), Present Fatalistic (OR = 1.96; 95%CI: 1.16-3.32), and lower levels of Past Positive (OR = 0.40; 95%CI: 0.22-0.71); and higher levels of impulsivity (Sensitivity to Reward) (OR = 368.57; 95%CI: 45.34-2996.46) and cannabis-related problems (OR = 1.30; 95%CI: 1.07-1.59).

The assessed variables also differentiated between membership of the moderate and high psychopathology groups; the latter group was predicted by higher scores of Past Negative (OR = 3.62; 95%CI: 2.41-5.45), Past Positive (OR = 0.58; 95%CI: 0.38-0.89), and Present Fatalistic (OR = 1.58; 95%CI: 1.05-2.38) time perspective.

Table 11. Multiple Logistic Regression for clusters of psychopathology. Moderate vs. Low.						
	B	S.E.	Wald	OR	Lower CI	Upper CI
Moderate Cluster						
Intercept	-4.68	1.12	12.61***			
ZPTI (Past Negative)	1.40	0.23	36.70***	4.05	2.58	6.37
ZPTI (Past Positive)	-0.39	0.26	2.28	0.68	0.41	1.12
ZPTI (Present Fatalistic)	0.21	0.22	0.92	1.24	0.80	1.91
Impulsivity (SRS)	4.90	0.95	26.83***	134.35	21.06	860.82
MEEQ (Cognitive and Behavioural impairment)	0.07	0.02	8.45**	1.07	1.02	1.12
MEEQ (Craving and Physical Effects)	-0.13	0.04	10.53***	0.88	0.82	0.95
Cannabis problems	0.17	0.10	3.18	1.19	0.98	1.43
Cannabis frequency	0.02	0.11	0.04	1.02	0.82	1.28

*p ≤ .05, **p ≤ .01, ***p ≤ .001

Table 12. Multiple Logistic Regression for clusters of psychopathology. High vs. Low.						
	B	S.E.	Wald	OR	Lower CI	Upper CI
High Cluster						
Intercept	-9.43	1.60	34.89***			
ZPTI (Past Negative)	2.69	0.28	88.14***	14.66	8.34	25.69
ZPTI (Past Positive)	-0.93	0.30	9.72**	0.40	0.22	0.71
ZPTI (Present Fatalistic)	0.67	0.30	6.30*	1.96	1.16	3.32
Impulsivity (SRS)	5.91	1.07	30.55***	368.57	45.34	2996.46
MEEQ (Cognitive and Behavioural impairment)	0.05	0.03	3.19	1.05	0.10	1.11
MEEQ (Craving and Physical Effects)	-0.09	0.05	3.81	0.92	0.84	1.00
Cannabis problems	0.26	0.10	6.71**	1.30	1.07	1.59
Cannabis frequency	-0.12	0.14	0.78	0.89	0.68	1.16

*p ≤ .05, **p ≤ .01, ***p ≤ .001

Table 13. Multiple Logistic Regression for clusters of psychopathology. Moderate vs. High.						
	B	S.E.	Wald	OR	Lower CI	Upper CI
Moderate Cluster						
Intercept	-4.76	1.20	15.70			
ZPTI (Past Negative)	1.29	0.21	38.14***	3.62	2.41	5.45
ZPTI (Past Positive)	-0.54	0.22	6.16*	0.58	0.38	0.89
ZPTI (Present Fatalistic)	0.46	0.21	4.87*	1.58	1.05	2.38
Impulsivity (SRS)	1.00	0.70	2.08	2.737	0.70	10.76
MEEQ (Cognitive and Behavioural impairment)	-0.02	0.02	0.71	0.98	0.94	1.02
MEEQ (Craving and Physical Effects)	0.04	0.03	1.23	1.04	0.97	1.11
Cannabis problems	0.09	0.05	2.96	1.10	0.99	1.22
Cannabis frequency	-0.14	0.10	1.90	0.87	0.71	1.06

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

2.5 Discussion

2.5.1 Risk factors and cannabis use outcomes

The aim of this study was to examine the relationship between risk factors and indicators of cannabis use and dependence. By using different indicators of cannabis use, we sought to gain a better understanding of how risk factors associated with cannabis use differed by outcome measure. By looking at different cannabis use outcome measures, we aimed to address factors that may be associated with different stages of use, including: lifetime use (initiation), frequency of use, problems associated with use, and dependence. The results indicated that there was wide variation in the risk factors associated with cannabis use by outcome; anxiety sensitivity was the only risk factor that was a contributing predictor for all cannabis-related outcome variables.

Consistent with the study hypothesis, factors associated with cannabis use differed by outcome measure; the risk factors that were most significant predictors of lifetime cannabis use

were, for the most part, different than those for cannabis use frequency, dependence, and related problems. This is most likely because the different cannabis use outcomes describe different facets that inform the collective cannabis behaviour construct (Temple, Brown & Hine, 2010). Factors associated with lifetime cannabis use may correspond with the reasons why someone may be most likely to initiate or experiment with cannabis use; cannabis frequency may correspond to why someone frequently uses cannabis; cannabis-related problems correspond with the degree to which someone may use cannabis excessively or in more risky situations/environments; while cannabis dependence suggests the factors associated with developing dependency.

The lifetime cannabis use measure indicates whether or not a young person has ever used cannabis in their lifetime, and corresponds to whether a young person has or has not initiated cannabis use. The results of the multiple regression of lifetime cannabis use and personality, mental health and cannabis expectancy factors indicate which factors differ between young people who have used cannabis and those who have not initiated cannabis use. Cannabis expectancy constructs of Craving and Physical Effects, and Global Negative Effects were most related to lifetime cannabis use. Due to the the cross-sectional design of this study, causality cannot be determined. However, it would be expected that individuals who initiate cannabis use have different attitudes towards cannabis use generally than those who abstain. The negative correlation between Global Negative Effects suggests that those who abstain from cannabis are more likely to expect negative consequences from their use than those who have initiated use. Additionally, it is likely that those who have used cannabis will have different expectations regarding use outcomes than those who have never used cannabis, especially regarding how use will affect their body. The positive correlation between the Craving and Physical Effects and lifetime cannabis use supports this claim.

In addition to cannabis expectancies, aggression was positively correlated with lifetime cannabis use. Higher reported levels of aggression were associated with a greater likelihood of reported lifetime cannabis use. There are several possible reasons why aggression is related to the initiation of cannabis use. The self-medication hypothesis would argue that young people may use cannabis to help them relax and calm down from aggressive feelings (Khantzian, 1985). Longitudinal evidence suggest that externalising behaviours, like aggression, precede cannabis use initiation (Fergusson, Horwood & Ridder, 2007; Hayatbakhsh et al., 2008). However, it is possible that use of cannabis can exacerbate or contribute to aggressive behaviour. In a clinical population of dependent cannabis users, participants who reported difficulty controlling violent behaviour reported using cannabis to decrease aggression, but often reacted aggressively while intoxicated (Arendt et al., 2007). Furthermore, impulsive aggression corresponds to serotonin and dopamine systems within

the brain, and THC, a psychoactive component of cannabis, causes increased levels of dopamine. Lowered levels of serotonin exist prior to impulsive aggression outbursts, while dopamine levels are acutely increased following use (Seo, Patrick & Kennealy, 2008; Bossong et al., 2009). This is in alignment with theories that cannabis use precedes externalising behaviours and mental health outcomes (Brook, Cohen & Brook, 1998). Most research, however, posits shared causes of externalising behaviours, like aggression, and cannabis use as a result of shared genetic and environmental factors predicting both outcomes (Fergusson, Horwood & Swain-Campbell, 2002; Shelton et al., 2007). Another potential explanation for this relationship is due to the link between aggressiveness and deviant, anti-social behaviour, and more representative of that relationship, and not specifically related to cannabis use (Jones, Miller & Lynam, 2011; Moore et al., 2014).

In investigating the relationship between cannabis frequency and personality, mental health, and cannabis expectancy factors, only respondents who used cannabis in their lifetime were included. Similar to the analysis of lifetime cannabis use, several cannabis expectancy constructs were related to cannabis use frequency. Global Negative Effect expectancies were negatively correlated with cannabis use frequency, indicating that more positive outcome expectancies from using cannabis are associated with more frequent use of cannabis. Additionally, Perceptual and Cognitive Enhancement expectancies were positively correlated with cannabis use frequency, indicating that greater expectancies of Perceptual and Cognitive Enhancement were associated with greater cannabis use frequency. Thus, expectancies of euphoria and increased perceptual senses were associated with more frequent use of cannabis. These results are consistent with previous work that positive expectancies regarding cannabis are associated with more frequent use (Simons & Arens, 2007).

As well as cannabis expectancies, sex was a significant predictor of cannabis frequency, with women more likely to report frequent cannabis use than men. The majority of previous research has suggested that men are more likely to be users of cannabis and to use more frequently (Schepis et al., 2011). There are several possible explanations for this unusual result. It is possible that due to the sampling of the population, in which psychology students were recruited in addition to members of an online drugs forum, a greater proportion of women cannabis users were reported than usual (Bennett and Holloway, 2015). It is also possible that because the results are self-reported, women who tend to be more stigmatised for drug use, were more likely to report frequent cannabis because of the perceived anonymity of the online questionnaire (Simpson & McNulty, 2008; Gnamb & Kaspar, 2015).

Lastly, sensation seeking and anxiety sensitivity were significant factors associated with cannabis use frequency. Sensation seeking was negatively correlated with cannabis use frequency, indicating that higher self-reported sensation seeking scores were associated with less frequent cannabis use. Previous research has frequently found that sensation seeking is related to cannabis use (Crawford et al., 2003; Franken & Muris, 2006; Martins et al., 2008). This research elucidates that although sensation seekers may be more likely to use cannabis generally, they may be less likely to use frequently compared to others who have used cannabis in their lifetime. This suggests that when designing prevention services aimed at preventing young people from developing problematic use, sensation seeking may not be an appropriate screening tool for identifying at-risk individuals. Conversely, higher scores of anxiety sensitivity were related to greater cannabis use frequency. Thus, in addition to being related to lifetime cannabis use, anxiety sensitivity is also a factor associated with greater cannabis use frequency; however, it is unknown whether or not more anxious individuals self-medicate with cannabis, if cannabis causes anxiety symptomology, or if cannabis and anxiety are operating in a dual pathway model in which anxiety exacerbates cannabis use and cannabis use also exacerbates anxiety (Kedzior & Laeber, 2014). Regardless of the pathway, there is a relationship between cannabis use and anxiety that requires further investigation.

The cannabis outcome measure for cannabis dependence implicated several additional risk factors that had not been associated with the previously discussed outcome variables of lifetime cannabis use and cannabis use frequency. As with cannabis frequency, sex (being female) and anxiety sensitivity were positively correlated with severity of dependence, indicating that women and anxious individuals were more likely to have higher score on the dependence scale. Sex differences in reported cannabis dependence was, once again, an unusual result as males were more likely than females to develop dependence (Wagner and Anthony, 2007). The association between cannabis dependence and anxiety sensitivity further illustrates a strong relationship between all aspects of cannabis use. Cannabis expectancies of Perceptual and Cognitive Enhancement, Cognitive Behavioural Impairment, and Social and Sexual Facilitation were implicated. Both Perceptual and Cognitive Enhancement and Cognitive Behavioural Impairment were positively correlated with cannabis dependence, while Social and Sexual Facilitation was negatively correlated. Results indicate that for those with higher dependence scores on the SDS, expectancies of diminished cognitive abilities (Cognitive Behavioural Impairment) and poorer ability to facilitate social and sexual interaction (Social and Sexual Facilitation) were greater. Unlike cannabis frequency, the results of this analysis show that those with higher levels of dependence expect more negative consequences of their use, including impaired thinking and difficulty facilitating social and sexual facilitation. In congruence with the drug instrumentalization theory, the cannabis expectancies

associated with dependent use, diminished cognitive abilities and lack of facilitation of social and sexual interactions, suggest that those with dependent use may be 'overinstrumentalizing' cannabis, and it is no longer being used purposefully to achieve a goal (Müller & Schumann, 2011).

Although cannabis use initiation, frequency, and dependence are the most common indicators for cannabis use, the study sought to investigate different ways in which non-dependent cannabis users may experience problematic outcomes. Based on emerging research that has highlighted the difficulties in measuring cannabis-related problems, this study analysed the relationship between use and those cannabis-related problems that resulted directly because of use behaviour (i.e. missing work, not having enough money, problems with friends) (Asbridge et al., 2014). Cannabis frequency and anxiety sensitivity were the strongest predictors of cannabis-related problems. Higher levels of reported cannabis-related problems due to cannabis frequency is an expected outcome, as those who are more frequent users of cannabis are more likely to be dependent/problematic users (Coffey et al., 2003; Walden & Earleywine, 2008). Although anxiety was a significant predictor for several other outcome variables, its relationship with cannabis-related problems was strongest. Several other risk factors were associated with cannabis problems, including: time perspective (Future orientation), cannabis expectancies (Global Negative Effects and Cognitive Behavioural Impairment), and impulsivity (Sensitivity to Reward). Lower levels of Future time perspective were associated with more cannabis-related problems. Lower Future time perspective scores suggest less consideration for the future, and, specifically, future consequences. Thus, it would be expected that one might experience more problematic use outcomes if they are not as cognisant of the potential future consequences of their use. Greater cannabis expectancies of Global Negative Effects was also associated with greater associated cannabis problems, indicating that having greater expectations of negative outcomes from cannabis use is associated with experiencing more cannabis-related problems. Furthermore, expectancies of greater Cognitive and Behavioural Impairment was associated with more reported cannabis-related problems; expectations of greater impairment when using cannabis were associated with cannabis-related problems. Higher levels of impulsivity (Sensitivity to Reward) were also associated with cannabis-related problems, which highlights that more impulsive behaviour may lead to more problematic outcomes (Simons & Carey, 2002).

2.5.2 Cannabis use and psychopathology groups

In addition to developing a better understanding of risk factors associated with cannabis use outcomes, this study also sought to inform future applications of indicated prevention research efforts by developing a greater understanding of the risk factors related to problematic cannabis

use. Firstly, the study sought to identify groups based on psychopathology amongst a non-clinical sample of young people. Secondly, this work looked to explore the relationship between psychopathology and cannabis use behaviour, and cannabis use risk factors. Previous research has established that risk factors, including sensation seeking, impulsivity, marijuana expectancies, time perspective, and psychopathology, including aggression, anxiety sensitivity, and depressive symptomology, have been associated with or implicated in the initiation of use, or the development of cannabis use behaviour (Silins et al., 2013). While there has been work that has looked at different facets of psychopathology (for example: depression and anxiety (Arseneault et al, 2004; Cheung et al., 2010, Hayatbakhsh et al., 2007, Patton et al., 2002; and van Laar et al., 2007) and it's relationship between cannabis use behaviour and cannabis use risk factors, there has been little work exploring the relationship between cannabis use behaviour and cannabis risk factors and different classes of psychopathology. Thirdly, this work sought to explore how membership to classes of psychopathology was associated with cannabis use behaviour and cannabis use risk factors and its potential as a targeting mechanism for indicated prevention efforts.

2.5.3 Psychopathology groups

In addition to investigating how related risk factors associated with cannabis use outcomes, this research examined how different groups of users may be identified, which in turn may inform how prevention may be used to target those most at-risk for problematic use outcomes. Latent Profile Analysis identified three distinct groups based on self-reported aggression, anxiety sensitivity and depressive symptomology. General psychopathology levels were the defining characteristic of each group. The emergence of general psychopathology instead of specific anxious, depressive, or aggressive groups suggests that in this sample at least, the specific form of psychopathology may not be as important of a feature as the collective degree to which psychopathology is reported. Some research has suggested general psychopathology be viewed as an index that operates on a spectrum (Caspi et al., 2013; Eaton et al., 2015).

The identification of general psychopathology groups at a sub-clinical level provides an alternative approach for the investigation of mental health and its relationship with substance use. Due to the non-clinical nature of the sample, it may prove that because self-reported aggressive, anxious, or depressive symptoms are operating at a sub-clinical level, that the corresponding aggression, anxiety, and depression outcomes are not as pronounced or as important as the general level of psychopathology experienced. Identifying specific risk factors of aggression, anxiety sensitivity, or depressive symptomology and their relationship to substance use outcomes may place too much significance on the corresponding subclinical level of aggression, anxiety or depression.

The relationship between aggression, anxiety or depression may not be as important as the combined level of general psychopathology experienced. As such, it may be a more effective strategy to amalgamate different facets of psychopathology and create a general psychopathology construct. Some research has suggested measuring general psychopathology may be a useful tool and may be more useful than looking at specific psychopathological constructs (Caspi et al., 2013; Eaton et al., 2015).

2.5.4 Psychopathology group analysis

Three groups were identified using LPA, a low, moderate and high psychopathology groups. Using ANOVA analyses, the three identified groups were compared across cannabis use outcomes and risk factors associated with use. The following section discusses the differences between the cannabis use outcomes and associated risk factors and the identified psychopathology groups.

2.5.5 Cannabis use outcomes

Cannabis outcome measures of frequency and problematic outcomes related to use were analysed. Self-reported cannabis use problems were different between groups, while there were no significant differences in reported cannabis use frequency. Specifically, the low and moderate psychopathology groups differed from the high psychopathology group. These findings support the hypothesis that higher levels of psychopathology may be related to problematic use outcomes, and that frequency of use, in and of itself, is not determinant of problematic use. The framework describing instrumentalized drug use states the 'overinstrumentalization' of use is the root to problematic use outcomes, and that frequency is not indicative of problematic use (Müller & Schumann, 2011). This is aligned with cross-sectional data that implicates coping-motivated cannabis use as a risk factor for dependence (Bonn-Miller & Zvolensky, 2009; Norberg & Copeland, 2012; Fox et al., 2011). In correspondence with these results, this suggests that while individuals in the higher psychopathology group may not be more likely to use cannabis frequently, they are more likely to experience problematic outcomes from their use. This would suggest that frequent use, instrumentalized to achieve the desired effect, whether social or sexual facilitation or any other intended effect, is not necessarily associated with problematic outcomes. Thus, infrequent, experimental or recreational users of cannabis may still experience problematic outcomes from their use, which is likely to be dependent on other factors which may include psychopathology. The relationship between cannabis-related problems and psychopathology suggests that experiencing cannabis-related problems is not necessarily a result of cannabis use frequency. This is congruent with research that has shown that cannabis exposure is not linked to cannabis dependence among

frequent cannabis users, but coping motives and negative, stressful life events are most predictive of cannabis dependence (van der Pol et al., 2013a). However, the measurement of frequency of use may be an issue when linking problematic use and frequency when factors like joints per day or potency of cannabis aren't measured. Differentiating types of frequent cannabis use behaviour may demonstrate frequency as a critical component in the development of cannabis-related problems among frequent cannabis users (Temple et al., 2011; Zeisser et al., 2012). Although the cross-sectional design of this study does not allow for the assessment of causality, cannabis-related problems, not frequency, are associated with membership to a group defined by level of psychopathology. It is generally believed that cannabis use corresponds with a problematic outcome, and frequent cannabis users are certainly more at-risk for developing dependency (Noack, Höfler & Lueken, 2011); however, it may be that factors associated with the use, including personality types, temporal perspective, and psychopathology, are major contributors to the experience of problematic use outcomes.

2.5.6 Cannabis use expectancies

In addition to differences in cannabis use outcomes, the identified psychopathology groups differed on cannabis use expectancies. Generally, more frequent cannabis users have more positive expectancies than less frequent users, while many non-users have negative expectancies (Simons & Arens, 2007; Galen & Henderson, 1999). Despite differences in reported cannabis use problems, only the Cognitive and Behavioural Impairment dimension of cannabis use expectancies differed amongst psychopathology group. Cognitive and Behavioural Impairment expectancies were significantly lower in the low psychopathology group than in moderate and high psychopathology groups. If greater impairment was associated with more problematic cannabis use outcomes, it would be reasonable to expect that Cognitive and Behavioural Impairment expectancies would be greater for the high psychopathology group. As expectancies of cannabis users are likely to be a reflective of past use experiences, greater reported cannabis use problems would be associated with a greater expectation that use behaviour would be associated with cognitive and behavioural impairment. This suggests that individuals in the higher psychopathology groups are more likely to use to an extent in which they experience a greater level of impairment, or perceive their experience or expected experience to be more impaired than individuals in the low and moderate psychopathology group. These results are similar to previous research that has shown that those with greater social anxiety report more negative cannabis effect expectancies (Buckner et al., 2007). In the previous analysis, Cognitive and Behavioural Impairment expectancies were associated with cannabis use dependence (severity of dependence), but not for any other cannabis use outcomes

(lifetime use, cannabis frequency, or cannabis problems). It may be that individuals with higher levels of psychopathology may be more likely to view their experiences as potentially problematic or impaired. Another potential reasoning for this is that a higher level of psychopathology may make one more vulnerable to negative outcomes from cannabis use, which may lead to greater 'impairment' and more problematic outcomes.

2.5.7 Time perspective

Time perspective, particularly dimensions of Past Negative and Present Hedonistic perspective, was significantly different among identified psychopathology groups, with the higher levels of these constructs reported in the high psychopathology group. These results are similar to other research looking at time perspective and mental health (Anagnostopoulos & Griva, 2011; Papastamatelou et al., 2015). Past Negative time perspective represents a generally negative view of the past, while Present Hedonistic corresponds to a perception in which impulsivity and risk-taking is applied to behaviour and the concept of time. There was a very strong relationship between psychopathology group and Past Negative perception, indicating that membership into the high psychopathology group corresponded with a high level of Past Negative time perspective. It is unclear whether individuals with high levels of Past Negative have negative past experiences, or whether these experiences are reconstructed negatively. It may be that individuals with higher levels of psychopathology are more likely to view their past experiences as negative, which would correspond with the previous assertion that levels of impairment due to cannabis use may be reconstructed to a larger extent than by other groups of lower psychopathology. Additionally, the Present Hedonistic time perspective corresponds to present pleasure and is not concerned with future consequences. Thus, individuals in the high psychopathology group were more likely to have a negative perception of their past events, and more likely to engage in impulsive, risky pleasurable behaviours to meet their present needs, without much consideration for the future.

2.5.8 Impulsivity

Impulsivity is associated with substance abuse, disruptive behavioural disorders and aggression (Barratt et al., 1999; Allen et al., 1998; Dougherty et al., 2003; Verdejo-Garcia, Lawrence & Clark, 2008). Impulsivity, both measures of Consideration of Future Consequences and Sensitivity to Reward, differed between the low psychopathology group, and the high and moderate psychopathology group; there were no significant differences in impulsivity between the high and moderate psychopathology groups. These constructs provide an understanding of the degree to which the implications of behaviours are considered as well as the degree to which one would be

willing to adopt this behaviour in order to obtain a reward. This suggests that the low psychopathology group would be a less risk-taking and more future-oriented, while the moderate and high psychopathology group would engage in more impulsive behaviour, with far less consideration for the potential consequences.

2.5.9 Sensation seeking

There were no reported differences between psychopathology group and sensation seeking. Sensation seeking is a personality construct often attributed to drug seeking behaviour and risk taking. Sensation seeking measures an individual's interest in seeking new and novel experiences, and is unlikely to be related to one's psychopathology (Zuckerman & Neeb, 1979).

2.5.10 Psychopathology

There were statistically significant differences among anxiety and depressive measures among all three groups, while aggression differed between the moderate and high psychopathology group and the low psychopathology group. Furthermore, the least degree of difference among the factors that determined the groups was between aggression, with no significant difference demonstrated between the moderate and high psychopathology groups.

2.5.11 Differences by psychopathology group

In addition to looking at the composition of the psychopathology groups, differences between clusters were specifically investigated.

2.5.12 Differences between Low and Moderate psychopathology groups

There were significant reported differences between the low and moderate psychopathology group in time perspective (Past Negative), impulsivity (Sensitivity to Reward), and two elements of cannabis expectancies (Cognitive and Behavioural Impairment and Craving and Physical Effects). Despite differences in risk factors associated with cannabis use behaviours, there were no significant differences when comparing these groups when looking at cannabis use frequency or problems. Thus, although the risk factors associated with cannabis use outcomes differ between low and moderate groups of psychopathology, they did not influence or affect cannabis use outcomes. There were differences between Past Negative time perspective, impulsivity and Sensitivity to Reward, and the cannabis expectancy of Cognitive and Behavioural Impairment, in which the moderate psychopathology group reported higher levels than the low group. The low psychopathology group reported a higher level of expected Craving and Physical Effects of cannabis than the moderate psychopathology group. Craving and Physical Effects expectancies corresponds

largely to the ways in which cannabis affects the body and appetite (Aarons et al., 2001); thus, membership to the low psychopathology group greater likelihood of expectancies of Craving and Physical Effects of cannabis. It may be that the moderate psychopathology group may be more attuned to Cognitive and Behavioural Impairment effects due to their own greater level of psychopathology, while the low psychopathology group may be more attuned to the Physical and Craving Effects of cannabis use (Buckner et al., 2007; Buckner & Schmidt, 2008; Buckner & Schmidt, 2009). Higher levels of impulsivity and Past Negative time perspective suggest that the moderate psychopathology group is more likely to view their past experiences as negative, and more likely to engage in impulsive behaviours geared towards reward (Anagnostopoulos & Griva, 2011; Papastamatelou et al., 2015).

2.5.13 Differences between Moderate and High psychopathology groups

The only differences measured between the moderate and high psychopathology groups were dimensions of temporal perspective, including: Past Negative, Past Positive, and Present Fatalistic. A greater Past Negative time perspective was significantly more likely to be a characteristic of the high psychopathology group, than the moderate psychopathology group. This is likely to be a result of the higher levels of anxiety sensitivity and depression reported within the psychopathology group, which correspond to negative perceptions regarding past experiences. Additionally, the Present Fatalistic time perspective suggests the high psychopathology group is more likely to be present focused, with little regard for future consequences of present behaviour (Anagnostopoulos & Griva, 2011; Papastamatelou et al., 2015). Conversely, the moderate psychopathology group was likely to have higher scores of Past Positive time perspective indicating that they are more likely to have a nostalgic and positive view of their past. Although these results suggest that the high psychopathology group is likely to be more negative regarding their experiences as well as focused on the present with little regard for future consequences, these increased risk factors associated with cannabis use do not translate into statistically significant differences between cannabis use frequency or associated problems between groups. There are several possible explanations for these differences. There are a complex web of factors that are linked between both cannabis and other drug use and mental health (Jané-Llopis & Matytsina, 2006). It is likely that the risk factors associated with cannabis use are also linked to psychopathology. Although there are differences between these groups, it is likely they are a reflection in the difference between psychopathology and not cannabis use outcomes. Previous research has found that mental health factors, aside from externalising behaviours, are similar among frequent, non-dependent cannabis users and the general population, while mental health factors are worse among dependent, frequent cannabis

users (van der Pol et al., 2013b). Alternatively, the level of difference in psychopathology between the groups may not be great enough to display differences in use cannabis use outcomes, and a greater difference would be necessary for differences in cannabis use outcomes to be discerned.

2.5.14 Differences between Low and High psychopathology groups

There were significant differences between the low and high psychopathology group in risk factors associated with cannabis use, including temporal perspective (Past Negative, Past Positive, Present Fatalistic) and impulsivity (Sensitivity to Reward), as well as reported problems associated with cannabis use. As with the two previous analyses looking at the differences by psychopathology group, Past Negative time perspective is a strong predictor of class membership, with greater likelihood of membership the high psychopathology group with higher scores of the construct. Furthermore, Present Fatalistic time perspective is also associated with membership to the high psychopathology group. Conversely, a positive and nostalgic view of the past (Past Positive) is associated with membership to the low psychopathology group. These results further illustrate that temporal perspective is likely to be significantly related to psychopathology, and one's view of past events is likely to be influenced by the degree of anxiety, depression and aggression they report to be experiencing (Anagnostopoulos & Griva, 2011; Papastamatelou et al., 2015). In addition to risk factors associated with cannabis use, greater reported cannabis related problems were associated with membership to the high psychopathology group. Although there were no reported differences between the low and moderate, or the moderate and high psychopathology groups, significant differences were detected between the low and high psychopathology group. This is consistent with evidence linking mental health and cannabis problems (Degenhardt, Hall, & Lynskey, 2001; Chabrol et al., 2005; Rey et al., 2002; Monshouwer et al., 2006; Degenhardt et al., 2013). The high psychopathology group either engages in more problematic use due to the factors associated with this membership (anxiety, depression and aggression) than peers in the low psychopathology group, or they are more likely, due to other factors like temporal perspective and impulsivity, to view their experiences with cannabis as problematic (Ansell et al., 2015).

2.5.15 Conclusions

These analyses provide important findings for prevention work, particularly around risk factors and their relationship with cannabis use outcomes. There is debate in the cannabis literature about the challenges in cannabis prevention and research, particularly regarding cannabis assessment, like frequency and potency (Temple, Brown & Hine, 2010; Copeland, 2011; Patton, 2011; Earleywine, 2011; Hammersley, 2011; Andréasson, 2011). Results demonstrate that the ways in which we assess

cannabis use influences which risk factors are associated. This work highlights the importance for prevention work to focus on the perceived user profile and which risk factors are associated with the target population. For indicated prevention, targeting frequent cannabis users individuals may not be appropriate. Although relationship between the risk of dependence and cannabis frequency is well-documented (Hall & Degenhardt, 2009), research has shown that in identifying problematic cannabis users, user-related harm may be more suitable (Davis et al., 2009; Thake & Davis, 2011; Zeisser et al., 2012; Asbridge et al., 2014). Some research has suggested cannabis dependence does not necessarily indicate problematic cannabis use (Liebregts et al., 2015). It may be more useful to explore different ways to assess cannabis use behaviour in order best target users most susceptible to experiencing problematic outcomes (Hughes et al., 2014; van der Pol et al., 2014; van Laar et al., 2013; van der Pol et al., 2013b). Indicated prevention efforts could specifically target which users have problematic outcomes and work to curb those issues and prevent the graduation to dependent use.

