Developing the evidence base to address tobacco and cannabis co-use amongst young adults

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Abstract

Background: Tobacco is the leading cause of preventable death, and cannabis the most frequently used illicit substance worldwide; the two substances are commonly co-used, but rarely co-treated. Co-use appears to be associated with a higher degree of mental health disorders, poor psychosocial outcomes, and lower cessation outcomes compared to single substance use. Tobacco and cannabis are each complex products which are intrinsically linked through co-administration and to a lesser extent concurrent use, but reveal key differences including legality, harms, and treatment responses, which present unique challenges when considering how to address problematic or dependent use of both.

Aim: This work aims to develop the evidence base for an intervention to address tobacco and cannabis co-use.

Methods: Three studies were conducted; first, a systematic review of co-use interventions, which included single substance use interventions which measured both substances pre and post intervention. Uncontrolled studies were reviewed using narrative description, and treatment effects on tobacco and cannabis cessation and reduction were meta-analysed using Bayesian methods. Second, an online questionnaire survey of young adults in three further education settings was conducted, using the Capability, Opportunity and Motivation behaviour change model to structure the content. Detailed co-use, demographic and personal factors were collected, and regression analysis used to identify factors predictive of quitting behaviours. Third, a qualitative interview study with young adults recruited via the survey explored experiences of and attitudes towards quitting either or both tobacco and cannabis. Data were analysed using Framework method. Finally, results from all three studies were synthesised and indicated intervention opportunities presented.

Results: The systematic review included 20 studies, 11 of which were included in the meta-analysis. Only six co-use interventions have been developed or tested and none could be included in the meta-analysis, although they do appear feasible. Bayesian meta-analysis showed that treatment effects were not seen on tobacco cessation (RR 1.10, CrI [0.68, 1.87]) nor on cannabis cessation overall (RR 1.48, CrI [0.92, 2.49]), although in subgroup analysis by intervention target, a small significant effect was seen on cannabis cessation in multi-substance interventions (RR 2.19, CrI [1.10, 4.36]) but not in cannabis targeted interventions. More studies required to test the efficacy of co-use interventions and

measurement of co-use requires further development and should be included in single substance interventions.

The survey showed that amongst a sample of n=141 young adult co-users, over three quarters (77%) reported experiencing a mental health problem. Most (75%) consumed cannabis in a joint with tobacco, and a third (33%) usually used high potency cannabis. Motivation to quit tobacco was much higher than for cannabis, and 60% had no intention to quit cannabis. Multivariable models of quitting behaviours indicated that being LGBTQ+ decreased the likelihood of engaging in tobacco quitting behaviour (OR 2.60, CI 1.14-5.93, p=0.023), as did living in a deprived area (OR 1.31, CI 1.09-1.57, p=0.004). No individual factors were predictive of cannabis quitting behaviour.

The qualitative interview study identified a range of influences on both use and quitting for tobacco, cannabis and co-use; 18 young adults were interviewed. Cannabis was considered both a source and salve of mental health problems, and a rich, two-way relationship was described. Family, peers and relationships played an important role in initiation, maintenance and supporting quit attempts for both tobacco and cannabis. Young adults practised cannabis harm reduction, including co-administration as a form of this, although sometimes based on erroneous beliefs; they sought information to inform this but found this lacking, so developed their own knowledge and understanding based on personal and peers' experiences, and online sources. By contrast they had a broad understanding of tobacco-related harm. Findings from all three studies were synthesised, and where indicated, potential intervention opportunities were described.

Conclusions: The findings from this thesis make a unique contribution to the expanding literature on co-use, reaching beyond existing evidence on co-use prevalence and harms to consider how to address problematic and dependent use employing mixed methods. The findings demonstrate the complexity of the relationship, explore harm reduction methods and identifying additional risk factors which require further investigation. Opportunities to intervene are required and identified in this thesis; further research is required to develop acceptable and feasible interventions amongst young adults in the UK.

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Context of PhD programme

I began this PhD programme in January 2017, initially on a full-time registration. In 2019, I switched to part-time registration in order to take on a nursing role in a cannabis clinic for people with psychosis for one year, I then remained as part-time student for the remainder of the programme. A number of interruptions throughout programme were taken for family reasons. Data collection was completed prior to the Covid-19 pandemic.

I received funding in the form of a Nightingale Scholarship from the Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care which covered tuition fees, research costs and a stipend. In 2022 I was awarded an Emergency Grant by the Foundation for Women Graduates towards living costs whilst writing up this thesis.

Presentation of thesis findings to date:

Oral presentations:

1. 'Co-use and co-quitting: Predicting motivation to quit tobacco and cannabis amongst further education college students in the UK'. **Lisbon Addictions**; Lisbon PT, October 2019
2. Examining predictors of quitting behaviours amongst UK vocational college students who co-use tobacco and cannabis' *in symposium* 'Understanding factors associated with cannabis and tobacco co-use: implications for achieving health equity', **Society for Research in Nicotine and Tobacco Annual Meeting**; Baltimore US, March 2022

Poster presentations:

1. Walsh H, McNeill A, Duaso M; 'Tobacco and cannabis co-use: a systematic review and meta-analysis of treatment interventions'; **SRNT Europe Annual Conference**, Munich, DE September 2018
2. Walsh H, McNeill A, Duaso M; 'Measuring tobacco and cannabis co-use: methodological findings from a systematic review and meta-analysis of treatment interventions'; **SSA Annual Meeting,** Newcastle, UK, November 2018

3. Walsh H, McNeill A, Duaso M. 'Exploring gender differences amongst young adults who co-use tobacco and cannabis'. **SSA Annual Meeting,** Newcastle UK, 2019
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I'll tell them all about it one day.

Chapter 1: Introduction & Background

1.1 Introduction

This chapter provides an introduction to the nature, scale, impact, and context of the problem in question, and consequently a rationale for the thesis. The topic of tobacco, cannabis and co-use, including definitions, prevalence, harms, addiction and treatment for addiction is presented; the context for the thesis and the unique contribution made is described. The chapter introduces the methodological approach used to develop the evidence base for an intervention to address co-use, including the underpinning theory, and states the aims and objectives of the thesis. The chapter concludes with an outline of the thesis structure.

1.2 The nature of the problem

Co-use in this context refers to the use of both tobacco and cannabis, and as will be shown, it is in many ways greater than the sum of its' parts. Definitions of both tobacco, cannabis and co-use are presented, and co-use is, in this instance and for the purposes of the work in this thesis, identified as the 'problem'. It is acknowledged that considering co-use as a problem is only one way of understanding it; this introductory chapter sets out to explain the reasons it may be considered a problem and provides a rationale for the thesis.

1.2.1 Defining tobacco

Tobacco is the general term used to describe products which are prepared from dried leaves of the tobacco plant, such as rolling tobacco, manufactured cigarettes, chewing tobacco or snus. In addition to tobacco, electronic vaping devices are also now widely available; most of these do not contain tobacco but nicotine, a key constituent of tobacco which has addictive properties; some heated tobacco products ('heat-not-burn') are also available.

Tobacco smoking is prevalent worldwide and used by many despite well-established evidence of its significant adverse health effects. Most people who smoke tobacco will do so because they have become dependent on the nicotine, although it is the toxins released by burning tobacco and the consumption of tar which are known to produce adverse health effects (World Health Organization, 2015). Nicotine delivered via a tobacco cigarette is a rapidly absorbed drug, which has a quick effect on the central nervous system. The nicotine in tobacco binds to the nicotinic cholinergic receptors in the brain, where it facilitates the

release of neurotransmitters including dopamine (triggering a pleasure response) and acetylcholine (triggering a cognitive enhancement) amongst several others (Benowitz, 2008). Once nicotine levels then decrease in the brain, withdrawal symptoms may begin quickly, and can be difficult to tolerate; these could include negative affect, sleep disturbance, decreased cognitive performance and attention disturbance (Shiffman et al., 2006). The quick effect of nicotine contributes to its high addiction potential, although nicotine is relatively harmless. It is the tar, along with the many additional chemicals added to a cigarette, which causes significant health harms; therefore someone may smoke to consume nicotine, but suffer the consequences of consuming tar (Action on Smoking and Health, 2018; Russell, 1976).

1.2.2 Defining cannabis

Cannabis is derived from the dried leaves of the cannabis plant and can then be processed in various ways into a number of products. These include dried leaf, flower or seeds, known generally as 'herbal' cannabis; 'resin', a soap-like substance produced from plant material; and oil, extracted from the plant into a more concentrated form of cannabis, hence the term also used is 'concentrates' (European Monitoring Centre for Drugs and Drug Addiction, 2019).

Cannabis is consumed in various ways; most commonly herbal cannabis or resin is rolled with tobacco in paper (called a 'joint' or 'spliff') or inhaled using a pipe or 'bong' (waterpipe). Other less common methods include using a vapouriser (electronic device) to consume herbal cannabis; heating then inhaling concentrates ('dabbing'); and consumption in an edible form such as sweets (Hindocha et al., 2016).

Cannabis use is usually categorised into 'recreational' or 'medicinal' (Curran et al., 2016); this thesis focuses on recreational use, where cannabis is consumed primarily for its' psychoactive effect. Cannabis acts on the cannabinoid receptors CB1 and CB2 located in the brain, and pleasurable effects of use include feelings of euphoria, relaxation and heightened sensory perceptions. However, use can also induce feelings of paranoia, anxiety, and hallucinations, and impair both episodic and working memory. Both 'positive' and 'negative' effects are primarily dependent on the potency of the cannabis product. Potency is determined by the concentration of the two cannabinoids tetrahydrocannabinol, (THC), and cannabidiol, (CBD) in the product. These two cannabinoids have a roughly opposite effect; THC impairs learning, induces psychosis-like effects, and increases anxiety; CBD by contrast

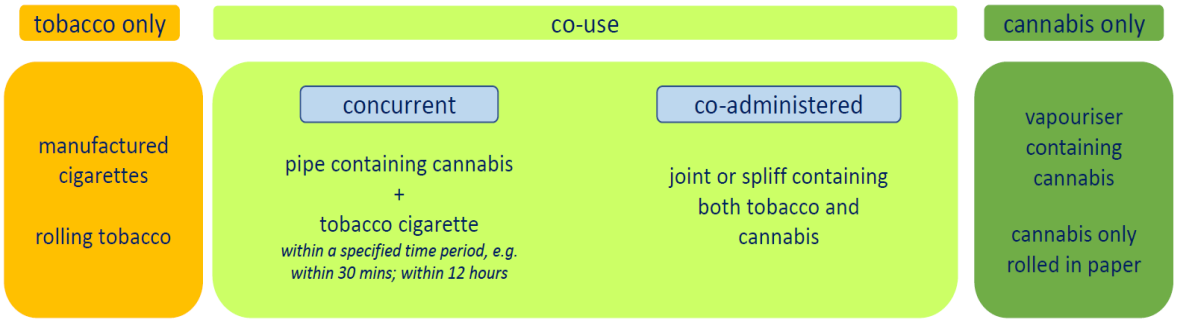
can enhance learning and has anti-anxiety and anti-psychotic effects (Freeman, Tom P. et al., 2021). When used together, CBD may ameliorate the effects of THC; thus, the ratio of THC to CBD is important (Curran et al., 2016; Freeman, Abigail M. et al., 2019). In recent years the amount of THC found in available cannabis in the UK has increased and the ratio of THC to CBD less well balanced, leading to concerns about increased harmful effects of cannabis (Chandra et al., 2019; Englund et al., 2017)

Synthetic cannabis is a commonly used term to describe novel psychoactive substances, which can be produced in such a way that it looks similar to and is consumed in a similar way to cannabis. However, it is a significantly different substance to cannabis, with different effects, clinical outcomes and epidemiology, and is not addressed in this thesis (Darke et al., 2021; Kalk et al., 2016).

1.2.3 Defining co-use

The term *co-use* is used in the literature to refer to any use of tobacco and cannabis, whether this is co-administered or concurrent as shown in Figure 1. Co-administration describes the use of both substances in the same product, i.e., a joint, spliff; concurrent use describes any use of tobacco and any use of cannabis, within a given time period as shown (Hernandez-Serrano et al., 2018).

Figure 1 Co-use, co-administration and concurrent use



The term 'co-use' covers a spectrum of use patterns and combination of products, including variation within the relative use of each. For example, someone may smoke tobacco cigarettes occasionally, but smoke joints daily; smoke a large number of tobacco cigarettes daily and smoke a joint only occasionally; or smoke joints which include tobacco, but only occasionally, and never cigarettes. All of these combinations come under the umbrella term

'co-use', although the individual is exposed to differing amounts of each substance in each scenario.

1.2.4 Terms used in this thesis

The terms 'tobacco' and 'cigarettes' are often used interchangeably (Cox et al., 2022); throughout this work, the term 'tobacco' refers to either loose rolling tobacco or manufactured cigarettes, which are the most common forms of tobacco use in the UK.

The work in this thesis discusses combustible tobacco smoking, commonly referred to as 'smoking', and combustible cannabis use, sometimes also known as 'smoking', or 'having a smoke'. For this reason, 'smoking' without quantification is avoided in this thesis, and 'tobacco use' and 'tobacco smoking' are used interchangeably; both terms refer in this work to combustible tobacco consumption. Combustible cannabis smoking is referred to as 'cannabis use', unless other forms of cannabis consumption are being discussed, in which case these are specified. This work is primarily concerned with combustible tobacco and cannabis use, typically cigarettes and joints, and where other forms of administration or other nicotine or tobacco products are referred to, this is specified.

This thesis considers the needs and experiences of young adults. The term 'young adults' is typically used to refer to people aged 18-24, and sometimes 18-30. Adolescents from the age of 16 may be included in a definition of 'emerging adults' or 'adolescents and young adults', or 'AYA'. For ease of reading, 'young adults' is used throughout this thesis in its' broadest definition and includes adolescents from the age of 16 and adults up to the age of 30.

The question of how to refer to people who use substances in written work is also considered here. Good practice would indicate a preference for people-first language, e.g., 'person who uses drugs' rather than 'drug user'. As will be demonstrated in this thesis, people who use both tobacco and cannabis are a heterogenous group who are not readily identified and who may not consider themselves a distinct group. To date, as far as we are aware, there is no evidence indicating what term may be acceptable to people who use both tobacco and cannabis, such evidence would be valuable. Reflection throughout the process of this thesis on the history and connotations 'user' and the word 'smoker' led to considering the use of 'people who use tobacco and cannabis' or 'people who co-use', or

subsequent acronyms (Atayde et al., 2021; Goodwin, Renee D. & Walker, 2022). However, 'co-user' is a descriptive and concise term widely used in the literature, albeit not entirely satisfactory and it is acknowledged that it may not be acceptable to some. For the sake of simplicity, specificity and ease of reading, 'co-users'; 'tobacco smokers' and 'cannabis users or smokers' are used within this thesis when necessary, and efforts made to avoid sentence structure which requires these terms.

1.2.5 Purpose of tobacco and cannabis co-use

Co-administration as a form of co-use has been described as having a partly practical purpose; it facilitates a 'dilution' of cannabis, and therefore allows for greater control over cannabis consumption (Amos et al., 2004; Banbury et al., 2013) although these reasons do not fully explain the differences in co-use patterns worldwide. As Hindocha (2016) identified, co-administration is more common in Europe and Australasia, but it is not clear why co-users in these regions include tobacco when consuming cannabis whereas cannabis users elsewhere typically do not (Hindocha, C., Freeman, Ferris, Lynskey, & Winstock, 2016). One plausible explanation is that when cannabis first became widely available in the UK, this was in resin form, which requires consumption with tobacco in order to properly burn. Once established as a 'norm' this practice has simply continued, despite other types of cannabis now being more widely available. Other regions such as North America where the climate was more favourable to growing cannabis were able to access herbal cannabis which could be rolled and smoked without requiring tobacco to facilitate burning (Knodt, 2018).

Co-use including concurrent use is considered next. Rabin and George (2015) have explored the possible mechanisms to explain co-use and identified a number of synergistic effects. Animal studies suggest that a primed endocannabinoid system (from prior cannabis use) may lead to an increased potential for nicotine addiction, though less evidence is available describing the influence of the nicotinic system on cannabis. There is a suggestion that cannabis and tobacco are co-used to offset the negative effects of each other; for example the cognitive impact of tobacco (a 'buzz') might offset the cognitive impact of cannabis (decreased arousal); this offsetting may also incorporate withdrawal symptoms, but further research is required to determine the extent of this influence (Rabin & George, 2015).

Other significant mechanisms of action relating to co-use include genetic vulnerability to addiction and the 'gateway' hypothesis, which previously suggested that tobacco may serve

as an introductory route to cannabis, although the reverse is now also considered (Badiani et al., 2015) and the concept of the gateway hypothesis per se reconsidered (Kleinig, 2015). Lastly a common route of administration which may act as a behavioural cue to use the other substance is also suggested as a reason for co-use, or even co-administration (Rabin & George, 2015).

Qualitative literature expands our understanding of the function of co-use. A Canadian study with adolescent cannabis and co-users identified three categories; 'purists', (those who used cannabis alone and were 'anti- tobacco'); 'mixers' (those who used cannabis with tobacco but didn't consider themselves tobacco smokers); and 'tobacco smokers' who identified as tobacco smokers who also used cannabis. Differences were identified in health beliefs and risk perceptions of the two substances, where tobacco was largely seen as harmful to health, but cannabis a 'natural' product, and therefore less harmful (Haines-Saah et al., 2014).

The Haines-Saah study provides insight into 'types' of co-users, although based in Canada and so it reflects patterns of co-use there which include those who use cannabis without tobacco; nevertheless, the findings are still relevant to the UK setting. Akre (2010) describes findings from focus groups with young adult cannabis users in Switzerland, where co-use patterns are similar to the UK: the study finds that cannabis was again perceived as 'natural', and therefore less harmful to health; co-users acknowledged an ambivalent boundary between addiction on tobacco and cannabis and described substitution between the two and, subsequent nicotine addiction after a period of co-use (Akre et al., 2010).

Highet (2004) and Amos et al (2004) interviewed young people in the UK, and findings from both describe the role of cannabis in maintaining tobacco use, if not tobacco addiction, and that the two substances were intricately related. In Amos et al's 2004 study, participants described wishing to quit tobacco, but finding they could not, as they still needed it to facilitate cannabis use. Overall, in both studies a preference for quitting tobacco over cannabis was noted. All of these qualitative studies describe participants using tobacco as a replacement when they wanted to smoke cannabis but it was not possible (Highet et al., 2004, Amos et al., 2004, Banbury et al., 2013).

Tyler's 2015 doctoral thesis explored co-use with young people in England and presented the concepts of 'tobacco-for-cigarettes' and 'tobacco-for-cannabis', and 'wanting cannabis, needing tobacco'. Young people made the distinction between tobacco which they used in a joint alongside cannabis, and the tobacco contained within cigarettes; these were separate practices, and a 'smoker' only referred to someone who used tobacco for cigarettes, and not tobacco for cannabis. The second concept highlights the views identified in Tyler's thesis towards cannabis, which was used for pleasure, and tobacco which was more reluctantly used to facilitate cannabis use. These two concepts encapsulate the differing perception of both substances amongst young people, despite the two being closely associated, and used in the same way (Tyler, 2015).

There are some common themes across the qualitative findings regarding co-use, and evidence from the UK and Switzerland where co-administration is common; these findings begin to describe the phenomena of co-use, its purpose and features.

1.3 The scale of the problem

1.3.1 Tobacco prevalence

Worldwide, an estimated 22.3% of the population used tobacco in 2020, and smoking remains one of the biggest public health threats we face today (World Health Organization, 2015). Rates of smoking in the UK continue to decline year on year; in 2019 14.4% of the population smoked, a fall from 21% in 2009, although still far from the government's Smokefree target of 5% prevalence by 2030 (*Making smoking obsolete: summary.*2022) . UK prevalence shows some variation across age groups: in 2019 4% of youth (aged 8-15) reported ever smoking; 21 % among those 16-24 were current smokers, rising to 25% amongst those aged 25-34 in 2019 (NHS Digital, 2019) [1].

Tobacco smoking prevalence is not evenly distributed across society. Rates are higher among people from disadvantaged groups including those with lower income or unemployed (Hiscock et al., 2011; Reed, 2020), those who are homeless (Soar et al., 2020), and those with mental health problems and substance use disorders (Drope et al., 2018; Hiscock et al., 2011; Lin et al., 2016; Richardson et al., 2019). Data from the Office of National Statistics

[1]Data collection methods changed during the Covid-19 pandemic; hence 2019 data are used here to allow comparison across time points

(ONS) describes the differences in prevalence by occupation group; in England in 2018, 9.3% of people in managerial and professional occupations smoked compared with 23.4% in routine and manual occupations (Office for National Statistics, 2020a). Notably, this established disparity in smoking prevalence and people from disadvantaged and marginalised groups continues to grow; as an example, the ONS reports that the gap in smoking prevalence between those in routine and manual occupations and those in other occupations has widened since 2012.

People with mental health problems in England have a higher than average smoking prevalence at 40.5% (Doll et al., 2004; Office for Health Improvement and Disparities, 2019; Physicians, 2013; Szatkowski & McNeill, 2015); and what appears to be the highest smoking prevalence across health conditions is seen amongst those in treatment for substance misuse disorders, estimated at 84% in an international review (Guydish et al., 2016). Smoking causes significant harm to these populations who in addition face poorer health outcomes separate to tobacco related harm (Gruer et al., 2009; Hiscock et al., 2011).

1.3.2 Cannabis prevalence

Worldwide, 4% of the population used cannabis in 2020, which represents an overall increase since 2010 (UNODC, 2022). In the UK, cannabis use had been in decline from its highest point in 1995 when 9.5% of adults reported past year use, although amongst 16-24 years olds this was 26%; until 2013 (reported as 6.3% and 13.5% respectively). However, since 2013 the rate has been increasing slowly, and in 2020 prevalence of past year use was given as 7.8% and amongst young adults at 18.7% (Office for National Statistics, 2020b).

1.3.3 Co-use prevalence

Routes of administration of cannabis differ worldwide, influencing the prevalence of co-use. In Europe and Australasia cannabis is predominantly used with tobacco, i.e., co-administered, whereas in North America a range of consumption methods are common, and tobacco and cannabis are typically used concurrently (Hindocha, C. et al., 2016).

US adult studies suggest that despite tobacco smoking prevalence decreasing overall, it is increasing amongst cannabis users, and an estimated 54% of current daily cannabis users also smoke tobacco (Pacek et al., 2018). Amongst US adolescents and young adults, use of tobacco was noted in over half of current cannabis users (Dierker et al., 2018). Amongst US

daily tobacco smokers over the age of 12, 9.01% smoke cannabis daily (Goodwin, R. D. et al., 2018). UK data on co-use of tobacco and cannabis is not widely available on the same scale as US studies, although one recent study found that 81% of past year cannabis users also used tobacco (Hindocha, Chandni, Brose, Walsh, & Cheeseman, 2021).

We can see that UK cannabis users are very likely to use it with tobacco but is less clear how many tobacco smokers also use cannabis; this is being explored in a future systematic review (Skelton et al., 2022).

1.4 The impact of the problem

1.4.1 Tobacco Harms

Smoking is implicated in a broad range of health outcomes across all life stages. It has a causal association with a range of cancers, including lung, larynx, oral cavity, bladder, oesophagus, and liver, and is a contributory factor in breast, kidney and pancreatic cancer (Benowitz, 2008; Surgeon General, 2014; West, Robert, 2017) . Smoking significantly increases the risk of heart disease, stroke and respiratory disease including chronic obstructive pulmonary disease, tuberculosis, and asthma. Reproductive health is affected by smoking; it is known to increase the risk of primary and secondary infertility, congenital malformations, complications in pregnancy such as pre-eclampsia, low birth weight, premature birth, and sudden infant death. More general effects of smoking include poor overall health status, diabetes, dental disease, rheumatoid arthritis, autoimmune disease, inflammatory bowel disease, and some eye disease (Surgeon General, 2014).

The burden of smoking on both mortality and morbidity is significant (Doll et al., 2004). An Australian study suggested that up to two thirds of deaths in current smokers are attributable to smoking (Banks et al., 2015). In England during the period 2017-18, it was estimated to be attributable for 16% of all deaths, and for 4% of all hospital admissions (NHS Digital, 2019). Further, the impacts of smoking reach beyond health, as it has a negative impact on employment, reduces earnings, increases care costs and causes poverty (Reed, 2020; Reed, 2021).

Tobacco use is associated with mental health across multiple domains. As referenced in section 1.3.1., prevalence of tobacco use is high among people with mental health conditions compared to the general population, and up to a third of the UK population of

smokers may have a mental health condition (Brose et al., 2020). The relationship between tobacco use and mental health is multi-factorial and complex: as well as high prevalence, other factors include the provision, uptake and outcomes of smoking cessation treatment (Lê Cook et al., 2014; Spaducci et al., 2020; Trainor & Leavey, 2016) and differences in smoking behaviours and outcomes (Chesney et al., 2021; Richardson et al., 2019).

The relationship also appears to be bi-directional, i.e., that smoking may be considered a consequence of having a mental health condition, but also that smoking may be a causal factor in the development of a mental health condition . There is an emerging body of evidence indicating a potential causal association with tobacco and mental health conditions; (Firth et al., 2020; Gurillo et al., 2015; Vermeulen et al., 2021; Wootton et al., 2022). Evidence describing the impact of quitting smoking on mental health is also available: the most recent Cochrane review of mental health and tobacco use concluded that there is very low to moderate certainty that quitting smoking is associated with moderate improvements in mental health (Taylor, GMJ et al., 2021). In time we may see tobacco being understood as a clear reason for poor mental health and included in a summary of tobacco harms.

1.4.2 Cannabis Harms

It is important to note that many people use cannabis regularly without any apparent harm to either mental health or physical health; however, high rates of co-use of tobacco and cannabis have made it difficult to isolate the impact of cannabis from tobacco, limiting our understanding of cannabis harms.

Cannabis use has been shown to be associated with several short -term adverse effects, such as risk of road accidents, anxiety and psychotic symptoms at high doses. Longer-term effects include chronic bronchitis and impaired respiratory function, impaired educational attainment, subtle cognitive impairment in long-term daily users and an increased likelihood of using other illicit drugs (Campeny et al., 2020; Hall & Degenhardt, 2014; National Academies of Sciences, Engineering, and Medicine et al., 2017).

Cannabis has increasingly been linked to a number of adverse mental health effects as seen earlier in the reference to THC and CBD. The evidence base for an association between psychosis and cannabis use is expanding, and high-potency cannabis use is found to be associated with a higher risk of psychosis, an earlier onset of psychotic illness and a higher

rate of relapse in existing psychotic illness (Englund et al., 2017; Petrilli et al., 2022). The debate continues as to whether this indicates a causal effect, but a consensus appears to be emerging that cannabis use may precipitate the onset of psychosis amongst young people with a predisposed vulnerability, for example genetic vulnerability (Volkow et al., 2016; Wainberg et al., 2021).

The impact of cannabis use on affective disorders such as depression or anxiety is emerging. Systematic reviews have found evidence to support increased risk of affective illness amongst cannabis users, but the quality of evidence was considered to be low (Moore et al., 2007) and the scope of evidence limited (Lev-Ran et al., 2014).

Evidence suggests there is in fact higher likelihood of becoming addicted to cannabis than developing a psychotic illness, particularly if use starts in adolescence (Englund et al., 2017); therefore, risk of cannabis addiction should be considered as a significant mental health outcome (National Academies of Sciences, Engineering, and Medicine et al., 2017; Schlossarek et al., 2016). For co-users, this risk sits alongside the (even higher) risk of tobacco addiction amongst those who smoke tobacco even irregularly (Birge et al., 2017).

1.4.3 Co-use Harms

Co-use appears to be associated with more harmful consequences than tobacco or cannabis use alone.

Physical health harms are reviewed by Agrawal et al (2012), who found respiratory symptoms amongst cannabis-dependent young adults who co-used were found to be greater than those who smoked tobacco only; cannabis was associated with chronic bronchitis and impaired respiratory function though potential links to lung cancer are unsubstantiated (Agrawal et al., 2012). Meier and Hatsukami (2016) have reviewed literature on the toxicology and exposure that co-use delivers; the findings are limited by the small populations investigated, and the wide variety of forms of co-use and products used, nevertheless it appears that some forms of co-use may increase carbon monoxide exposure when compared to single substance use (Meier & Hatsukami, 2016). The evidence base on co-use harms is limited to date, but it is plausible to anticipate greater physical health harms from co-use than from each single substance alone.