The first analyses investigated the associations of risk factors associated with cannabis use, and looked at those associations across different use outcomes variables. Risk factors associated with lifetime cannabis use, which corresponds with whether one has initiated cannabis use, differed from the risk factors associated with severity of dependence, problematic outcomes, and frequency. These results suggest that the factors that may be associated with initiation of cannabis use are not the same factors that lead to the continued use of cannabis. Thus, universal prevention efforts that seek to stop the initiation of cannabis use may look to factors that are associated with lifetime cannabis use, while indicated and selective prevention efforts may target different risk factors.

The second analyses looked specifically at groups of users by psychopathology, and sought to determine if this might be a potential tool for indicated prevention. Research has highlighted the relationship between cannabis and mental health (Cheung et al., 2010; Degenhardt et al., 2013; Degenhardt, Hall & Lynskey, 2003; Crippa et al., 2009; Stinson et al., 2006). The results indicated that higher levels of psychopathology were associated with more problematic cannabis use outcomes, but not frequency. This suggests that higher psychopathology may not be linked to frequent use of cannabis, but rather problematic outcomes when recreational or experimental use occurs. This is consistent with research that has shown the mental health of non-dependent, frequent cannabis users is similar to the general population, while the mental health of frequent, dependent cannabis users is worse (van der Pol et al., 2013a). This suggests that using psychopathology as a screening instrument for targeted, indicated prevention efforts may be suited to target high psychopathology and tailor interventions to the specific relationship between psychopathology and problematic use outcomes.

Understanding more about the relationship between psychopathology and problematic cannabis use would be necessary, but this provides evidence that targeting specific problematic users, opposed to frequent users, may be a way to prevent experimental and recreational cannabis users from experiencing problematic outcomes or transitioning into problematic, dependent use.

2.5.17 Limitations

Several limitations should be considered, including the study population, self-report data, internet-based survey, cross-sectional design, comorbidity of anxiety, depression and aggression, and confounding factors. This investigation specifically was interested in young people without a previous clinical diagnosis of a clinical affective disorder. Despite this established criteria, it seems highly possible that several of the participants in this study may meet the criteria of clinical depression, anxiety, and alcohol and drug dependence. Furthermore, although a significant portion of respondents were university students, analyses showed that these participants did not significantly differ in their responses to other participants. The cross-sectional design of this study limits our ability to comment on the causal relationship between level of psychopathology and the use of alcohol and drugs. It does, however, examine the complexities related to factors associated with assessments of cannabis use. Additionally, a potential limitation of this outcome is the comorbidity of anxiety and depression (Lamers et al., 2011). As shown in section 2.2, there are numerous risk and protective factors associated with drug use. In addition to their relationship with drug use outcomes, many of the risk factors have been shown to be related. For example, over 60 confounding factors were considered to determine whether causal explanations of cannabis use and mental health outcomes (psychosis) were overestimated (Moore et al., 2008). It is likely that factors not included in the models for this study, like IQ, sociodemographic markers, and poor educational attainment would contribute to the model, and consideration of these non-included factors must be considered when interpreting these results.

Chapter 3

Implicit associations and cannabis use behaviour in frequent cannabis users

3.1 Introduction

One of the main challenges in drug and alcohol research is understanding why people engage in behaviours despite possessing knowledge that it is detrimental to their health. In drug and alcohol research, explicit measures, such as attitudes, knowledge, and use expectancies, have been primarily used to predict behavioural outcomes of use, like in study 1 of this PhD (von Sydow et al., 2002). The previous study in this PhD looked at explicit measures and their relationship with cannabis use outcomes. Despite the extensive use of explicit measures in drug and alcohol research, this measurement tool has considerable limitations, including participants' self-presentation efforts for their answers to be aligned with social convention, and lack of self-insight and knowledge regarding the underlying mechanisms that contribute to their behaviour (Nisbett & Wilson, 1977; Schwarz, 1999; Schwarz & Oyserman, 2001). Theories regarding behaviour suggest that a dual-process model of "rational" and "impulsive" processes jointly predict behaviour (Strack and Deutsch, 2004), an indication that the sole use of explicit measures (rational processes) to predict behavioural outcomes is insufficient. The rational processes is a system in which behavioural decision are made based on facts and knowledge (explicit measures), and the impulsive system is a system based on associative links and motivational orientations (implicit measures). Implicit cognitions are spontaneous evaluative responses to stimuli which have been shown to influence behaviour (Perugini, 2005). To provide a more comprehensive understanding of how cognitions affect alcohol and drug behaviour, researchers have developed tools to measure the impulsive cognitive processes and the implicit evaluations that influence drug and alcohol behaviour in conjunction with explicit measures.

The Implicit association test (IAT) is a test used to measure implicit cognitions (IAT; Greenwald, McGhee & Schwartz, 1998). The IAT test is administered by presenting the participant with stimuli (word, or picture) representing target and attribute dimensions. The main objective for the participant is to categorise the stimuli as quickly and accurately as possible. The participant performs the categorisation task in several different phases for the target dimension (e.g. race: Black vs. White) and attribute dimension (e.g. Positive vs. Negative). In the critical phases of the

task, participants perform double-categorisation tasks in which they are instructed to make binary decisions for stimuli for two dimensions simultaneously (e.g. press left button for Black and Positive Words, and press right button for White and Negative Words), followed by a phase in which the target and attribute dimensions are switched (e.g. press left button for Black and Negative Words and press right button for White and Positive Words). In the IAT test, response latency and accuracy are the main dependent variables (generally latency is used as the primary variable of interest). The underlying reasoning for using this methodology is that the pattern of response latencies and error percentages provide an index to the strength of the target-attribute association in memory. In the aforementioned example, the difference between the average response latency between the two combination phases would be calculated to produce the IAT effect. Therefore, if participants were faster at responding when the combination of White and Positive versus Black and Negative than when the combination is reversed, the conclusion would be that the participant has a more positive association with Whites than Blacks, even though the participant may not admit to this directly when asked.

In addition to the IAT, several variants of the test have been created in order to deal with some of the limitations of the original test. For example, when studying alcohol and drugs, it is important to test both negative (e.g. unhealthy) and positive (e.g. fun) associations independently, as expectancies are not mutually exclusive. In order to test both of these associations, the unipolar IAT was developed in which the target attribute (e.g. unhealthy) is contrasted with a neutral attribute, and then repeated with the other target attribute (e.g. fun) and the same neutral (see, for example, Jajodia & Earleywine, 2003). This technique has been used particularly with measuring positive and negative associations with the target of alcohol versus soft drinks (e.g. Wiers et al., 2003; Houben & Wiers, 2007; Tibboel et al., 2015). This data can then be used to understand how negative and positive implicit associations of alcohol affect behaviour separately and concurrently. A limitation of the IAT measure is that when two categories are contrasted by the participant, conclusions derived can only be made in reference to how one views a selected category in comparison to another (De Houwer, 2001). To compensate for this limitation, a further variant of the IAT test, the single-category IAT (SC-IAT), was developed and eliminates comparison of two target categories.

The SC-IAT requires participants to categorise words as quickly as possible into different sets and is presented in four blocks (e.g. Houben & Wiers, 2008; Dekker et al., 2009). In the first block, participants press the left key when the stimulus word that comes up in the middle of the screen is an attribute word (e.g. active) and press the right key when the stimulus word is neutral. In the

second block (combination task), participants press the left key when the stimulus word is an attribute or a cannabis word and press the right key when the stimulus word is neutral. In the third block (reversed practice phase), participants press the left key when stimulus word is neutral and press the right key when the target word is an attribute word. In the fourth block (reversed combination phase), participants press the left key when the stimulus word is neutral or a cannabis word and press right when the stimulus word is an attribute word. The difference between the reaction times of the combination and reversed combination phases is the IAT effect and gives an indication of the strength of association between the target (e.g. cannabis) and the affective category (e.g. active) (Greenwald, McGhee & Schwartz, 1998).

A key component in addition to measuring implicit associations towards drugs and alcohol is measuring the strength of implicit cognitions and their influence on behaviour. Hedonism is conceptualised as the motivation to seek and participate in pleasure-oriented behaviour (Veenhoven, 2003). This seeking of pleasure is thus considered to be related to the indulgence of sensory-oriented pleasures such as drug use, often with reward pathways being influenced by hedonic effects (Wise & Rompre, 1989; Featherstone, 1991; Szmigin et al., 2008; Nestler, 2005; Koob & Moal, 2005; Everitt & Robbins, 2005; Kalivas, 2005). The paradox of hedonistic behaviour is if the participation in a hedonistic lifestyle leads to unhealthy (potentially unpleasant) behaviour a true hedonist would reject this behaviour. This suggests that a hedonist participates in 'risky, hedonistic' behaviours despite the risk involved, or because the pleasure derived from the experience in the short-term has a greater importance to the individual (Sullivan, Hammerstein & Hagen, 2008). Thus, it should be noted the seeking of pleasure-oriented behaviour is not the only component associated with the construct, but also hedonic impulsivity.

In order to measure hedonistic impulsivity implicitly, it is not only the evaluation of pleasure-oriented stimuli that must be assessed, but also the inability to down-regulate the influence of these stimuli over time. The regulation of these evaluations is called affect regulation (Hoffman, Friese & Roefs, 2009). An adapted version of the Affect Misattribution Procedure is used to measure hedonic impulsivity (Payne et al., 2005; Hoffman, Friese & Roefs, 2009). This task presents participants with positive (pleasure) and negative oriented stimuli, followed by neutral stimuli which are rated by the participant (Payne et al., 2005; Hoffman, Friese & Roefs, 2009). A standard task is completed, followed by the same task with an extended period of time between the presentation of affective stimuli and the evaluation of the neutral stimuli (Payne et al., 2005; Hoffman, Friese & Roefs, 2009). Individuals who continue to rate neutral stimuli influenced by the presentation of hedonic affective

stimuli have more difficulty down-regulating hedonic impulses and are more likely to participate in hedonic behaviour (Payne et al., 2005; Hoffman, Friese & Roefs, 2009).

The present study had two specific aims. Firstly, it investigated how implicit cognitions regarding cannabis expectancies as well as the ability to down regulate impulses (affect regulation), influenced cannabis use and related behaviour. Moreover, this research sought to build upon the first study of this PhD, to explore how implicit measures added to models that use explicit measures and risk factors associated with cannabis use behaviour. Secondly, the research looked to specifically understand how previously determined factors associated with cannabis use influenced cannabis-related behaviour in frequent cannabis users. It was hypothesised that the inability to down-regulate impulses (affect regulation) and greater positive implicit expectancies of cannabis would be associated with greater levels of cannabis-related behaviour. Additionally, it was hypothesised that higher levels of psychopathology would be related to greater levels of cannabis-related behaviour in frequent cannabis users.

3.2 Methodology

3.2.1 Participants and procedure

Participants were recruited through Liverpool John Moore University psychology student population, and by snowball sampling. Participants were included if English was their first language, they were between the ages of 18-35 years-old, and reported using cannabis at least weekly; participants were excluded if they indicated that they were colour-blind or dyslexic as this would affect performance on the experimental test. Frequent cannabis users were targeted to focus on the relationship between the extent of cannabis behavioural involvement and adverse outcomes.

Participants first completed the SC-IAT and the modified version of the affect-misattribution procedure, followed by a battery of questionnaires. Next, participants were asked to roll a typical 'joint' using a cannabis-like substitute (a cooking herb) and provide information regarding their joint using behaviour, in order to obtain more data regarding cannabis user behaviour. Following all elements of the data collection procedure, participants were debriefed.

Ethical approval was obtained from Liverpool John Moores University Research Ethics Committee for this research. Participants were presented with a participant information sheet describing the nature of the research. Participants were fully informed of the nature of the interview and provided their written consent on the day of the research following a discussion of the participant information sheet with the researcher. Participants were informed that their participation was voluntary and of their right to withdraw from the research at any time without

reason. Furthermore, participants were informed that their anonymity would be protected and no references to individuals, place names or organisations would be made in documentations regarding this research. Participants received course credit or a £30 Love-2-Shop vouchers in exchange for their participation. The payment of drugs users for their participation in drugs research and the corresponding ethics are an important consideration. A review and practical guide to these considerations concluded that payment is ethically justifiable in most cases of drugs research (Fry et al., 2015). Payment as undue influence and payment as justifiable incentive for participation was considered, and this research aimed to ensure that payment of vouchers to research participants was an appropriate reimbursement for their time. The research payment strategies employed by comparable research studies were reviewed and evaluation when making decisions regarding the amount of incentive offered.

3.2.2 Materials and measures

3.2.3 Implicit measures

The Implicit Association Test and the Affect Misattribution Procedure were programmed and controlled using INQUISIT Millisecond software package (INQUISIT 3.0, Millisecond Software, Seattle, WA, www.millisecond.com).

3.2.4 Hedonistic impulsivity (affect regulation)

The Affect Misattribution Procedure is a task developed to measure the extent to which briefly presented positive and negative stimuli influence the pleasantness judgment of neutral stimuli presented shortly afterwards (AMP; Payne et al., 2005). The AMP effect measures the positive/negative judgements of the neutral stimuli when preceded by positive/negative primes and the difference in evaluation between positive and negative prime trials serves as the indicator of affective reactivity towards these stimuli. An updated version of AMP was developed to measure how affect regulation is down-regulated over time (Hoffman, Friesen & Roefs, 2009). In addition to the original AMP, a second within-subjects condition in which the time between prime and target presentation (stimulus-onset-asynchrony; SOA) is increased from 100ms for the standard AMP trial to 1000ms. Utilising this AMP method, the dependent measure of affect regulation is the difference in affective reactivity between the long and short SOA. The rationale being that rating of the neutral stimuli following the presentation of the valenced prime after a longer time between stimuli indicates a higher affect regulation (Hoffman, Friesen & Roefs, 2009).

For the prime stimuli, 20 positively and 20 negatively valenced pictures were selected from the IAPS (Lang, Bradley, & Cuthbert, 2005). Prime stimuli were presented for 75ms according to a

predetermined, random order that was identical for all participants. In addition, each prime was paired with a new neutral image for evaluation, a Chinese target pictograph taken from Payne et al. (2005). Each pictograph was presented for 200ms followed by a mask. The order in which SOA (100ms vs. 1000ms) were presented to the participant was randomly selected.

In order to ensure that the Chinese target pictographs were neutral, Chinese fluency was assessed to make certain that the characters presented were ambiguous. To assess Chinese proficiency, participants were asked, “How well do you speak Chinese?” with response options ranging from 1 (not at all) to 4 (fluently). No participants reported being fluent in Chinese.

3.2.5 IAT test

The IAT test was used to measure participants perceived evaluations of cannabis-related words (Greenwald et al., 1998; Field, Mogg & Bradley, 2004). The IAT has previously been used to evaluate the valence of drug-related words in samples of cannabis users (Field, Mogg & Bradley, 2004, Dekker et al., 2009; Ames et al., 2007; Ames et al., 2013). Implicit affective associations towards cannabis were assessed using three unipolar Single Category Implicit Association Tests (SC-IATs; Karpinski & Steinman, 2006), and have previously been used in cannabis research (Dekker et al., 2009). Each SC-IAT measured a different affective association towards cannabis. Three subscales (‘active’ for positive arousal; ‘negative’ for negative affect; ‘relaxed’ for positive sedation) have been previously used in drugs research (for example: Ames et al. 2007; Wiers et al. 2007; Dekker et al., 2009) because they represent the three main types of expectancies associated with cannabis (Goldman & Darkes, 2004; Wiers, 2008; Dekker et al., 2009). The words used for the affective, cannabis and neutral categories were derived from previous research (Dekker et al., 2009; Table 1).

In the SC-IAT, participants must categorise words as quickly as possible by pressing the right or left button. Each SC-IAT consisted of four phases and was presented in random order (Dekker et al., 2009; Table 2). During the practise phase (block 1), a target word appeared in the middle of the screen. The participant pressed the left key (‘E’) if the target word that appeared was a valenced word (e.g. a word from the list of one of the affective categories: active, relaxed or negative; Table 1), or pressed the right key (‘I’) when the target word was a neutral word (e.g. from the list of neutral words; Table 1). In the combination task (block 2), participants pressed the left key when either the target word was a valenced word or a cannabis word, and pressed the right key when the target word presented was a neutral word. In the reverse practice phase (block 3), participants pressed the left key when the target word was a neutral word, and pressed right when the target word was a cannabis word. In the reversed combination task (block 4), participants pressed the left

key when the target word was either a neutral word or a cannabis word, and pressed the right key when the target word was a valenced word. During the combination task (block 2) and the reverse combination task (block 4), cannabis is paired with either one of the affective categories or the neutral category. The difference in reaction times measured between these two blocks is the IAT effect, which indicated the strength of the association between cannabis and the affective category (for example: active, relaxed, or negative) (Greenwald et al., 1998; Dekker et al., 2009). Participants with a strong association between cannabis and an affective category, finding it easier on the task with the cannabis word and the affective word on the same side, would consequently complete the task faster compared to the reverse task, when the cannabis words and the relaxed word are on opposite sides (Dekker et al., 2009).

Table 1. Word stimuli for IAT (Dekker et al., 2009).

Active stimuli	Creative; Energetic; Cheerful; Motivated; Talkative
Neutral stimuli	Indefinite; General; Usual; Standard; Impartial
Relaxed stimuli	Relaxed; Calming; Contented; Comforting; Reassuring
Neutral Stimuli	Accompanying; Preceding; Supplementary; Frequent; Additional
Negative stimuli	Miserable; Suspicious; Listless; Anxious; Confused
Neutral stimuli	Central; Daily; Middle; Common; Customary
Cannabis stimuli	Weed; Hash; Cannabis; Stoned; Blow

Table 2. Schematic overview of the block sequence for active, relaxed and negative single-category implicit association tests (SC-IATs) (Dekker et al., 2009).

	Block 1 Practice Phase	Block 2 Combination Phase	Block 3 Reversed Practice Phase	Block 4 Reversed Combination Phase
Active SC-IAT	Active Neutral	Active Neutral Cannabis	Neutral Active	Neutral Active Cannabis
Relaxed SC-IAT	Relaxed Neutral	Relaxed Neutral Cannabis	Neutral Relaxed	Neutral Relaxed Cannabis
Negative SCIAT	Negative Neutral	Negative Neutral Cannabis	Neutral Negative	Neutral Negative Cannabis

3.2.6 Explicit measures

3.2.7 Explicit cannabis expectancies

The explicit cannabis expectancy measure is a questionnaire with 18 unipolar items consisting of statements related to using cannabis and an affective outcome, the same as those that were used in the implicit measure (positive arousal, positive sedation, and negative) (Dekker et al., 2009; Eastwood et al., 2010). Participants indicated the extent to which they agreed or disagreed with each statement on an unmarked visual analogue scale (VAS). Lower values indicated a higher level of expectancy. Moderate levels of consistency were measured in the scales: positive-arousal ($\alpha = .666$), positive-sedation ($\alpha = .691$), and negative ($\alpha = .787$). This questionnaire was chosen to ensure consistency between the implicit and explicit expectancy measures.

3.2.8 Impulsivity and sensation seeking

Impulsivity was measured using the Consideration of Future Consequences (CFC) instrument (Strathman et al., 1994), and the Sensitivity to Reward questionnaire (Torrubia et al., 2001). The CFC measures the extent to which individuals consider the potential distant outcomes of their current behaviours, and the extent to which they are influenced by these potential outcomes. This measure showed good reliability ($\alpha = .888$). The Sensitivity to Reward Questionnaire is based on Gray's Behavioural Approach System (BAS; Gray, 1981) and measures impulsive dimensions of personality ($\alpha = .825$).

The Sensation Seeking Scale (SSS) measures the sensation seeking trait, defined by Zuckerman (1979) as "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences (p.10)". The Brief Sensation Seeking Scale (BSSS; Hoyle et al., 2002) is an 8-item, shortened version of the original scale and considered to be a valid and reliable measure ($\alpha = .738$).

3.2.9 Trait self-control

The short version of the trait self-control scale will be used to measure individual differences of self-control on a wide variety of behaviours (Tangney, Baumeister & Boone, 2004). An index of self-control was used combining the scores of the 13 items with a possible range between 0 (low trait self-control) and 5 (high trait self-control; $\alpha = .549$).

3.2.10 Aggression

The Buss and Perry Aggression Questionnaire (BPAQ) is a 29-item questionnaire that assesses the dimensionality of aggression and how it is manifested, looking specifically at four factors: verbal aggression ($\alpha = .844$), physical aggression ($\alpha = .883$), anger ($\alpha = .887$), and hostility ($\alpha = .870$) (Buss and Perry, 1992).

3.2.11 Anxiety sensitivity

The ASI-3 is an 18-item adaption of the Anxiety Sensitivity Index (ASI) that provides three subscales of anxiety sensitivity: cognitive ($\alpha = .916$), social ($\alpha = .543$), and physical ($\alpha = .846$) anxiety sensitivity (Anxiety Sensitivity Index; Reiss et al., 1986; Taylor et al., 2007). The scale shows good reliability and validity in non-clinical populations and shows improved psychometric properties compared to the original Anxiety Sensitivity Index (Taylor et al., 2007).

3.2.12 Depression

The Center for Epidemiological Study of Depression Scale (CES-D) is a 20-item self-report scale designed to measure depressive symptomatology in a non-clinical population (Radloff, 1991). The scale showed good reliability in the current sample ($\alpha = .883$).

3.2.13 Time perspective

Time perspective assesses the cognitive processes that organise human experience into past, present, and future temporal frames (Zimbardo, 1999). The 56-item time perspective questionnaire (ZPTI) examines five dimensions of time perspective: Past Negative ($\alpha = .797$), Present Hedonistic ($\alpha = .801$), Future ($\alpha = .790$), Past Positive ($\alpha = .743$), Present Fatalistic ($\alpha = .627$). The test has acceptable internal consistency and test-retest reliability.

3.2.14 Dependent variables

3.2.15 Cannabis frequency and joint consumption

To assess participants' cannabis consumption during the past week, they were asked write down how many occasions they smoked cannabis and how many joints they smoked on each occasion in accordance with the 'timeline followback' methodology. This approach has excellent test-retest reliability and convergent and discriminate validity for the assessment of cannabis and other illicit drug use (Fals-Stewart et al., 2000). To compute the dependent measure, participants were to roll a joint to assess the amount of cannabis used per joint. Once participants completed the self-report section of the study, participants were presented with rolling papers, tobacco, and a legal herbal

cannabis substitute (similar in appearance and smell to cannabis), and were asked to roll a ‘typical’ joint to estimate the quantity of cannabis and tobacco used per joint (Mariani et al., 2011). This method was used to obtain a more accurate measure of cannabis use as there is great variation in the amount of cannabis used per joint. The provided supply of cannabis and tobacco was weighed before and after the experiment procedure, and the difference determined the quantity of cannabis and tobacco used in the joint. Participants were informed that the substance was a legal cannabis substitute prior to the task and that they would not be breaking the law.

In addition to reporting on cannabis consumption, participants answered questions about other aspects of their cannabis use, including the variation in quantity of cannabis and tobacco used, and the frequency in which the participant rolls the joints they smoke. Most (87.5%) used tobacco with their joint. A considerable number of participants (25%) never rolled the joints they smoked and only 20% indicated that they always rolled their own joints. In the joint rolling task portion of the experiment, participants who never rolled their own joints were asked to proceed as best they could. This did, however, have implications for the reliability of cannabis estimates used in this study. Participants were also asked the reasons for which they might alter the quantity of cannabis and tobacco in their joints. The people they were smoking with, the quantity they had, time of day, work/life responsibilities and intended high were all given as reasons.

3.2.16 Severity of dependence

Cannabis dependence was assessed using the cannabis version of the Severity of Dependence Scale (C-SDS), which provides an overall score ranging from 0 to 15, with higher scores indicating more severe dependence. This scale shows good reliability ($\alpha = .705$) (Martin et al., 2006).

3.2.17 Cannabis-related problems

Cannabis-related problems index was measured using a list of 17 items derived from the 19-item Marijuana Problems Scale (MPS) (Stephens et al., 2000). Participants were first asked whether or not they experienced a problem in the past 90 days (e.g. legal problems; difficulty sleeping), and then were asked if this problem was caused or worsened due to cannabis use. Two items from the original scale (“feel bad about your use”; “withdrawal symptoms”) were eliminated due to their reference to specific drug use. The removal of specific references to drugs was to focus specifically on problems associated due to use, and not dependency problems. The scale in the current sample had good reliability ($\alpha = .740$).

3.2.18 Cannabis composite score

In order to obtain a normally distributed dependent variable with minimal Type I error, a composite cannabis score was calculated (e.g. Thush et al., 2007). Z scores of cannabis frequency, cannabis quantity per joint, number of joints per week, cannabis-related problems, and severity of dependence scale were calculated. Next, a mean of the five Z scores was used to create the cannabis composite score. This score provided a composite that includes different dimensions of cannabis use, including frequency of use, number of joints and the amount of cannabis used per joint, as well as problems and dimensions of dependency experienced due to cannabis use.

3.2.19 Drugs use index

Drugs use index was a bespoke composite measure that included the number of drugs a participant had used in their lifetime. Participants were asked about their lifetime use of ecstasy, heroin, cannabis, cocaine, anabolic steroids, legal highs, hallucinogens, amphetamines, and ketamine. The mean score for the drugs index was 4.06, indicating the average participant had used or experimented with at least 4 different drugs.

3.2.20 Craving for cannabis

The 12-item brief version of the Marijuana Craving Questionnaire (MCQ-SF; Heishman, Singleton & Liguori, 2001 and Heishman et al., 2009) was used to assess subjective cannabis craving. The MCQ-SF items are based on a four-factor scale structure of the MCQ: compulsivity, emotionality, expectancy and purposefulness. The MCQ-SF is a valid and reliable measure of marijuana craving, measuring the same multidimensional aspects of the MCQ in marijuana users not seeking treatment (Heishman et al., 2009). The craving questionnaire was presented at the beginning of the experiment and again at the end to investigate whether the experimental procedure affected cannabis craving.

3.2.21 Alcohol use

The Alcohol Use Disorders Identification Test (AUDIT) was used as a brief screening instrument to identify harmful and hazardous drinking. Using a diagnostic cut-off of 11, 25 (62.5%) of those who had used alcohol were considered to be at risk for hazardous and harmful drinking (Fleming, Barry & Macdonald, 1991). In addition to the AUDIT, participants were asked about frequency of drunkenness; participants were asked, 'How many times have you been drunk in the past month?'

3.2.21 Missing values computation

Multiple imputation was used to account for missing data (SPSS). Multiple imputation is an approach used to deal with the problem of missing data by creating several different probable imputed data sets and pooling the results obtained from them. Multiple copies of the dataset are created and missing values are replaced with imputed values, derived from the predictive distribution of the data, based on the Bayesian approach (Rubin, 1996). Each of the imputed datasets is used to fit the intended model, using an average of the imputed datasets to give overall estimations. In SPSS, only the unstandardized betas are given, so standardized betas, *r* values, and *f* values are calculated by hand by taking the mean values of the imputed datasets (SPSS, 2009). In the following sample five measures had missing data and were used to create multiple imputations: aggression (Physical), AUDIT score, depression, drugs index, drunkenness frequency, and self-control.

3.2.22 Statistical analyses

A multiple regression analysis was employed with cannabis composite score as the dependent variable. Multiple regression analysis was chosen for its predictive validity when using an independent variable and multiple continuous, dependent variables. Gender and Age were entered using a forced entry first into the first step of the model because of their strong association with cannabis outcomes in the extant literature. For other steps, a step-wise approach was used. The second step included drug-related factors of audit score, frequency of drunkenness and drugs use index. The third step was explicit cannabis expectancies. The fourth step included measures of mental health: aggression, anxiety sensitivity and depression. The fifth step of the model included personality measures of impulsivity (Sensitivity to Reward and Consideration of Future Consequences), sensation seeking, time perspective and self-control. The final step of the model included implicit cognition measures of affective associations towards cannabis and hedonic impulsivity.

3.3 Results

3.3.1 Sample characteristics

The sample consisted of 40 (60% male) participants, the majority of which were students (85%). Psychology students at Liverpool John Moores University received course credit for their participation, while all other participants received a £30 Love-2-Shop vouchers. The mean age was 22.8 (range = 18-35, SD = 4.1). The racial and ethnic composition of the sample was predominately

White (90%). Table 3 gives the demographics of the sample population, while Table 4 provides general drug use data.