Psychosocial and mental health impacts of co-use are described in the literature; there is a strong positive relationship between adolescents and young adults who have mental health problems and co-use of tobacco and cannabis (Ramo et al., 2012); the debate continues in the literature around cannabis and mental health as to whether this represents a causal effect or a shared vulnerability. Peters et al (2012) report on clinical correlates of co-use and found a higher rate of psychosocial problems amongst adults who co-used in comparison to those who used cannabis only, but not in comparison with those who used only tobacco. This suggests that it is the addition of tobacco to cannabis use which increases the psychosocial impacts over and above those found relating to cannabis use (Peters, E. N., Budney, & Carroll, 2012). This suggests that the role of tobacco in cannabis use may be a causal factor in poorer outcomes; plausible explanations include this being a result of nicotine in tobacco driving an increased use of cannabis, but this finding remains unexplained and further evidence needed. Ramo et al (2012) reviewed evidence on co-use amongst adolescents and young adults, and found the most consistent associations with risk behaviours, mental health problems and neurocognitive consequences (Ramo et al., 2012).

Whilst evidence pertaining to specific health risks of tobacco and cannabis co-use is less well-established, there is an increasing body of evidence to indicate that co-use of both appears potentially more complex and more challenging to address than single substance use only. Amongst tobacco smokers who also use cannabis, evidence reviewed by Peters (2012) suggests that in comparison with smokers who do not use cannabis, cannabis users are not more likely to report a tobacco use disorder (see below for definition) (Peters, E. N. et al., 2012). A small prospective UK study identified that illicit drug use (including but not limited to cannabis use) was a negative predictor of a successful smoking cessation attempt, suggesting that those who use illicit drugs may find it harder to quit smoking; this requires further investigation amongst cannabis users (Stapleton et al., 2009). Amongst cannabis users who also smoke tobacco, the evidence reviewed suggests that there is an increase in the reports of cannabis use disorders (see below for definition) (Peters, E. N. et al., 2012); a finding expanded on by Dierker who identified that nicotine addiction was associated with cannabis use disorder (Dierker et al., 2018).

Evidence on co-use of tobacco and cannabis has to date largely focussed on US population samples. US patterns of co-use are distinct to UK (and European) patterns, as are public

health approaches to tobacco and nicotine use, and legal status of cannabis. Very few studies have explored motivation, attempts and experiences to quit either or both substances in the context of co-use, including a European or UK context (Lemyre et al., 2019). A recent US study summarised how it appears that motivation to quit tobacco is not different amongst cannabis users than among non-cannabis tobacco users, but rate of attempts is significantly lower (Strong et al., 2018). This discrepancy requires further exploration in a UK context since co-use patterns differ between the US and the UK and Europe.

1.4.4 Tobacco addiction

Tobacco use disorder is characterised in the Diagnostic and Statistical Manual version 5 (DSM-5) by increased tolerance, withdrawal and persistence despite attempts to stop (American Psychiatric Assocation, 2013).

Transition to tobacco dependence (e.g. regular use with some adverse effects on stopping) then addiction (e.g. use driven by a high motivation to continue despite serious risk of harm) (*Addiction Ontology.*)is a likely outcome for many who smoke. The proportion of people who try a single cigarette and go on to become a daily smoker, at least for a period of time, is high at 69% (Birge et al., 2017). Multiple interventions to disrupt this trajectory are needed, and continued efforts are required to ensure that regular smokers are adequately supported to quit smoking, despite the decline in smoking prevalence in recent years. The focus of tobacco control is shifting toward priority groups amongst whom smoking prevalence remains higher and harder to address (Asthma and Lung, 2022; Bonevski et al., 2017; Department of Health, 2017)

1.4.5 Cannabis addiction

Criteria for cannabis use disorder defined in the DSM-5 are similar in nature to other substance use disorders, and notably similar to tobacco use disorder criteria; they include an increase in tolerance, experience of withdrawal symptoms and continued use despite physical or psychological problems arising from use (Hasin et al., 2016).

Whilst many people will try cannabis at some point during their lifetime, estimates of the number of cannabis users who go on to develop a cannabis use disorder ranges from 9-10%

(Englund et al., 2017; Winstock et al., 2010) although among regular cannabis users, this may rise to 22% (Leung et al., 2020).

1.5 Responses to tobacco, cannabis and co-use

1.5.1 Treatment for tobacco addiction

The evidence base for smoking cessation and tobacco addiction treatment is well-established, and since 2001 provision in the UK has been comprehensive and successful, comprising standardised, universal and widely available Stop Smoking Services (SSS) which deliver evidence based behavioural support and recommend or provide suitable licensed products to replace nicotine (West, R. et al., 2013). However, recent changes to funding have affected the coverage of provision and uptake of such services appears to be reducing (Kale et al., 2019; Latif et al., 2021) .

Evidence consistently indicates that a combination of *both* behavioural support and licensed products such as NRT or e-cigarettes is the most effective way to quit smoking, as described by the National Institute for Health and Care Excellence (NICE) (National Institute for Health and Care Excellence, 2021)

Harms relating to tobacco use are well-established; this knowledge is widespread, and treatment is underpinned by robust evidence. The situation is not the same for cannabis, as will be described.

1.5.2 Treatment for cannabis use disorder

Treatment for cannabis use disorder (CUD) in the UK is provided by substance misuse services, which since 2013 are delivered via local authorities. No standard treatment for CUD is endorsed by NICE. Pharmacological treatments for CUD are not currently approved for use in the UK, and a recent Cochrane review of pharmacotherapies for cannabis addiction identified that evidence is limited due to small sample sizes and inconsistency across studies (Marshall et al., 2014). To address CUD, substance misuse services report providing a combination of psychosocial interventions such as motivational interviewing and cognitive enhancement therapy (Monaghan et al., 2016).

Evidence suggests the prevalence of CUD may be rising, as indicated by an increase in service presentations in the last two decades (Monaghan et al., 2016). Although the most common reason for substance misuse treatment presentation in the UK remains opiate and

alcohol use, (excluding tobacco use disorder) amongst all other presentations cannabis use is the highest at 56%. As described earlier, this may be partly due to increased availability of high-potency cannabis (i.e., cannabis with a high THC content) (Office for National Statistics, 2020b). A recent study from the Netherlands has shown a positive relationship between increased THC content of cannabis and presentations to treatment services (Freeman, Tom P. et al., 2018).

Although an increase in treatment seeking for cannabis use has been noted, evidence also suggests that there is a significant proportion of people using cannabis who experience problems related to their use but who do not seek treatment. The most recent Adult Psychiatric Morbidity Survey (2014) has estimated that 2.3% of the whole population showed signs of cannabis addiction, though of these only 14.6% had ever accessed treatment (McManus et al., 2016). The Global Drug Survey of 2015 found that almost a third of all users wanted to use less cannabis (27.7%), 16.1% wanted help to use less, but only 4.6% said they were planning to seek help in the next year (Hindocha, C. et al., 2016).

To summarise, there may be an increasing prevalence of problematic cannabis use escalating to a disorder, but which remains a largely unmet need since so few cannabis users access treatment, and since there is insufficient evidence on what constitutes effective treatment.

1.5.3 Treatment for co-use

Co-use presents a unique challenge in treatment interventions. Single use of each of these substances is harmful, but in different ways, both substances are used for different reasons to achieve different effects. Co-use is apparently common, since cannabis is widely used and co-administration the most frequent route of administration. However, co-use is infrequently reported in either clinical settings and research studies, meaning co-users are a cohort of potentially 'hidden' tobacco smokers who do not identify as such, and as a result may not be targeted during smoking prevention or cessation promotion, or in routine clinical encounters with healthcare professionals (Hindocha, Chandni et al., 2021). Although tobacco cessation treatment is cited as a requirement within substance misuse services in the UK (Clinical Guidelines on Drug Misuse and Dependence Update 2017 Independent Expert Working Group, 2017), it does not appear to be well-integrated, and service provision is low. Government data on adult substance misuse treatment services from 2019/20 reports that

just 3% of service users were offered a referral for smoking cessation intervention, despite 58% of substance misuse treatment recipients identified as recent smokers[2] (Public Health England, 2020). This suggests that when cannabis users seek treatment via a substance misuse service for their cannabis (or other substance use in addition), it is likely they also co-use tobacco, and likely this is not adequately addressed.

We have established that treatment services for tobacco and for cannabis (i.e., substance misuse services) do not effectively screen for or report use of the other substance and can infer that co-users who access these services are unlikely to have their co-use adequately identified or addressed. We can also consider the impact of co-use within tobacco or cannabis treatment studies. As described previously, literature on the impact of co-use on cannabis cessation treatment outcomes suggests that co-users experience more severe withdrawal and CUD symptoms, and fare worse in cannabis cessation itself. The impact of co-use on tobacco cessation treatment is more mixed, and better measurement of co-use is required to full address this question (Driezen et al., 2021; McClure, E. A., Rabin, Lee, & Hindocha, 2020; McClure, Erin A. et al., 2019).

We can see that co-use is a potentially significant influence on existing treatment outcomes, and that given the multi-faceted relationship between the two substances it warrants further attention.

However, it is also important to consider that co-users may not necessarily see their co-use as problematic; they may wish to continue one of the substances or may construct the idea of 'problematic use' differently to that presented in standard treatment formats. Co-users may not consider that existing treatment services are ready or able to address their needs, or they may simply be unaware of them. Amongst co-users who do consider themselves tobacco dependent it is not clear whether they might access tobacco addiction treatment or not (Kale et al., 2019; Latif et al., 2021). Although a significant proportion of people who access substance misuse services also use cannabis (Public Health England, 2020) they are mainly presenting for treatment for a different drug (alcohol or opiates); cannabis is the primary problematic drug of treatment for only a small number of adults in services (20%), although

[2] Data from 2019/20 used for comparison across time points and to avoid recent changes due to Covid-19 pandemic

in services for youth this rises to 89% (Public Health England, 2021). Although the latter represents a large proportion of young people accessing treatment, the proportion of people who use cannabis and seek treatment remains very low, as described earlier, only 14.6% of the 2.3% who met criteria for a CUD, i.e., 0.003% of the general population (McManus et al., 2016).

Given the decreasing use of Stop Smoking Services, alongside an increase in treatment seeking for cannabis use and the impact of co-use on treatment outcomes, new methods are required which address co-use of tobacco and cannabis. Recent NICE guidelines indicate tobacco cessation interventions are needed which prioritise those with additional substance misuse disorders and support the exploration of digital media as an adjunct to other interventions (National Institute for Health and Care Excellence, 2021). Evidence is required to better understand how to provide such interventions, and in what format.

1.6 Identifying a target population

This chapter has so far provided an overview of co-use at a broad population level, including the scale, impact and responses to co-use. In order to develop evidence for an intervention or interventions to address co-use, it was necessary to identify a target population. This would allow greater depth of evidence for a specific group of people, and therefore better match the needs of the intended audience. To determine an appropriate target population, prevalence of use and lifecourse transitions were considered.

Prevalence of both tobacco and cannabis is highest within the young adult age range, as described earlier. Tobacco smoking prevalence in the UK general population in 2018 was 14.7%, but amongst 16-24 year olds prevalence was higher at 16.8%. The highest prevalence is seen in the age group 25-34, which in 2018 was 19.2% (Office for National Statistics, 2019). Cannabis use statistics are provided through the Crime Survey for England and Wales; in 2018 7.6% of adults reporting use cannabis in the past year; this rises to 17.3% amongst young adults aged 16-24 (Office for National Statistics, 2020a).

These statistics indicate that young adulthood represents the life stage where people are most likely to use tobacco and/or cannabis; however, it was also necessary to capture experiences of quitting and attempting to quit. The percentage of adults up to the age of 24 who have previously smoked tobacco but have subsequently quit remains small (8.4% in

2018) but jumps to 43% amongst those aged 25-34, suggesting that changes in tobacco use, including quitting, are more likely to occur as someone ages through their twenties (Office for National Statistics, 2020a). A similar picture is seen for cannabis use. European Monitoring Centre for Drug and Drug Addiction (EMCDDA) data indicates that the average age of first using cannabis is 16, and the average age of first accessing treatment for this is 26 (Schettino et al., 2015). We can see that late teenage years to mid or late twenties may capture initiation of use, a shift to regular use, development of problematic use and help-seeking, presenting an 'age of opportunity' to intervene to disrupt a trajectory toward addiction on either or both substances. For this reason, the age range of the intended audience, and therefore the population sample for the studies in this thesis extends from 16 to 30.

1.7 Summary

This introduction has outlined the nature and scale of tobacco and cannabis co-use, particularly amongst young adults and described the wide-ranging impact which reaches beyond that of tobacco or cannabis use alone. Despite co-use prevalence, treatment services which address each substance do not routinely screen for, or take into account use of the other, and there is no evidenced co-use treatment intervention aimed at UK young adults. This chapter has highlighted the outstanding treatment need and gaps in the evidence, identifying the risks posed by each substance in the current climate in particular for young adults, and how we need a better understanding of how to address co-use amongst. This demonstrates the rationale for this thesis: to develop the evidence base for an intervention which addresses co-use.

In the next section I describe the aims and objectives for this work, building on the rationale as described above. The second part of this chapter describes the methodological and theoretical approaches to undertaking the work to meet these objectives. The chapter concludes with an outline of the thesis structure.

1.8 Aims and Objectives

Aim:

To develop the evidence base for an intervention which addresses the co-use of tobacco and cannabis amongst a young adult population.

Objectives:

To achieve this aim, the objectives of the research are as follows:

1. to identify, evaluate and synthesise the findings of existing research on the evidence for co-use interventions
2. to gain a detailed understanding of the spectrum of co-use patterns and quitting behaviours amongst the target population of young adults
3. to explore the views and experiences of co-users in quitting either or both substances amongst young adults
4. to identify relevant target behaviour(s) and develop the theoretical basis for an intervention/s to address these target behaviours in young adults

1.9 Developing the evidence base for an intervention

The thesis is made up of three separate, sequential studies. This section describes the overall structure, methodological approach, and theoretical basis for the thesis. Detailed methods for each of the three studies are described in their individual chapters.

1.9.1 Complex intervention development

Interventions addressing health issues or behaviours can be divided into simple or complex interventions, although in practice there are few simple interventions. Complex interventions are those which include a number of interacting components, a number of behaviours required of both the recipient and facilitator of the intervention, and a number of outcomes with a degree of variability (Craig et al., 2008). It is clear that an intervention which seeks to address co-use will be complex, involve several components and behavioural elements, and will need to encompass the added challenge of addressing use of not one but two substances.

Multiple approaches to intervention development are found in health related literature. A systematic review of these carried out by O'Cathain et al (2019) described a taxonomy of approaches, which as an example include 'theory and evidence based', 'target population based' and 'partnership'. Development of complex interventions using a framework and theoretically informed process is widely recommended and even required to ensure that interventions have the best possible chance of efficacy and implementation (Craig et al., 2008; O'Cathain et al., 2019).

Approaches such as Evidence Based Co-Design (EBCD) and Person-Based Approach (PBA) were considered for this thesis. Although EBCD is appealing since it centres the patient experience from inception (O'Cathain et al., 2019), meaning that priorities and needs are identified by the patient, not necessarily the researcher or clinician, it is commonly used among existing 'patient' groups, and for service development. It was anticipated that people who co-use may not have any contact with services in relation to their tobacco or cannabis use and may not be motivated to address either or both, and so considerable work may be needed to identify a suitable 'patient' group, which was anticipated to be beyond the realistic time and resources available for this thesis. PBA is used to develop digital interventions (Yardley et al., 2015), and therefore appeared promising for addressing substance misuse among a group of people not necessarily identified as 'patients' of a specific service; and has the advantage of providing a useful platform for researchers to develop digital interventions, recognising they may not have pre-existing programming skills. However, it became apparent during the planning stages of the thesis that there was not enough background literature on the attitudes and experiences of co-users in relation to quitting or changing their use, which meant that more development work was required before a 'required' intervention could be identified, or the decision made that the format for this intervention should be digital.

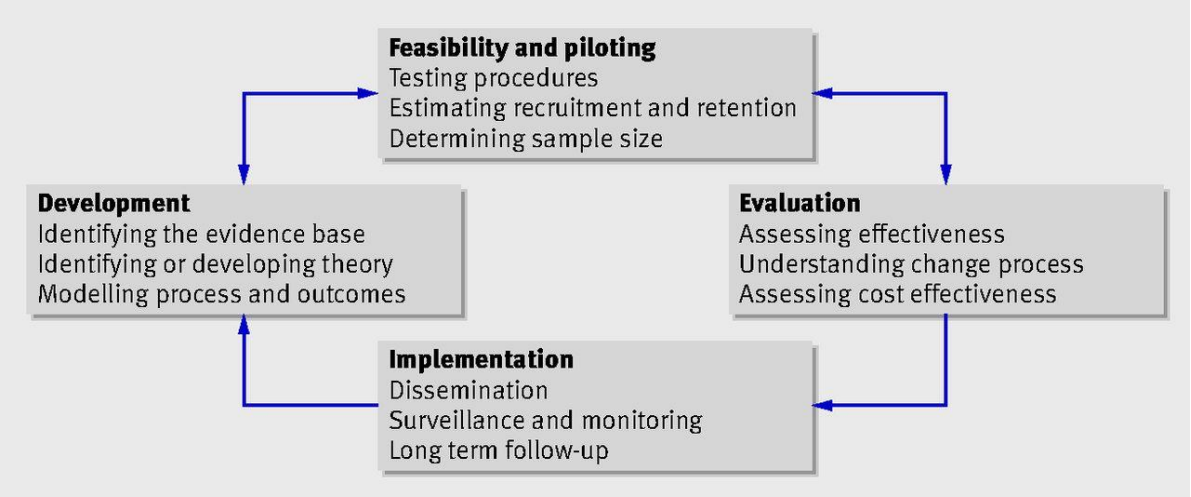
For these reasons, a theory and evidence-based approach seemed preferable, and the Medical Research Council (MRC) Framework for developing interventions was chosen. The MRC Framework provided a broad framework in which to proceed and was less prescriptive than other approaches. Given that the concept of 'co-use' as a problem to be addressed was relatively recent in the literature, and not yet well understood or described from a co-user perspective, then the MRC framework allowed for the development of this evidence base, including an exploration of the theory required to address tobacco and cannabis co-use.

1.9.2 MRC Framework

The MRC first produced guidance for developing complex interventions in 2000, then updated these in 2006 and again in 2019 (Craig et al., 2008; Skivington et al., 2021). Guidance from 2006 was used to inform in the design of this thesis, and this guidance is to referred from now on in the current chapter. The subsequent update (published in 2021) is used to consider the findings of the thesis in chapter 5.

The MRC guidance from 2000 describes the process from development to implementation using the phases required in drug development, reproduced from Craig 2008 in Figure 2.

Figure 2 Key elements of the development and evaluation process, reproduced from Craig 2008



The current thesis focuses solely on the development phase; Figure 2 is shown to demonstrate all the phases required in the process which begins with an idea for an intervention and ends with an evaluated intervention which is implemented in practice. Craig and colleagues describe how this process from development to implementation does not necessarily follow a linear trajectory, although best practice suggests that each stage is undertaken systematically. Each of the steps in the development phase are described below with reference to Craig 2008.

Identify the evidence base: before any development work takes place, it is essential to understand the existing evidence base for similar interventions. A high-quality systematic review should be carried out if none exist

Identifying and developing theory: the anticipated changes and how these will come about should be identified, and the theoretical basis of these changes explored using either existing theory or developing new theory

Modelling process and outcomes: once the intervention has been designed, it is useful to consider how it will be delivered, and evaluated; this process may inform suitable measures and outcomes and can identify issues to address prior to undertaking a feasibility trial

The MRC framework indicates the starting point is establishing the existing evidence base; if not available then a systematic review is the first requirement in this process. This thesis

comprises three studies, which are outlined at the end of this chapter, and which begin with a systematic review.

1.10 Theoretical background

As we have seen, the MRC guidance indicates that anticipated changes in an intervention should be underpinned by a theoretical basis, and that either existing or new theory should be used.

The health issue to address is identified as co-use of tobacco and cannabis, and the relevant context is the absence of treatment for co-use, or for tobacco or cannabis which takes co-use into account. Co-use as a pattern of behaviour requires investigation, to determine how best to address it.

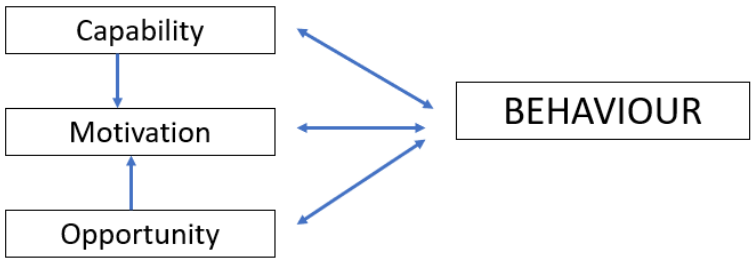
The COM-B model was developed following a review of existing behaviour change theories (Michie, S., Atkins, & West, 2015), and aims to present a broad, comprehensive model of behaviour change. The model offers a theoretical basis for initially identifying the specific behaviour which the intervention seeks to change, and then exploring what change mechanisms are required to achieve. For this reason, COM-B appeared to fit well with the stage of the evidence base for co-use.

1.10.1 COM-B model

The COM-B model is commonly used in the development of interventions for substance misuse interventions and a large number of intervention studies employ this approach, hence the pool of reported applications is significant (Michie, Susan, van Stralen, & West, 2011).

The COM-B model, also referred to as a 'behaviour system', describes the components which influence the generation of the identified behaviour. These three components are *capability* (an individual's psychological and physical capacity); *motivation* (the internal and external processes which direct the behaviour) and *opportunity* (the factors located outside an individual which make it possible to carry out the behaviour). These are shown in Figure 3.

Figure 3 COM-B model (adapted from Michie et al 2013)



When applied to the design (or development) of behaviour change interventions, the change required in each component is considered. The model provides a structure to undertake design which is comprehensive and takes account of the system of behaviour and ensures a systematic approach. Each component can be further sub-divided into psychological and physical capability and opportunity, and reflective and automatic motivation processes. With the exception of reflective motivation, all are required for any given behaviour to take place.

Although simple and easy to understand, this model has been further expanded to provide a detailed framework for considering behaviour change interventions.

1.10.2 The Behaviour Change Wheel

The Behaviour Change Wheel (BCW) is a synthesis of frameworks used in behaviour change and has at its' core the COM-B model. It provides a structure in which to consider the intended behaviour change in its fullest context and to characterise interventions and moves beyond the individual behaviour to the systematic factors that will affect the implementation of that behaviour change on a wider scale. It encourages a systematic approach to evaluating the options available.

The work in this thesis focuses on the development of an intervention, and the design of an intervention forms part of this. Although the work of this thesis does not include the design process itself, in exploring the theoretical basis for an intervention, some elements of the design process are present, which include identifying the behaviour to change, and exploring what is required for that to change. The development of the evidence base will therefore consider the 'intended behaviours' and what may drive these behaviours. Building

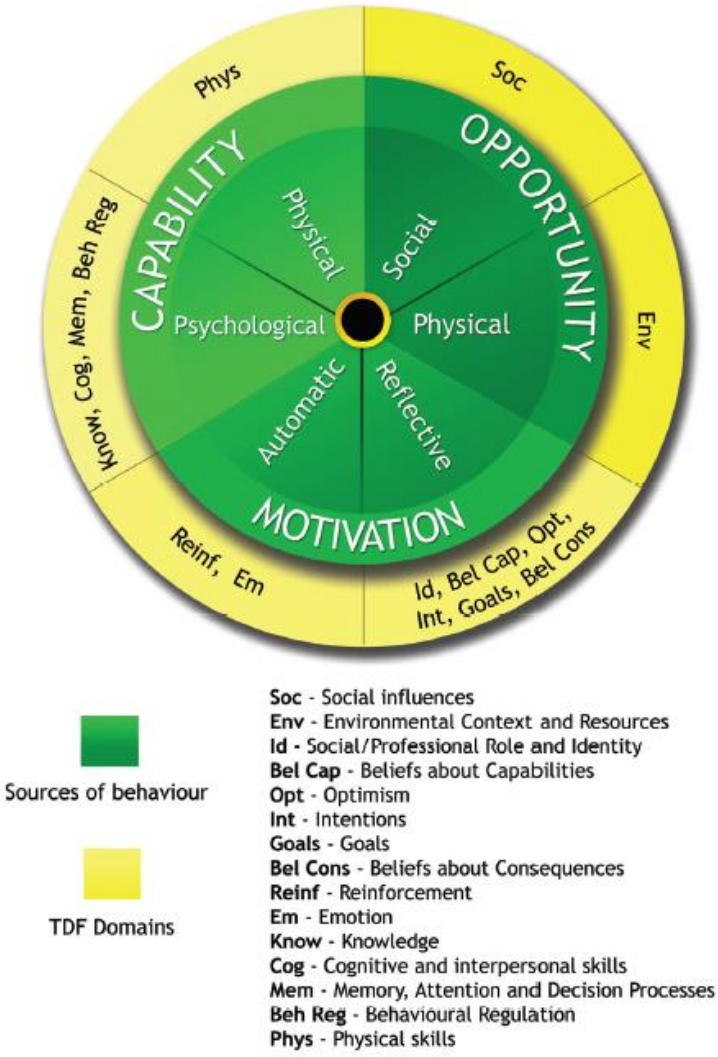
on the COM-B, a more detailed framework is provided by the same authors, the Theoretical Domain Framework (TDF) (Michie, S. et al., 2015).

1.10.3 Theoretical Domains Framework

The TDF is an integrated framework devised from a review of theories and constructs, a further development of the COM-B model (Cane et al., 2012). It provides a detailed structure, or matrix, which allows the user to systematically address the questions which need to be answered in order to proceed in the development of an intervention.

The TDF (with reference to the COM-B) is shown in Figure 4.

Figure 4 Theoretical Domains Framework (reproduced from Michie et al., 2014)



The fifteen domains listed above are used in this thesis as the underpinning structure in which the data collected in this thesis are considered.

This second section of the chapter has demonstrated the rationale for the overarching framework of the thesis, the MRC guidance, and has then described the selection of the theoretical basis for the work, and the relevance of the TDF to this. This chapter will now go on to present the methodological approach.

1.11 Methodology

1.11.1 Mixed methods research

The work in this thesis uses mixed methods to meet its aims. Mixed methods are commonly used in health research and are defined simply by their use of both qualitative and quantitative research methods, although the question of how the findings are integrated becomes more complex (Doyle et al., 2009).

There are many reasons for using mixed methods to answer research questions, but in intervention development using the MRC guidance for complex intervention development, then use of qualitative research is common. Qualitative research allows for the generation of data about the context of a behaviour, the way in which a particular issue is conceptualised by a group of people, and critically can provide insights that are unexpected – that is, answer questions that the researcher did not know they did not know, nor that they needed to answer. It may also allow for the 'triangulation' of data, considering data from various sources and in various formats which together can build a richer picture of the problem under investigation (Doyle et al., 2009).

Three basic designs of how to conduct mixed methods research are described in the literature, although more complex designs exist alongside these (Doyle et al., 2016). The three designs are:

- Convergent (or parallel): quantitative and qualitative data are collected concurrently but standalone; findings are merged at the interpretation stage
- Explanatory sequential design: quantitative study is carried out, and a qualitative study is then undertaken to explain or expand upon findings in the first study
- Exploratory sequential design: begins with a qualitative study which might be used to determine or define a problem; quantitative study is then used to test this understanding in a larger sample

Within this thesis, using the MRC guidance pre-determined some of the stages in the mixed methods design. For example, since no systematic review of interventions to address co-use was identified, this formed the first part of the thesis as described.

Next, to begin the intervention development process, an understanding of how use, co-use and quitting experiences were described by the intended population of young adults was required. Although a qualitative study appeared an obvious next step, it became apparent that determining the sampling frame for such a study was a challenge. Given that very little data existed on co-use in the UK, it was not possible to identify a particular pattern of co-use which might prove more amenable to intervention, what demographic factors indicated a greater degree of risk of problematic use, or who might be more motivated to address their co-use. To fill this knowledge gap, a quantitative survey was planned, which could then inform how and who to sample for the more in-depth qualitative study that then followed.