Table 3. Demographics. (N = 40)	
Sex (%)	Female = 0.40; Male = 0.60
Age (in years)	M = 22.8; SD = 4.1
Ethnicity (%)	White British = 0.90
	Mixed Race = 0.05
	Black British = .025
	Other = .025
Student (%)	0.85
Relationship	Single = 0.525
	In a relationship = 0.475

Table 4. Alcohol, tobacco and cannabis use. (N = 40)	
	<i>M (SD)*</i>
<i>Alcohol</i>	
Age of initiation (Years)	13.95 (1.43)
AUDIT (N = 39)	14.28 (5.85)
Above diagnostic cut-off (%)	25 (0.625)
Drunk frequency (N = 36)	4.72 (3.75)
<i>Tobacco</i>	
Age of initiation (Years) (N= 39)	14.82 (2.01)
Fagerström nicotine dependence (N = 23)	0.348 (0.573)
<i>Cannabis</i>	
Age of initiation (Years)	15.95 (1.66)
Cannabis use frequency	2.98 (0.62)
Severity of dependence	2.63 (2.38)
Above diagnostic cut-off (SDS ≥ 4)	13 (32.5 %)
Cannabis-related problems	2.41 (2.38)
Joint quantity	0.20 (0.15)
Days per week	3.15 (2.15)
Joints per week	7.33 (8.67)
*M(SD) measurement unless otherwise noted	

Table 5. Use of drugs other than cannabis. (N = 40)				
	Never	Lifetime	Past year	Past Month
Ecstasy (%) (N = 39)	30.8	12.8	28.2	28.2
Heroin (%) (N = 37)	97.3	2.7	0	0
Cocaine (%) (N = 39)	30.8	15.4	28.2	25.6
Hallucinogens (%) (N = 39)	38.5	17.9	30.8	12.8
Ketamine (%) (N = 37)	51.4	18.9	18.9	10.8
Legal Highs (%) (N = 37)	54.1	21.6	16.2	8.1
Amphetamines (%) (N = 38)	36.8	10.5	28.9	23.7
Anabolic Steroids (%) (N = 38)	94.4	5.6	0	0

Table 6. Cannabis joint descriptives. (N = 40)					
Tobacco in joints (%)	Yes			No	
	87.5			12.0	
Joint quantity variation (%)	None	A little	Some	A lot	
	10.0	52.5	22.5	15.0	
Frequency of time joint rolling (%)	None	Little	Some	A lot	All
	24.4	14.6	12.2	26.8	21.8
Variation between tobacco and cannabis ratio (%) (N = 36)	None	A little	Some	Quite a bit	
	8.3	41.7	25.0	25.0	

Table 7. Measures.				
	N Valid	Missing	Mean	SD
<i>Cannabis composite score</i>				
Severity of dependence	40	0	2.62	2.38
Cannabis joint quantity (in grams)	38	2	0.2	0.14
Cannabis frequency	40	0	6.77	1.6
Cannabis problems	39	1	2.41	2.38
<i>Other substance use variables</i>				
AUDIT	39	1	14.28	5.84
Drug use index	36	4	4.02	1.91
Drunk frequency	36	4	4.72	3.75
<i>Mental Health</i>				
Aggression (Anger)	40	0	16.28	7.83
Aggression (Hostility)	40	0	19.5	7.8
Aggression (Physical)	39	1	24	8.58
Aggression (Verbal)	40	0	15.48	4.94
Anxiety (Cognitive)	40	0	3.95	5.22
Anxiety (Physical)	40	0	0.51	0.42
Anxiety (Social)	40	0	0.74	0.27
Depression	38	0	14.18	8.88
<i>Cannabis expectancies</i>				
MEEQ (Arousal)	40	0	52.96	14.58
MEEQ (Relaxation)	40	0	32.2	15.28
MEEQ (Negative)	40	0	64.01	18.23
IAT (Arousal)	40	0	0.001575	0.304515
IAT (Relaxation)	40	0	0.191325	0.248648
IAT (Negative)	40	0	0.019875	0.266776
AMP	40	0	0.0402	0.06812
<i>Personality</i>				
Self-control	38	2	36.18	9.14
Sensation Seeking	40	0	4.21	0.56
ZPTI (Future)	40	0	3.26	0.62
ZPTI (Past Negative)	40	0	2.99	0.77
ZPTI (Past Positive)	40	0	3.47	0.52
ZPTI (Present Fatalistic)	40	0	2.57	0.54
ZPTI (Present Hedonistic)	40	0	3.68	0.51
Impulsivity (SRS)	40	0	0.55	0.2
Impulsivity (CFC)	40	0	3.2	0.83

3.3.2 Original dataset

Multiple regression analysis was undertaken to examine the relationship between cannabis use and drug-related, cannabis expectancy, mental health, personality, and implicit cognition factors. In this analysis, the dependent outcome variable was the composite score of cannabis use frequency (days used), joints used per session, quantity of cannabis per joint, cannabis-related problems experienced and severity of dependence. Using a stepwise approach (backwards method), gender and age were entered into the first step. The final model accounted for 49.3% of the variance in composite cannabis score and was a significant fit of the data ($F(4, 30) = 6.33, p = .001$). The adjusted R^2 (.415) shows little shrinkage, indicating that the model would generalise well. Gender ($\beta = -0.252, p < .10$) and age ($\beta = 0.598, p < .01$) were entered into the variable, and gender was non-significantly negatively correlated (being male was more associated with greater cannabis composite score) while age was positively correlated (being older was associated with a greater cannabis score). Drug-related cognitions, specifically the explicit cannabis expectancy 'sedation', was found to be highly correlated with cannabis composite score ($\beta = -0.749, p < .001$), with higher scores of sedation-related expectancies correlated with a lower cannabis composite score. Additionally, impulsivity Consideration of Future Consequences was significantly associated with composite cannabis use ($\beta = 0.346, p < .01$), indicating that greater consideration of future consequences was associated with a higher cannabis composite score.

Table 8. Model summary for regression of cannabis composite score on original data. (N =31)			
	<i>b</i>	<i>SE b</i>	β
Final Model			
Constant	-1.705	0.61	
Gender	-0.327	0.187	-0.252#
Age	0.087	0.025	0.598**
MEEQ (Sedation)	-0.029	0.007	-0.749***
Impulsivity (CFC)	0.247	0.103	0.346*

Note. $R^2 = .493$. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

3.3.3 Imputed data (Pooled estimate)

Multiple regression analysis was performed to examine the relationship between cannabis use and drug-related, cannabis expectancy, mental health, personality, and implicit cognition factors as done in the original analysis above. The same backwards approach was used as with the original data. Please note that SPSS does not compute traditional p values for pooled estimates. Compared to the analysis of the original dataset, the imputed data had more factors included in the model, with the inclusion of anxiety sensitivity (physical) and aggression (physical). The standardized beta values for explicit cannabis expectancy 'sedation' and impulsivity (Consideration of Future Consequences) were similar to analysis of the original dataset, while standardized beta values for age and gender were much smaller. The final model accounted for 63.28% of the variance in composite cannabis score, while the adjusted R^2 (.5524) shows little shrinkage, indicating that the model is generalisable. Gender ($\beta = -0.011$) and age ($\beta = 0.052$) were entered into the variable, and gender was negatively correlated (being male was more associated with greater cannabis composite score) while age was positively correlated (being older was associated with a greater cannabis score). Drug-related cognitions, including the explicit cannabis expectancy sedation ($\beta = -0.725$) and negative ($\beta = -0.588$), were found to be correlated with cannabis composite. Both were negatively correlated with cannabis composite score, indicating the greater expectancies of sedation and negative outcomes associated with cannabis use is related to a lower cannabis composite score. Additionally, impulsivity Consideration of Future Consequences was significantly associated with composite cannabis use ($\beta = 0.328$), indicating that greater consideration of future consequences is associated with a higher cannabis composite score. Anxiety (physical) ($\beta = -0.378$), and aggression (physical) ($\beta = 0.268$), were both correlated with cannabis composite score; anxiety sensitivity to physical responses was associated with lower levels of cannabis composite score, while higher scores of physically manifested aggression was associated with a higher cannabis composite score.

Table 9. Model summary for regression of cannabis composite score on imputed data. (N =40)			
	<i>b</i>	<i>SE b</i>	β
Final Model			
Constant	-0.541	0.636	
Gender	0.013	0.137	0.0112
Age	0.075	0.019	0.0517
MEEQ (Sedation)	-0.028	0.005	-0.7254
Impulsivity (CFC)	0.236	0.08	0.3288
MEEQ (Negative)	-0.019	0.005	-0.588
Anxiety Sensitivity (Physical)	-0.044	0.015	-0.3788
Aggression (Physical)	0.018	0.008	0.2688

Note. $R^2 = .632$. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

3.4 Discussion

3.4.1 Implicit cognitions and cannabis outcomes

The first aim of this study was to investigate the relationship between implicit cognitions and their relationship with cannabis use outcomes. Positive (both aspects of arousal and sedation) expectancies of cannabis use were hypothesised to be associated with higher reported levels of cannabis use outcomes, while negative expectancies were hypothesised to be associated with lower levels. Results indicated, however, that the association between the composite cannabis score and expectancies was only evident for explicit (negative and sedation subscales), and not implicit measures.

There are several possible explanations for why implicit cannabis expectancies were not found to be associated with the composite cannabis use outcomes measure. First, implicit cannabis expectancies may not be significantly different within frequent (weekly) users of cannabis. In other research looking at implicit cannabis expectancies, differences between users and non-users of cannabis implicit cognitions were indicated by comparing the two groups (Field et al., 2004; Field et al., 2006). The results highlighted the differences in implicit cognitions between users and non-users of cannabis suggesting that non-users had a negative attitude to cues of cannabis that was not present in users of cannabis. This difference is likely because of the cultural perception and societal

representations of cannabis, as well as the drugs legality; non-users of cannabis are likely to have negative associations of cannabis from education, both culturally and formally through schools, that it is an unhealthy, illegal, and dangerous drug (Swanson, Swanson & Greenwald, 2001; Field et al., 2004). In other studies looking at implicit cannabis associations among heavy cannabis users and controls, significant differences were found in implicit negative cannabis associations (Dekker et al., 2010; Beraha et al., 2013). In the present study, there was no relationship between frequency of use of cannabis and negative implicit cannabis expectancies, despite differences in negative expectancies of cannabis use when using explicit measures. These results reveal that among frequent users of cannabis, there were no differences in their response to cannabis cues and how quickly they are able to categorise them as 'negative', while there are differences in explicit cannabis expectancies. Although negative implicit associations with cannabis do not differ among frequent users of cannabis, explicit negative expectancies of cannabis do differ among frequent users of cannabis. This suggests that frequent users, although they do not differ in implicit, unconscious negative associations, differ on their conscious ruminations of negative cannabis expectancies based on their cannabis use outcomes. This could be because a sample of heavier, more problematic cannabis users was needed to identify differences in cannabis experiences among frequent users, or that the implicit association test does not adequately measure implicitness (see, for example: Fiedler, Messner & Bluemke, 2006).

The results of the present study indicate that lower cannabis composite score were associated with lower negative and positive (sedation) explicit expectancies of cannabis. This would suggest that in frequent users of cannabis, those with lower negative or positive (arousal) expectancies are likely to have lower cannabis use outcome scores. These results are similar to other research which has shown greater cannabis-related problems were related to greater explicit negative expectancies (Beraha et al., 2013). Explicit and implicit measures of cannabis expectancies measure user associations with cannabis, and despite measuring the same concept, these measures are based on different dimensions of the construct. Implicit expectancy measures reflect unconscious associations between affective states related to cannabis use (Greenwald et al., 1998), while explicit expectancy measures reflect ruminations of past cannabis behaviour and experiences which lead to a expectations of future use outcomes, or a representation of how cannabis behaves when used (Aarons et al., 2001). The implicit expectancy score measures the speed of categorisation, limiting the degree of self-awareness for ruminations and conscious thought regarding the expectations of use behaviour and focusing specifically on the strength of unconscious associations between affective states associated with cannabis (De Houwer et al., 2009). Conversely, explicit measures of expectancies allow for reflection of a multitude of cannabis

knowledge, including cultural and societal perceptions and personal experiences, resulting in a thought-based evaluation of cannabis use and expected outcomes of use (Jones, Corbin & Fromme, 2001). These results suggest that among weekly users of cannabis, expectations of cannabis that are a result of reflective consideration, opposed to implicit associations, are more indicative of varying cannabis use behaviour. Thus, it would appear that although previous research has identified differences in implicit associations between cannabis users and non-users, this study suggests that among frequent users of cannabis there are no marked differences in the implicit associations of cannabis that differentiates between frequency, intensity and problematic outcomes of use.

In addition to implicit cannabis use expectancies, another element of implicit cognitions measured in the present study was hedonic impulsivity (affect regulation) as measured through the affect misattribution procedure (AMP). This measure was used to estimate the ability to down-regulate impulses, like cannabis cues that were used in previously discussed measures of implicit cannabis expectancies (Field et al., 2004; Ames et al., 2007; Dekker et al., 2010; Beraha et al., 2013). The measure specifically looked at how valenced stimuli influenced the evaluation of neutral stimuli and how this response changes based on the duration of time between the presentation of the valenced stimuli and the neutral stimuli. Previous research investigating the role of eating habits, implicit expectancies and the affect misattribution procedure found a relationship with affect regulation (Hofmann, Friese, & Roefs, 2009). The results indicated that affect regulation mediated the relationship between expectancies and food consumption (Hofmann, Friese, & Roefs, 2009). It was hypothesised, based on these results, that individuals with greater affect regulation, having a greater difficulty down regulating impulses, would be more influenced by implicit associations and as a result be more likely to engage in more risky, intensive cannabis use leading to a greater cannabis composite score.

The results of the study indicated that the measure of hedonic impulsivity (affect regulation) did not influence cannabis consumption among frequent cannabis users. Similar to effect expectancies, an explicit measure of impulsivity, specifically the Consideration of Future Consequences scale, was found to be associated with the composite cannabis score. These two measures, however, measure very different dimensions of impulsivity. While affect regulation looks at the degree to which one is influenced by stimuli (Hoffman, Friese & Roefs, 2009), the Consideration of Future Consequences measures the degree to which one considers the future when making decisions (Strathman et al., 1994). Although it was hypothesized that affect regulation would be highly associated with cannabis use outcomes, there are several reasons why this may not be the case. Epidemiological evidence suggests that most users of cannabis will use will never

graduate to dependent use (Lopez-Quintero et al., 2011). It is possible that in this sample of frequent cannabis users, there was no marked difference among responses to cannabis stimuli and affect regulation. It might be necessary to compare this group to more frequent, heavier cannabis users, or to non-using controls. Furthermore, hedonic impulsivity (affect regulation) may be an apt measure for discerning how users of legal drugs, such as tobacco and alcohol, are influenced by implicit associations. Although it would seem likely that cannabis users would be presented with cannabis stimuli in their lives, it is unlikely they would be exposed to stimuli as frequently as alcohol and tobacco, which are more accessible due to their legality, and consequently may have less of an effect on behaviour.

3.4.2 Implicit cognitions and prevention

In addition to understanding how implicit cognition may provide a better understanding of the factors that influence cannabis use behaviour, this research sought specifically to look at the potential of implicit cognitions measures to be used as a future tool for indicated prevention. This study looked specifically at frequent, young cannabis users and the associations between risk factors associated with use, and a composite cannabis measure reflective of factors most associated with developing dependence, including frequency of use, intensity of use and problems related to use. If greater likelihood of cannabis dependence had an association with implicit measures, it suggests that traditional prevention efforts may be ineffective at preventing the escalation of use by not addressing unconscious cognitions related to behavioural outcomes. Thus, implicit cognitions would be a potentially strong tool for identifying individuals at risk for developing dependence and an opportunity to develop an innovative way for designing interventions. These results, however, suggest that in this sample there was not an association between implicit associations of cannabis, or hedonic impulsivity, and related cannabis consumption. Previous research has suggested that there are differences among users and non-users of cannabis and negative implicit associations of cannabis, yet there does not appear to be differences among users of cannabis that reflect the degree of their use related behaviour. It is likely that lesser negative associations experienced by users of cannabis, but are present to a greater degree in non-users of cannabis, are based personal experiences with cannabis and that many frequent users of cannabis continue to use because they have more positive expectancies with use. Based on the results in this study, it is unlikely that implicit cognition tests of cannabis expectancies would be a useful tool for other types of interventions, particularly universal prevention; the implicit association with cannabis in a population of cannabis users is likely to be an appropriate target for preventing the initiation of use. Emerging research on bias training and modification has shown promise, with one web-based study

showing effectiveness in reducing drinking behaviour (Schoenmakers et al., 2010; Boffo et al., 2015; Wiers et al., 2015a; Wiers et al., 2015b). Further research around implicit cannabis associations and cannabis use in young people is needed to assess whether bias modification training is a suitable prevention strategy for cannabis use.

3.4.3 Relationship between cannabis and risk factors

3.4.4 Age

The results of the analysis showed that age was associated with related cannabis consumption, with older participants reporting higher scores on the cannabis composite score. Recent epidemiological data from the UK details that as age increases reporting last year use of cannabis decreases (Home Office, 2015). However, in this sample, an inverse relationship exists. The current sample consists largely of students and it is likely that although they are all frequent users (weekly) of cannabis, the ways in which they use may be different and effect the outcomes of use (Shrier et al., 2013). It may be that although ‘frequent users’ were classed similarly, there are in fact, quite different subsets of users within this population (Miller and Plant, 2002; Hammersley & Leon, 2006). It may be that some frequent users of cannabis in the sample are recreational/experimental, polydrug users who are seeking drug use experiences, not specifically seeking out cannabis use (Schelle et al., 2015). Thus, it may be that older cannabis users in this sample may be more interested specifically in cannabis use and have more intensive use behaviours than younger, frequent users. Further research investigating the types of cannabis user profiles in young people and how use develops as they age is necessary.

3.4.5 Cannabis effect expectancies (Negative)

Self-reported cannabis effect expectancies (negative) had a negative association with cannabis composite score; lower negative effect expectancies of cannabis were associated with a lower cannabis consumption score. This indicated that those participants who expect negative outcomes from their use of cannabis were more likely to have lower cannabis consumption scores, which is similar to other research (Buckner, 2013). Other studies, however, have shown that higher levels of negative expectancies are related to intensity of cannabis use (Hayaki et al., 2010; Connor et al., 2011). As cannabis consumption is an amalgamation of measures of frequency, intensity and related-problems, this suggests that in this study having negative expectancies is associated less frequent, less intensive use sessions and less problematic use outcomes. Further research, however, is needed to understand drug user profiles and behaviour, specifically why users continue to use, and how use experiences influence expectancies.

3.4.6 Cannabis effect expectancies (Positive sedation)

Higher scores of effect expectancies (positive sedation) were associated with lower cannabis consumption scores, indicating that lesser expectancies of sedative experiences with cannabis were associated with lower composite scores of cannabis consumption. In frequent cannabis users, expectancies of relaxation are associated with less frequent intensive, problematic use. Previous research has identified that positive effect expectancies are related to more frequent use, but not related to cannabis dependence (Connor et al., 2011). Furthermore, research on cannabis expectancies has found that low levels of positive expectancies in addition to high levels of negative expectancies were related to abstinence (Galen & Henderson, 1999). Effect expectancies (positive sedation) refer to cannabis making one feel comforted, relaxed, or calm. This suggests that users in this sample who expect experiences with cannabis that were positively calming and comforting, were less likely to have greater cannabis consumption scores. This finding suggests that expectancies of relaxing cannabis experiences, potentially based on previous experience, may result in less intensive, problematic, and frequent use. This suggests that research focusing on the role of cannabis use expectancies, intentions and outcomes may provide a better understanding of how use behaviour in frequent cannabis users differs. Research has demonstrated that cannabis effect expectancies are related to other factors, like impulsivity and anxiety, and cannabis use behaviour (Vangness, Bry, & LaBouvie, 2005; Buckner & Schmidt, 2008; Buckner & Schmidt, 2009). Furthermore, this suggests that cannabis use outcomes may influence future use outcomes and behaviours; cannabis users with relaxing use experiences may use differently than cannabis users with arousal, or negative experiences. This highlights the importance of identifying cannabis user profiles and the ways in which they use cannabis, the degree of variability between drug use intentions and outcomes, and how to specifically target user profiles that have the greatest propensity for transitioning to problematic, dependent use and what factors protect users from these outcomes.

3.4.7 Impulsivity (Consideration of Future Consequences)

Results indicated that lower scores of impulsivity (greater Consideration of Future Consequences) were associated with higher scores on the cannabis composite measure. Although this may initially seem like a counterintuitive association, the Consideration of Future Consequences measure of impulsivity looks specifically at how one considers the future when making decisions (Stratham et al., 1994). One study looking at delay discounting and cannabis found no differences among impulsivity (Consideration of Future Consequences) and cannabis dependent, formerly cannabis dependent, and control groups (Johnson et al., 2010). Cannabis, however, is popularly believed to

have fewer negative health outcomes than tobacco, alcohol, and many other drugs, and this may lead to a dependent-cannabis use population that is high in delay discounting, dissimilar to other drug-using populations (Johnson et al., 2010). In the present study, greater Consideration of Future Consequences was associated with a greater cannabis composite score, as in a more frequent, intensive and problematic use. This suggests that in the current sample, greater Consideration of Future Consequences may be more indicative of frequent, intensive and problematic cannabis use outcomes. This suggests that among frequent cannabis users, more research is needed to understand the different types of drug users and the factors associated with different use pathways and outcomes, and how knowledge about health outcomes associated with cannabis may affect the perceived risks associated with use.

3.4.8 Aggression (Physical)

Aggression, specifically physical manifestations of aggression, was associated with higher levels of composite cannabis scores; thus, among frequent users of cannabis, higher self-reported scores of physical aggression were associated with higher cannabis consumption scores, reflecting the frequency, intensity and related problems of cannabis use. In chronic cannabis users, withdrawal from use has been associated with more displays of aggressive behaviour (Kouri et al., 1999). There are many possible pathways to explain the relationship between physical aggression and cannabis composite scores. For example, cannabis use is associated with the ability to produce a calming, relaxing effect on users (Hall & Solowij, 1998), which may be used as a means of self-medication for alleviating pre-existing feelings of aggression (Arendt et al., 2007). Additionally, physically aggressive behaviour, especially if it results in an altercation of a physical nature, is representative of an impulsive, deviant behaviour, and the use of cannabis may be associated with general deviant behaviour (Herrero, Estévez, and Musitu, 2006). These pathways are not mutually exclusive and it is likely that some users may use cannabis to curb feelings of aggression, while the relationship between physically aggressive behaviour and cannabis use outcomes may be the association between deviant behaviour. Further research is needed to investigate profiles of cannabis users, and which individuals may be self-medicating and which individual's use may be reflective of general deviance, and how to design interventions to prevent these groups from transitioning to problematic, dependent use.

3.4.9 Anxiety (Physical)

Results of the present study indicate that physical anxiety, when physical changes in the body (tightening of the chest, an upset stomach) manifest into anxious ruminations, was associated with

lower cannabis consumption scores (Taylor et al., 2007). The use of cannabis generally causes physical, bodily responses and as a result it would seem likely that a cannabis user that finds physical, bodily changes to be anxiety-inducing would be less likely to participate in heavier, more intensive use behaviour. It is important, however, to note that the present sample was compromised of frequent cannabis users. Thus, it would inform further research investigating the degree to which physical anxiety would prevent use of cannabis, and the degree to which it influences the decision-making process for cannabis users. Evidence from one earlier study found a relationship between anxiety sensitivity and coping motives for cannabis use (Bonn-Miller, Zvolensky, Bernstein, 2007). Although the majority of research linking anxiety and cannabis focuses on aspects of social anxiety (Buckner et al., 2006; Buckner & Schmidt, 2008; Buckner & Schmidt, 2009), physical anxiety and sensitivity to bodily responses, may be a factor that deters young people from frequent, intensive and problematic use, and should be further investigated to understand how this relationship mitigates use among young people.

3.4.10 Conclusions

This study provided evidence that suggests implicit cognitions do not add to current models of use behaviour for frequent cannabis users in a sample of young people. Although implicit associations and cognitions may influence behaviour, it is unlikely that they do so to a degree that makes them suitable for targeting in indicated prevention efforts. This research, however, does highlight that among frequent users of cannabis, previously determined risk factors of mental health factors/psychopathology, personality factors and explicit cannabis expectancies are associated with more frequent and problematic use outcomes. These results highlight the need for further research investigating types of drug user profiles. The results of this study demonstrate that specific risk factors are associated with more frequent, intensive and problematic cannabis use behaviours. Furthermore, it is imperative to develop a better understanding of how groups of cannabis users behave, and the characteristics of these groups, so that prevention efforts can be designed to target groups of users most likely to graduate from recreational/experimental use to problematic/dependent use.

3.4.11 Limitations

The experimental design of this study limits the generalisability of data and the results derived. Due to the small and predominately student population sample, these results should be considered with caution. Additionally, tasks used to evaluate implicit associations towards drugs are a part of an evolving area of research, and future developed implicit measure tasks and may serve as a more

appropriate and valid instrument. Despite these limitations, these results are the first of their kind to look at multiple risk factors associated with cannabis use, including implicit cognitions, and the factors which are most associated with problematic and frequent use in young people. Further research examining the relationship between factors associated with problematic use in young, frequent users of cannabis is needed to understand which users are most susceptible for developing problematic use outcomes, and why other users maintain unproblematic use, or discontinue use.

Chapter 4

Cannabis use behaviour and problems among young people in support services

4.1 Introduction

4.1.1 *Cannabis use and dependence*

Cannabis is the most widely used illicit drug globally (United Nations Office on Drugs and Crime, 2015), however the majority of users will never develop dependency, and of those who try cannabis some 9% will develop dependence (Budney et al., 2007; Lopez-Quintero et al., 2010). Frequent cannabis is often associated with an increased risk of developing dependency (Coffey et al., 2003, Grant and Pickering, 1998; Noack, Höfler, & Lueken, 2011), however even in daily users, only an estimated 20-50% develop dependence (Coffey et al., 2002; EMCDDA, 2009). The underlying mechanisms which explain why certain individuals develop dependency and others do not are not yet understood. More knowledge regarding the development of dependency in high frequency users, including the predictors associated with problematic use development, is needed to inform prevention and treatment for young people most at-risk for developing cannabis dependence and associated problems.

In assessing cannabis use in young people, it is important to define the distinction between non-dependent and dependent users. Dependent users will experience significant problems from their use that reduce their ability to control their use, while non-dependent frequent users will not experience these drug-related problems (Budney & Moore, 2002, Looby & Earleywine, 2007; Temple, Brown & Hine, 2011). Although cannabis is known to be related to many adverse effects (Hall & Solowij, 1998; Hall & Degenhardt, 2009), addressing this distinction is important because some evidence suggests that cannabis use, to a certain extent, is relatively harmless for much of the population (Nutt et al., 2010; Van Amsterdam et al., 2010). Additionally, when comparing dependent and non-dependent users, evidence shows that the risk of comorbid disorders is much lower in non-dependent frequent cannabis users, highlighting the difference between dependent and non-dependent users (Swift, Hall, & Teesson, 2001; van der Pol et al., 2013b).

4.1.2 Cannabis dependence and services for young people in the United Kingdom

Despite evidence that cannabis use is declining (Home Office, 2015), the increasing number of young people entering treatment for cannabis is cause for concern (Public Health England, 2015). There are a multitude of potential reasons for increased incidence of young people entering treatment for cannabis as well as the poor treatment outcomes. Recent evidence suggests that there is an association between cannabis potency and severity of dependence (Freeman & Winstock, 2015). Thus, while less people may be using cannabis, the proposed increased levels of THC in street cannabis may be responsible for the increased number of people presenting at treatment for problematic, and/or dependent use (Hamilton et al., 2014). In addition to developing dependent use, high-potency cannabis is associated with onset of psychosis (Di Forti et al., 2013; Di Forti et al., 2014; Di Fort et al., 2015). Although the link between high-potency cannabis and psychosis has been debated, with the self-medication hypothesis and residual confounding presented as alternative explanations (Macleod et al., 2004; Gage, Zammit & Hickman, 2013; Hall & Degenhardt, 2015).

Until the early 2000s, the majority of cannabis available in the UK market was cannabis resin, which accounted to roughly 70% of the 'street' market, with traditional imported herbal cannabis, followed by sinsemilla (known generically as 'skunk') providing the remainder (Hardwick & King, 2008). Both cannabis resin and herbal cannabis have 2–4% Δ 9-THC, however resin has a similar proportion of cannabidiol (CBD) (which counters the psychotic effects of Δ 9-THC) to Δ 9-THC, while, in a study of cannabis seized in the UK, herbal cannabis had less than 0.1% CBD (Hardwick & King, 2008; Potter, Clark & Brown, 2008). Evidence, however, shows that sinsemilla has increasingly taken over the UK market, representing high potency cannabis, with a THC concentration that has been consistently rising. In a report of seizures of cannabis in England in 2008 by police showed, analysis showed that sinsemilla had a market share of more than 70%, and concentration of Δ 9-THC was 12–18% with little cannabidiol present (Hardwick & King, 2008; Potter, Clark & Brown, 2008). There is, however, no causal evidence linking high-potency cannabis and psychosis, and there are arguments that suggest that those experiencing psychosis combat symptoms with cannabis, and that increased rates of psychosis and cannabis might be more reflective of other social factors, and increased access to mental health services (Macleod & Hickman, 2010). In addition to increased treatment due to availability of high potency cannabis, it is likely that the increase in young people entering treatment for cannabis is due to improved access to treatment services, which may mean that more people needing treatment are accessing services than before (Hamilton et al., 2014), and that people with low levels of use are entering treatment to improve social function without necessarily having to achieve abstinence, resulting in poorer treatment outcomes (Monaghan et al., 2015). Also, the

effects of funding changes in services for young people with alcohol and drug issues may also lead people who were previously utilising low threshold services (which are no longer as available), now using more serious, treatment services (Public Health England, 2013; Hamilton et al., 2014).

4.1.3 Instrumentalized drug use

Evidence detailing cannabis use behaviour and patterns, among both dependent and non-dependent users, provides a better understanding of underlying mechanisms leading to the development of problematic, dependent use. In addition to the frequency of use, a multitude of other factors influence use outcomes, including: mode of use (water bong, joint, vaporized, pipe), type of cannabis (skunk, resin, herbal, oil, edibles), and factors like when, where, with whom, and cannabis use expectancies (Hughes et al., 2014; Buckner, 2013, van der Pol et al., 2014). In an environment in which most users of cannabis, even frequent, daily users of cannabis, never develop problematic or dependent outcomes (Budney et al., 2007; Lopez-Quintero et al., 2010), understanding how non-addictive use behaviours differ from problematic use behaviour may provide a useful pathway in understanding the underlying mechanisms for problematic use. The drug as instruments framework postulates that drugs can be instrumentalized, a behavioural process in which psychoactive drugs are consumed to change the present mental state into a previous mental state allowing 'better performance of other, previously established behaviours and better goal achievement' (Müller & Schumann, 2011). The instances, called proximal mechanisms, in which psychoactive drugs are used to reach instrumentalized goals include: improved social interaction, facilitated sexual behaviour, improved cognitive performance and counteracting fatigue, facilitated recovery from and coping with psychological stress, self-medication for mental problems, sensory curiosity, euphoria/hedonia, and improved physical appearance and attractiveness (Müller & Schumann, 2011). This framework is similar to theory and evidence linking motivations for cannabis use and cannabis use outcomes (Bonn-Miller & Zvolensky, 2009; Bonn-Miller, Zvolensky & Bernstein, 2007; Bonn-Miller et al., 2008; Buckner et al., 2007; Bujarski, Norberg & Copeland, 2012; Charbol et al., 2005; Fox et al., 2011; Johnson et al., 2010; Mitchell et al., 2007; Simons, Correia & Carey, 2000; Zvolensky et al., 2007). Furthermore, among frequent cannabis users, coping motivations for cannabis use are associated with dependence (Benschop et al., 2015). The drugs as instruments framework suggests that non-addictive psychoactive drug users are knowledgeable and purposefully instrumentalize their use to achieve intended outcomes (Müller & Schumann, 2011). Conversely, drug addiction or problematic drug outcomes, are the result of the escalation of drug use to the point in which drug use becomes compulsive and controlled, goal-directed instrumentalization is no longer the outcome (Müller & Schumann, 2011).

Taking into account the drugs as instrument framework, it is important to acknowledge cannabis user knowledge, patterns and decision making and how they inform outcomes of use. There is limited qualitative work exploring cannabis use motivations and expectancies (Hammersley et al., 2001; Miller & Plant, 2002; Hammersley & Leon, 2006; Osborne & Fogel, 2008; Järvinen & Ravn, 2011; Liebgrets et al., 2015). In addition to focusing on factors that contribute to the development of problematic use behaviours and patterns, it is important to understand the subjective experiences of the majority of cannabis users who never develop problems or dependency. A more in-depth understanding of motivations for use and the positive experiences associated with cannabis use may help provide suitable alternatives for those wishing to limit or cease use, and provide prevention workers with a better understanding of who might be most at-risk for developing problematic cannabis use patterns.

4.1.4 Cannabis normalization in the United Kingdom

The concept of 'drug normalization' has been proposed to describe the increase in prevalence of drug use by young people in the UK beginning in the 1990s (Measham, Newcombe & Parker, 1994; Parker, Aldridge & Measham, 1998; Aldridge, Parker & Measham, 1999; Parker, Aldridge, Egginton, 2001; Parker, Williams & Aldridge, 2002; Parker & Egginton, 2002; Parker & Williams, 2003; Parker, 2005; Aldridge, Measham & Williams, 2013). Although recent prevalence data suggests drug use by young people has decreased, it remains high compared to other European and international countries (for example, see Hibbell et al., 2011). Normalization is not a rigid theoretical paradigm, but a malleable framework that evaluates attitudes and behaviours associated with illicit drug use and their development over time (Parker, 2005). This framework operates through dual pathways and may explain how cultural shifts provide an environment for increased use (illicit drugs), and how increased stigmatisation and public health campaigns can alter the perceived normality of other social behaviours (tobacco) (Parker, 2005). Critics of normalization argue that normalization fails to acknowledge cannabis subcultures, particularly the importance of opposition and cultural differences in cannabis user subculture (Sandberg, 2012). Furthermore, it has been argued that normalization oversimplifies young people's cannabis choices and their meaning (Shiner & Newburn, 1997).

It should be noted that the theory of drug normalization is based on non-dependent drug use. Although the sample investigated in this study would not be considered non-dependent users, consideration of this theory is appropriate and relevant when considering the evolution of their use behaviour, particularly when combined with perspectives of over-instrumentalisation. This work seeks to understand the development of cannabis use, and how it might become problematic within

an environment of normalization. Consideration of an environment in which recreational use is normalized provides a lens for which to view the development of problematic use, and whether use is inherently problematic, or transitions and dips in and out of recreational, non-problematic use behaviour.

The concept of drug normalization has been operationalised into six dimensions in order to better understand the evolution of attitudes and behaviours towards 'recreational' drug use (Parker, 2005). The proposed dimensions of drug normalization that describe this phenomenon are: availability and accessibility of illicit drugs; increased prevalence of drug experimentation; increasingly tolerant attitudes of illicit drug by both users and non-users of drugs; social accommodation of 'sensible' recreational drug use by abstainers, the 'cultural accommodation' of drug cultures in the media, and more liberal policy shifts (Parker, 2005; Aldridge, Measham & Parker, 2011). Although this framework is used to look at drug use generally and the evolution of illicit drug use perception by the public, the normalization process has advanced to the degree to which recreational cannabis use is regarded by some as a normalized behaviour (Parker et al., 2002). A consideration of the dimensions of normalization allows for cannabis use to be viewed in the social and cultural environment, and how use is negotiated, expressed and interpreted under these conditions. This consideration allows for openness in interpreting the development of cannabis use behaviour in young people, how social and cultural environments for problematic users may be experienced differently.

Cannabis use normalization is based on the idea that stigmatisation or deviance associated with recreational use no longer exists or is low. In some countries, however, such as Sweden, low prevalence rates, public attitudes, and strong prohibitionist drug policies means that illegal drug use is not normalized (Snitzman, 2008). The most well-known and influential work regarding cannabis use motivation is that of Becker, and his study of recreational cannabis users, the majority of which were jazz musicians (1953; 1955). This work highlighted two key points regarding deviant behaviours: 1) people who deviate from the norms of conventional society and culture are not anomalies, but average people who derive pleasure from activity considered 'illicit by moral entrepreneurs'; 2) the use of cannabis, or other drugs, does not necessarily lead to problematic, dependent use, but can be, and often is a controlled activity (Järvinen & Ravn, 2014; Osborne & Fogel, 2008). This work has contributed to the development of drug research describing cannabis use as either 'calculated hedonism' (Featherstone, 1991) or 'controlled loss of control' (Measham, 2004), in which drug users are rational risk managers, with use that is a compatible and functional aspect of their lives (Askew, 2016; Järvinen & Ravn, 2014; Hutton, 2006; Malbon, 1999; Measham,

Aldridge, & Parker, 2001; Measham, Newcombe, & Parker, 1994; Parker, Aldridge, & Measham, 1998; Sanders, 2005; Williams & Parker, 2001). This suggests that dual process models, which include implicit bias and associations, a reliable predictor of substance use, complicate the normalization theory and the concept of rational decision making (Rooke, Hine & Thornsteinsson, 2008). The consensus from this research is that recreational drug use is largely a normalized behaviour (Measham et al., 1994; Parker et al., 1998), with 'sensible', unproblematic use considered to be a behaviour that is socially and culturally facilitated (Järvinen & Ravn, 2014). Although there are critics of the 'normalization' hypothesis (Aldridge, Measham, & Williams, 2011; Measham & Shiner, 2009; Shildrick, 2008), the research focuses primarily on recreational, controlled cannabis use with little work focusing on why and how individuals transition into problematic, dependent use patterns (Järvinen & Raven, 2014).

There has been limited work exploring cannabis use problems and young people in the UK (Hammersley *et al.* 2001; Miller & Plant 2002; Hammersley & Leon, 2006; Hathaway *et al.* 2008). Hammersley et al. (2001) outlined self-identity and cannabis use in young people, particularly highlighting the importance of understanding how this influence use behaviour and outcomes. . An investigation of young, heavy cannabis highlighted that among frequent users, there were different motivations and contexts within which use occurred (Miller and Plant, 2002). Furthermore, despite evidence suggesting that cannabis users were not a homogenous group, it was also suggested that many cannabis users did not use other illicit drugs, emphasising the importance of investigating cannabis users as a specific group, and not as general polydrug users. A reconsideration of the construct of cannabis abuse and dependence was subsequently proposed, demonstrating evidence that chronic, frequent cannabis use was not, necessarily problematic in itself and that an emphasis on treatment and prevention of use associated with health and psychosocial harms was important (Hathaway et al., 2008).

Furthermore, exploratory qualitative research has investigated the motivations and the social context for use, and supports the view that the majority of cannabis users' exhibit controlled use. For example, in interviews with middle-class, Canadian adult cannabis users there was little evidence to support the idea that there was a 'typical' cannabis user, and that different users tend to have different experiences of their cannabis use (Osbourne & Fogel, 2008). This research supported previous findings that users often make rational, not compulsive, decisions about their use, which is often used to enhance leisure time/activities (Osbourne & Fogel, 2008), and is in contrast with research that implicates sensation seeking and hedonic impulsivity (Donohew et al., 2000; Dougherty et al., 2012). Furthermore, this research supports the drug normalization thesis in that

cannabis use was integrated into the day-to-day life of users and did not lead to negative consequences (Osbourne & Fogel, 2008). This research, however, is limited to the use of cannabis by 'middle-class' individuals, and does not extend to the wider population; in particular, vulnerable population groups, such as racial/ethnic/sexual minorities, individuals with low socioeconomic status, and young people with little social capital, who may be more susceptible to or are already experiencing problems. Evidence from marginalised drug users in Dublin found that normalisation was differentially experienced, despite similar cost-benefit consumption choices, due to social exclusion and inclusion in the informal drugs economy (O'Gorman, 2016). More research on the experience of marginalised groups and their experience of normalisation is needed.

An important aspect in the assessment of cannabis use, when considering normalization, is how use is influenced by perceived risks and harms. Cannabis normalization theory suggests societal and cultural perceptions of risk mediate the relationship between adult cannabis use behaviour patterns. In a study of Canadian adult cannabis users and the relationship between normalization, cannabis use, and perceptions of risk and harm was explored (Duff & Erickson, 2014), specifically addressing attitudes towards health risks associated with cannabis and the risk profile of cannabis in Canada and its evolution (Duff & Erickson, 2014). The risk profile of cannabis in Canada was viewed by participants as an environment in which conservative views towards drug use were less common due to increased prevalence and emerging public awareness of evidence of therapeutic benefits of cannabis use (Duff & Erickson, 2014). Furthermore, participants mostly agreed that the health harms associated with cannabis were 'modest and manageable and less significant than those related to alcohol and tobacco use' (Duff & Erickson, 2014). Despite this, cannabis was not considered to be without potential harms, with concerns regarding use and its relationship with health risks (predominately cancer and respiratory problems), emotional problems (mental health issues such as anxiety and depression, bad trips, and memory issues), parenting/pregnancy concerns, and the risk of developing dependence, although most felt that these potential harms could be managed (Duff & Erickson, 2014). Participants expressed how their 'state of mind' and social norms regarding appropriate use (particularly around timing, frequency and quantity of use) mediated their cannabis use decision making and helped them avert potential harms (Duff & Erickson, 2014). Of particular interest was the expression of participants that harms experienced by themselves or by their peer group to be more integral to shaping attitudes towards use than knowledge of general health risks (Duff & Erickson, 2014). The authors note that the diminished risk profile of cannabis in Canada in addition to the lack of perceived health or social consequences from controlled, moderate use has compounded into the culture of normalization in which cannabis has few perceived risk (Duff & Erickson, 2014). This work highlights the need for consideration of how

problematic outcomes of use are perceived and responsibilities and consequences of use are negotiated by problematic cannabis users.

It is important to consider how risk perception, and the influence of cultural and societal norms and perceptions, influence and contribute to cannabis use behavioural patterns. In both the UK and internationally, cannabis use is the most frequently used illicit drug by young people (United Nations Office of Drugs and Crime, 2015). Despite prevalence rates suggesting a degree of 'normalization', the ways in which risks are perceived by individuals and how they are presented by societal and cultural bodies' influence the degree to which use is perceived. A study of Canadian newspaper reports on cannabis found 'privileged normalization', in which use was acceptable for some, and found deviant by those without power (Haines-Saah et al., 2012). The risk profile in the UK is likely to be much different among specific population groups, and different than countries with more liberal laws, like Canada, United States (some states) and the Netherlands. The lack of consensus regarding cannabis drug policy, particularly in the UK, make cannabis prevention difficult (Monaghan, 2014; Shiner, 2015). Some countries have either implemented, or are in the process of adopting new policies towards cannabis, with many also implementing 'medicalised' availability (Cerdá et al., 2012; Spapens, Müller, and van de Bunt, 2014; Fisher, Kuganesan, & Room, 2015; Snitzman & Zolotov, 2015). Varied international cannabis laws and varied print media depicting cannabis produce a very confusing public perception of cannabis (Coomber, Morris & Dunn, 2000). In the United Kingdom the severity of penalty for cannabis use and possession has shifted, with its classification raised from a Class C to a Class B drug in 2009 after being temporarily downgraded (Monaghan, 2014; Shiner, 2015). Although factors like high levels prevalence, availability for an illicit drug, accommodating attitudes from non-cannabis using peers (although nuances of this have been demonstrated) support the normalization thesis, the illegal status of cannabis and its associated stigma complicates it (Chatwin & Potter, 2014; United Nations Office of Drugs and Crime, 2015; Hathaway et al., 2015). In a qualitative study investigating the stigma and normalization in cannabis users in Canada, results emphasised that cannabis users do not fit the myths and stereotypes perpetuated in the media, and although the illegal status of cannabis did not affect their use behaviour, it altered their perception of their own use (Hathaway et al., 2011). In the UK, where cannabis use has returned to greater severity of potential criminal justice harm after temporarily being suspended (Monaghan, 2014; Shiner, 2015), the stigma associated with use and normalization must be investigated. Specifically, how vulnerable groups who are more susceptible to stigma, are affected by perceptions of cannabis users in an environment of 'normalization'.

Evidence suggests that cannabis users make calculated decisions based on risk (Parker, Aldridge, Measham, 1998; Duff & Erickson, 2014), although these decisions are affected by automatic behaviour and unconscious biases (Rooke, Hine, & Thorsteinsson, 2008). It is important that we understand how risk is assessed and interpreted in response to use behaviour. Furthermore, it is important to contextualise this both from users' own experience and that of their peers, and from media and cultural influences, and how it is disseminated. Specifically, in an environment of 'normalization', how young people who use cannabis, initiate use, and then (sometimes) transition into problematic, or dependent use, and how they negotiate this use in their lives, and how their perceptions and others' perceptions of their use influence their use behaviour and outcomes. Furthermore, how they envisage their own use and its effect on their life, and the potential ways in which use could cease or be adapted.

Under the tenets of the normalization thesis cannabis use is considered a rational choice, yet only as it applies to recreational use (Aldridge et al., 2011). In contrast, problematic and dependent use is considered non-recreational as it interferes with daily functioning (cf. Kronbæk & Frank, 2013). As a result, whilst recreational use by frequent, non-dependent users would be bound by a considered, cost-benefit analysis, different considerations would be factored by frequent dependent, non-recreational users. However, cannabis dependence is not a homogeneous condition, and understanding the continuum of experience for dependent users is critical (McBride, Teesson, Slade, & Baillie, 2010). Thus, it is important to examine whether and how frequent dependent users differ in leisure from frequent, non-dependent users and trajectories. Furthermore, understanding the relationship between leisure and cannabis dependence trajectories may help target prevention and treatment; specifically by focusing on frequent users at high risk of dependence, as most frequent users of cannabis have use patterns that are bound by their leisure time (Liebrechts et al., 2015). Additionally, the concept of 'ageing out' of drug use must be considered, as research on young amphetamine-stimulant users in Australia found that although health, wellbeing and responsibilities contributed to a change in use pattern, including quitting and less frequent use, negotiation of non-stigmatised and 'normal' identities influenced changes more strongly (Green, 2016).

Cannabis use trajectories and the role of delinquency and leisure were explored in an investigation of young cannabis users in the Netherlands (Liebrechts et al., 2015). The Netherlands is a particularly useful place to explore cannabis use within the context of normalization because of the legal framework for cannabis, in which use is tolerated (Spapens, Müller, & van de Bunt, 2014); these results, however, have limitations in their generalisability because cannabis use is not legal or

tolerated in many Western countries, including the UK. Utilising a longitudinal approach, qualitative interviews, with 1.5-year and 3-year follow-up interviews, were conducted. Results supported normalization theory, with evidence suggesting that frequent, non-dependent cannabis users led 'conventional lives' and that cannabis use was mediated by work/study responsibilities and was generally used in leisure time (Liebregts et al., 2015). Furthermore, results indicated that definitions of problematic use and dependency need development to address the more nuanced behaviour, as many participants use trajectory shifted between dependent and non-dependent use, and dependent use was not evidenced by 'homogenous, stable' use (Liebregts et al., 2015). The definition of dependent use in the DSM-V did capture dependency within this study population and suggests that the way in which dependency is operationalised in the DSM-V is oversimplified (Liebregts et al., 2015).

4.1.5 Cannabis normalization discourse

Although global prevalence rates indicate that cannabis is increasingly a 'normal' behaviour, one in which a large minority of the population engages at some point in their life, there are critics of the assertion that this is a normalized behaviour (Blackman, 2004; Ramsay & Partridge, 1999; Shildrick, 2002; Shiner & Newburn, 1997, 1999). In particular, the idea of normalization suggests that the behaviour is without stigma, a point of contention with some researchers (Hathaway, Comeau, & Erickson, 2011; Sandberg, 2012; Hathaway et al., 2015). In a Norwegian population of 100 cannabis users, cannabis discourse was explored, particularly around normalization, subculture, and neutralisation/risk denial and justifications discourses (Sandberg, 2012). This research investigated how users of cannabis negotiated their use in relation to cultural and societal perceptions of use. With normalization discourse emphasising the normalization thesis, and that use is normal, and that those who use are not 'others'. Subculture and neutralisation/risk denial discourses provide different theoretical narratives to cannabis use. Subculture theory posits that special groups exist with particular values and lifestyles, that may deviate from the general, normal population, and that these groups often embrace these differences, while being labelled by others. In relation to discourse, this perspective emphasises the celebration of use, and the benefits of use and the enlightenment of those who use. Neutralisation/risk denial discourse focuses on the denial of harms related to cannabis, and the focus is placed on misinformation as well as the harms related to other substances like alcohol and tobacco. Sandberg argues that normalization as a thesis for researching cannabis use is insufficient, particularly in a Norwegian context (2012). Sandberg argues that both normalization and subculture discourses operate concurrently and relegating research to one style improperly frames conclusions about the role of cannabis in contemporary culture (2012).

Furthermore, the use of neutralisation discourse to justify cannabis use, both in normalization and subculture discourse suggests that cannabis use is stigmatised and users are forced to address and negotiate it (Sandberg, 2012). Normalization discourse around cannabis has particularly emphasised the comparison between cannabis and alcohol use, with comparisons used largely to legitimise cannabis use (Järvinen & Demant, 2011; Sandberg, 2012; Mansson & Ekendahl, 2013). In a content analysis of online discussion of alcohol and cannabis on drug forums in Sweden, important nodes of discourse around danger and discrimination were explored (Mansson and Ekendahl, 2013). This particularly illuminates how policy discriminates use of cannabis, and the perceived dangers around alcohol and cannabis, with constructions of alcohol being harmful and cannabis being harmless prevailing (Mansson & Ekendahl, 2013).

Moreover, research is needed that investigates perceptions of cannabis in the context of normalization and its associations with the initiation of use, current use behaviour, and use development. Particularly when designing prevention programs, it is important to address the relationship between positive cannabis perceptions and how they are associated with cannabis use production and maintenance (Hammersley & Leon, 2006). In a study of Norwegian young adults (aged 16-21 years-old), positive and negative perceptions of cannabis were related to cannabis use, perceived normative use, and acceptance of use (Holm et al., 2013). The positive perceptions of cannabis were as useful as perceptions of risk associated with use and the perception of the prevalence of their peers use in cannabis use outcomes (Holm et al., 2013). Prevention work that focuses on risk perception and the risks associated with cannabis use may not appropriately address the factors young people consider and negotiate when making decisions about their cannabis use.

This evidence highlights the nuances of normalization, and how cultural environments and perceptions contribute to the consideration of the framework across different cultures. Although normalization focuses on recreational, non-problematic use, the use of this framework is useful in understanding different types of use behaviour. Particularly in the UK, the country within which normalization theory was developed, acknowledgment of this environment is useful in looking at problematic use outcomes, and how they develop in an environment in which recreational use is largely normalized. Of particular interest is how use develops and use is interpreted and perceived by young people who are considered problematic cannabis users.

4.1.6 Transition to problematic use behaviour

There has been some work that has explored the transition from recreational to regular use of illegal drugs (Järvinen & Ravn, 2011). This has noted the distinct differences that differentiate recreational

and regular use, including: networks (open networks vs. closed networks), partying (all night partying vs. whole weekend), intoxication (as a means to another intended goal vs as a goal in itself), access to drugs (buying only vs. buying and selling), effects of drugs (fixed vs. diverse), and self-presentation (in control vs. alternations between control and loss of control) (Järvinen & Ravn, 2011). In this sense, regular users are not described in terms of frequency of use, but the factors that contextualise use behaviour, thus a recreational user may use frequently. The interviews with young, polydrug users described the transition from recreational to regular use as subtle, gradual transition, which they were not conscious of as it was occurring (Järvinen & Ravn, 2011). Further research with young cannabis users in drug treatment in Denmark used the concept of drug narratives to identify underlying causal mechanisms for the transition from recreational to regular cannabis use (Järvinen & Ravn, 2015). Four causal narratives were identified childhood experiences/trauma, self-medication, peer influence; alternative life approach/perspective (Järvinen & Ravn, 2015). Additional dimensions were considered to further explore the nuances of these causal narratives, individual vs. societal explanations for use and agency vs. fatalism in consideration of future use (Järvinen & Ravn, 2015). This construction of causal use narratives provides evidence of how users conceptualise their current and future use, including the factors which made them vulnerable to problematic use and the underlying mechanisms which influence their future use behaviour (Järvinen & Ravn, 2015).

4.1.7 Purpose and aims of this study

In the previous studies of this PhD, the aim has largely been to formulate and understand cannabis use behaviour, with an emphasis on defining, exploring problematic cannabis use and the factors that are associated with problematic cannabis use outcomes. The first two studies looked specifically at general, student populations of cannabis users. This study focused on young people who were in touch with drug services. Using open-ended interviews, the objective of this study was to gain a better understand of young people who are considered to have developed problematic cannabis use outcomes. Specifically, the aim of this study was to explore several areas related to cannabis use, including:

- 1) How does cannabis use initiation transition from recreational cannabis use to problematic or dependent use behaviour? This includes the exploration of logistical nature of use, including the acquisition of cannabis, the environment in which use occurs, and the patterns of use and how they influence and change cannabis use patterns over time.

2) How do cannabis expectancies, intentions, beliefs and perceptions influence behaviour and use outcomes? Cannabis use, and in particular, how it's meaning and importance is reflected in the users experience and outcome of use, and how this is managed in their life.

3) What are the perceptions of current use behaviours and the motivations for use behaviour modification or cessation? Based on the drug treatment services the participants were in touch with, there was an assumption that there is a desire for modification of current cannabis use behaviour in most participants. An exploration of how and if participants want cannabis use to be modified, the motivations for desire to change current use behaviours, the perception and effects of use modification/cessation, and the ramifications of behaviour change will be employed.

The study looked at four specific factors of use: cannabis use history; cannabis use experiences; cannabis behaviour and knowledge; and motivations for cannabis use and cessation/modification of use. The drug instrumentalization framework provided a tool to examine cannabis use experiences, behaviour, knowledge and motivations and how users evaluated their use behaviours, while normalization theory was used to contextualise these behaviours within the UK cannabis environment and how this influences these behaviours.

4.2 Methodology

4.2.1 Qualitative analysis approach

This study was informed by the social constructivist approach, in which knowledge and experience of cannabis is constructed through social interaction (Lincoln & Guba, 2000; Charmaz, 2006; Andrews, 2012). Adapting this approach allows for the consideration of the language and discussion used by social groups, and focuses on the ways in which meaning is created, negotiated, sustained and modified. The emphasis, therefore, was placed on perspectives, both individual and collective, and the recognition of a reality that is both subjective and objective, and the construction of knowledge and meaning is dependent on context. This research, as a result, focused on how research participants' knowledge and experience around cannabis was constructed, and the subsequent individual and shared meanings expressed. This approach allowed for exploration regarding how identity and experience of cannabis was negotiated through participants' cannabis use history, and the evolution of meaning, identity and knowledge.

The transcripts were read several times for familiarity, and grouping of the data was conducted in order to find similarities and differences between accounts in a pre-determined manner. The themes were then related and studied in relation to the theoretical concept of

‘normalization’ and ‘instrumentalization’ and how they could be applied to the concept of young cannabis use. When presenting quotations as examples, an effort has been made to ensure that the quotations used were representative of young people’s views and experiences. Any inconsistencies and contradictions within the data have also been acknowledged.

4.2.2 Theoretical position

This study was informed by the drug normalization thesis and the ‘drugs as instruments’ framework (Müller & Schumann, 2011; Measham, Newcombe & Parker, 1994; Parker, Aldridge & Measham, 1998; Aldridge, Parker & Measham, 1999; Parker, Aldridge, Egginton, 2001; Parker, Williams & Aldridge, 2002; Parker & Egginton, 2002; Parker & Williams, 2003; Parker, 2005; Aldridge, Measham & Williams, 2013). The drug normalization thesis contextualises the environment in which cannabis use exists in the United Kingdom. Despite critics of normalization (Blackman, 2004; Ramsay & Partridge, 1999; Shildrick, 2002; Shiner & Newburn, 1997, 1999; Aldridge, Measham, & Williams, 2011; Measham & Shiner, 2009; Shildrick, 2008), evidence supports the idea that the many cannabis users do so without stigma, and do not encounter significant problems as a result of their use. This theoretical position contextualises the current cannabis environment in the United Kingdom. Furthermore, it allows the researcher to examine use under the assumption that the development of problematic or dependent use outcomes is non-normal. In tandem with this theoretical approach, the drugs as instruments framework infuses and explores agency, and how cannabis intentions, expectancies and knowledge are used to ‘instrumentalize’ non-addictive, psychoactive drugs and how this influences use outcomes.

The focus of this study was predominantly on individuals who exist on the periphery, and how these vulnerable individuals navigate their trajectory of use and negotiate the patterns and outcomes of use in an environment of ‘normalization’. Under this theoretical approach, cannabis use is considered a normalized behaviour, one that is done without prejudice and stigmatisation, and is done so as a rational choice that takes into account risk, and is motivated by specific outcomes, mediated by knowledge and experience, and instrumentalized without problematic outcomes. Furthermore, this theoretical approach allowed use described by the participants to be considered normal, until otherwise described. By adopting this approach, users were able to express their own perception of their cannabis use and the ways in which it may or may not be related to acute and associated problems. Furthermore, this research explored agency among users, the motivations for use, and how, or if, use is overinstrumentalized in this population, and explored the possibility that use in and of itself is not homogenously problematic, and the circumstances in which problematic use arises. This inclusion of the drugs as instruments framework allowed for the

consideration of meaning and purpose of use, and how this is negotiated. This theoretical approach allowed for a more nuanced understanding of cannabis and the variability in use patterns and outcomes and how users may flux in and out non-problematic, normalized use behaviour.

4.2.3 Interview guide

A cannabis interview guide was developed around factors associated with problematic cannabis use outcomes and the framework of 'drug normalization' (see Appendix 1). Four aspects of cannabis use were used: *Cannabis History*; *Cannabis Experiences*; *Cannabis Use Behaviour and Knowledge*; and *Cannabis Motivations and Cessation*, with emphasis on drug instrumentalization throughout. *Cannabis Use History* included questions about the initiation of cannabis use and the evolution of use behaviour from initiation to current or most recent use behaviour. This included factors surrounding the first use session, the environment and people associated with cannabis use and the circumstances in the initial use session. Furthermore, questions were included on the development of use behaviour, its evolution over time, and the factors that contributed to changes in use behaviour. This section was important for the understanding of how use was constructed over time, and how the interpretation of their own use is expressed and negotiated, and how the factors associated with use contribute. *Cannabis Experiences* sought information regarding the types of experiences that result from cannabis use, including both positive and negative feelings and attitudes, and how these have evolved throughout their use history. This was important for understanding the meaning associated with cannabis use. *Cannabis Use Behaviour and Knowledge* sought information regarding the relationships associated with purchasing cannabis and how use was negotiated through friendships and dealers. Furthermore, questions regarding user knowledge of the cannabis they use, how they make decisions about getting and using cannabis, and how their intended outcomes are negotiated through their use behaviours are explored. This allows for the understanding of how use was pragmatically negotiated. Lastly, *Cannabis Motivations and Cessation* questions surrounded their current intention to either reduce or cease using cannabis, with the assumption that many participants will seek to abstain or reduce their use because of their association with the drug support services. Particularly, the reasons for their intention to change their cannabis use, tools and strategies they employed, and expected barriers to changing their use behaviour. This allowed the researcher to understand how they view their current and future use behaviour, and how they intend to negotiate any possible differences. The main points of interest were:

Environment: Emphasis will be placed on the contextualised environment in which use occurs. Specifically, drawing on work by Järvinen and Ravn (2011) exploration of aspects of the use environment including: network, access to cannabis, and patterns of use.