The mixed methods design was therefore an explanatory sequential design; although in common with the convergent design, findings were not merged until the interpretation stage.

The methodological and theoretical background to the thesis has been introduced. Next, the epistemological approach is presented, followed by the thesis structure.

1.11.2 Paradigmatic approach

The methodology adopted for this mixed methods thesis has been presented; further to this the researcher is required to establish their location in relation to the world they are researching, and their stance towards the how they understand the knowledge they are creating. Therefore the underlying stance in using differing methods to answer the research questions, i.e. the paradigm assumed, is presented here.

As the primary researcher in this study I have worked on the assumption and understanding that I am influencing and impacting the world I am studying, and vice versa. There is no single 'truth' that I am seeking to reveal, but I am presenting a subjective view of a phenomenon which has been created through my interactions with the research process (Bleiker et al., 2019).

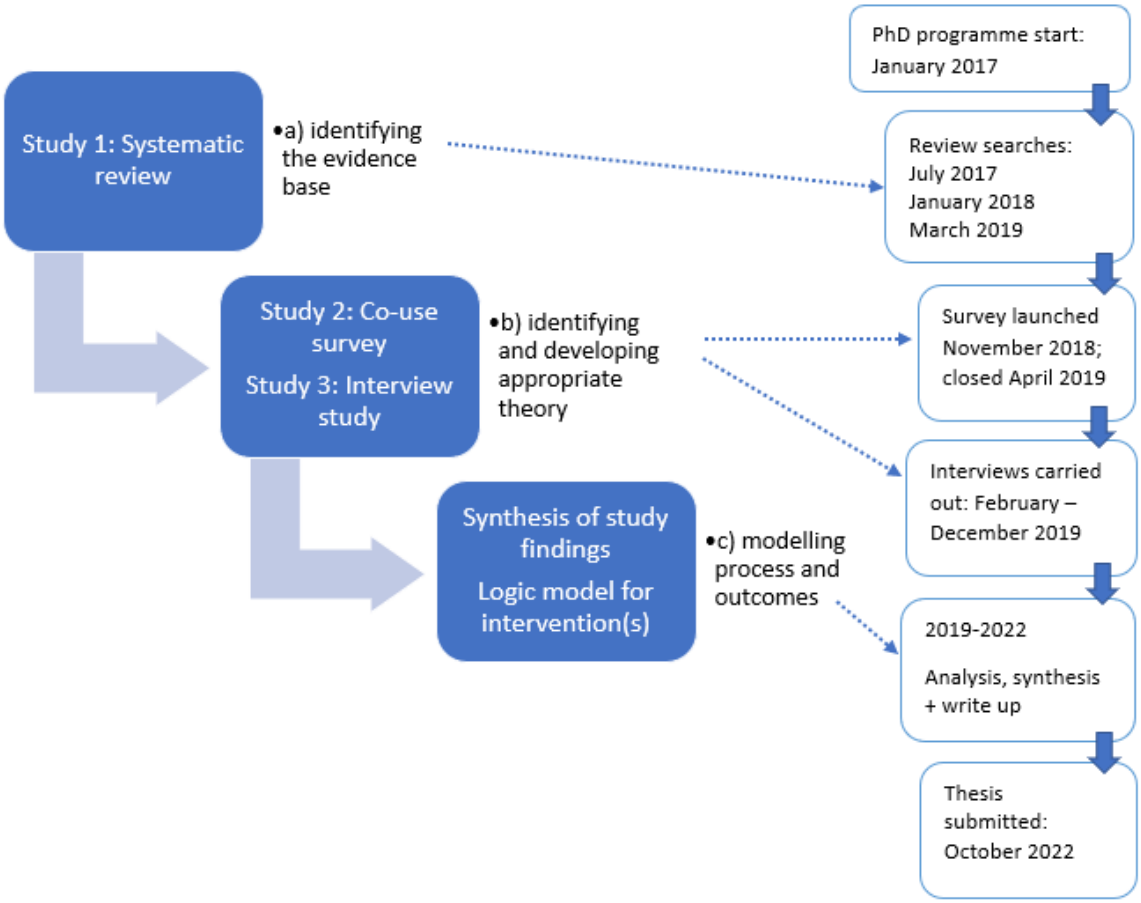
Shannon-Baker (2016) describes a critical realist perspective for mixed methods research as taking the stance that the world is constructed through individual standpoints, recognises

there are realities which cannot be known, and that theory may add to this construction of knowledge but cannot encompass the complete view of a phenomenon (Shannon-Baker, 2016). Therefore, in order to articulate the values and approach that I as the researcher take throughout this thesis, critical realism describes the choices made and approached adopted to emphasise the perspectives provided by each study, which combined may produce a partial representation of the phenomenon of co-use within the population studied, and which focus on the context of knowledge construction.

1.12 Thesis structure

A structure for the current thesis is presented in Figure 5. The MRC guidance for complex intervention development is referenced in the steps a, b, and c, and the theoretical basis for the development process is described. The methodology and approach to integration has been described; subsequent chapters will describe the detailed methods employed in each study.

Figure 5 Thesis structure, components and timeline in relation to development phase of MRC guidance



Studies 1,2 and 3 will help to identify both the target sample but also the target behaviours that the intervention seeks to address. For example, the study 1 findings will seek to establish whether a simultaneous intervention is feasible; and whether any co-use interventions have been developed or tested using controlled studies. This will be further informed by the experiences described in study 2, and from detailed interviews in study 3. The question of treatment demand must be addressed before deciding on the format of the intervention; studies 2 and 3 will be addressing the question of whether and where young adults who co-use tobacco and cannabis might seek treatment for both substances, and where treatment could potentially be provided.

The final step described in the MRC guidance as applied in Figure 5, step c, makes an assumption that the intervention has been designed. The focus of the thesis here is on the development of supporting evidence which could inform the design of an intervention or interventions, rather than the design process itself which would include decisions about the content, format and delivery, all of which require stakeholder involvement.

1.12.1 Outline of the thesis

Chapter 1**: Introduction**

Chapter 1 introduces the topic of tobacco, cannabis and co-use, and establishes co-use in the context of a health-related problem. The existing literature regarding co-use, its' prevalence, impact and responses are presented. This provides the rationale for the thesis, and the aims and objectives follow. To describe how these objectives will be achieved, the overarching methodological approach is described, the underpinning theory and the structure of the thesis are presented

Chapter 2**: Study 1: Systematic review of interventions addressing or reporting co-use outcomes**

The first study describes a systematic review of interventions which address or report co-use outcomes, which includes a Bayesian meta-analysis. The rationale, objectives, methods, results and discussion are described, and the published article is presented in appendix 6.

Chapter 3: **Study 2: A questionnaire study of quitting tobacco and cannabis amongst young adults**

The rationale for the survey, methods, and results are presented, and findings discussed.

Chapter 4: **Study 3: A qualitative interview study: understanding quit attempts amongst young adults using tobacco and cannabis**

The rationale for the final study, methods and results are presented, and the findings discussed.

Chapter 5: **Synthesis and intervention opportunities**

This chapter synthesises the findings from studies 1,2 and 3, and as a means of applying the findings, it then provides suggested intervention opportunities.

Chapter 6: **Discussion and conclusions**

The discussion outlines the main findings, and reviews each of the objectives in light of these. It then considers the methodological approach, the strengths and limitations, and dissemination. Finally, conclusions are drawn.

Chapter 7: **References**

Chapter 8: **Appendices**

The appendices include (but are not limited to) the ethical approvals; questionnaire schedule; qualitative interview schedule and an example of interview data and analysis.

Chapter 2: A systematic review and meta-analysis of interventions which address or measure co-use of tobacco and cannabis

2.1 Introduction

Tobacco and cannabis are two of the most commonly used psychoactive substances worldwide, are frequently co-used, and yet usually treated separately in clinical interventions. Addressing problematic and dependent use presents a unique challenge; this review aims to investigate interventions which seek to address this challenge.

The term *co-use* is used in the literature to refer to any use of tobacco and cannabis, whether this is 'co-administered' or 'concurrent', as outlined in Chapter 1 (Hernandez-Serrano et al., 2018).

Literature describing existing interventions which address tobacco and cannabis separately and in combination will be outlined to provide a context to the current systematic review.

2.1.1 Tobacco use disorder interventions

A significant body of evidence on smoking cessation interventions exists. A large number of Cochrane reviews on various methods and settings mainly within adult populations have been carried out including nursing interventions (Rice et al., 2017), internet interventions (Taylor, Gemma M. J. et al., 2017), group interventions (Stead et al., 2016) and pharmacotherapy (Cahill et al., 2013). Key findings from this body of evidence suggest that combining pharmacotherapy interventions with behavioural support is likely to be the most effective (Stead et al., 2016). NICE recommends this combination of behavioural support and pharmacotherapy, and this forms the basis of treatment provision within the national UK Stop Smoking Services (NICE, 2021).

Cochrane reviews have also addressed interventions for specific populations, including young people and people with substance misuse disorders. The review of interventions for young people found limited evidence to support interventions commonly used in adult populations, although group therapy showed some promising results (Fanshawe et al., 2017). While the quality of evidence in the smoking cessation in substance use disorder review was considered low, the authors concluded that pharmacotherapy combined with counselling was associated with highest rates of tobacco abstinence (Apollonio et al., 2016).

2.1.2 Cannabis use disorder interventions

Several studies, including Cochrane reviews, have investigated the efficacy of cannabis use disorder interventions, although the literature is not as extensive as evidence for smoking cessation.

Two relevant Cochrane reviews have been published; one on pharmacological treatments for cannabis addiction (Nielsen et al., 2019) and a second on psychosocial interventions for cannabis use disorder (Gates et al., 2016). The former included 21 randomised controlled trials (n=1755 participants in total), and found that quality of evidence was low or very low; THC preparations may be of some value, but no conclusions can be drawn as yet (Nielsen et al., 2019). The latter found 23 studies (n=4045 participants in total) and concluded that that moderate evidence was provided for psychosocial interventions reducing frequency of use in the short-term, but that abstinence was rarely achieved, and efficacy tended to be lower than for other substance use treatments. The evidence showed greatest support for Motivational Enhancement Therapy (MET) with Cognitive Behaviour Therapy (CBT) based interventions of greater intensity and duration over four sessions, though positive effects tended to reduce over time (Gates et al., 2016).

In addition to the Cochrane reviews, nine studies using computerised interventions aimed at reducing cannabis use were reviewed and significant reductions found in the use of cannabis, as well as other substances (Olmos et al., 2018). Hoch carried out a similar review aimed only at digital interventions for non-clinical settings (four studies) and found a small effect on reduction in use (Hoch et al., 2016). Tait (2013) found a small but significant effect size in ten studies of internet and computer-based interventions which aimed to reduce frequency of cannabis use (Tait et al., 2013).

2.1.3 Tobacco and cannabis co-use interventions

The significant and often synergistic relationship between tobacco and cannabis which operates on both a physiological and psychological level (Rabin & George, 2015) has been described, as well as the apparent challenges seen in trying to quit one substance in the context of the other (Peters, E. N. et al., 2012). A review focussed on treatment studies for African American populations found no dual interventions (Montgomery et al., 2017); and no interventions have been identified which focussed specifically on co-administration (Schauer et al., 2017).

Reviews of co-use literature have indicated such interventions are warranted (Agrawal et al., 2012; Rabin & George, 2015; Ramo & Prochaska, 2012). The potential of pharmacological treatments in dual interventions has been discussed (Rabin & George, 2015), as well as the efficacy of sequential or simultaneous interventions and the most relevant evidence from single substance use interventions to inform dual interventions (Agrawal et al., 2012).

Across this thesis as a whole, the specific focus is on young adult co-use. Focussing the systematic review on interventions which targeted young adults was considered, but it was anticipated that this would lead to a very small number of included interventions. Further, evidence relating to interventions for all ages would still include young adults, may stratify results by age, and was still potentially useful to establishing the extent of the evidence base. Therefore, the systematic review did not seek to focus on young adults only.

2.2 Objectives

To date, dual interventions targeting co-use have not been reviewed systematically. It is important to investigate what type of interventions have been carried out; what format these take, whether they address both substances equally and whether they are acceptable and feasible for participants. Additionally, interventions aiming to address one substance may have an impact on use of a second substance, for example due to the association of the two substances, by the participant applying behaviour change techniques to the second substance, or alternatively by an increased compensatory use of the non-targeted substance.

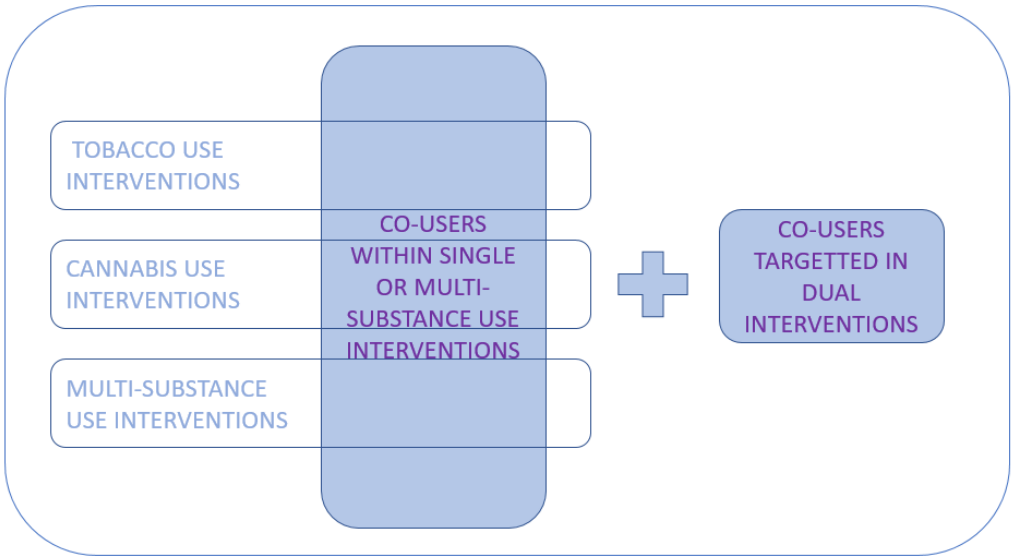
Therefore, this systematic review seeks to:

1. Investigate the evidence base for interventions which address use of both tobacco and cannabis use

2. Investigate the evidence base for interventions which address tobacco or cannabis and report on outcomes pre and post for both substances

Figure 6 describes the sample of participant outcomes sought in this review.