Stigma and perceptions of use: Perceptions of use, both perceived by others and by themselves, will be explored and how these influence use behaviour and the interpretation of one's identity, and construction of current and future use concepts.

Instrumentalization: Motivations for use were key aspects of understanding how problematic use arises. Cannabis use intoxication intended to achieve specific goals was associated with less problematic use than use purely for the purpose of intoxication (Müller & Schumann, 2011). Focus on where the motivations for use within participants were explored, and how specific goals were negotiated and achieved.

Outcomes of use: Although motivations for use were important as were intended outcomes of use, outcomes of use were critical in understanding both the underlying mechanisms for use and how and why problems arise because of use.

4.2.4 Population and recruitment

This study was based on 11 qualitative interviews with cannabis users in contact with drug services in Northwest, England. The interviewees were in touch with either one, or both, of two services: a young people's service for drug support and young homeless people with housing support needs. Interviewees were recruited by staff at the services and were informed of the research project. Interested participants were then designated appointments for interviews to take place. Interviews were conducted in a private office in the drug support service, and a recreation room in the housing support centre.

Interviews took place between April 2011 and June 2015. Initially, four interviews took place in 2011 through local drug support services; however, no more appropriate participants were identified. After initial analysis of the data, additional interviews took place in 2015 and an additional 7 participants were identified to develop emerging themes in more detail. Participants were paid £20 in vouchers, which could be redeemed at several clothing, grocery or electronics shops, for their time and contribution to the study. This method was also approved as being appropriate by the gatekeepers for the qualitative interviews (for discussion of ethics of paying drug users for research participation see section 3.2.1) The interviews lasted between 20 minutes and an hour, with most taking about 40 minutes. The interviews were semi-structured and based on four themes: *Cannabis History; Cannabis Experiences; Cannabis Use Behaviour and Knowledge; and*

Cannabis Motivations and Cessation. A semi-structured interview guide was chosen to allow for participants to expand and explore critical elements that were important for individual participant, but also allowed the investigation to be focused on specific elements of cannabis use development overtime to support comparability of analysis. Furthermore, interviewees were asked to fill out a brief questionnaire describing their history of alcohol and drug use. In line with social science research ethical standards, interviewees were given informed consent and allowed to withdraw at any time. Considerable time was given to delivering informed consent to participants to ensure that separation between the support services and the interviewer was understood, and to ensure the participants were not coerced by staff to participate; the interviewer read through the participant information sheet with each participant and explicitly discussed the consent process, the role of the researcher, and the rights of the participant. Interviews were digitally recorded and transcribed verbatim with all identifiable data anonymised. Interviews were coded and analysed by the researcher who conducted the interviews.

4.2.5 Analysis Procedure

Directed Content analysis is a qualitative methodology used to expand upon existing theory or prior research (Hsieh & Shannon, 2005). It is an approach that provides a structured process of qualitative analysis that identifies core concepts and values defined by previous theory as initial coding variables (Hickey & Kipping, 1996; Potter & Levine-Donnerstein, 1999). Using the predetermined theory, operational definitions are developed for each category and used accordingly to provide guidelines for thematic analysis of content (see Appendix 2).

The previous chapters in this PhD have sought to gain an understanding of the factors related to the motivations for individuals to experiment with cannabis use, and the factors associated with the continued use of cannabis for individuals who experiment with cannabis. This work seeks to build on this information by gathering data from interviews conducted with young people engaged with community-based drug services. Such young people typically access services to help with the reduction of use or to address associated behaviours, and self-identify as problematic or dependent users of cannabis. Thematic coding schemes were developed prior to the analysis of interviews. The interview guide was developed to provide a time-based linear evaluation of the progression of use from initiation to the current use behaviour. Additionally, key components derived from previous findings from this PhD regarding factors associated with problematic use outcomes were incorporated into the interview guide. Interview transcripts were initially read for understanding and to surmise each case. The coding framework was then applied to all interviews.

4.2.6 Ethical considerations

Ethical approval was obtained from Liverpool John Moores University Research Ethics Committee for this research. Participants were fully informed of the nature of the interview and provided their written consent on the day of the research. Participants were informed that their participation was voluntary and of their right to withdraw from the research at any time without reason.

Furthermore, participants were informed that their anonymity would be protected and no references to individuals, place names or organisations would be made in documentations regarding this research.

4.3 Results

4.3.1 Demographics

Eleven young people (4 female and 7 male) volunteered to participate in the interviews. All participants were between 18-25 years of age at the time of the interview and all were White, and born in the UK. Participants were current cannabis users except for one who had recently ceased using cannabis, and all had initiated cannabis use prior to 18 years of age. Only one participant reported not using alcohol, with the other participants reporting early initiation of use (younger than 15 years of age) and frequent or heavy use of alcohol. Tobacco use was reported in all interviewees, with all initiating use prior to 17 years of age and all reporting smoking 21-30 cigarettes a day. All participants reported using at least one other illicit drug in addition to cannabis in their lifetime, while three reported using at least one other illicit drug in the past 12 months. Additionally, data, including drug use statistics, on participants interviewed for this study is presented in tables 1-3.

Table 1. Descriptive statistics. (N= 11)	
Sex (% female)	41.8
Age (Years) (M(SD))	20.81 (2.08)
Country (%)	England (100)
Ethnicity (%)	White (100)

Table 2. Drug statistics (alcohol, tobacco and cannabis). (N = 11)					
Alcohol	M (SD)*				
Age of initiation (Years) (N = 10)	13.9 (1.52)				
	Never	Less than weekly		Weekly	
Alcohol use frequency (%) (N = 10)	3 (30)	5 (50)		2 (20)	
Drinks in typical drinking session (%) (N = 9)	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
	1 (11.1)	1 (11.1)	3 (33.3)	2 (22.2)	2 (22.2)
Tobacco					
Age of initiation (Years) (N = 11)	14.0 (2.05)				
Tobacco use frequency (%)	Never		Daily		
	2 (18.2)		9 (81.8)		
Number of cigarettes per day (N = 10)	10 or fewer		21-30		
	5 (50.0)		5 (50.0)		
Cannabis					
Age of initiation (Years) (N = 11)	14.54 (1.63)				
	Never	Less than weekly		Daily	
	1 (9.1)	4 (36.4)		6 (54.5)	
*M(SD) unit of measurement unless otherwise noted					

Table 3. Use of drugs other than cannabis. (N = 11)				
	Never	Lifetime	Past year	Past Month
Ecstasy (%)	36.4	18.2	36.4	9.1
Heroin (%)	90.9	2.7	0	9.1
Cocaine (%)	27.3	27.3	36.4	9.1
Hallucinogens (%)	27.3	27.3	36.4	9.1
Ketamine (%)	63.6	36.4	0	0
Legal Highs (%)	36.4	27.3	27.3	9.1
Amphetamines (%)	72.7	18.2	0	9.1
Anabolic Steroids (%)	100	0	0	0

4.3.2 Cannabis history

The Cannabis History section was designed to understand the environment in which cannabis use was initiated, and the ways in which use developed and evolved.

4.3.2.1 Cannabis initiation

The Cannabis use history section of the interview guide asked participants about the initiation of use and the circumstances regarding their first experiences of use. Specifically, this was undertaken to better understand how use developed with consideration of theoretical concepts of drug normalization and drug instrumentalization. Nearly all of the interviewees reported that they were introduced to cannabis by friends or partner, with the majority of interviewees describing initial use sessions occurred either in a park or at a friend's house. Only one participant reported being in a hostel when introduced to cannabis, and described an experience in which they were 'pestered' into initiation by older men. All participants were 17 or younger when they initiated cannabis use, with the earliest reporting initiation of use at 12 years old. Any element of 'peer pressure' was only alluded to by other participants, with language and tone that described gentle offering, or interest in trying cannabis, but some references to the 'wrong crowd' or 'wrong people' and other language associated with 'deviant youth behaviour' were made. One participant described a social environment in which cannabis was visible and commonplace. A social environment in which cannabis use was accessible and accepted seemed to permeate throughout the interviews.

"Umm, well when I was 12 and I first started secondary school, mixing with the wrong crowds, the older lads, we used to smoke cigarettes and that and went behind the bike shed, ya know, and I started from there, ya know, they were smoking green behind the bike shed and that...just started doing tokes and started then." (Participant 1; male)

"...was just like with mi friends and we were all having a spliff, and I was standing with them and they asked if I wanted some, like I thought, 'yeah, I'll have some...." (Participant 3; female)

"Yeah, I lived on a street where everyone smoked weed, and everyone on the streets around, a mass community of weed smokers." (Participant 8; male)

The first instance of use of cannabis was associated with tobacco use in every participant except one, who reported smoking a blunt (a cannabis joint without tobacco) and then eventually adding tobacco into his joints. A few participants reported drinking alcohol during their first use session, but the majority used cannabis and tobacco exclusively, and none reported using any other illicit drugs. Participants' described casual, intimate use sessions with a small group of people, opposed to a communal, party-oriented initial use session. The social aspect of use however, was also a key element associated the initial use session. When describing their interest in initiating cannabis use, one participant noted how their friends and/or peers who were using cannabis seemed 'relaxed' or 'chilled out'. This outcome associated with use appears to be an important factor in encouraging the initiation of use.

"I was about 16 and a couple of weekends....erm, just wanted to try it because they all seemed to be dead chilled out, laughing, and having a joke and I always like, more like stressing over exams and stuff, and that's when I first started" (Participant 2; female)

"Like in a park on a day out with just kids." (Participant 6, female)

"Basically, I was in a band and after the band practice we went to (the park)....and he had the bag of lemon haze weed and put it into thing and smoked it. It was the first time I smoked; it was the first time I smoked anything." (Participant 10, male)

Cannabis initiation was described as a natural progression by most participants, who described a casual, initial use session with friends or peers. One participant described a more intensive experience, in which the use of cannabis was integral to gaining a sense of belonging with their social group.

'What happened was I come out of the army, right? I joined the marching regiment, I smoked ciggies in there because I was stressed out because I missed my family and that, but when I came out they wouldn't let me go back and live with them (parents), you know what I mean? So I moved into a hostel. As soon as I moved into the hostel I started hanging out with a couple lads in there who smoked weed and people kept pestering me to have a go. I was only 17 and I was in a worker's hostel and they were all 30 plus, so I thought, 'yeah, I'll have a go' and since that day I haven't stopped.' (Participant 4; male)

“Just out with mi mates at a park, just out for a few bevvies, a few drinks and that, cuz I used to drink when I was younger, so we used to go to the park and drink and smoke at a young age, like 12/13, and then moved to cannabis at 15.”(Participant 9, female)

The outcomes of the initial use session was recounted as mostly positive by every participant, with most emphasising the ‘high’ that was experienced, and that the experience left them feeling ‘relaxed’. In addition to noting the ‘high’ and ‘relaxation’, other participants noted how they felt more confident, and laughed, while some noted how they felt paranoid and were fearful. Furthermore, several participants discussed how they believed the initial high was one that could never be experienced or reached again, and one even described their current use as constantly trying to recreate that subjective experience high. In addition to the feelings experienced relating to the effects of the drug, one participant noted how the experience of using cannabis ‘just felt right’.

“At first it was quite scary, it was good at first, I don’t know, I got a bit paranoid then, and just going into me house I was dead like nervous, whereas if I wouldn’t have had a drug I would have just walked in normal but I was nervous because I knew I took drugs and that but when I started the more I smoked it the less paranoid I was getting about going in because I wasn’t getting caught, and then I was enjoying it I was getting my giggles, I was chilling out, and I wasn’t thinking about the stuff that was going on.” (Participant 2, female)

“It was amazing. Just feel so relaxed, and felt a lot more confident.” (Participant 3, female)

“Alright, I felt good, it just felt right at the time” (Participant 5, male)

“I just laughed for like an hour, like it was really, really good. It was the best high I’ve ever had in my life.” (Participant 6, female)

“I thought it was mad at first to be honest, just sat there and couldn’t move or nothing, just layed there, chilled out, stoned out of mi head” (Participant 7, male)

4.3.2.2 Cannabis development

The development from initial cannabis use to present cannabis use behaviour was critical, particularly in understanding how problematic use developed and evolved.

4.3.2.3 Cannabis behavioural development

Although use initiation generally followed typical expectations of drug experimentation (tobacco and alcohol, followed by cannabis, followed by ‘harder’ drugs), the development of use following initial cannabis use varied among participants. Some expressed how use quickly escalated to more frequent use, while other participants described use trajectories that were either more gradual or far more nuanced, describing times which were either more frequent or use was much less. For participants that reported the greatest negative consequences as a result of their cannabis, a rapid

escalation of frequent use following initiation was described. Participants, who described a more gradual, or inconsistent use pattern, reported less extensive consequences as a result of their use.

"It would be day and night, day to night, straight away when I wake up before I even leave my house. I'd have three spliffs before I leave and ya know just to make me feel like if I left the house I'd be like a bit anxious or ya know a bit paranoid ya know what I mean but if I had 3 joints inside me I'd feel great I'd be buzzing." (Participant 1; male)

"It wasn't frequent from the start because I was too young. When I came home that first time, my mom actually smokes as well, she was like she knew and then I started smoking a bit in the house with, and it was like when I got to sixth form I started to smoke every day and it as mainly it was to deal with because I've got mental health issue...and now it's just fine, I just do it." (Participant 6, female)

"We just bought it more often, and we bought more of it more often, and then we started buying tobacco and putting it into joints as well, nothing out of the ordinary, just started smoking more often really." (Participant 7; male)

In addition to the evolution of use frequency, the context and environment of use evolved among participants. All participants reported that cannabis was a social experience, but after the initial use session, many participants described using on their own. Most participants who reported using cannabis on their own did so specifically because they instrumentalized cannabis to either 'relax' following work or school, or to help them get to sleep in the evening. Although the participants who described the most severe consequences of use reported using on their own, so did participants who reported the least severe consequences of use. It appears that potential over-instrumentalisation, however, rather than solitary use, is most indicative of more severe consequences of use.

'It would be day and night, day to night. Straight away when I wake up, before I even leave my house I'd have three spliffs before I leave, and ya know, just to make me feel like if I left the house I'd be all like a bit anxious or ya know a bit paranoid, ya know what I mean, but if I had 3 joints inside me I'd feel great...'. (Participant 1; male)

'It used to be a like a group of us, and then as you get older, you go different ways, and I just carried on smoking it, on my own'. (Participant 2, female)

"I do smoke my own, I've said that many times. If I got a bag of weed I'm sitting on my own, I'd rather sit and smoke with someone else, maybe to the end of the bag, I might have a spliff on my own." (Participant 8, male)

"Yeah, I do smoke on my own, especially at night time, like when I got to bed, I'll have a spliff on my own and go to sleep, that's the only way I can get to sleep." (Participant 9, female)

4.3.2.4 Change in acute effects of cannabis

A key point in understanding the change in cannabis use behaviour over time is the consideration of the ways in which the effects of acute use changed over time. Most participants discussed how the amount of cannabis needed to attain the level of high they desired increased over time. Others described how the high they desired to achieve was no longer attainable. Despite many reporting that the amount and frequency of cannabis needed to achieve their desired high increased, one participant described how experience using cannabis improved their use outcomes and experiences.

“Yeah, when I first started it was like not even 4 pulls and it’d be knocking me out for hours. And then making me feel like that ‘buzz’ but now it’s like you’ve got to smoke one then build another and then smoke it and then build another to get the effect because you’ve smoked it that long that it’s not doing nothing to ya it’s a waste of money” (Participant 1; male)

“Yeah, like, at the beginning, I felt like, I’d only have to smoke like a quarter of it, and feel really stoned, where now, I have to smoke a whole ten pounds worth to me self or with one other person, for me to feel the same way I felt with a couple of pulls a couple of years ago” (Participant 9; female)

“Definitely, at first I didn’t have a clue what it was going to do to me, just seen people on films, people smoking weed, then when I tried it, you do actually get high, it’s mad, and each time you get high, it’s just like more experience on it for you, you make your high better for yourself, from knowing what you know.” (Participant 10, male)

4.3.2.5 Changes in feelings about cannabis use

In addition to the behavioural and acute effect changes associated with cannabis, most participants described that the ways in which they viewed their use of cannabis over time. Participants who reported fewer negative consequences of use had a less negative summation of their use compared to other participants who experienced more severe consequences of use. About half of the participants indicated that there were times in which their perception of cannabis use became negative as a result of their experiences and outcomes. The catalyst for these changes in feelings about cannabis use seemed to be informed by both physical and mental changes from using cannabis, as well as factors like financial and social outcomes resulting from use.

“We used to play a lot of football and I just used to be on the streets and sitting around and I grew up down in London and here, just hang in the streets and football and weekends and partying and going ...I used to go to free raves when I was younger when I started getting into heaving drugs like ecstasy, party drugs and just like whatever comes along...” (Participant 1; male)

“I felt happy like it was a nice buzz, but after that say about 4 months after that, I started to feel like my world was collapsing because all mi money before I started smoking I always had money, and then when I started smoking I never had money, I started feeling more tired...” (Participant 4; male)

"It was alright at first, it just got worse and worse and worse, you know what I mean, in the end it was just boring and depressing." (Participant 5; male)

4.3.2.6 Cannabis transitions

An important consideration in cannabis use development is understanding how users transition in and out of problematic use, and the variability of use behaviour. In order to demonstrate this among participants in this sample, this section will look at one participant (Participant 2; female) and describe how their use developed over time, with a particular emphasis on how they perceived their use as problematic and non-problematic.

Participant 2 initiated cannabis use with friends and was drawn to use by the perception of other users and their experience with cannabis, particularly the perceived relaxed and 'chilled' demeanour of users. The participant was interested in use to alleviate their own stress because of exams.

"Errrm, I was about 16 and a couple of weekends....erm, just wanted to try it because they all seemed to be dead chilled out, laughing, and having a joke and I always like, more like stressing over exams and stuff, and that's when I first started."

When asked about her current use of cannabis, she described substantial variability, with one week smoking daily and the next possibly abstaining.

"It depends. I'm up and down at the moment with my cannabis use. One week I could be smoking every day, and then I could two weeks without it, and then I could go a month on it, It's up and down really."

Part of the variation of cannabis use is due to the management of responsibilities. In addition to responsibilities, emotional triggers also seem to influence the amount and frequency of cannabis use. The participant described different school responsibilities as a reason to reduce their use of cannabis, and stress from familial relationships as a cause for an increase in use behaviour. Furthermore, the participant noted that when things were going well, it was easy to manage cannabis use, but when life was 'difficult' it impeded on their ability to manage their use.

"Yeah, cuz, say with 6 weeks holidays if I'm off from school I'll smoke it then, now I'm in Uni, when I've got exams and things, I just try and stay completely off it, all together."

"It's when I get stressed out, and what's the point of arguing mi mum anyways, mine as well have a spliff and chill out, and then you have one and then you have another and then it leads to another 20 bag."

"Erm, it's difficult to stop all together, but it's not difficult not to stop when life's going ok, if you understand...."

The participant also noted that they did not smoke cannabis for several years because of their partner, and as a result, used other drugs, including alcohol and cocaine. This highlighted how environmental opportunity and relationships influenced drug decisions, include type and frequency.

“Yeah, when I was like 16 and using and then I was back on it when I was 21, so from when I was 21 until I was now it’s been the worst.”

“I got into a relationship, and he didn’t smoke weed, so, like, I gradually stopped myself, and it was more the scenery of alcohol and cocaine and that...”

By looking at participant 2 exclusively for cannabis transitions, it becomes apparent that use for the individual is difficult to ascertain at a glance. Use variability and experiences are bound by their current situation, and changes in responsibilities, relationships and environment contribute to changes in use behaviour. The influence of factors associated with use is critical in understanding use behaviour and transitions from non-problematic to problematic use. Although participants might not currently be expressing problematic use behaviour, the propensity for problematic use behaviours is an important consideration. Specifically, it is important to understand the mechanisms that contribute to the experience of problematic outcomes and how users negotiate the factors that influence behavioural outcomes.

4.3.3 Cannabis experiences

This section looks specifically at cannabis use experiences, particularly the consideration of use intentions and outcomes. With consideration of drug instrumentalization theory, which argues that non-addictive psychoactive drug use is purposeful and deliberate, the outcomes of use, both positive and negative, were reported as well as intentions and expectancies of use.

4.3.3.1 Cannabis use purposeful outcomes

Informed with the drugs as instruments framework, participants were explored the purposeful reasons for their cannabis use. Participants were not specifically asked about any of the instrumentalized factors of non-addictive psychoactive use, but generally about their use experiences. There are eight factors identified within the framework, however, in this study participants only discussed five of those factors: high/hedonia, improved cognitive performance, self-medication for mental illness, improved social interaction, coping with psychological stress and sensory curiosity/expansion. Factors associated with purposeful use, including facilitation of sexual behaviour and improved physical appearance and attractiveness were not reported by participants.

4.3.3.2 High/hedonia

High/Hedonia represents the instrumentalized drug use with the intention of achieving euphoria or intense well-being, happiness. Although this is an outcome frequently associated with psychoactive drug use, the dosage required and potential for tolerance requiring higher doses posits hedonia as a pathway that may easily lead to over-instrumentalization (Müller & Schumann, 2011). High/Hedonia was mentioned by several participants, although not necessarily as their main intended outcome of use, but an enjoyable by-product of use.

‘When I first started I enjoyed the ‘buzz’ off it, ya know, like the way that makes you feel like ‘WAY’ you lose your mind a bit that kind of stuff, but it makes you feel like stoned for 10 minutes, and that buzz is like a hypo one where you just sit there you’re laughing but then it just like goes so it’s just a waste of time really.’ (Participant 4; male)

4.3.3.3 Improved cognitive performance

Improved Cognitive Performance describes instrumentalization with the goal of increasing cognitive performance, sometimes to counter mild impairments as a result of fatigue, exhaustion or mood swings (Müller & Schumann, 2011). Only one participant indicated use cannabis for the intention of improved cognitive performance, although other participants noted use cannabis for improvement in cognitive performance in artistic endeavours, which for this analysis we chose to classify as creativity and thought expansion (see 4.3.3.7).

“it’s just relax and play games and stuff like that, and concentrate more on things more, do mi coursework and stuff, like I actually work better.” (Participant 3; female)

4.3.3.4 Self-medication

Self-medication is the instrumentalization of psychoactive drugs with the intention of curbing or altering aversive mental states, typically with the aim of assuaging anxious or depressed mood states. Self-medication is consistently discussed as a potential mechanism for drug use, particularly cannabis for the alleviation of symptoms of mental health disorders, like anxiety and depression, as well as schizoaffective disorders (Lazereck et al., 2012). Results indicated that self-medication was instrumentalized in particular with feelings of anxiety and depression. Although instrumentalization by self-medication was described as a way to alleviate anxious and depressive symptoms, participants described a pathway in which this mechanism was often over-instrumentalized exacerbating those symptoms as well.

“I was a lot more anxious before I started smoking weed than I am now.” (Participant 3; female)

“I’ve got bad anxiety problems and depression anyways which doesn’t help me smoking weed, but I feel like it helps me in a way, when I have a spliff, I can relax, I don’t think, I don’t worry, because I worry about the littlest things, the stupidest things, and soon as I have a spliff I forget all about my worries and then just be me then, that’s the only time.” (Participant 9, female)

4.3.3.5 Improved social interaction

The instrumentalization of cannabis for improved social interaction is used for the facilitation of social behaviour. In addition to enhancing the social interaction, the social environment is enhanced by the use of psychoactive drugs (Müller & Schumann, 2011). Participants described their cannabis use as a means for social interaction, mostly described as a casual means for ‘hanging out’ and socialising with friends and partners. Participants, however, also described that cannabis use was ingrained into their social life, to the point where it may be more of an outcome of being in a social group that predominately uses cannabis, rather than a way to instrumentalize use. As a results, although most participants referred to the use of cannabis for this reason, this did not seem to be their primary reason for use. Rather, participants described this as a secondary or tertiary reason for their use.

“Yeah, that would be affected quite a lot to be honest cuz near enough everyone I know smokes weed, like everyone, and if they’re smoking weed and I’m not, I wouldn’t want to be chilling with them, so I’d see less of my friends to be honest, definitely affect the social group 100%.” (Participant 9; female)

“Just hanging, chilling, a social thing.” (Participant 8, male)

4.3.3.6 Coping with stress

Goal-oriented cannabis use to cope with stress was used to transition an affective state of tiredness/stress to one of relaxation/fresh. The psychoactive drug instrumentalization is used with the intention to speed up this process (Müller & Schumann, 2011). For many of the participants, stressful lives were described, and cannabis was depicted as a both a cause for stress and a tool to alleviate stress. As participants were in contact with housing and drug support services, the sample in this study would likely experience more stressful living situations than those in the general population, which may account for why their cannabis use would be discussed in relation to problematic, or stress-inducing outcomes. Furthermore, the use of cannabis to alleviate these stressful situations and experiences seemed to indicate a cycle in which cannabis became both a contributing factor and a perceived tool to alleviate stress. The use of cannabis to instrumentalize the alleviation of stress was often described as ‘chilling me out’, or some type of escapism from reality and the factors causing stress.

"I had it rough, ya know, my Dad was an alcoholic and, ya know, had rough environments and situations and that just made me....helped me to forget about home and that just ummmm chilled me out...." (Participant 1; male)

"Just the way it makes you feel like, like, I have lots going on in mi head, and worry, and I have guilty feelings, and I think about mi nan a lot, mi two nans that passed away, when I have a spliff, it's not like, like you don't have to, it's not that I forget about them, it just doesn't hurt inside as much, it's not as vivid." (Participant 2; female)

"For me, I don't even enjoy it anymore, but I know I just, it relieves stress, it's not me being stoned, like that's a plus, if that makes sense, for me it's smoking it, and letting it hit the back of your throat when, it feels like, I can't explain, I just woke up, I can't even explain, it hits the back of your throat and it's like, 'fair enough', it's one of them." (Participant 11; male)

4.3.3.7 Sensory curiosity/expansion

The instrumentalization of drug use for sensory curiosity is with the intention of expanded perception horizon. Novelty and expanded perception of stimuli and environment permit the restructuring of information to gain new perspective (Müller & Schumann, 2011).

Instrumentalization for sensory curiosity/expansion was described by less than half of the participants. The use of was often described by participants who used cannabis for creative and artistic expression. The use of sensory curiosity/expansion was described by participants who described less problematic outcomes for their use. It may be that particular instrumentalized goals result in less problematic outcomes than others.

"it's just you think about different things when you're high, it's just entirely different things, and nothing that's related to what you're doing or anything that bothers you, like even if there's nothing bothering you, the thing that you think about normally and the things you think about when you're high are completely different." (Participant 10; male)

"It makes me think about other stuff, the other life out there, we can't be the only ones here, that's what it makes me think and believe, and then, I've sat there for ages puzzling me head." (Participant 11; male)

4.3.3.8 Consequences of cannabis use

Although the use of cannabis to achieve specific outcomes is within the framework of non-addictive psychoactive drug use, it is important to consider how use can be overinstrumentalized. If use to achieve these outcomes becomes uncontrolled, it is likely to be problematic for the user.

Furthermore, it is important to consider how outcomes of use could become problematic due to consequences related to both acute and long-term use. Nearly all of the participants reported consequences that they attribute to their use of cannabis, with varying degrees of severity and frequency. Consequences as a result of cannabis use are likely to occur for both problematic and

non-problematic users of cannabis, but excessive and recurring problems due to use is cause for concern. Consequences were coded into four categories: social, financial, mental health and criminal justice. Consequences of use were similar by gender, except for criminal justice effects, with only male participants reporting involvement in gang activity or being arrested for possession of cannabis.

4.3.3.9 Criminal justice consequences

Criminal justice consequences of cannabis use were described by nearly half of the male participants, while none were described by female participants. In general, participants who described criminal justice consequences of use did not indicate any greater levels of problematic use in other areas. However, criminal justice consequences were often described by participants who were more engaged with a cannabis lifestyle that included low-level dealing and gang activity. Additionally, participants who experienced criminal justice consequences described lives more on the periphery of the 'normal population' than others, and lesser belief in their desire or belief that their cannabis use could change.

"Loads, being nicked with bags of weed on me, so I've been like cautioned and fined, like 80 pounds spot fine for having a ten bag, how stupid that was, and ya regret even getting the ten bag, to be honest with ya a ten bag isn't worth an 80 pound fine is it, but that's it, I get judged by police, ya know how police know you're face when they've nicked ya for weed, they'll always, police will see you they'll always follow you and search you." (Participant 4; male)

"No, got arrested with a few bags of weed that was a few years ago." (Participant 5; male)

4.3.3.10 Financial consequences

Every participant described financial consequences that resulted from their cannabis use. In most instances, money problems seemed to be one of the main issues at the forefront of their negative perception of their use. These financial consequences were described as an impediment to the evolution to a life out of support services. Furthermore, in describing a desire to change their use, financial issues were often described to be one of the primary motivations of cannabis behaviour change.

"Yeah, if I didn't get into it I wouldn't be spending money it on useless crap." (Participant 3, female)

"Just money problems. For last year, I went through a stage, because of stuff that was going on, just smoking it all the time, more to just to block out the world than actually wanting to do it, you know what I mean, I spent so much, I must have spent 80 pound a week, every week, but apart from that, I've never been paranoid and stuff off it." (Participant 6; female)

4.3.3.11 Mental health consequences

In addition to financial consequences, mental health consequences were described by all participants. In addition to anxiety and depression, deficiencies in memory and other mental capacities were described, although to a much lesser extent than anxiety and depression. In

addition to cyclical issues with instrumentalized stress, mental health consequences were described as a bidirectional relationship; although issues with mental health were believed to be a result of cannabis use, cannabis use was also instrumentalized to alleviate these consequences. The relationship between mental health self-medication and consequences of use seems to be a very complex relationship, one that was described by the majority of participants in this sample.

“I was border and border and felt depressed and depressed, and now I’m suffering from anxiety and depression, I think, that’s the effects of what it does to ya, you know what I mean.” (Participant 5; male)

“I’d say my memory, it’s rubbish, like especially short term more than long term, if someone said to me what have you been doing an hour ago or where was you an hour ago, I’d say I don’t know.” (Participant 9; female)

4.3.3.12 Social consequences

Like financial and mental health consequences of use, social consequences were described by a majority of the participants. Unlike financial and mental health consequences, however, there was much greater variability in the severity of those consequences. The most severe of consequences were those that resulted from family relationship issues, which led to estrangement from members of their family. In most instances, however, participants described breakdowns in relationships with friends and partners. In addition to relationships, many participants described social consequences of use that resulted in them being on the periphery of society, although it is difficult to ascertain if this was caused or contributed to by cannabis use.

“Family relationships breaking down.” (Participant 2; female)

“How it affects me is I can’t see my family now...” (Participant 11; male)

4.3.3.13 Effects of consequences of use and their influence on use behaviour and outcomes

The next section contextualises the experiences and outcomes young people reported about their cannabis use. This ranged from the positive experiences they associated with cannabis, to how their use escalated, and how the escalation of use altered their perception and experiences with cannabis. Many participants reported that as their use continued they experienced increasing negative consequences, which outweighed the positive effects of their use:

‘Well, I say there were positives from when I first started smoking weed. It helped me forget what was going on at home and so that was a positive because, ya know, when I was really young and I seen a lot at home and mainly just for that I say it was positive....but as you get older it gets pure negative...more bad has happened in my life than fucking good from doing drugs. I’ve hurt my friends, I’ve hurt my friends and all that...’. (Participant 1; male)

“It’s changed. It’s more different now. Because when I first started, it’s like you pull so many because you get stoned, and like you’re here just you’re like happy like because you just started doing it, but now it’s gets boring because it’s a habit, and like you’re constantly like ‘I need a spliff, I need a spliff’

constantly it just takes over you, it changes you, and you can't do nothing about it, unless you're willing to change, but it's hard, like nowadays I know you say there's jobs out there, but there isn't, some people don't, but since I've been smoking cannabis but I've been nicked for it so I've got a record off that, so if I hadn't started smoking I wouldn't have the record, it's doesn't change ya, it makes ya different, people call you pothead, people say oh look at him he smokes week don't talk to him, that's what some people are like." (Participant 4; male)

"What am I doing with my life? Why am I sitting here doing this when I smoked it about 7 years to 8 years non-stop? Why am I still doing this? How much money have I got when you accumulate? When I don't think about how much I spent, I just roll with it and with whatever is going on that day?" (Participant 8, male)

It should be noted that some of the reported negative outcomes were related to the outcomes of a 'cannabis lifestyle' and not specifically acute cannabis use. The criminal justice consequences related to cannabis can lead to social stigma and create obstacles in obtaining employment. Furthermore, of those participants who reported significant negative opinions about their own use behaviour, most were involved in the sale of cannabis (all who reported dealing cannabis were male). Additionally, two of the four participants who reported dealing cannabis had quit using cannabis at the time of interview. Other participants, however, reported that as their use of cannabis continued, they did not experience significant problems associated with their use behaviour. Although they experienced problems/consequences as a result of their use, they reported that their use was largely, a positive aspect of their life.

"I don't think you'll ever get the same as when you first try it when you're only sixteen. It's like a buzz then. Now, it's just like more chilling me out when I use it now. I like to have it after me tea, say, and just chill and watch and film and chat with mi mates or something." (Participant 2; female)

"It's just like, I just like it, like I don't even know, it doesn't give me any bad side effects, I've recently come off anti-depressants and all my friends will go out and just like get really drunk or take coke or ecstasy or whatever and I can't do that because it just sends me weird, whereas weed I can go just smoke spliff after spliff after spliff and be fine and it never does anything bad to me. It's just Larry." (Participant 6; female)

"It's not like a major part of my life, don't get me wrong, it's not something I'm addicted to, but I do enjoy it, it's there, it's something I enjoy, and if I enjoy it I'm going to do it." (Participant 10; male)

4.3.4 Cannabis use behaviour and knowledge

The Cannabis Use Behaviour and Knowledge section of the interview guide was designed to ascertain how participants acquired cannabis, and the social facilitation of use through dealers and friends. Furthermore, this section aimed to gain a better understanding of the knowledge users possessed about the cannabis they typically purchased, and how purchasing decisions were made.

Lastly, this section sought to outline patterns of use and how they were negotiated, both in purchasing cannabis and how and when they used it.

4.3.4.1 Cannabis frequency of use

Cannabis frequency is difficult to assess and interpret. Due to varying quantities used in joints, different strengths of cannabis strains, the ways in which cannabis is often used and shared in a social environments, among other factors, traditional estimates of number of days, or number of joints do not provide a clear picture of use behaviour. Therefore, participants were asked to describe their frequency of use generally and how their own use behaviour varied.

“It depends. I’m up and down at the moment with my cannabis use. One week I could be smoking every day, and then I could two weeks without it, and then I could go a month on it, It’s up and down really.” (Participant 2; female)

“In a day, at most like 12 spliffs, so like a 10, like an eighth a day.” (Participant 6; female)

“Once a week maybe, if that.” (Participant 10; male)

“I use less weed, that’s what makes people paranoid when you put loads of weed in that’s why I only put a little bit in.” (Participants 11; male)

4.3.4.2 Negotiation of use with responsibilities

The ways in which cannabis use negotiated their use in their daily lives provided insight into how they managed their experiences and balanced this with their other responsibilities. Most participants reported that their use was negotiated with their other responsibilities, like work and school. The negotiation of cannabis use behaviour around responsibilities does not, as reported below, necessarily indicate that use was considered any less problematic. However, participants who had fewer responsibilities tended to describe more intensive daily use sessions. Some participants also described how their cannabis changed from a social activity, to one that they engaged in to relax, or help them sleep.

“After work, or college or uni, yeah.” (Participant 2; female)

“It’s mostly, when I wake in the morning I have one, and then it’s like after 12 o’clock, after midday, it’d be like in between 1 and 3 in the morning, one after another all the way through.” (Participant 4; male)

“Yeah, definitely, when I first started it was during the day when we was chilling out, now if I have spliff it will be before I go to bed and go sleep.” (Participant 7; male)

“Yeah, apart, because I’m like in college Monday, Tuesday, Wednesday, so I don’t smoke it, like if I get up in the morning, I’ll have a ciggie and then go to college I know I can’t smoke it, erm, but as soon as I’ve got back, I’ve got it on my mind when I’m in college, but then as soon as I get back, the first thing I do is buy a bag of weed or have a spliff.” (Participant 9; female)

4.3.4.3 Cannabis purchasing frequency

Most respondents reported purchasing cannabis nearly every day, and often from friends or dealers. Cannabis purchasing behaviour provides insight into their use environment, and how use decisions are made and how, in an unregulated market, knowledge of cannabis content is negotiated. Participants described the frequency of their purchasing behaviour and from whom they purchased. Most participants reported frequent cannabis purchase, with daily or every few days, and purchased from the same few, trusted sources. The information presented on cannabis purchasing frequency was also informed by cannabis ‘knowledge’ and potency preferences.

“Yeah, because it was like, only when...when I first started I only had a couple of drags, then I started like smoking more like, getting a 10 bag. A 10 bag would last me before about a week and then I went up to, I was smoking about 60 pounds worth a day.” (Participant 2; female)

“Every few days, 10 bags.” (Participant 3; female)

“The weed I was getting, you know when I first started smoking weed it gets you stoned quicker, doesn’t it? But then, gradually, after a while you been smoking, you need more of a spliff, so you’d get more weed to put in the spliff. Every week, I’d be spending like 300 quid every two weeks.....” (Participant 4; male)

“Every day, 10 pounds worth a day, at least, if I can get my hands on more, I’d get more, I smoke it with other people as well, so I’d smoke my 10 pounds, and then obviously, I’d smoke it with other people so I’d be consuming more than just my 10 pounds.” (Participant 9; female)

In addition to reporting frequent purchasing of cannabis, most participants reported that they typically used the same few, trusted sources, while a minority of participants reported an expansive cannabis network.

“Quite a lot, well 10 people or something like that.” (Participant 3; female)

“Different. Sometimes, like, when I used to do it kind of thing I’d always just take mine, but then I stopped it for good reason, because I’ve seen so many of my mates getting nicked and they asked me to put tents [for the growing of cannabis] in me flat and set up and I was like no. But then, umm, I go to the same one usually, but then sometimes he doesn’t have like good weed in, so umm after going to the same dealer mostly, but it’s just weird like I could leave here and go to the same person if he has nothing and go down the street and go to another one street and just keep knocking and knocking until I find one.” (Participant 4; male)

“I’ve got like four, but it’s always the same four people.” (Participant 6; female)

4.3.4.4 Cannabis knowledge and preference

The participants described their knowledge about the cannabis they purchased, and though they described having ‘options’, there seemed to still be uncertainty about quality and the degree to which the cannabis may have been tampered with some participants being more discerning than others in the quality of strain of cannabis they purchased:

‘Well, you know sol, that’s like pure mixed with all stuff. The green is occasionally sprayed and stuff it’s not good is just like chemicals really, proper weed it’s good....Yeah, you have options. But like, I still normally go through a friend and say ‘do you have like decent skunk? And go like, ‘what do you think is the best?’” (Participant 2; female)

‘I’m not fussed about what cannabis I’m getting. If I know what it is, and I have an option for going somewhere and getting a different thing, I’ll go for the better one, but I’m not 100% on it myself, I don’t look too much in it.’ (Participant 3; female)

‘You have to go with it don’t you. If the smell of it smells like cheese then it’s a good one. If you get it and it doesn’t smell of nothing then you don’t know what’s in it and you’re just risking your own health and for something that could be a load of shit.’ (Participant 4; male)

“I try not to get skunk, but I do prefer green. But if someone offers me like pollen or whatever I won’t be like no”. (Participant 6; female)

When asked to describe what would constitute ‘good quality’ cannabis, it was suggested that stronger, more potent cannabis was desired, but that the quality of cannabis they received was quite variable. Furthermore, participants noted that the main two strains available in their area were *Haze* and *Cheese*, with most having a preference towards one or the other.

“Like, you don’t need as much in a joint as, you know....it’s enough to not choker [fill] it out.” (Participant 2; female)

That you get stoned better..... ridiculous, it’s constant, sometimes it’s stronger, sometimes it’s shit, I think it depends on how dry kind of thing.” (Participant 4; male)

“Yeah, like haze I’d rather, I’d prefer to get haze then cheese you know what I mean, because haze was nicer than cheese you know what I mean, but it got to the extent where I wasn’t asked what I got it didn’t matter what I got.” (Participant 5; male)

“So say I was to get haze or the cheese, I’d prefer to smoke the cheese because the haze one makes me feel a bit whoa you know what I mean it makes me angry then I get paranoid pretty quick off haze then I would cheese but there’s the two differences but I prefer cheese because I’m more mellowed and relaxed then all you’re not constantly paranoid on what’s being said or who’s gonna say something to you so you just say the same with cheese depending on how much THC is in it.” (Participant 11; male)

4.3.5 Cannabis motivations and cessation

The last section of the interview asked participants about their motivations and reasons for using cannabis, whether they would like to decrease or discontinue use, and their reasons for any desired behaviour change. There were the most varied responses by participants in this section of the interview.

4.3.5.1 Motivations of behaviour change

Some participants were happy with their use, others wanted to use less, and others had either quit using or hoped to. Other people, family members and friends, and a desire for a 'normal' life were reported as reasons for a desired change in cannabis use behaviour.

'My mom, really, like I wanted it for myself obviously, I wanted it for myself for years, but like I said I couldn't change my life'. (Participant 1; male)

'Because I don't want to be dead when I'm older, I don't want to be wasting away look, ya know with my face, and just I don't want to waste my life away with spliffs, do you know what I mean? I want to go out there and do something why I'm still young, instead of sitting around wasting years smoking weed, wasting everything aren't I?' (Participant 4; male)

Even though some participants reported wanting a change in their cannabis use behaviour, some of them believe only certain experiences with cannabis, like a 'scare', or pregnancy would be a catalyst for a change in their behaviour.

"I know the only way to do it was my, obviously my own baby if I was pregnant or if that happened or something scary like that or my like family reasons or something like that but not for a job, because obviously it is important and I need it for money and for rent, and stuff like that, but weed is a part of my life, so I can't just cut weed out for a job or you get me, that's how I feel." (Participant 9, female)

4.3.5.2 Barriers to behaviour change

Although many participants expressed a desire to decrease or discontinue use, participants described many barriers to achieving this desired outcome. Participants noted that they had triggers, or that they just weren't confident altering their use.

'I tried so many times, see down there I had so many triggers for me, so many triggers, for me now, my coping mechanism if I have a bad day I'll come to here I'll go see good people, my coping mechanism back then was I'll run straight to drugs' (Participant 1; male)

'Erm, it's difficult to stop all together, but it's not difficult not to stop when life's going ok, if you understand...' (Participant 2; female)

'Yeah, it's just like when I feel settled with myself, because I'm still having issues with mi self-esteem and stuff like that, when I feel settled, I feel like I'll be able to stop'. (Participant 3; female)

'Because there's nothing there in place to replace it. Like there's nothing there now which I can think of that would make me stop it at the moment, so like if I stopped it now and I had something to occupy my mind, but there's nothing there at the moment, so I have to get that sort of first level of do stuff, got stuff to do constantly, the more stuff you have to do the better you are to get off it, cuz if you don't time to break.' (Participant 4; male)

For participants who had no current desire to modify their use, they did note that if their use behaviour changed or began to have a negative impact on their life, this would change.

"If it affected me in a bad way, if like because I do have psychosis, if it negatively impinged on that I'd stop using it straight away, like I'm using it to help me, not to not help me." (Participant 6; female)

'An effect from the weed to scare me off of it, like happen on me that would shock me.'" (Participant 8; male)

Other participants had a much more relaxed, nonchalant approach to cannabis behaviour change. When asked how they would cut down, most described a 'cutting down' period that would lead to complete cessation. This transition from frequent cannabis use was described as a natural progression.

'Erm, at the moment, if I was to stop now, it would be drastic, but if it was over a period of time, I reckon it'd be a lot better for me, that's what I'm trying to do....cut down and then eventually stop when I'm ready to.' (Participant 3; female)

"I don't think it'll be too different from I am now because I don't smoke weed too often it's just I'll be around different people who don't smoke weed rather than being around people who do smoke weed." (Participants 10; male)

"Yeah, I just think it's going to happen. Like I'll just stop being around them when they're high. And things like that. I'll decide to just be around them when they're sober and things like that. But I don't think it's going to be choice, it's just things happen." (Participant 11; male)

Of the participants who had already ceased using cannabis described that although there previously had been a desire to discontinue use, there wasn't a commitment to the process.

'Because I knew what lifestyle I live, I wasn't going in it wholeheartedly, yeah, you gotta do something, you want to get an achievement out of something, you got to put your whole heart behind, and you'll be allowed to do it ya know what I mean, when my mom, this time around, my mom cried to me, and I know what you mean, it hit me, it hit home to me, and that was the drive for me, I tried so many times, I had to take myself out of the situation and put myself in this sort of situation I'm in in this recovery I'm standing here now, I still have a long way to go.' (Participant 1; male)

Of particular concern was how several participants described that they were ‘addicted’ to cannabis. Although they didn’t describe features of ‘addiction’, they described how cannabis was a critical part of their life and their ability to function.

“It’s a apart of mi, I think it’s a part of my life, like I can’t live without it I feel like basically it’s like a limb like you can’t like you know what I mean chopping off my arm if I cut cannabis off it’d be like chopping off mi arm, that’s what it feels like I need it in my life to live like to make me function sometimes I know it makes me dozey at the same time but it makes me feel normal if I’m not stoned and I’m just normal to everyone else I’m font feel normal to myself I like to feel that stoned or just that mellow feeling just that feeling off the weed you know what I mean, even though I don’t get stoned like I used to in the day, there’s still something you know what I mean, I’m not normal, like now I haven’t had a spliff you know what I mean, I just woke up half asleep, but I haven’t had a spliff so I feel normal and I don’t like that feeling, I like to feel stoned.” (Participant 9, female)

4.3.5.3 Tools for cannabis behaviour modification

In addition to asking about future or current interest in cannabis behaviour modification, participants were asked how they would go about change. While some participants noted that they felt the change would happen naturally as they got older, most suggested that they would employ the use of a support service, or were already actively engaged with a support service to modify their cannabis use. Despite all participants being in touch with support services, the levels of engagement and intentions varied widely.

“I come here though to [name of service], they try and get you off it as well. But it’s more about what you want in your life. So like, that’s what I want to do, so hopefully in the next couple of months, I’ll be able to reduce it right down and be off it.” (Participant 4; male)

“I’d go to [name of service] and say I want to quit then probably be like cold turkey, but when I don’t smoke weed I tend to start smoking cigarettes, to like counteract kinda thing, I’d rather smoke 1 spliff a day or like 2 spliffs a day then smoke 10 cigarettes, you know what I mean, because I think they’re worst for you.” (Participant 6; female)

Although some had already engaged in support work, the process of modifying or altering behaviour was considered to be a relatively long process. Changes in use behaviour could also be due to changes in responsibilities, and use could subsequently be adjusted to fit around those demands.

“....(my) support worker here, just phoned him up and started speaking to him and that, I was still smoking it then though, I wasn’t as bad and just went down and down and down, and on new year, I was with him, say about 2 years, 2011 I think it was, or 2010, and I just....in 2012 going to 2013 I cut

down totally then, I was only having like the end a 10 bag or something, and like 2 months into that or 3 months into that just swerved it off altogether, been off it like now 2 and a half years.”
(Participant 5; male)

*“umm, I am, I have cut down lately, well over the last 6 months I’d say I cut down a bit, only because I’m coming at it with *support service* I’ve got a worker, so I’m, I wouldn’t say because of that it is helping a bit, but I’m just trying myself because I’m in college so half the day I’m in college so I’m not smoking it where before I wasn’t in college so I was smoking all day, so bits like that that’s how I’m stopping”* (Participant 9; female)

Even when cessation occurs for a considerable period of time (for example: 6 months), participants noted that when they began using again, it was not to the same frequency as before.

“I got one of those electric ciggies and I just decided to up and quit and I did quit for about 6 months but I started smoking weed again and that started me getting high again.” (Participant 10; male)

4.4 Discussion

The results of this study are discussed in relation to the four themes: *Cannabis History; Cannabis Experiences; Cannabis Use Behaviour and Knowledge; and Cannabis Motivations and Cessation*. Particular emphasis will be put on use intentions and how they influence behavioural outcomes, and how this information may inform indicated prevention. Following the trajectory of use behaviour from initiation to problematic use outcomes, these results will be contextualised with consideration of drug normalization and drug instrumentalization frameworks (Parker, Aldridge & Measham, 1998; Müller & Schumann, 2011).

The results of the interviews indicated that initiation of cannabis use was facilitated by social interaction, generally with friends. These were broad social experiences in which initiation was invited by friends or peers and was not considered to be a planned event, but rather a casual, spontaneous experience. Following the initiation of use, however, most interviewees reported a relatively rapid escalation to regular and self-defined problematic use and for many of the participants in this study, the escalation of use was quite rapid and that their use environment and experiences changed concurrently. This suggests that specific risk factors may create a vulnerability, for some individuals, that leads to a propensity for the development of problematic use outcomes, and that these may be identifiable and inform future prevention efforts. This discussion will explore the results of this study in regards to the ways and reasons for cannabis use, and how this information may inform indicated prevention.

4.4.1 Cannabis history

4.4.1.1 Initiation of cannabis use

Among participants in this study, cannabis initiation occurred in early adolescents and was mediated by social relationships with friends or partners. Cannabis initiation, for example, has been associated with attending bars and not having organised leisure time for males, and cannabis-using friends in females (e.g. Perez et al., 2010). These assertions are aligned with the results of this study, in which males reported general deviant behaviour prior to use as well as unorganised leisure time, while most female respondents reported having friends that were cannabis-users, often being the ones who facilitated the initiation of use. The context of use, as described by participants, suggested an environment in which cannabis use was not, however, considered particularly deviant, although some references to ‘wrong crowds’ were made. Additionally, the atmosphere of use was detailed as a causal initiation by friends, often at a house or in a park, with a group of friends. The ways in which use occurred, casually and in situations in which the participant would frequently find themselves in, suggests that the development into frequent, habitual use was easily facilitated. Furthermore, as most participants reported positive, enjoyable experiences of use, it would further encourage the continuation of cannabis use behaviour with their social group.

4.4.1.2 Cannabis development

The development of use following initiation is an important factor in prevention, and how to identify and design interventions for those most likely to develop problematic cannabis use behaviours. Although a few participants noted that they did not adopt frequent, problematic cannabis use behaviours directly following initiation, the majority of participants discussed that they immediately began using cannabis frequently. The rapid development of use frequency from initiation is an important factor for consideration. The shift from initiation to frequent, habitual use suggests that there may be particular vulnerabilities that require intervention prior to use, or early in use trajectory. Alternatively, in an environment of normalization, if social groups have access, resources and time to engage in cannabis use and report their experiences as positive, it is likely that use will become more frequent, especially if they have a lack of other commitments or responsibilities. However, although research on drug normalization for non-problematic users is needed (Hammersley, 2005), it is important to understand why the participants in this study developed problematic use behaviour, and how particular vulnerabilities or environment contributed. Furthermore, the identification of risk factors is important to the development of cannabis prevention efforts (Stone et al., 2012). Particularly, the differences among users with frequent,

habitual cannabis use, to those with infrequent, inconsistent cannabis use, which is less associated with problematic outcomes, and how social groups may facilitate the development of frequent, habitual cannabis use (Lee et al., 2007).

The development of use behaviours highlights the importance of context of use on outcomes and consequences, and how social groups and environment can influence initiation and use development (Connell et al., 2010; Staff et al., 2010; Tucker et al., 2013). However, as use developed, many interviewees reported that they began to use cannabis on their own, often before bed or to relax at the end of their day at school or work. Understanding how cannabis use transitions from social to solitary use may be useful in evaluating use outcomes, with some research evidencing the association of solitary cannabis use and problematic use (Tucker et al., 2006; Noack, Höfler & Lueken, 2011; van der Pol et al., 2013c). Both the participants with the most severe and least severe reported consequences associated with cannabis use, reported habitual, solitary use, thus solitary use shouldn't be considered an indicator of problematic use. Participants who reported the least severe of consequences and used cannabis in a solitary context, discussed that their use was 'goal-oriented' relaxing, a sleep aid or to improve their cognitive ability for tasks. Furthermore, those participants often described use sessions that were, although frequent, less frequent and less intense than their peers, with a more clearly expressed intended outcome. Other participants, who used in a solitary context but experienced self-described severe consequences due to their use of cannabis, tended to describe use that was throughout the day, albeit mediated by responsibilities, and often their primary focus. This highlights the important of context, intentions and environment on use outcomes.

4.4.2 Cannabis experiences

4.4.2.1 Cannabis intentions

In this study, the 'over-instrumentalization' of psychoactive drugs seemed to be an occurrence that happened quite quickly within the study population following the initiation of use. Participants reported high frequency of use and a large financial burden of use from the onset. Financial problems were associated with interest in cannabis treatment in previous research (Buckner, Ecker & Cohen, 2010). Based on their self-reported lack of cannabis knowledge and intentions prior to the initiation of use, it is likely that the participants were 'naïve users' and would have lacked the drug knowledge to participate in 'goal-directed' use (Müller & Schumann, 2011). In particular, the responses of the participants suggest that 'recovery from and coping with psychological stress' and

‘self-medication for mental problems’ were proximal mechanisms for which use was continued by respondents. Unsurprisingly, cannabis is often associated with the reduction of stress (Boys et al., 1999; Boys et al., 2001; Müller & Schumann, 2011) and cannabis is thought to contain chemicals that control the emotional impact of stimuli and aid in the reduction of aversive memories (Mechoulam et al., 1998; Marsicano et al., 2002). It is likely that those with a predisposition of extreme psychological stress, and with little social resources to ameliorate their stress, may be especially vulnerable to exhibiting ‘over-instrumentalization’ of cannabis in order to assuage these stressors. Respondents noted that cannabis helped them to ease the psychological stress of memories, as well as make them feel ‘relaxed’ and relieved from the stresses they were under. Furthermore, although they didn’t specifically report any clinical diagnoses related to anxiety, depression or any other clinical mental health disorders, participants suggested that the use of cannabis was helpful in alleviating feelings of sadness and other symptoms associated with poor mental health. This suggests that the participants were unable or unwilling to pursue any other options to ameliorate psychological stress, or had difficulty in carrying them out previously. As a result, the instrumentalization of cannabis to mitigate the effects of psychological stress was over-instrumentalized, with most participants expressing how important and useful cannabis was for this purpose. Although there is still ambiguity regarding links between mental health, particularly around causality, the evidence does support an association between them, and how early initiation and frequency of use is associated with mental health outcomes (Van Ours & Williams, 2010; Van Ours & Williams, 2012; Copeland, Rooke & Swift, 2013; Degenhardt et al., 2013; Yuraseck & Hadley, 2016). More research focusing on how mental health, stress, and cannabis use are negotiated is needed.

In addition to alleviating psychological stress, participants noted many other intended outcomes for cannabis use, and reported nearly all the described intentions in the ‘instrumentalization’ framework apart from sexual facilitation. Three participants noted how they used cannabis specifically to enhance their perception for artistic, creative endeavours. This is aligned with previous research in which self-reported creativity and cannabis use are described (Green, Kavanagh & Young, 2003; Hammersley & Leon, 2006), although evidence from laboratory experiments dispute this claim (Kowal et al., 2015). Creativity through expanded perception horizon, along with self-medication and stress, and social facilitation seemed to be the most prominently described instrumentalized goals. ‘Goal-directed’ cannabis use, however, was not constant for all participants. All participants described use that was both ‘goal-directed’ and ‘over-instrumentalized’, however when the goal of cannabis use was alleviation of psychological stress or self-medication of mental health issues, there was more likely to be a tendency for over-

instrumentalization. Further research is needed to understand the mechanisms for use in these ‘goal-directed’ categories, particularly around cannabis use and creativity where there is substantially less evidence.

4.4.2.2 Cannabis use outcomes and consequences

Cannabis use motivations are often linked with use outcomes, and enjoyment/fun, conformity, experimentation, social enhancement, boredom, and relaxation are reported as some of the most common reasons for use (Lee et al., 2007). It is important to consider motivations of use, because the ways in which use occurs is linked to use outcomes, and it also informs the ways in which prevention interventions can be disseminated. Stress, as both a risk factor and a motivation for cannabis use, and stress-related factors are associated with cannabis consumption (Hyman & Sinha, 2009). Many participants described cannabis use behaviour motivation influenced by a desire to ameliorate stress and other psychological issues. Although cannabis may be used to alleviate issues of psychological stress and other issues, like depression and anxiety, it seems that there may be a bidirectional relationship in which cannabis also exacerbates these issues. Stress and coping models of addiction support this claim (Will & Hirky, 1996), as chronic cannabis use among young adults who use cannabis as a coping strategy are more likely to experience poor mental health, greater pathology, and distress than peers who use predominately for social reasons (Brodbeck et al., 2007).

There does, however, seem to be a variety of both acute and long-term problems related to cannabis use (Karila et al., 2014), with this sample reporting acute effects related to outcomes directly from use and the ramifications of use related to continued use behaviour, including financial and social issues. Although cannabis may help to assuage psychological stresses acutely and aid in sleep (Bonn-Miller, Babson & Vandrey, 2014; Kevorkian et al., 2015; Moitra et al., 2015), it seems that the ramifications of frequent use can contribute to additional issues around relationships, stigma and financial circumstances that result in psychological stress (Dahl & Heggen, 2014; Duff & Erickson, 2014; Liebrechts et al., 2015). It appears that individuals who are already in a vulnerable position due to their age and interaction with drug and homelessness services, are already more likely to have stressful lives, and that although cannabis is used to cope with stress, it also creates additional stressors. It is likely that young people with more social capital, and less life stressors, would not experience the same degree of consequences due to their use of cannabis. Although frequent cannabis users that are middle-class experience negative social and financial consequences related to use, it appears they do so to a much lesser degree than the participants in this study (Osborne & Fogel, 2008).

4.4.3 Cannabis use behaviour and knowledge

4.4.3.1 Cannabis use frequency

Frequency of cannabis use, particularly around the ways in which use is quantified and evaluated in young people, is critical to understanding cannabis use behaviour and its outcomes. The identification of problematic cannabis users is often based on frequency of use, a technique that has been criticized as an oversimplified approach to assessing use behaviour, which largely ignores daily consumption and the context of use (Temple, Brown & Hine, 2010; Copeland, 2011; Patton, 2011; Earleywine, 2011; Hammersley, 2011; Andréasson, 2011; Asbridge et al., 2014). Although the majority of users were habitual, daily users of cannabis (two participants quit cannabis, or used an alternative drug, like the legal high, 'spice'), their patterns of use were varied, both by the degree of cannabis they consumed, as well as the amount of times they used per day. In describing their cannabis use, there seemed to be considerable variation in use to the extent that it was difficult for the participant to gauge their own use. Additionally, because users often share the cannabis they purchase with their friends, and also share cannabis offered to them by their friends (Coomber & Turnbull, 2007), it was difficult to estimate daily use. Furthermore, because cannabis use frequency is often oriented around responsibilities and social factors (Hughes et al., 2014), use is quite variable. Although users discussed their daily use of cannabis, they also described fluctuations in the amount they purchased and used, and factors which contributed to these changes, including daily stressors and the amount of cannabis needed to achieve their desired level of intoxication, which is influenced by the intensity of their cannabis use (i.e. more intense use requires more cannabis to achieve the desired level of high). The 'over-instrumentalization' of cannabis was not a constant among participants, but rather for most, something that intensified occasionally when dealing with particularly stressful situations or circumstances, or when they were without many responsibilities.