Figure 6 Diagram showing cohort of co-users who form basis of review



2.3 Method

The systematic review and meta-analysis protocol was prospectively registered in the PROSPERO database (PROSPERO 2017 CRD42017071188).

2.3.1 Eligibility criteria

2.3.1.1 Study design

Included studies were intervention studies which were controlled or uncontrolled, pilot or feasibility studies. Prevention interventions, or interventions aimed at developing healthier behaviours but without specific intervention content relating to substance use behaviour change or treatment were excluded.

2.3.1.2 Intervention aims

As described in framework above, studies which targeted one substance but collected data on change in use of the other (non-targeted) substance were also included, as well as multi-substance use interventions (MSI).

2.3.1.3 Participants

No limits were placed on age of participants, recruitment setting, motivation to quit either substance, or level of use of either substance.

2.3.1.4 Control/comparator condition

No limits were set on type of control use.

2.3.2 Identification of studies

Five databases were used to search for relevant studies: Embase, Web of Science, Medline, PsychINFO, CINAHL. Reference lists from included studies and cited literature reviews were also searched.

Search strategies were developed for each database, using controlled vocabulary and keywords. Each strategy used a combination of terms relating to tobacco and tobacco use treatment (i.e., cigarette/s, tobacco dependence/addiction, smoking cessation, smoking cessation treatment) and cannabis and cannabis use treatment (i.e., cannabis use disorder, cannabis use treatment, marijuana). A filter was applied to the Medline results to select intervention studies only. Articles published from January 1990 to July 2017 written in English, French and Spanish were included. The search was repeated in January 2018 and March 2019.

All searches and initial screening of abstracts for review were carried out by the main author HW. HW reviewed full articles, and all three authors reviewed potentially included articles. Discrepancies were resolved through discussion between authors.

2.3.2.1 Search strategy

The Medline search strategy is shown in Figure 7; for other databases a similar combination of search terms and keywords were used.

Figure 7 Search terms used in Medline search

Search term	Tobacco	Cannabis
Subject headings	Tobacco use/or Tobacco Use Disorder/ or Tobacco/or Tobacco Use Cessation/ or Tobacco Products/ or Smoking/ or Smoking Cessation	Cannabis/ or Marijuana Smoking/ or Marijuana Abuse
Keywords	"cigarette" or "smoking"	"cannabis" or "cannabis smoking" or "cannabis use disorder" or "cannabis abuse" or "marijuana"
Limit applied	"clinical study or clinical trial"	

2.3.3 Outcome measures

The primary outcome of the review was change in use of tobacco and cannabis, measured by abstinence ("quit rates") and reduction in use at final follow-up. Therefore, each study had potentially four outcome measures though some papers provided only a single measure for each substance.

Although tobacco reduction is not usually considered clinically significant, cannabis reduction by contrast may be. Cannabis abstinence is not necessarily the goal of cannabis use treatment, rather reduction in frequency and/or quantity of use may be more commonly sought by participants (Sherman, B. J. & McRae-Clark, 2016). Participants have reported an improvement in quality of life following cannabis reduction (Brezing et al., 2018)therefore a reduction may have a clinically significant, meaningful outcome.

Duration of abstinence was not taken into account in this review as it was considered beyond the scope of the review. Cessation was taken as point prevalence at final follow-up. All outcomes whether biochemically verified or self-reported were included. Biochemical verification when used is indicated in Table 2.

Outcome measures for tobacco and cannabis differ significantly, which presents a challenge when reviewing co-use outcomes. Cigarettes, notwithstanding hand-rolled cigarettes, are a pre-determined size, and usually smoked by a single individual. Cannabis however can be smoked in a multitude of ways, often with other people, and with a varying amount of cannabis within a joint, or pipe. Measurement varies between frequency of use and amount of use. For the purposes of this review, frequency of use was selected as a reduction outcome as it is more commonly found in the literature (Lee, Schlienz, Peters, Dworkin, Turk, Strain, & Vandrey, 2019).

2.3.4 Data extraction

Outcome data including tobacco and cannabis cessation and/or reduction, and characteristics of studies including location, study design, intervention content and whole sample demographics were extracted using a data extraction form which was piloted, then adapted. A second author MD then checked all data used in meta-analysis and a selection of remaining data used in a table of study characteristics and quality appraisal.

2.3.4.1 Contact with authors

Authors were contacted when the paper indicated that they had collected tobacco and cannabis use measures both pre and post intervention, but not reported this in the paper, in order to provide outcome data on the sub-group of participants who reported tobacco and cannabis use at baseline, i.e., co-users. Demographic details of the sub-sample were not requested, as it was expected that the whole sample demographic details would not be significantly different to the co-users sub-group.

A total of 25 authors were contacted up to three times. Of these, four did not reply, seven indicated they did not have the available data or were unable to provide it, and one provided data which could not be used as the format was not compatible with other data. 13 authors provided included data (Adams et al., 2018; Buchowski et al., 2011; Gmel et al., 2013; Kadden et al., 2007; Laporte, Vaillant-Roussel, Pereira, Blanc, Eschalier, Kinouani, Brousse, Llorca, & Vorilhon, 2017; McCambridge & Strang, 2004; McCambridge et al., 2008; McClure, Erin A. et al., 2014; Metrik et al., 2011; Peters, E. N., Petry, Lapaglia, Reynolds, & Carroll, 2013; Venner et al., 2016; Vogel et al., 2018; White, Helene R., Mun, Pugh, & Morgan, 2007; Winstock et al., 2009). One author (McCambridge) provided data on two studies (2004, 2008) and another, White,

suggested a further study (White, H. R., Mun, & Morgan, 2008) which hadn't been found in the original search, and so following review this was included.

Two authors provided the original anonymised dataset for review authors to analyse (Peters et al. 2013, White et al. 2007); the remainder provided analysed outcome data.

Data were included in each meta-analysis where the measurement was comparable across studies, e.g., cigarettes per day. In the case where data were collected on frequency of cannabis use per week, this was adjusted to per last 30 days by calculating then multiplying daily rate. Kadden et al. (2007) and Peters et al. (2013) both compared four interventions using a dismantling design; the intervention with the fewest components was selected as the control, and the intervention with the most selected as the intervention comparator.

2.3.5 Data extraction

Data were extracted from each study and from each provided dataset and entered into a CSV file. Where authors had provided raw data, the analysis of new (unpublished) data was carried out by HW and both dataset analysis and data extraction for each of the ten RCT studies was checked by a second author MD.

2.3.6 Statistical analysis

Meta-analyses using Bayesian and traditional frequentist methods were carried out. Bayesian meta-analysis (BMA) provides the full posterior distribution of parameters, in contrast to frequentist methods which provide only the confidence intervals. Confidence intervals demonstrate the range in which the true value lies, or in this case pooled effect size; whereas BMA allows us to see the probability that the true effect size lies between two stated values (Harrer et al., 2021; Röver, 2017). BMA may also be more appropriate for analyses including only a small number of studies (Higgins, Julian P. T. et al., 2009).

BMA usually requires the integration of prior knowledge, 'priors', when calculating the pooled effect size (Röver, 2017). The selection of 'priors' available to use includes either broad prior distributions, which have minimal effect on the data, or using the data from the studies themselves to inform the BMA (Gelman et al., 2017). In this instance, the data from current studies was used as an 'informative prior', in the absence of any similar previous meta-analysis. For cessation outcomes, the minimum risk ratio of 1 and a standard deviation

4 were therefore included. For reduction outcomes, the median of the effect size and the median of the standard deviation were used as weakly informative priors.

Using Bayesian methods in this analysis therefore sets a precedent, since the outcomes of these analyses can become the 'priors' for subsequent replications of this meta-analysis. It is anticipated that intervention studies will increasingly address both tobacco and cannabis, and increasingly report on co-use outcomes of both substances within single substance interventions, therefore using Bayesian methods in this first meta-analysis of tobacco and cannabis co-use would support such replication.

Since BMA is a relatively novel approach to use for meta-analysis, frequentist meta-analysis (FMA) was also carried out and is presented to allow for comparison, and as a form of sensitivity analysis.

2.3.6.1 Cessation outcomes

The risk ratio for each included study was calculated as follows:

$$\frac{a \div b}{c \div d}$$

where a=number quit in intervention group, b= total number in intervention group, c=number quit in control group and d= total number in control group.

2.3.6.2 Reduction outcomes

Reduction was calculated as standardised mean change (SMC) of cigarettes per day (CPD) and days of cannabis use in past 30 days, from pre to post, in intervention and control condition. SMC was selected as measurement of reduction varied across studies, and it allowed for a standardisation of the scale prior to analysis. The SMC analyses the change in mean difference for each study in each condition, which therefore accounts for variability in level of use at baseline. In each meta-analysis, variance was estimated at 0.8 as it was not available within study original data.

2.3.6.3 Meta-analyses procedure

Both BMA and FMA were carried out using RStudio statistical software packages 'metafor' and 'bayesmeta' (RStudio Team, 2020). Outcomes were pooled and presented as forest plots using R software (R Core Team, 2022). Code is listed in appendix 5.

Regardless of whether the study authors had applied intention to treat principles, this was applied across all the meta-analyses using study author's raw data. Since the intervention targets varied across all studies, this formed the structure for sub-group analysis (dual, multi-substance, tobacco or cannabis focussed interventions). Heterogeneity was measured using tau (Rücker et al., 2008). Variance was not available within the original study data, so a conservative estimate of 0.8 was assumed.

2.3.7 Assessment of methodological quality

The Cochrane Risk of Bias assessment tool was used for randomised controlled studies (Higgins, Julian PT et al., 2011). The Russell standard for tobacco studies were used to assess quality of tobacco use reporting; this includes six criteria: 1) 6 or 12 months duration of abstinence 2) continuous abstinence measured 3) biochemical verification 4) intention-to-treat (assume those lost to follow-up are still smoking) 5) include protocol violators in analysis 6) blind follow-up (West, Robert, Hajek, Stead, & Stapleton, 2005). The uncontrolled studies were reviewed using Law's Critical Review Form (Law et al., 1998).

2.3.7.1 Publication bias

Trim and fill was used on funnel plots to determine the risk of publication bias (Duval & Tweedie, 2000).

2.4 Results

2.4.1 PRISMA diagram and table of included studies

Figure 8 PRISMA diagram of systematic review

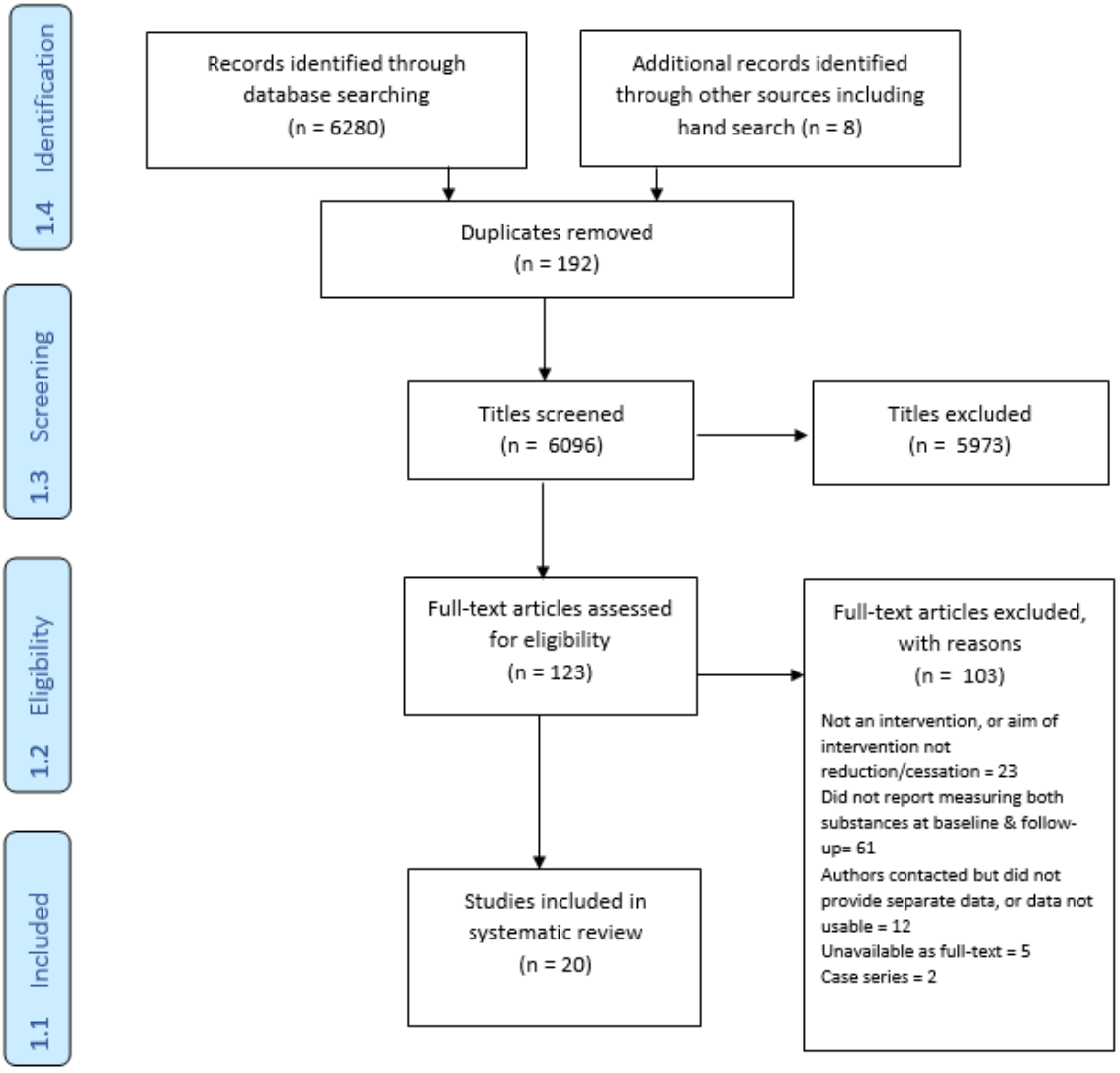


Table 1 Characteristics of included studies

Study	Target substance	Location	Study design	Inclusion criteria	Intervention	Comparison/ control	Length of follow-up	Duration of intervention	Sample size of co-users	Attrition rate (whole sample)
Hill 2013	Tobacco & cannabis	USA	Pilot	Age 18+; meet DSM criteria for CUD + TUD	IT, CBT, NRT	-	10 weeks	10 weeks	12	42%
Becker 2015		Switzerland	Feasibility	Age 18+; daily T smoker; weekly C smoker	GT, IT, NRT + V	-	6 months	5-6 weeks	77	24%
Lee 2015		USA	Single treatment with historical control	Age 18+; C use 45/past 90 days; daily T smoker	CAIT, MET, CBT, CM, NRT	Historical trial data	12 weeks	12 weeks	32	44%
Adams 2018		USA	Within subject	Age 18+; C use 5 days/past 7;	MAT, SCC, V	MAT, SCC (crossover design)	8 weeks	4+4 weeks	6	0%

			cross-over; medication	+ve urine C test						
Beckham 2018		USA	Pilot study	Age 18-70; has CUD; 40/past 90 day C use; daily T use in past week and smoked for past year	ART, CM, CBT, NRT	-	6 months	6 weeks	5	0%
Lee 2019		USA	RCT	Age 18=, has CUD, T use past 5 days	MET, CBT, CM, NRT	Sequential cessation	24 weeks	12 weeks	67	35%
Buchowski 2011	Cannabis	USA	Pilot	Age 18+, meet DSM criteria for CUD, non-treatment seeking, less than 10 CPD in past year	AE	-	4 weeks	2 weeks	6	14%