4.4.3.2 Cannabis strains

In addition to the frequency and intensity of use, the strain of use was important in the desired high and intended acute outcome of cannabis use. Little research has been done investigating strain preference and use outcomes, although one study has shown preference among medical cannabis use for sleep problems (Belendiuk et al., 2015). Participants frequently cited two strains of cannabis, *Haze* and *Cheese*. Most, but not all, participants had preference for one or the other, with *Haze* being desired more frequently for perception enhancement and *Cheese* being desired more for relaxation. Participants described that they initially sought out cannabis generally, but as they used more frequently and gained more cannabis knowledge and more experience, they developed

preferences and relationships with dealers who they believed would deliver the cannabis necessary to achieve their desired cannabis outcomes. Some participants were more particular with what they desired, while others more willing to use cannabis even if it wasn't the type they were originally seeking to purchase. It appears that some users have very explicit rules that govern their cannabis use, including how they use and which strain they will use, while others maintain more flexibility and openness in their use behaviour.

4.4.4 Cannabis motivations and cessation

4.4.4.1 Motivations and barriers to behaviour change

Although nearly all participants were in contact with drug services to modify their cannabis use, the level of commitment differed greatly between participants. Some participants expressed that they were content with their current cannabis use behaviour, or expressed that they had already modified their use to a level that they believed was appropriate. Other participants described intense use behaviour in which use modification or cessation seemed unlikely, yet desired, some described an 'addiction' or 'dependency' to cannabis. Two participants ceased cannabis use with the assistance of local drug support services. Evidence has highlighted the issues regarding drug treatment for cannabis in the UK, with type of treatment delivered, pathways to treatment, perceptions of cannabis risk by staff, and greater cannabis knowledge by clients all cited as issues (Monaghan et al., 2016). Most participants reported varied use histories, including times when they had cut down significantly, or used to a much greater extent, while one participant noted that they had completely quit, but eventually began using again, albeit to a much lesser degree. Some participants noted that their use was more reflective of the stage of their life, and that they believed they would likely cut down and cease using when they had more responsibilities, like work and family. Evidence has shown that cannabis use patterns are mitigated by work and leisure and often shift between dependent and non-dependent use (Osborne & Fogel, 2008; Liebrechts et al., 2015). Acknowledgment of gender differences, particularly for female cannabis users, is an area in which development is needed. Although some male and female participants discussed how adult responsibilities and family life would lead to cannabis use modification, the gendering of drug roles, and the specific differences experienced by female drug users is largely ignored (Measham & Williams, 2011). In this study, for example, one female participant believed that only pregnancy and motherhood would lead to cannabis behaviour change/modification.

A theme that emerged amongst participants was that a 'scare' that occurred from acute use would be a catalyst for cannabis use behaviour change (Ogdon & Hills, 2008). This suggests that the

lack of immediate consequences as a result of acute use was a barrier to behaviour change. Alternatively, this explanation may be used by cannabis users in order to rationalise why they are unable to modify their use behaviour.

4.4.5 Informing indicated prevention

The results of this study aim to provide a better understanding of the shifting types of cannabis use and use transition among young people. In addition to reporting cannabis to aid with feelings of psychological distress and self-reported mental health difficulties, the respondents of this study reported changes in the circumstances in which they used cannabis. Rather than public, social circumstances of use, cannabis use behaviour eventually included ritualised, private use behaviour. Several participants discussed that use was necessary for them to feel well enough for them to engage in their day-to-day life. Although many participants used cannabis in the morning if their responsibilities for the day allowed for it, only one described that this was imperative only a daily basis. This supports emerging evidencing linking solitary cannabis use and problematic use outcomes, although better understanding of the mechanisms of this relationship are needed (Buckner, Ecker & Dean, 2016; Creswell et al., 2015). In addition to solitary use, the increased frequency of use to chase the 'high' experienced when one first starts using was described. The 'buzz' that inexperienced users feel when cannabis use is initiated eventually dissipates, yet interviewees had vivid memory of this experience and the chasing of this feeling encouraged their continued use of cannabis. One participant noted, however, that thought this is experience of 'high' was sought the use of cannabis eventually evolved to one in which the intention was simply to 'chill out' or relax. Use instrumentalization seemed to evolve from seeking a 'high' to a relaxation or alleviation of psychological stressors. Although the motivation for enhancement (high) was not related to dependence in young, frequent cannabis users, parallels were found among boredom motivations and young people in other studies (Lee et al., 2009; Benschop et al., 2015)

Recognising the potential vulnerabilities in the respondents of this study, and how their cumulative experiences are representative of the transition from non-addictive to problematic use is a key element in informing prevention programs. This research provides evidence to suggest that psychological stress and mental health deficiencies may be a pathway for individuals to transition to problematic cannabis use, a shift that appears to be rapid. Evidence from dependent and non-dependent users has shown that while non-dependent users have similar mental health to the general population, mental health is worse for dependent users (van der Pol et al., 2013b). Instrumentalization frameworks suggest that a key function in the prevention of the transition from regular, non-addicted psychoactive drug users to addictive problematic use is to focus on 'over-

instrumentalization', or a dependence on the drug to achieve major life goals (Müller & Schumann, 2011). Furthermore, it suggests that an overview of instrumentalization patterns and the use of psychoactive drugs to achieve life goals should be reviewed (Müller & Schumann, 2011). Under the guise of this framework, one would need to look at three major aspects the psychoactive drugs users life course: the environmental and social factors, the personal factors associated with propensity for use (personality factors, mental health, beliefs and attitudes), and previous use behaviours, including the underlying intentions for their use, and the development and evolution over time. Firstly, as residents of the UK, the respondents in this study were associated with an environment of normalization in which there was relatively easy access to and availability of cannabis, and initially indicated perceived public social acceptability. Secondly, participants noted feelings of psychological stress and beliefs that their cannabis use aided them in alleviating psychological harms that they were experiencing. Thirdly, the respondents reported that their use behaviour escalated to the point of frequent use, in which a large financial burden was placed on them, and that use behaviour resulted in problematic and unwanted outcomes, and more perceived stigma. This suggests that in an 'environment of normalization' the keys to preventing the 'over-instrumentalization' of use is to focus on education and how to safely use psychoactive drugs similarly to how public health education encourages safe, responsible alcohol consumption.

The instrumentalization framework postulates that psychoactive drug users need to be 'educated' and 'informed' with specific intended outcomes for their use and titrate and negotiate their use accordingly. This component is reflective of the 'drug normalization' theory which suggests youth and adolescent drug use is an interplay of human agency and social structure (Measham and Shiner, 2009). The social structure, and the background for which 'drug normalization' exists, is evidenced by the growing landscape of drug availability in the UK (Downey & Verster, 2015). Albeit drug use may be related criminal behaviour, drug gangs, and influence from gender, ethnicity, age and socio-economic background, the initiation of drug use is not bound by a deviant, low-socioeconomic background, but permeates through all classes of society (Monaghan et al., 2015). Despite data that suggests many cannabis users will eventually transition, or 'grow out' of use as they age, a proportion of those who use cannabis may develop problematic/dependent use behaviours (Lopez-Quintero et al., 2010). Applying the human agency element of the 'drug normalization' theory ties in with the emphasis in the instrumentalization framework that suggests that users must be 'educated' and make decisions regarding their use behaviour accordingly. However, although cultural perceptions of drug use may be normalized, the public health approaches and education provided for young people are largely based on the prevention of use and abstinence aims which lack information regarding the 'safe', 'informed' use of drugs. This results in

a system in which drug availability and experimentation is frequent and 'normal', but information detailing the ways in which psychoactive drug use are safely used are not readily available or disseminated to young people. This subsequently results in 'naïve, uneducated' drug users who initiate use based on information from other, unreliable sources.

The implication of the intersection of the instrumentalization framework and 'drug normalization' theory for indicated prevention is the acknowledgement of specific vulnerabilities for the development of problematic drugs use and dependency and that human agency and 'informed' drug use behaviour may help to prevent the overinstrumentalization of use. In both aspects, acknowledgement of human agency is critical in the development of indicated prevention. In the context of 'drug normalization', particularly for cannabis which has the highest rates of use among young people, a large proportion of young people will experiment with cannabis and should be educated on the ways in which drugs are used and how to use them in a safe way. Unlike education campaigns that focus on the dangers and pitfalls of recreational drug use, focus should be placed on allowing young people information that enables them to adopt and adapt to 'healthy' ways to use drugs, similarly to some alcohol education programs. Furthermore, individuals with perceived vulnerabilities regarding the increased likelihood of developing problematic use behaviours, like individuals with high levels of psychological distress or mental health difficulties, may receive targeted prevention efforts tailored towards the risks associated with use and advice on how to best navigate the environment of 'drug normalization'. The interviewees in this study reported initiation into cannabis use and increasingly frequent use behaviour that was far from 'goal-oriented', but rather used as a tool to aid in coping with the stresses of life and to 'escape' from reality. Although many of the users reported prolonged, frequent use of cannabis, when asked what they knew about the drug, and specifically about the cannabis they purchase, they often gave uninformed, unknowing responses. Bridging the information gap among cannabis knowledge in an environment of 'normalization' is likely to help prevent problematic use outcomes.

In addition to lack of information regarding cannabis, respondents in this study demonstrated key vulnerabilities related to their problematic cannabis use behaviour and over-instrumentalization. Key vulnerabilities, like mental health factors and psychological distress, were likely to account for the overinstrumentalization of use by participants. While most participant discussed that their use initiated with their peers as a social experience, this quickly shifted to a more solitary and increasingly frequent endeavour used to curb mental distress and as a coping strategy for difficulties, which eventually led to the creation of additional difficulties caused by excessive use. Additionally, when respondents discussed their experiences of use behaviour, they

discussed several different reasons and resulting outcomes from their use. Despite these differing circumstances, they were consistent in their accounts of a need for repeated and excessive use in order to relax or merely 'exist' and that in response to their use they experienced negative and problematic outcomes.

Although vulnerabilities associated with over-instrumentalization of use as described by participants may be a promising avenue for indicated prevention, it is important to consider the context and environment of cannabis use among users, particularly among users who could be considered to be at the fringes of society. In particular, participants in this study were in contact with homelessness services for young people and engaged in social programs are considerably more vulnerable than the general population.

4.4.6 Risk factors suitable for targeting in the development of indicated prevention

The association between psychological distress and cannabis use is not undocumented in the academic literature. A systematic review of longitudinal general population studies assessing the relationship between illicit drug use and young people and psychosocial harms were inconclusive in finding a causal link between cannabis use and psychosocial harm (Macleod et al., 2004). This research, however, looked specifically at the causal relationship of cannabis use that leads to the development of psychosocial harms. Furthermore, the authors postulate that psychosocial problems are likely to be a precursor to problematic patterns of illicit drug use and that the use of cannabis may exacerbate pre-existing harms (Macleod et al., 2004). More recent work has investigated the relationship between moral disengagement, psychological distress, resistive self-regulatory efficacy and cannabis and alcohol use among young people in Australia and found evidence to suggest that higher moral disengagement and lower resistive self-regulatory efficacy were associated with initiating cannabis use, although psychological distress was not associated with cannabis initiation (Newton, Havard & Teesson, 2012). The findings support theory that in an environment of 'drug normalization', high levels of moral disengagement and lower resistive self-regulatory efficacy are associated with initiation of cannabis use. However, the initiation of cannabis use in and of itself is a generally common and unlikely to be associated with problematic outcomes. Although preventing the initiation of use is certainly purposeful in preventing harms, based on prevalence data, preventing the escalation of problematic use is associated with more burden. Building on the association between psychological distress and substance use, an internet-based universal prevention campaign aimed at the harm minimisation of young people effective at reducing alcohol and cannabis use (Newton et al, 2009; Newton et al., 2010) was also found to reduce factors associated with use, including truancy, psychological distress and moral

disengagement (Newton et al., 2014). This provides evidence that prevention work has the potential to both curb excessive, or over-instrumentalized use, as well as the factors that may predate or exacerbate use behaviour. Furthermore, this suggests that more tailored indicated prevention work for young people with increased vulnerability for developing problematic cannabis use behaviours may help to cease the transition to problematic dependent use while focusing on the underlying mechanisms to those behaviours.

Levels of psychological distress may be an important factor in assessing whether individuals have vulnerability in developing problematic cannabis use outcomes. Research looking at the relationship between self-harm, psychological distress and substance use found an association between current cannabis use and past year self-harm (Moller et al., 2012). Although this research does not provide evidence to a causal relationship between cannabis and psychological distress, or the degree and frequency of cannabis use, it suggests that there may be association between cannabis and psychological distress. Self-medication hypotheses and model pathways suggest that psychological distress, often stemming from trauma, may be often a precursor to substance misuse as well as exacerbate outcomes of use (Garland, Pettus-Davis, & Howard, 2013). Although this research suggests that the outcomes of extensive and often violent traumatic events lead to more extreme substance misuse, it is likely that lesser perceived trauma and psychological distress could lead to more extreme, problematic levels of substance misuse as well. In alignment with the 'drugs as instruments' framework, this suggests that the use of illicit substances to cope and deal with psychological stresses may become 'overinstrumentalized' to the degree to which use behaviour becomes problematic. This evidence suggests that honing in on key vulnerabilities related to problematic illicit drug use outcomes and how these vulnerabilities evolve and intersect with use behaviour is critical in the development of indicated prevention work aimed at the reduction of harm and problematic use outcomes.

4.4.7 Determining problematic use in an environment of normalization

An environment, in which drugs are normalized, facilitates access and social acceptability of use. Cannabis use has reached the point of normalization in much of the western world, with the legalisation of use becoming increasingly more commonplace and as a result led to initiation and recreational use that is to a greater degree than other illicit drugs. Perhaps as a result of the greater prevalence of cannabis use in relation to other illicit drugs, cannabis use is no longer considered a widely stigmatised behaviour. By nature, this makes the differentiation between experimental/recreational use and problematic/dependent use difficult to ascertain. Furthermore, this makes it difficult for prevention work, even within the context of a harm reductionist

perspective, difficult to maneuver; determining harm of use, in a research environment in which all use is usually deemed problematic, unlike, for example alcohol, provides difficulty in sorting out problematic and unproblematic cases of use. Furthermore, disseminating information, often to young people under the 18 years of age, about the 'safe, healthy' ways to use illicit drugs proves to be a moral conundrum. Due to the cultural and social normalization of cannabis use in the United Kingdom, prevention work geared towards licit substances like alcohol and tobacco may be more relevant in adapting prevention work for cannabis consumption. Prevalence data suggests that the majority of cannabis users discontinue use as they age, likely due to growing responsibilities of family and professional lives, or possibly because frequent use may be considered more stigmatised as one ages. In order to provide appropriate education and prevention campaigns, research must work towards identifying and defining problematic cannabis use and designing programs that are oriented towards the prevention of problematic use outcomes. Specifically, prevention work is saddled with the responsibility of creating programs that identify young people most at risk of graduating from experimental/recreational use to dependent/problematic use. In an environment in which nearly a third of people under 25 years of age will initiate cannabis use, prevention work needs to acknowledge that use is likely among young people and equip them with the information and knowledge needed for them to make healthy, effective choices regarding their decisions and behaviours with cannabis.

4.4.8 Conclusions

Although this research was exploratory in nature, it provides a contextualisation to existing theories regarding the development of problematic cannabis use behaviour. This research provides evidence to suggest that psychological stress and mental health are factors that may influence cannabis use outcomes, and create specific vulnerabilities in young people. Further research investigating how young people navigate use in an environment where illicit cannabis consumption is illegal, yet relatively common, and how young people gain knowledge about how they use is needed. This evidence would help to provide prevention work to limit and prevent problematic/dependent cannabis use behaviour among young people.

4.4.9 Limitations

Although this research did not specifically assess whether or not the participants of this study were clinically dependent on cannabis, participants were in contact with drug services and self-reported problematic cannabis use and a desire to cease, alter or receive assistance in continuing to be abstinent. As a result, it is important to understand the association between problematic cannabis

use and mental health factors. Specifically, to develop a better understanding of how cannabis use and mental health interact, and unravel the pathways of the development of both cannabis and mental health issues. A systematic review of the evidence of cannabis use and the development of psychotic or affective mental health outcomes suggests that there is an increased risk for psychotic outcomes for cannabis use, but the evidence for affective mental health outcomes is less strong (Moore et al., 2007). Reporting lifetime cannabis use had a dose-response effect with psychosis, while the findings for depression, anxiety and other clinical affective disorders were less consistent and addressing causality in those instances was more tenuous (Moore et al., 2007). The comorbidity of substance use and mental health problems is becoming increasingly apparent, with research demonstrating that self-reporting last year substance use increasing the likelihood of having a co-occurring mental health problem (Chan, Dennis, & Funk, 2008). Additionally, young people (aged 18-25) were the most vulnerable to co-existing substance use and mental health issues (Chan, Dennis, & Funk, 2008). A more comprehensive understanding of how the mental health of the interview participants, and the state of their mental health prior to these interviews, would have provided a better understanding of how cannabis use affected use and how the two factors interacted.

Research on young people, university students, suggests that of those who engage in cannabis 9.4% meet the criteria for cannabis use disorder (CUD) (Caldeira et al., 2008). Furthermore, young people defined as at-risk (smoking cannabis more than 5 times in that past year), reported high levels of problems (Caldeira et al., 2008). This provides further evidence that contextualising the instrumentalization of use among young cannabis users, both the frequency to which they use, the social circumstances around their use, and the intentions behind their use behaviour is needed. Furthermore, research regarding the life course of cannabis use for young people needs to be addressed. Research suggests that although young people report frequent use, and even meet clinical levels of dependency, this might not translate into continued dependent use based on the dips of prevalence data that are reported. This research focuses specifically on frequent, problematic users of cannabis, but the 'frequent' aspect of their use should not be considered synonymous with all cases of cannabis use behaviour. Both frequent and infrequent cannabis use can be associated with problematic outcomes, and research addressing the circumstances and intentions around problematic outcomes is needed.

This research provides evidence that cannabis use problems among young people can cause problematic use outcomes and exacerbate existing self-reported problems among young people. This research, however, focuses specifically on young people in touch with drug services who are

likely to have experienced greater cannabis-related problems than the majority of other users. Although this does not provide generalizability of 'cannabis experience', it does provide insight into how use may develop into problematic use. Further research is needed on cannabis experiences of young people, particularly of young people who 'instrumentalize' use and experience limited problematic outcomes from their use. Additionally, research on problematic outcomes for non-frequent users would help to provide evidence of how information regarding 'healthy, safe' use could be disseminated.

Chapter 5

General discussion

The studies described in this PhD have sought to provide evidence to inform the feasibility of adapting current prevention programs for targeted, indicated prevention for those most vulnerable to developing problematic/dependent cannabis use. This discussion will firstly review the studies conducted in this PhD and how they cumulatively add to our understanding of cannabis use, and prevention, particularly around risk factors associated with cannabis use behaviour. Next, this discussion will briefly discuss the evidence that supported this research and what new insights this research has provided. Lastly, this discussion will then provide recommendations for future directions for prevention work and research that will inform, and the best ways to negotiate these within the current framework of UK drug policy.

5.1 The measurement of cannabis behaviour and factors associated with use

A main topic addressed in Study 1 of this PhD was the exploratory analysis of factors associated with cannabis use outcomes, the measurement of these outcomes, and the relationship between associated factors and cannabis use outcomes. Longitudinal research has identified a multitude of factors associated with substance use (Beato-Fernandez et al., 2005; Belcher and Shinitzky, 1998; Beyers et al., 2004; Bränström, Sjöström, & Andréasson, 2008; Challier et al., 2000; Costa, Jessor & Turbin, 1999; Donovan, 2004; Hawkins, Arthur & Catalano, 1995; Hawkins, Catalano & Miller, 1992; Kandel et al., 1986; Kliwer & Murrelle, 2007; Labouvie & McGee, 1986; Newcomb & Felix-Ortiz, 1992; Oman et al., 2004; Ostaszewski & Zimmerman, 2006; Stone et al., 2012; Thompson & Auslander, 2007; White, Pandina & LaGrange, 1987). The results of this initial study indicated that factors predicting cannabis use outcomes such as measures of lifetime use, frequency of use, severity of dependency and problems associated with use behaviour varied significantly. This indicates that cannabis use outcome measures, which provide insight to different aspects of cannabis use behaviour and user profiles, and the factors associated with them, are different. Thus, when using evidence from studies to inform prevention, the consideration of cannabis use measurement in identifying the population in which interventions should be aimed, and the factors appropriate for targeting that population is critical. Cannabis use measurement is currently a hotly debated topic (Temple, Brown & Hine, 2010; Copeland, 2011; Patton, 2011; Earleywine, 2011; Hammersley, 2011; Andréasson, 2011; Asbridge et al., 2014). Emerging research on cannabis use behaviour has sought to use new strategies for measuring cannabis use, including more detailed

assessments of intoxication, potency and frequency (van der Pol et al., 2011; van der Pol et al., 2013a; van der Pol et al., 2013b; van der Pol et al., 2013c; van der Pol et al., 2014; Hughes et al., 2014; Ansell et al., 2015; Asbridge et al., 2014). This study and the corresponding review of the analysis provided the basis for additional studies completed in this PhD and highlighted the importance in considering cannabis use measurement when extrapolating evidence to inform indicated prevention interventions.

One of the key aims of this PhD was to provide evidence to potentially inform indicated prevention for cannabis use among young people at-risk for developing problematic and/or dependent use behaviour. By looking at multiple cannabis use outcomes, the work examined how factors associated with use were related to different outcome measures. Thus, factors that were related to assessment of cannabis use (lifetime use history, frequency of use, and problems related to use) differed within the same population of users, although some of the factors were associated with multiple assessments of cannabis use behaviour. Results indicated that cannabis use outcome measures most associated with problematic behaviour, including assessment of problems associated with use, severity of dependence, and frequency of use, indicated the mental health symptomology was a potential pathway for targeting problematic users in this sample.

Based on the results of study 1, psychopathological symptomology was considered an avenue to explore in the development of indicated prevention approaches, although the relationship identified within the research did not suggest causality. However, additional analysis, a latent class analysis of the population grouped by severity of mental health symptomology, showed that in groups reporting greater severity of mental health symptomology, there was an association with (non psychopathological) problems associated with cannabis use behaviour. It is possible that greater use of cannabis leads to greater mental health problems; however, it is more likely that there is a bidirectional relationship between mental health and cannabis use. The association between mental health and cannabis use is well-documented, although issues regarding causality and confounding factors make interpretation difficult (Degenhardt et al., 2012; Copeland, Rooke & Swift, 2013; Schubart et al., 2013). Regardless, the relationship between mental health symptomology and cannabis use suggests that these constructs interact and influence each other, and although there is large literature on the relationship psychopathology and cannabis, a greater understanding of how mental health effects use behaviour and the implications for the development of prevention interventions are needed (Degenhardt, Hall & Lynskey, 2003; Macleod et al., 2004; Jané-Llopis and Matytsina, 2006; Moore et al., 2007; Lev-Ran et al., 2014).

5.2 Implicit cognition measures and cannabis use behaviour

Following the completion of Study 1 for this PhD, an additional experimental study was designed, further developing on the conclusions derived regarding cannabis use outcomes measurement and mental health symptomology. In order to refine the model of cannabis use behaviour measure and mental health symptomology, implicit cognition measures were assessed and the relationship between mental health symptomology, implicit cognition measures and cannabis use behaviour was explored. Implicit cognitions are unaware, uncontrollable, fast mechanisms that underlie behaviour, and the measurement of this allows to researchers to examine the beliefs and feelings that cannot be wholly expressed by explicit, self-report measures which rely on participant introspection (Nisbitt & Wilson, 1977; Roefs et al., 2011). The relationship between implicit cognitions and substance use has been documented (Rooke, Hine & Thornsteinsson, 2008; Stacy & Wiers, 2010; Wiers et al., 2015), although research on implicit cognitions and cannabis use is less extensive (Ames, Zogg & Stacy, 2002; Field, Mogg & Bradley, 2004; Ames et al., 2005; Field, 2005; Field et al., 2006; Dekker et al., 2010; Cousijn, Goudriaan & Wiers, 2011; Beraha et al., 2013; Cousijn et al., 2013; Schmits et al., 2015). Results have shown varied results with cannabis users showed lesser negative implicit associations with cannabis-related words than non-users (Field, Mogg & Bradley, 2004), heavy cannabis users have demonstrated a stronger implicit positive-arousal association with cannabis (Beraha et al., 2013), no correlation between implicit cannabis association and cannabis use in young adulthood (Dekker et al., 2010) and negative implicit expectancies with cannabis having a negative relationship with cannabis frequency and problems in adolescents (Schmits et al., 2015).

The population for this study, unlike the general student population of the first, consisted of weekly cannabis users. This sample was chosen in order to understand differences among frequent cannabis users and to try and identify which users might be most likely to develop problematic use behaviours, and to apply more sophisticated measurements of cannabis use behaviour. In other studies looking at dependent and non-dependent cannabis users, factors, including current problems and mental health, had a stronger association with dependence and problematic use than the current study (van der Pol et al., 2013a; van der Pol et al., 2013b). Two additional components were added to the design for Study 2: additional measurements of cannabis use behaviour and tests of implicit cognitions and cannabis-related stimuli. Additional measurements of cannabis use behaviour were used in order to get a better understand of behaviour, and how other dimensions of use, such as the amount of cannabis used per joint, related to factors associated with use and other measures of cannabis consumption.

The addition of implicit measures aimed to provide evidence regarding cannabis use decision-making and how use was related to cannabis stimuli among frequent cannabis users. As evidenced by the Study 1 of this PhD, the measurement of cannabis consumption and behaviour provides is crucial in understanding the development of problematic use behaviour. To provide a better understanding of how cannabis is used, amongst the population that reported use of cannabis joints, participants were asked to roll joints (a cannabis substitute was provided) to estimate the amount of cannabis and tobacco typically consumed. Additionally, participants were asked questions about their joint rolling behaviour, including: who rolls their joints and the variability amongst the joints they smoke. This provided evidence of the variation of cannabis use behaviour among frequent cannabis users, and emphasised the need for more evidence regarding decision-making and use behaviour amongst frequent cannabis users. This is important in differentiating cannabis user profiles and identifying characteristics of frequent cannabis users most vulnerable to developing problematic outcomes due to their use. Although the variation among cannabis use behaviours did not indicate differences in problematic outcomes or composite measures of use, results indicated that there were considerable differences amongst use patterns and behaviours in this study. The rationale for this study was to provide evidence leading to inform better ways to identify and target individuals who may be appropriate for indicated prevention interventions. Subsequently, this evidence would address the potential of new, emerging methods in disseminating prevention interventions like bias modification (Boendermaker, Prins & Wiers, 2015; Boffo et al., 2015; Wiers et al., 2015).

In addition to the development of cannabis measurement, implicit cognition tests were used in an attempt to assess the use of new measurement techniques to inform prevention efforts. This work examined how frequent cannabis users responded to cannabis stimuli, their association to that cannabis expectancies, and their ability to regulate implicit cognitions. Although the results indicated that implicit measures used in this study did not add to previous models of cannabis consumption and associated factors of use, this avenue of research should not be discontinued. The relationship between implicit associations and drugs has been well-documented, with links identified in a range of populations (Ames, Franken & Coronges, 2006; Rooke, Hine & Thornsteinsson, 2008; Stacy & Wiers, 2010). Despite advances in our understanding of neuroadaptive changes resulting from drug use (Bechara, 2005; Bechara, Dolan & Hindes, 2002; Everitt, Dickinson & Robbins, 2001; Everitt et al., 2008; Volkow & Fowler, 2000; Adinoff, 2004), implicit cognitive measures and their influence on processes of addictive behaviour are still new and underdeveloped (Ames et al., 2013). Research using fMRI and implicit association tests showed neural activity consistent with dual processes framework in a sample comparing non-users and users of cannabis (Ames et al., 2013). In

the sample for this study, cannabis users were not compared to non-users, unlike other studies which have used the SC-IAT for cannabis expectancies (Dekker et al., 2010; Beraha et al., 2013). Differences in results might therefore have been due to the lack of an external drug naïve control group to compare with cannabis users. In both of those studies, significant negative implicit associations were shown in both cannabis users and controls (Dekker et al., 2010; Beraha et al., 2013), while higher weekly cannabis use was associated with negative implicit associations in (Beraha et al., 2013). Methodological issues could explain differences in results, including the ‘figure ground effect’, the noticeability salience of stimuli as the cause of IAT effect not implicit attitudes (Rothermund & Wentura, 2004). Results in other similar studies (Dekker et al., 2010; Beraha et al., 2013) may be the results of ‘figure ground effects’, although alcohol-arousal effects could not be explained by ‘figure ground effects’ in one study (Houben & Wiers, 2006). Furthermore, the relationship between extra-personal associations, like cultural norms, may, at least in some part, contaminate the IAT effect (Houben & Wiers, 2007). Furthermore, it is possible that the homogeneity in cannabis use behaviour did not warrant significant differences in implicit expectancy association and affect regulation, although differences were detected in explicit expectancy measures. Further development of the measurement of implicit cognitions may provide better tests, and it is possible that the ways in which cannabis influences brain behaviour, including memory and reaction times, might muddy the ability for these test to accurately assess the construct. Regardless, this evidence shows that there are considerable differences amongst frequent cannabis users, and evidence is needed to understand how these differences contribute to different use trajectories and the development of associated problems.

5.3 The experiences of young problematic cannabis users in services

Evidence provided in the first two studies of this PhD indicated that a focus on more detailed cannabis use behaviour measures to better identify and understand problematic cannabis use development in young people is needed. The strengths of using assessment of psychopathological symptomology as a tool for targeting those most vulnerable was identified in those studies. An additional study was designed to contextualise these results and gain a better understanding of how problematic use developed and evolved in young people. The final study of this PhD consisted of interviews with young people in contact with drug and housing services, and identified by staff as young people with current or previous problems due to their use of cannabis. The aim of this study was to provide an understanding of use behaviour and its development over time, and was framed in references to normalization and instrumentalization theories.

As described in Section 4.1.4, according the normalization thesis, the UK cannabis environment posits a culture in which cannabis use is not particularly stigmatised for many young people (Parker, Aldridge & Measham, 1998). Cannabis has a significant cultural presence, with considerable references in TV, film, music and literature (Manning, 2007). In fact, a large minority of young people will use cannabis casually and will never develop problems from their use (Lopez-Quintero et al., 2010). This climate of normalized cannabis use makes it important for prevention researchers to identify those most likely to develop problems as a result of their use, and develop and design interventions to target those individuals and respond to their specific vulnerabilities. The normalization framework, however, is not without criticism. The normalization framework has been described as the conflation of ubiquitous drug experimentation with less common use (Shiner & Newburn, 1999), an oversimplified framework that ignores socioeconomic status among other factors (Shildrick, 2002), and while others have pointed its reliance on multidimensional factors of drug taking and cultural norms (Perreti-Watel, 2003). Despite public opinion of cannabis that is increasingly liberal and pragmatic (Gould & Stratford, 2002), the perceived perception of use seems to effect cannabis users. Parker, Aldridge & Measham (1998) argued that drug decisions are based on a cost-benefit system, in which enjoyment is weighed against potential risks and harms, like social disapproval, criminal justice sanctions and health issues (Aldridge, Measham & Parker, 2011; Shiner & Winstock, 2015). Several studies have examined how this cost-benefit system is experienced, and how the stigma associated with use is negotiated and managed by cannabis users through various means (Shiner & Newburn, 1997; Sandberg, 2012; Järvinen & Ravn, 2014; Duff & Erickson, 2014; Hathaway et al., 2015). This work highlights that despite increasing liberal public opinion, stigma and perception of cannabis use still impact on users.

Interviews with young people identified as problematic, or former problematic users of cannabis, detailed their use history and their development of problematic use behaviours. These results indicated that cannabis was readily available to most young people and that for most who developed problematic use behaviours, their use quickly developed into self-described problematic use. The development of use, as described by young people in contact with drug and housing services, and its problematic nature corresponded with a multitude of contributing factors, including self-described stress and mental health symptomology. Furthermore, the use of cannabis seemed to coexist with other deviant behaviour and unstable environments lacking structure. These interviews, however, further emphasised the bidirectional relationship between cannabis and mental health symptoms, and a relationship in which cannabis was used to alleviate these symptoms, yet also contributed to them. The interviews with young people provided insight into how cannabis was negotiated in their life, and as well as the types of problems experienced because

of use. Of particular note was how the participants described few problems as a result of acute use, but rather noted how the lifestyle of being a cannabis user was one of the most disruptive elements, particularly regarding finances, employment and relationships. This suggested that perceived normalization may not exist for the participants in this sample.

The perceived normalization the participants experienced is highlighted by the mixed messages of cannabis use by UK drugs policy and media reports. In the United Kingdom, there is currently increasing debate regarding drug use, and to a large extent the use of cannabis, and the public policy framework that dictates the rules and regulations on its use, production and distribution. A general review of the past 20 years of cannabis research outlined dependence and the physical and mental harms that could result from its use (Hall, 2014). This review of epidemiological data on cannabis use and its effects suggested that cannabis use likely increases the risk of physical, particularly cardiovascular health, can produce dependence, and is likely cause or exacerbate mental health and other psychosocial harms (Hall, 2014). Although this evidence was a collation of previous evidence supporting these claims, these results were sensationalized in the media, with a Daily Mail article titled, 'The terrible truth about cannabis: Expert's devastating 20-year study finally demolishes claims that smoking pot is harmless' (Daily Mail, 2014). In addition to this article, general media representations presented an image of the dangers of cannabis, and likening its use to other, potentially more harmful illicit drugs, like heroin. This sensationalism is representative of the media perception of cannabis, how it is presented in the media, and why it becomes difficult for public health to disseminate accurate information to best inform and advise people on health behaviour.

Despite the majority of mainstream media publications comparing cannabis use to heroin, the Guardian has produced several articles recently discussing drug policy and its effects on use behaviour, and the Observer recently printed a spotlight on drugs that invited academic researchers to highlight current issues and trends regarding illicit drug use in the United Kingdom. 'The Guardian view on drugs policy: time for the politicians to study the evidence' highlights recent data from the home office that suggests drug policy has little effect on use behaviour of illicit drugs, but does effect costs, while The Observer 'Drugs Uncovered 2014' provided current public perceptions of drugs, current emerging trends, and data that paints an accurate depiction of current use behaviour in the UK (The Guardian, 2014; The Guardian, 2014a). The contrasting information, the misinformation, and the differing ways in which cannabis knowledge is presented in the media provide a very confusing message about illicit drug use, particularly that of cannabis. The ways in which the media present knowledge about drug use and perception will surely influence young people's drug use

behaviour. Recognising the conflicting and confusing messages disseminated by the media is an important aspect in considering how to proceed with prevention efforts, especially in an environment where cannabis use is so prevalent among young people.

The current UK Drugs Strategy aims to reduce demand and restrict supply of illicit drugs while building recovery in communities. To achieve these goals, the strategy aims to reduce illicit and other harmful drug use and increase the number of people recovering from drug dependence (Home Office, 2010). One way in which the UK Drugs Strategy tackles these aims is by the classification which designates penalties for possession, supply and use of drugs. The classification of cannabis has undergone changes in recent years, with the Advisory Council for the Misuse of Drugs recommending a reduction in the severity to Class C that was followed through, only to be overturned under pressure from politicians and reinstated as a Class B substance. The reclassification of cannabis, followed by its return to its original classification, did not produce any differences in prevalence rates. It's likely that this return to its original classification only produced greater effort for police in enforcing drug laws as well as penalising and imposing judicial harms on low-level users. This policy shift also represents a considerable difference compared to the rest of global cannabis policy which has been increasingly shifting towards more liberal policies. The UK Drugs policy landscape is a series of confusing and contradictory claims and practices that is likely to make decision-making for young people difficult. Oscillating drug policy coupled with fear mongering media assertions in an environment in which 'drug normalization' exists, particularly with cannabis, sends mixed messages regarding cannabis use.

The culminating interviews from this study provide considerable insight into problematic cannabis users, their relationship with cannabis, and how use-related problems develop. These results, due to the sample of cannabis users in touch with social support services, are not generalisable to the general population, but may still provide insight into mechanisms of drug instrumentalization and drug normalization. Most interviewees described cannabis use which was oriented around responsibilities, and used to alleviate stressors and relax, and rarely used in an indulgent manner or to party. This is similar to research on socially, integrated cannabis users in Canada (Duff & Erickson, 2014). However, many participants described times when they were particularly stressed or dealing with difficulties, they had the propensity to over use cannabis in order to escape or cope with their problems. This, however, was in direct contrast to work on socially integrated cannabis users in Canada who reported restricting use during times of stress (Duff & Erickson, 2014). This behaviour tended to exacerbate their current problems because of the financial implications, and tensions that arise from perceptions of use from friends or family

members. Thus, it is possible that the 'rules' enforced about use by socially integrated cannabis users protect them from problematic outcomes, and the development of such 'rules' could be beneficial to young people. Furthermore, this is consistent with research that looks at socially integrated and disintegrated drug users (Järvinen & Ravn, 2014). This research has shown that among drug-using youth, social interaction is both a motivating factor and protective factor for use, although it is possible that use, in and of itself, is the cause of the disintegration (Järvinen & Ravn, 2014). A better understanding of how individualised, disintegrated use, and how this develops (as a precursor to treatment, or as a result of treatment) and how this effects use development is needed. Furthermore, there was a split among participants and their intended future use behaviour, with some believing that use would naturally diminish or cease as they develop family or career responsibilities, with others believing it would be difficult to stop using and aren't sure it is attainable for them. This highlights the variation of cannabis users in touch with drug services, including varied use intentions and treatment needs (Hamilton et al., 2014).

5.4 Cumulative results and how they inform indicated prevention

The culminating evidence from this PhD suggests that a variety of factors are associated with problematic cannabis use, particularly environmental factors, cannabis instrumentalization, and mental health symptomology. Although evidence from Study 1 showed associations between cannabis use and mental health symptomology and other factors, more in-depth analysis was conducted to explore the nuances between cannabis user behaviour and associated factors. In Study 2, emphasis was placed on frequent cannabis users, at least weekly consumption. Results indicated considerable variation among use patterns. Cannabis use behaviour, however, was not associated with implicit cognitions as hypothesised, which did not contribute significantly to differences in problematic cannabis use outcomes; explicit expectancies and mental health factors, however, were associated with cannabis use outcomes. In order to develop a better understanding of how problematic use developed and how use was negotiated by habitual cannabis users, in-depth interviews were conducted with problematic cannabis users in touch with drug and housing social services. Through these interviews, evidence gleaned that problematic cannabis use tended to be exacerbated by mental health symptomology, although there was a duality to use, which was often used to alleviate mental health symptoms as well. The results suggested that use often became problematic when their environment or life was particularly stressful, and that cannabis use tended to become overinstrumentalized as a result. Participants noted that their cannabis use was quite variable, shifting from self-described problematic to non-problematic use tendencies depending on personal factors.

Indicated prevention for cannabis must be oriented around the targeting of individuals most likely to develop dependency or problematic behaviour. The results of this PhD indicate that mental health symptomology may be a suitable construct to target and design such interventions. However, additional evidence is needed to understand the underlying mechanisms for which this relationship is bound. Results suggest that although mental health symptomology may be related, this relationship appears to be multifaceted, with cannabis alleviating symptoms and exacerbating problematic cannabis use, sometimes simultaneously. Interviews with young, problematic cannabis users suggest that the overinstrumentalization of use leads to problematic outcomes, and that anxiety and depressive symptoms, particularly, are often the root of overinstrumentalized behaviours. This result is similar to work looking at coping motivations and distress intolerance and cannabis use. Distress intolerance is conceptualised as substance use that is motivated by the avoidance or reduction of negative affect states (Baker et al., 2004). This coping mechanism is linked to more frequent and problematic use (Cooper, 1994; Hides et al., 2008; Johnson et al., 2010), and cannabis users with greater distress intolerance are more likely to use cannabis to cope than more tolerant individuals (Potter et al., 2011; Simons & Gaher, 2005; Zvolensky et al., 2007). This relationship appears to be more powerful for women than men (Bujarski, Norberg & Copeland, 2012). Although coping mechanism and the propensity to adopt coping mechanisms for use may be related to problematic use, the results of this analysis of young people in touch with social services highlight that cannabis use is variable, and that coping motivations to use cannabis are also variable. Prevention efforts targeted around cannabis use and goal-directed use and coping mechanisms must address the variability of use intentions and outcomes. Indicated prevention strategies, akin to alcohol based prevention work which proposes limits to drinking, might be useful in informing young people and their cannabis use behaviour, particularly those with distress intolerance vulnerabilities.

In addition to informing prevention efforts, this PhD provided evidence that measurement of cannabis is critical in understanding patterns of use and understanding the development of problematic user behaviours (Temple, Brown & Hine, 2010; Copeland, 2011; Patton, 2011; Earleywine, 2011; Hammersley, 2011; Andréasson, 2011). Problematic cannabis use, however, should be measured not merely by frequency of use, but also by intended outcomes of use, patterns of use, and problems experienced as a result. Frequency of use, although associated with cannabis-related problems, is too broad to encompass the nuanced characteristics of cannabis use behaviour, which should include potency, number of joints, and more detailed patterns of use. Emerging evidence showing differences among non-dependent and dependent frequent cannabis users demonstrates the need for a greater understanding of the nuances of cannabis patterns, and how they inform user profiles and use outcomes (Hughes et al., 2014; van der Pol et al., 2014; van Laar et

al., 2013; van der Pol et al., 2013b). Particularly when designing indicated prevention, it is important to understand how risk factors, which may be used for identifying individuals at risk for developing problematic use behaviour, are related to cannabis outcomes measures. Results from Study 1 of this PhD demonstrate that although some risk factors relate to multiple cannabis outcome measures, they measure different aspects of cannabis use behaviour. With evidence suggesting that focusing on problematic user may be the most appropriate pathway (Davis et al., 2009; Thake & Davis, 2011; Zeisser et al., 2012; Asbridge et al., 2014). This research suggests that focusing not only on problematic users, but on the mechanisms associated with specific problematic cannabis use events, may be the best way to inform indicated prevention efforts and advise young people at-risk how to negotiate and manage their cannabis use behaviour.

5.5 Novelty of this PhD

This PhD provides evidence of risk factors associated with problematic cannabis use in young people, and the importance of how cannabis use assessment on the identification of consequences and predictors of use. Specifically, the findings of this work contribute to literature on the relationship between psychopathology and problematic cannabis use behaviour, and the importance of use incorporating theory and frameworks such as instrumentalization to better understand patterns and outcomes of use. Furthermore, this work shows that implicit association tests do not significantly predict cannabis use involvement. This suggests that implicit association tests, as operationalised here, are not suitable for identifying young people at-risk for developing problematic use behaviours. Considering the underlying mechanisms for these patterns and outcomes of cannabis use are important in understanding how cannabis use develops, and the potential for harmful outcomes. Finally, it shows the importance of wider societal responses to cannabis use by some user groups, and the potential role of stigma in the development of problematic patterns and outcomes of use among young people.

5.6 Policy implications

So what does public policy regarding cannabis use mean in relation to the evidence produced by this PhD? Information regarding cannabis use must be particularly confusing for young people, as laws regarding its use vary widely by country, with media depictions of medicalised use and other legalised use, and wide-ranging media depictions (e.g. Hughes, Lancaster & Spicer, 2011; Lancaster et al., 2011). Varied media representations and perceptions of cannabis use coupled with prevention that focuses on harm reduction and abstinence towards cannabis equip young people with little information regarding cannabis use and its effects (Rosenbaum, 2016). Cannabis legality

shifts in the United States have opened a discussion about science and reality based prevention approach akin to alcohol (Rosenbaum, 2016). The results of this study indicate that, even among problematic users of cannabis, knowledge and cannabis use behaviour and experiences vary widely. Furthermore, most young frequent users of cannabis learn about use from their experiences and from their peers, with evidence suggesting that cannabis users may have more knowledge than those delivering treatment (Monaghan et al., 2015). Interviews with problematic users demonstrated that use could be overinstrumentalized, often in times of extreme stress. Learning to negotiate use to avoid overinstrumentalization seems critical in preventing frequent cannabis users from experiencing problematic use outcomes. Unlike socially integrated users in Canadian samples (Dahl & Heggen, 2014; Duff & Erickson, 2014; Järvinen & Ravn, 2014), it appears that young people in services lack the ability to moderate their use behaviour to avoid problematic outcomes. Thus, it would seem that educating young people on the effects of cannabis and how to use ‘safely’ use might prevent young people from experiencing problematic outcomes. More research regarding the relationship between distress intolerance, coping motivations for use and instrumentalization, and patterns and outcomes of cannabis use is needed to inform potential prevention programs.

In the UK prevention is bound to drug policy and the legality of cannabis. Particularly in the delivery of universal prevention, it is unlikely that informing young people about how to safely use cannabis is a potential avenue. An alternative approach might be reality, science-based education for young people on how cannabis effects mental health and the effects of excessive use. The evidence of this PhD showed an association between mental health symptomology and problematic cannabis use outcomes. Acknowledgment of how problematic use develops, in addition to how cannabis use works in legalised environments, including medicalised routes, might be helpful in informing young people, particularly in highlighting the bidirectional relationship between mental health and cannabis. More evidence, however, is needed regarding the relationship between cannabis use behaviours, including more detailed measurement, and mental health. It is likely that prevention focusing on abstinence will be ineffective in preventing problematic use, particularly when a large minority of young people experiment with cannabis and never experience problems, and global perceptions of cannabis and legal frameworks have an increasingly liberal approach. Furthermore, interviews with young people in social services suggest that those with less social capital and resources may be more vulnerable to experiencing problematic use outcomes.

5.7 Recommendations for future research and prevention

The culmination of this PhD provides evidence to inform the development, design and dissemination of indicated prevention for young people in the UK. Looking at risk factors associated

with problematic use outcomes, implicit cognitions and memory associations with cannabis-related stimuli contextualised within the environment of drug normalization as described by young people identified as problematic cannabis users in touch with drug and housing social services, this evidence suggests that there is a need for indicated prevention efforts, and that they need to be adapted greatly from current frameworks of prevention (Home Office, 2010, Home Office, 2015b). In identifying young people most at risk for developing problematic cannabis use, looking at risk factors that relate to cannabis use outcomes indicative of problematic use, stages of risk, is key (Hines et al., 2016). In identifying young people for indicated prevention for problematic cannabis use, factors associated with mental health symptomology might be useful, while measures of implicit cognitions are likely not appropriate. Implicit cognitions and the potential of bias modification for young, problematic cannabis users, however, is an area of research that needs further exploration. In designing and implementing targeted interventions, consideration of the instrumentalization of use may be helpful in identifying how problematic use develops in the context of the use environment, particularly around stigma and support, should be addressed.

The UK drugs environment is one in which cultural and media representations of use fluctuate between normalization to similarities with heroin (Daly & Sampson, 2012). Furthermore, public policy places considerable restrictions on cannabis use and places it as a more serious criminal offence than many other similar countries where legalisation for medical and non-medical purposes is becoming increasingly common (Hunt & Stevens, 2004; Pacula et al., 2014; Coombes, 2014; Monaghan, 2015). Although prevalence rates for cannabis initiation are high, use diminishes in the UK with age and a small portion of those that use cannabis develop problematic, dependent use behaviours (Home Office, 2015a; Burton et al., 2014). Despite this evidence, the majority of research and prevention in the UK is focused on universal prevention programs that are aimed at both the prevention of initiation and the reduction of harmful use (Foxcroft et al., 2003; Faggiano et al., 2008; Lemstra et al., 2010; Norberg, Kezelman & Lim-Howe, 2013; Faggiano et al., 2014). Programmes are needed that focus specifically on the most vulnerable groups, those most susceptible from developing dependent, problematic use (Tait, Spijkerman & Ripe, 2013). The evidence provided in this PhD suggests that risk factors associated with sub-clinical levels of mental health, particularly anxiety, may be suitable for targeted intervention. Furthermore, young people susceptible to 'over-instrumentalizing' their cannabis use, possibly as a coping strategy, may be particularly vulnerable. This research also highlights that implicit cognitions regarding cannabis do not appear to be a suitable the identification vulnerable young people for prevention. Rather, prevention should focus explicit, self-reported intentions, beliefs and knowledge regarding cannabis and its related use behaviour and how young people negotiate these constructs in an environment

of normalization. Additionally, it should be considered that young people that have problematic cannabis use may be experience problems due to other vulnerabilities, like mental health difficulties, familial problems, or other issues. Consideration of these vulnerabilities and unthreading the interaction between cannabis use behaviour, mental health outcomes and use environment is critical to informing indicated prevention interventions. Under the guise of the current public policy and cultural beliefs regarding cannabis in the United Kingdom, it is difficult to disseminate prevention programs that effectively deal with the real circumstances within which young people are likely to engage. Future prevention aimed at specific vulnerabilities associated problematic cannabis use may be adaptable and feasible within this current framework, but it seems unlikely that this will prevent many young people from graduating to problematic cannabis use.

5.8 Limitations

In interpreting the conclusions derived from this work, it is important to consider the limitations of this work. Specific limitations exist for each of these studies, in addition to limitations corresponding to the totality of this work. This section will specifically address the limitations regarding the totality of this work. This PhD encompassed three research studies with distinctly different methodological approaches and population samples. Although the inclusion of these different methodologies and samples provides a broad understanding of cannabis use and development, caution and consideration should be used when interpreting and building on conclusions derived from their totality. The mixed-methods approach used in this PhD was employed due to the exploratory nature of this work and the influence interpretation of these conclusions (Fetter, Curry & Creswell, 2012). This work collectively provides evidence regarding cannabis behaviour as it relates to informing indicated prevention, and should interpreted this way as it is the substantive focus. As a result, the varying methodological approaches employed do not allow for the direct comparison on cannabis use behaviour and limit the interpretation of these results beyond that substantive scope.

The population samples for each of these studies were different, with a general population, weekly cannabis users, and a frequent cannabis group in touch with support services used. The varying sample characteristics limit the ability to compare and contrast results from the studies undertaken. Results of the research undertaken informed the design of subsequent studies and helped to identify areas in which research was needed. This exploratory process, although highlighting issues critical to understanding of the development of cannabis use and informing indicated prevention, requires the acknowledgment of these varying techniques and limits the interpretation of comparing the results.

The concept of problematic cannabis use and dependence and its representation and measurement within this work and the academic literature places limits the conclusions derived from this work. Although attempts at consistency in cannabis use measurement were considered, the measurement of cannabis in each study differed. Although this contributed to a greater understanding of cannabis use behaviour generally and was employed to better inform indicated prevention, it limits to a great extent to the ability to draw any conclusions when directly contrasting the results of cannabis use behaviour between studies. Furthermore, the time frames in which this research took place are bound by changing drug environment, including an increase in legal highs, and cultural perceptions of drug use which may affect the interpretation of these results and their corresponding conclusions (Measham & Newcombe, 2015). Lastly, the majority of the data collected was from young people in the NorthWest of England and may be influenced by culture of this environment and consequently limit the generalisability of this data to the wider population.

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Appendix 1. Interview Guide. *Cannabis use behaviour and problems among young people in services.*

Determinants of Cannabis Use

Qualitative Interview Schedule

I'm Nathan and I am a researcher from Liverpool John Moores University.

I am working on a project that is interested in finding out about people's use and experiences with cannabis. We are talking to people from the North West, such as yourself, and are interested in your experiences with cannabis. We'll talk about what you about how you've used cannabis, what you think about it, and what you know.

This interview is confidential and no one outside this research team (me and Professor Harry Sumnall) will read what you have said. Staff members in this service or any others (such as the police) won't be able to see any of your answers.

I am not here to judge anything that you say as there are no right or wrong answers. It's important that you tell us what you really think and not what you think we want to hear.

The session will be recorded but no one will hear the tape recording other than me. Everything that is said will be typed up into written notes. Your name will not be on any of the notes or research reports that are printed. Is that ok with you? (Press recorders).

-

We need you to sign a consent form to show us you have agreed to take part. If you decide you don't want to take part in this interview then you can drop out at any time, thats fine. If you decide you don't want anything you have said to be used after you have taken part you can contact me using the details printed on the information sheet I'll give you at the end.

You will also receive a £10 high street voucher for taking part.

Are you happy to take part in this interview? **If no, stop interview session.**

Give out consent forms and collect.

To begin, please fill out this short questionnaire. **(If not give out questionnaires to be completed and explain that they are confidential).**

Section 1: Cannabis History

Firstly I am going to ask you some questions about your history with cannabis.

1. Please tell me how you first began using cannabis.
 - a. At what age did you begin using cannabis?
 - b. Who introduced you to cannabis?
 - c. What method did you use for smoking? Joint? Pipe? Bong? Vaporizer?
 - d. How did you feel when you first began using cannabis (including effects of using cannabis and effects of the experience)?
 - e. Did you use other substances with cannabis like alcohol, tobacco, or other drugs?
 - f. What sorts of activities do you associate with first experiences using cannabis?
Music? Film? Hanging out?
2. Please describe your use of cannabis during the past year.
 - a. How much cannabis do you use during a typical use session? Has this changed since you first began using cannabis?
 - b. What method do you use cannabis (joint, pipe, bong, vaporizer, etc.)? Has this changed since you first began using cannabis?
 - c. Do you use other substances with cannabis like alcohol, tobacco, or other drugs? Has this changed since you first began using cannabis?
 - d. Whom do you use cannabis with? Has this changed since you first began using cannabis?
 - e. When do you use cannabis (in the morning, after work/school/college, only at parties, etc.)? Do you smoke at different times compared to when you first began smoking?

Section 2: Cannabis Experiences

Now I'm going ask you some questions about your experiences with cannabis.

1. What types of experiences do you usually have when you use cannabis?
 - a. What are the positive feelings that you associate with cannabis? Are these positive feelings the same as when you first began using cannabis? If not, how have they changed?
 - b. What do you enjoy most about using cannabis? Has that always been the most enjoyable part of the experience?
 - c. How much variation is there in your experiences with cannabis? Have these experiences changed since you first began using? Are they more or less intense?
 - d. Do you think the cannabis you use is different from when you first began using cannabis? If not, how do you think it is has changed?
 - d. What problems (social, criminal justice, mental, financial, etc.) have you encountered due to your use of cannabis? Have you experienced more or less of these problems since you began using cannabis?

Section 3: Cannabis Use Behaviour and Knowledge

Now I'm going ask you some questions about how you get cannabis and what you know about it.

1. How do you get your cannabis?
 - a. If you purchase it, how often do you purchase cannabis?
 - b. What quantity of cannabis do you purchase?
 - c. Who do you get your cannabis from? Is it always the same source?
 - d. Do you share your cannabis with other people?
 - e. Do you ever use cannabis by yourself?
 - f. How has the ways in which you get cannabis changed over time?
2. What do you know about the cannabis you're purchasing?
 - a. Do you have options in the types cannabis you purchase (resin, skunk, herbal)? Different potency or different qualities (street names)? If so, how do you decide which to purchase?
 - b. What does "good quality" cannabis mean to you? What makes a type of cannabis better than another?
 - c. How much variation do you believe there is in the 'quality' of the cannabis you use?
 - d. Are there particular cannabis types (street names) that you prefer, or types that you don't like?
 - e. Do you purchase different types of cannabis based on how or why you're using it?
 - f. Do you think you know more about the cannabis you use than when you first began using cannabis? Please explain.
 - g. What did you know about cannabis when you first started? What have you learned about cannabis since?

Section 4. Cannabis Motivations and Cessation

I'd know like to ask you some questions about why you smoke cannabis and how you would feel about stopping your use of cannabis...

1. Why do you enjoy smoking cannabis?
 - a. How does cannabis make you feel about yourself? Do you feel more relaxed? More fun, or exciting?
 - b. Tell me a bit about your thoughts about the lifestyle of a cannabis user. Do you think people who smoke cannabis are different to those who do not? What do you enjoy about cannabis culture?
 - c. What do you think your life would be like if you didn't smoke cannabis? What kind of effect would not using cannabis have on your life?
2. Do you think you would ever like to stop using cannabis?
 - a. What would make you want to stop using cannabis?
 - b. Do you think you would find it difficult to stop using?
 - b. How would you quit using cannabis?
 - d. Would you seek help from drug services, online resources, or from anywhere else to help you stop using cannabis?

e. Have there been any periods of time, after you first began using cannabis, that you stopped using cannabis? Why did you stop using cannabis? What was that like? Did you replace cannabis with another substance (alcohol, tobacco, etc.)?

Section 5. Concluding questions

And just to finish...

1. Is there anything about cannabis, or your experiences with cannabis that you would like to share?

GIVE OUT PI FORM AND VOUCHERS AND THANK YOU

Appendix 2. Coding Scheme. *Cannabis use behaviour and problems among young people in services.*

Drug Normalization Theory (Parker et al., 1998, 2002)

1. Availability and accessibility
2. Drug trying rates
3. Recent and regular drug use (prevalence)
4. Social accommodation of 'sensible' recreational drug use (friends views of drug use)
5. Cultural accommodation of recreational drug use (media)
6. State responses in legislation and 'anti'-drug strategies

Drugs as Instruments Framework (Muller & Schumann, 2011) (Parker et al., 1998, 2002)

7. Improved social interaction
8. Facilitated sexual behaviour
9. Improved cognitive performance and counteracting fatigue
10. Facilitated recovery from and coping with psychological stress
11. Self-medication for mental problems
12. Sensory curiosity –expanded perception horizon
13. Euphoria, hedonia, high
14. Improved physical appearance and attractiveness

Cannabis Behaviour

Patterns of use

15. Frequency of use
16. Times when I use cannabis
17. Intensity of use
18. Other substances used with cannabis
19. How has use changed over time

Contexts of use

20. Who I use cannabis with
21. Situation in which we use

Method of cannabis consumption

22. Pipe, bong, joint, vaporizer
23. Purchase behaviour

Cannabis Outcomes

Consequences of Use

24. Health-related consequences
25. Social consequences
26. Mental health consequences
27. Financial consequences

28. Criminal just consequences

Acute Effects

29. Relaxation

30. Laughter 'a good laugh', Fun Time

31. Stress-free

32. Felt high

Perceptions of Cannabis use

33. Cannabis Lifestyle

34. Societal Perceptions of Use

35. Cultural/media perceptions of use

36. Community perception of users

37. Peer perceptions of users

Motivations for Use Change or Cessation

38. Cannabis importance in lifestyle

39. Cannabis cessation

40. Quit attempts

41. Change in use behaviours

42. Use of services or other resources to help quit or manage use

Cannabis Varieties

43. Type of cannabis

44. Addiction

45. The taste/smell