Laporte 2017		France	Cluster RCT	Age 15-25, C use 1 joint per month over 1 year	BI	Usual care	12 months	Single session	240	55.7%
Kadden 2007		USA	RCT	Age 18+, meet DSM criteria for CUD	CaseM or MET+CBT or CM or MET + CBT + CM	Each intervention	14 months	9 weeks	114	17%
McCambridge 2008		UK	RCT	Age 16-19; C use weekly;	MI	DIA	6 months	1 hr	265	19%
McClure 2014		USA	Parallel double-blind RCT; medication	Age 15-21; C use 3x weekly	NAC, CM, IT	Placebo, CM, IT	8 weeks	8 weeks	68	28%
Peters 2013		USA	RCT	18+, met criteria for C dependence	CBT or CBT+CM or CM or CM + CBT	Each intervention	13 months	12 weeks	91	13%
Winstock 2009		Australia	Inpatient medication trial for safety + utility	Age 18+; met criteria for CUD in past year	Li	-	12 weeks	1 week	13	15%

Vogel 2018	Tobacco	USA	RCT	Age 18-25; 1 CPD, 3 x per wk; current C use	OGT, CBT	SC advice website	12 months	12 weeks	254	29.2%
Gmel 2013	Multi-substance	Switzerland	RCT	Conscripts to military service, interested in receiving intervention	BI	ASU	6 months	20 mins	230	21%
McCambridge 2004		UK	RCT	Students reporting current drug use	BMI	'Education as usual'	12 weeks	Single session	19	10.5%
Metrik 2011		USA	RCT	Age 18+; 10+ CPD; heavy drinker	IT incl. alcohol; NRT	IT, NRT	26 weeks	4 weeks	57	15%
Venner 2016		USA	Pilot	DSM diagnosis of SUD, tribal enrolment,	MICRA (culturally adapted MI + community	-	24 weeks	16-20 sessions	3	Not given

				treatment seeking	reinforcement approach					
White 2007		USA	RCT	18+, students mandated to receive treatment	BMI	Written feedback	15 months	Single session	26	5.5%
White 2008		USA	RCT	18+, students mandated to receive treatment	Immediate written feedback	Delayed written feedback	7 months	Single session	14	4.8%

Key: ACRA: Adolescent community reinforcement approach; AE; Aerobic Exercise; ART: Abstinence Reinforcement Therapy; ASU: Assessment of substance use; BI: Brief Intervention; C: cannabis; CBT: Cognitive Behaviour Therapy; CM: Contingency management; CPD: cigarettes per day; CUD: cannabis use disorder; CWA: Continuous weeks of abstinence; DIA: Drug information and advice; DSM: Diagnostic and Statistical Manual; DU: days of use; FSN: Family Support Network; GT: Group therapy; IPD: inhalations per day; IT: Individual therapy; LC: Lithium carbonate; MAT: Medication assisted treatment (for opioid use); MET: Motivation Enhancement Therapy; MFT: Multidimensional family therapy; MI: Motivational Interviewing; NAC: N-acetylcysteine; NRT: Nicotine replacement therapy; PPA: point prevalence abstinence; SCC: Standard clinical care; T: tobacco; TUD: tobacco use disorder, V: Varenicline

2.4.2 Description of studies

Of the 20 studies, six were dual interventions targeting tobacco and cannabis (Adams et al., 2018; Becker et al., 2015; Beckham et al., 2018; Hill et al., 2013; Lee, D. C. et al., 2015; Lee, D. C. et al., 2019); seven targeted cannabis use (Buchowski et al., 2011; Kadden et al., 2007; Laporte, Vaillant-Roussel et al., 2017; McCambridge et al., 2008; McClure, Erin A., Gipson et al., 2014; Peters, E. N. et al., 2013; Winstock et al., 2009); six targeted multi-substance use (Gmel et al., 2013; McCambridge & Strang, 2004; Venner et al., 2016; White, H. R. et al., 2008; White, Helene R. et al., 2007) including Metrik who focussed on tobacco and heavy alcohol use (Metrik et al., 2011) and one targeted tobacco use (Vogel et al., 2018).

The majority of studies were published in the USA (n=14); five were published in Europe (two in Switzerland (Becker et al., 2015; Gmel et al., 2013); two in the UK (McCambridge & Strang, 2004; McCambridge et al., 2008), and one in France (Laporte et al., 2017)) and one in Australia (Winstock et al., 2009).

Eight of the studies focussed on young adult populations (McClure et al., 2014; McCambridge et al., 2008; Laporte et al., 2017; McCambridge et al., 2004; Gmel et al., 2013; Vogel et al., 2018; White et al., 2007 and White et al., 2008) and the remainder on adults.

2.4.2.1 Study design

Twelve interventions were randomised controlled studies (McCambridge & Strang 2004, Kadden et al. 2007, White et al. 2007, McCambridge et al. 2008, White et al. 2008, Metrik et al. 2011, Gmel et al. 2013, Peters et al. 2013, McClure et al. 2014, Laporte et al. 2017, Vogel et al. 2018, Lee et al. 2019); and eight were pilot or feasibility studies (Winstock et al. 2009, Buchowski et al. 2011, Hill et al. 2013, Becker et al. 2015, Lee et al. 2015, Venner et al. 2016, Adams et al. 2018, Beckham et al. 2018).

2.4.2.2 Population and settings

A total of 127 dual users were included in the uncontrolled studies, and sample sizes ranged from 3 to 27. In the controlled studies up to 1050 participants were included[3], and sample sizes ranged from 14-265. The mean age of the participants ranged from 15-30 years in

[3] Numbers for tobacco and cannabis outcomes differed slightly; 1050 participants provided tobacco outcomes, 1028 provided cannabis outcomes.

eleven studies (McCambridge & Strang, 2004, White et al. 2007, McCambridge et al. 2008, White et al. 2008, Buchowski et al. 2011, Gmel et al. 2013, Hill et al. 2013, Peters et al. 2013, McClure et al. 2014, Becker et al. 2015, Lee et al. 2015, Laporte et al. 2017, Vogel et al. 2018) and from 30-50 years old in the remaining nine studies.

The proportion of female participants in all studies ranged from 14-80%, and the proportion of non-white participants from 8.3% to 100%.

Most participants were recruited from non-treatment settings. Four of these studies recruited students in college settings (McCambridge & Strang 2004, White et al. 2007, McCambridge et al. 2008, White et al. 2008). The students recruited by both White studies were mandated to attend a substance misuse intervention following a violation of college rules on substance use in residential halls. Gmel et al. (2013) recruited within army conscripts signing up for mandatory army training; although substance misuse assessment was mandatory, participation in the brief substance misuse intervention was voluntary (Gmel et al. 2013). Nine studies recruited participants from the community (Kadden et al. 2007, Winstock et al. 2009, Buchowski et al. 2011, Metrik et al. 2011, Hill et al. 2013, McClure et al. 2014, Peters et al. 2013, Vogel et al.2018, Lee et al. 2019).

Of the remaining four, Beckham et al. (2018) recruited from a number of settings including a mental health and a substance misuse treatment clinic, Venner et al. (2016) and Adams et al. (2018) from within a substance misuse treatment setting, though of note the treatment was not specifically for cannabis addiction, and Laporte et al. (2017) via a general practitioner.

2.4.2.3 Content of interventions

2.4.2.4 Dual studies: integrating tobacco and cannabis treatments

Each of the six dual studies comprised at least two elements within the interventions. All provided or offered pharmacotherapy alongside a behavioural component, as indicated by the smoking cessation evidence base. Pharmacotherapy was in the form of nicotine replacement therapy (NRT) or medication such as varenicline or bupropion. In some cases, participants were provided with a single product (Hill et al. 2013) and in others they were offered a combination of NRT and varenicline (Becker et al. 2015). One study investigated

the effect of medication (varenicline), so in this case participants were expected to follow a regime (Adams et al. 2018); in others participants were recommended pharmacotherapy. Uptake of NRT was not routinely reported throughout the studies, so use of NRT across studies is anticipated to be variable.

Alongside pharmacotherapy, each dual intervention offered a form of behavioural intervention, as detailed in Table 1. Lee et al. (2015) used contingency management for abstinence from both tobacco and cannabis, and Beckham et al. (2018) and Lee et al. (2019) for abstinence from cannabis only.

Four of the dual interventions created new manuals for the delivery of co-use treatment, which were based on existing resources for both tobacco and cannabis behavioural treatment (Hill et al. 2013, Becker et al. 2015, Beckham et al. 2018, although the extent of integration of these resources to address co-use varied. For example, Lee et al's (2015, 2019) intervention included a module on co-use specifically, whereas Hill et al. (2013) assessed motivation to address each substance, but thereafter treatment was for either one or the other. The integration of treatment resources may have depended on the individual's co-use pattern, for example whether they co-administered the two substances, or whether they considered use of each was related; this is not detailed within the intervention descriptions. Amongst the dual studies, Lee et al. (2019) set out to test simultaneous versus sequential quit attempts. Hill et al. (2013) and Becker et al. (2015) set the same quit date for both substances, but other studies did not report in detail on whether dual quit attempts were simultaneous or sequential.

The delivery of the intervention was individual for four studies; Becker et al (2015) used an in-person group format. Beckham et al. (2018) was the only study to use telephone as a delivery method, although Lee et al. (2015, 2019) used computer-based modules.

One of these studies comprised a large sample size (Becker et al. 2015, n=77) and indicated important findings. Participants, following a separate intervention to raise motivation, were motivated to quit both substances simultaneously and demonstrated good attendance at all sessions. It may be relevant that this was the only intervention to offer group treatment, the influence of this is unknown. Other dual interventions were smaller in sample size, limiting the findings that may be drawn, but do suggest treatment demand for dual interventions.

Lee et al. (2019) did not find significant differences between sequential versus simultaneous dual treatment outcomes but did indicate that tobacco intervention participation did not appear to negatively affect cannabis treatment outcomes.

Each intervention provided a slightly different combination of behavioural elements, delivered in a different format, which along with the variety of pharmacotherapy offered and used adds to the complexity in assessing such interventions.

2.4.2.4.1 Multi-substance interventions (MSI)

MSI are intended to address use of a number of substances, on the basis that participants frequently report multiple substance use, and behaviour change techniques aimed at one substance may also impact use of another. The discussion content may typically be led by the participant, which forms one of the principles of motivational interviewing, an approach often used in MSI. Therefore, the extent to which each substance is addressed in each intervention is variable; all substances may be discussed, or only one or two at the participants' choice.

Four of the six MSI in this review were brief interventions comprising a single session. McCambridge & Strang (2004) and Gmel et al. (2013) used brief interventions consisting of motivational interviewing, whereas White et al. (2007) and White et al. (2008) delivered personal feedback on current substance use in comparison to peers, and information on associated risks either in person or in written format.

Venner (2016) provided a culturally adapted combination of motivational interviewing and community reinforcement approach, manual-based, for tribe members over a substantial period of time (between 16-20 sessions).

Metrik et al. (2011) provided a smoking cessation intervention consisting of four weekly sessions of individual counselling; the intervention group additionally received a brief alcohol intervention including feedback and goalsetting. The study considered the additional impact of the intervention on cannabis use hence it is considered within this review as a MSI, but the intervention aims and format are different to the other four MSI.

2.4.2.4.2 Cannabis use interventions

As with the previous two intervention categories, the format and content of cannabis use interventions also varied within included studies.

Seven studies in the review targeted cannabis use. These included an inpatient admission to address cessation and withdrawal of cannabis using lithium carbonate (Winstock et al. 2009), and brief interventions delivered by youth workers (McCambridge et al. 2008) or following the 'FRAMES' brief intervention model (Laporte et al. 2017). Both Kadden et al. (2007) and Peters et al. (2013) tested the range of interventions typically used to address cannabis use by including four treatment arms in each study, to isolate the impact of various components (Kadden et al. 2007, Peters et al. 2013). Buchowksi et al (2011) employed a guided aerobic exercise intervention over a two-week period, without specific reference to cannabis use; McClure et al. (2014) used a medication previously employed in smoking cessation to address cannabis use, similar in principle to Adams et al. (2018) dual intervention testing varenicline and included a behavioural component too.

2.4.2.4.3 Tobacco use intervention

Vogel et al. (2018) was the sole tobacco use intervention included. The treatment required participation in a private online treatment group, comprising daily contact with study professionals and six CBT sessions for participants ready to quit.

2.4.2.5 Outcome measures RCTs

Outcome measures for each RCT (n=12)[4] are shown in Table 2. Not all studies measured all four outcomes shown. Only two studies (McClure 2014 and Lee 2019) used biochemical verification for both substances. Outcome measures used in uncontrolled studies are shown in Table 3. These show biochemical verification was used for both substances in a number of studies; this reflects the fact that these were almost all dual studies so the focus was specifically on both substances.

[4] Note only 11 RCTs were included in meta-analysis, but outcome measures for all 12 are shown here

Table 2 Outcome measures used in RCTs

	Tobacco cessation *Biochemically verified (BV) or self-reported (SR)*	Cannabis cessation *Biochemically verified (BV) or self-reported (SR)*	Tobacco reduction	Cannabis reduction
McCambridge 2004	*SR*	*SR*	*cigarettes per week*	*frequency of use per week*
Kadden 2007	*SR*	*BV*	*CPD*	*joints per day*
White 2007	*SR*	*SR*	*CPD*	*frequency of use in past month*
McCambridge 2008	*SR*	*SR*	*CPD*	*past 30 days*
White 2008	*SR*	*SR*	*CPD*	*frequency of use in past month*
Metrik 2011	*BV*	-	-	*past 30 days*
Gmel 2013	*SR*	*SR*	*CPD*	*past 30 days*
Peters 2013	-	-	*days used in past 28*	*past 30 days*
McClure 2014	*BV*	*BV*	*CPD*	-
Laporte 2017	-	-	*cigarettes per week*	*joints per month*
Vogel 2018	*SR*	*SR*	-	-
Lee 2019	*BV*	*BV*	*CPD*	*Past 90 days used*

Table 3 Outcome measures used in uncontrolled studies

Study	Tobacco cessation	Cannabis cessation	Tobacco reduction	Cannabis reduction
Becker 2015	*BV*	*TLFB*	*CPD*	*TLFB*
Lee 2015	*BV*	*BV*	*CPD*	*TLFB*
Hill 2013	*BV*	*BV*	*CPD*	*TLFB*
Adams 2018	*BV*	*BV*	*CPD*	*TLFB*
Buchowski 2011	*TLFB*	*TLFB*	*TLFB*	*Joints per day*
Beckham 2018	*BV*	*BV*	*CPD*	*Number of times cannabis used in day*
Venner 2016	*TLFB*	*TLFB*	*TLFB*	*TLFB*

Studies using BV + CPD also mostly used TLFB for details

2.4.2.6 Frequency vs amount

Measurement of tobacco is relatively standard, as most studies (n=14) used cigarettes per day (CPD) as a measurement of level of tobacco use.

Cannabis measurement varied between frequency of use and amount of use across studies. Most studies (n=8) used past 30 day use, four used past 90 day use or percentage days of use. Over a shorter timescale, Becker et al (2015) and Lee et al (2015) both used frequency of use per day, and McCambridge & Strang (2004) chose frequency of use per week. The remaining studies used amount of cannabis consumed as a measurement, Hill et al (2013) measuring inhalations per day, and Buchowski et al. (2011) and Kadden et al. (2007) using number of joints per day. Vogel et al. (2018) measured only use/quit status.

2.4.2.7 Type of co-use

Despite addressing co-use, none of the dual studies reported any detailed measurement of co-use, though Becker et al (2015) did note the absence of validated instruments to measure this. Winstock et al. (2009) reported on co-use, i.e., whether participants co-administered both substances or use was concurrent and highlighted the distinction

between using tobacco whilst smoking cannabis and using tobacco in cigarettes. McClure et al (2014) asked participants how they smoked cannabis and re-assigned some to non-tobacco status because of the response but did not report on levels of co-use vs. co-administration systematically. Kadden et al (2007) also commented on the common practice of mixing tobacco and cannabis when smoking but did not specifically measure this.

2.4.2.8 Length of follow-up

The duration of follow-up varied considerably across all 20 studies.

Seven studies had a follow-up of up to 12 weeks; starting with Buchowksi (2011) at 4 weeks, Adams et al., (2018) and McClure et al., (2014) at 8 weeks, Hill et al., (2013) at 10 weeks and Lee et al., (2015, 2019), Winstock et al., (2009) and McCambridge &Strang (2004) at 12 weeks. Four studies (Becker et al., 2015, Beckham et al., 2018, McCambridge et al., 2008 and Gmel et al., 2013) followed-up at 6 months, Metrik et al., (2011) at 6.5 months, White et al., (2008) at 7 months, Venner (at 8 months, Laporte et al. (2017) and Vogel et al. (2018) at 12 months, Peters et al (2013) at 13 months, Kadden et al (2007) at 14 months and White et al., (2007) at 15 months.

2.4.2.9 Abstinence definition and biochemical verification

In defining tobacco abstinence, five studies (Metrik et al. 2011, Becker et al. 2015, Adams et al., 2017, Beckham et al. 2018, Vogel et al. (2018)) specified 7 day point prevalence abstinence (PPA) at end of treatment or follow-up assessments. No other studies described definition of tobacco abstinence.

Winstock et al. (2009) corroborated self-reported continuous cannabis abstinence with biochemical verification; otherwise, no other studies define cannabis abstinence.

All brief, single session interventions used self-report as report measures for tobacco and cannabis use at follow-up (McCambridge & Strang 2004, White et al. 2007, McCambridge et al. 2008, White et al. 2008, Gmel et al. 2013, Laporte et al. 2017,) although McCambridge et al. (2008) informed participants their substance use would be biochemically verified, which was expected to elicit a more accurate self-report, although it was not then tested.

Of the six dual studies, all used biochemical verification for tobacco cessation, and all except for Becker et al., (2015) used biochemical verification for cannabis cessation. Amongst the

other studies, although the target substance was cannabis, McClure et al (2014) measured both substances biochemically; Metrik et al. (2011) used biochemical verification for tobacco use but not cannabis use. Peters et al. (2015), Winstock et al. (2009) and Kadden et al. (2007) used cannabis biochemical verification only.

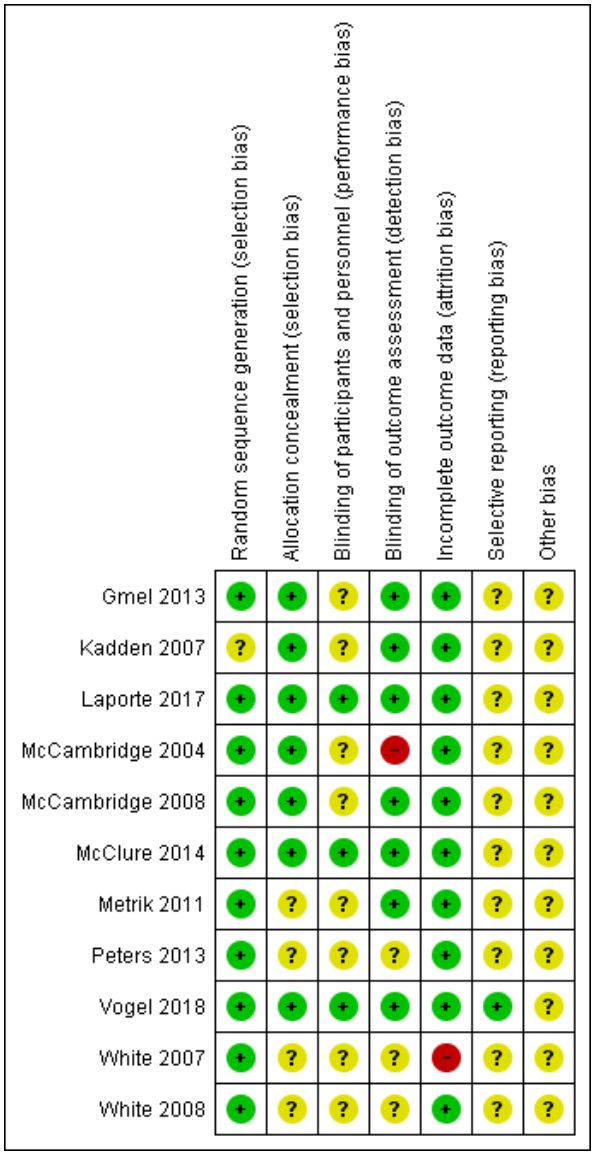
Methods used to verify tobacco abstinence included carbon monoxide (CO) and salivary cotinine analysis (Metrik et al., 2011, Hill et al., 2013); salivary cotinine only (Becker et al. 2015, Beckham et al. 2018); expired carbon monoxide only (Lee et al., 2015, Adams et al. 2018, Vogel et al, 2018).

Methods used to verify cannabis use were more varied. Kadden et al. (2007), Winstock et al. (2009), Hill et al. (2013), Peters et al (2013), McClure et al. (2014) and Lee et al. (2015, 2019) used urinalysis, without specifying cut off points for cannabis levels; Adams et al., (2018), Beckham et al. (2018) and specified levels of the excreted cannabis metabolite as THC-COOH <50 ng/ml.

2.4.3 Methodological quality

2.4.3.1 Risk of bias summary for RCTs

Figure 9 Cochrane Risk of Bias summary for controlled studies included in meta-analysis



The Risk of Bias summary (as applied to the RCTs included in the meta-analysis, n=11 only) indicates few high-risk items though there are several unclear items including performance and selection bias. Face to face interventions preclude full blinding procedures, and no protocols were located to determine selective reporting bias. Overall, the summary shows that the studies are of reasonable quality; none appear to be low quality, and McClure et al (2014) appears to be of high quality.

2.4.3.2 Quantitative critical review for uncontrolled studies

A standard critical review form was used to review quality of uncontrolled studies (pilot and feasibility, n=8) for potential bias and other quality issues. The review process highlighted high attrition rates in Lee at al. (2015), Hill et al. (2013), Winstock et al. (2009) and Becker et al. (2015), and poor adherence to intervention (medication) protocol in Adams et al. (2018). However, attendance and adherence to protocol was high in Becker et al. (2015) (despite lower final follow-up rates) and Beckham et al. (2018) the latter used contingency management. Three studies screened a large number of people but were only able to recruit a small number (Adams et al. 2018, Lee et al. 2015, Hill et al. 2013). Becker delivered a motivational enhancement intervention prior to recruitment to address potential low recruitment. Overall appraisal of quality for these studies indicates reasonable quality; attrition rates and screening issues are features to be expected of pilot and feasibility studies. The high rates of biochemical verification amongst the dual studies have been noted elsewhere.

2.4.3.3 Russell standard across all studies

Amongst the dual studies, Becker et al., (2015) met five of a possible six criteria, Adams et al., (2018) and Beckham et al., (2018) met four, Lee et al., (2015, 2019) met three and Hill et al., (2013) none.

Amongst the cannabis focussed studies, McCambridge et al., (2008) and McClure et al., (2014) met three, Kadden et al., (2007) met one and Peters et al., (2015) and Buchowski (2011) and Winstock et al., (2009) did not meet any.

Of the multi-substance focussed studies, Gmel et al., (2013) met two criteria, White et al., (2007) and White et al., (2008) met one, and Laporte (2017), Venner (2016) and McCambridge & Strang (2004) met none. Metrik et al., (2011) was a multi-substance use intervention, but the main focus was tobacco cessation, hence the study met five criteria.

The single tobacco focussed study; Vogel et al. (2018) met one standard.

Across each of the four categories use of Russell standard are largely as expected, i.e., studies that targeted tobacco specifically have applied more criteria, although since Vogel et al. (2018) was conducted remotely then few standards were possible.

2.4.4 Synthesis of study findings

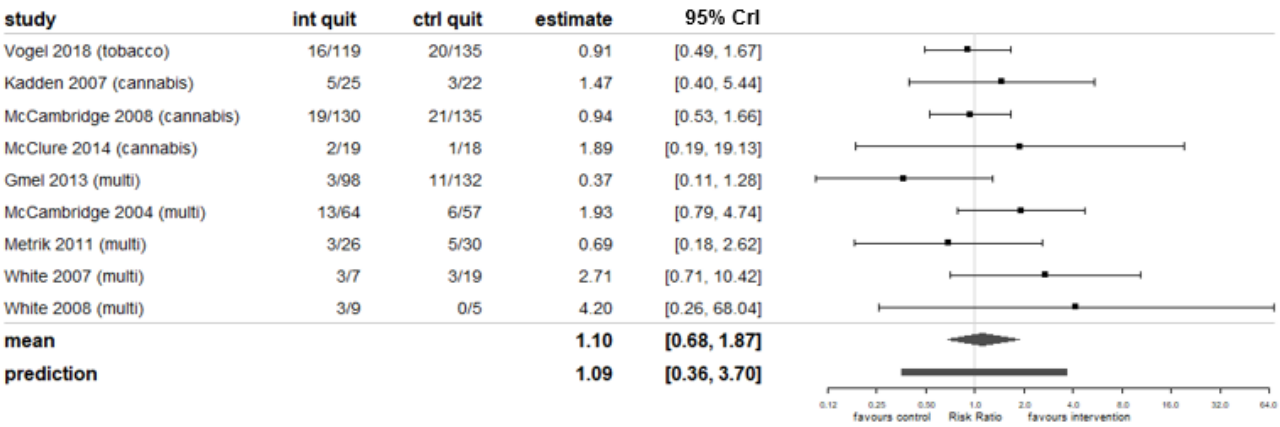
None of the RCTs included in this meta-analysis trialled dual interventions. However, given the plausibility of an impact on secondary substance use within a single substance use intervention, the anticipated effect on several substances in multi-substance use interventions, and that the impact on co-use in such interventions is otherwise undetected, meta-analysis was carried out to assess outcomes for co-users.

2.4.4.1 Meta-analysis of cessation and reduction outcomes

Of the eleven studies included in the meta-analyses, one was tobacco focussed (Vogel et al. 2018), five of were cannabis focussed (Laporte et al., 2017, McCambridge et al., 2008, Kadden et al., 2007, McClure et al. 2014, Peters et al., 2013) and the remaining five were MSI. One RCT (Lee 2019) was not included in meta-analysis as it compared sequential versus simultaneous cessation, and therefore the results did not align with other eleven RCTs, which measured cessation versus continued use.

2.4.4.1.1 Tobacco cessation

Figure 10 Forest plot of intervention effect on tobacco cessation



Heterogeneity: Q= 8.57, df=8, p=0.6, I^2=0.14, n=1050

Key: 'Intervention' = number who quit in intervention group/total in group; 'control' = number who quit in control group/total in group; intervention target shown in brackets after study name; CrI = Credibility Interval. NB not all studies targeted both substances

The effect of the interventions on tobacco cessation was not significant (risk ratio = 1.10 credibility interval (CrI) [0.68, 1.87]). Peters et al., (2013) was not included as data on

tobacco cessation was not collected in the study. Heterogeneity measured using I^2 was low at 14%.

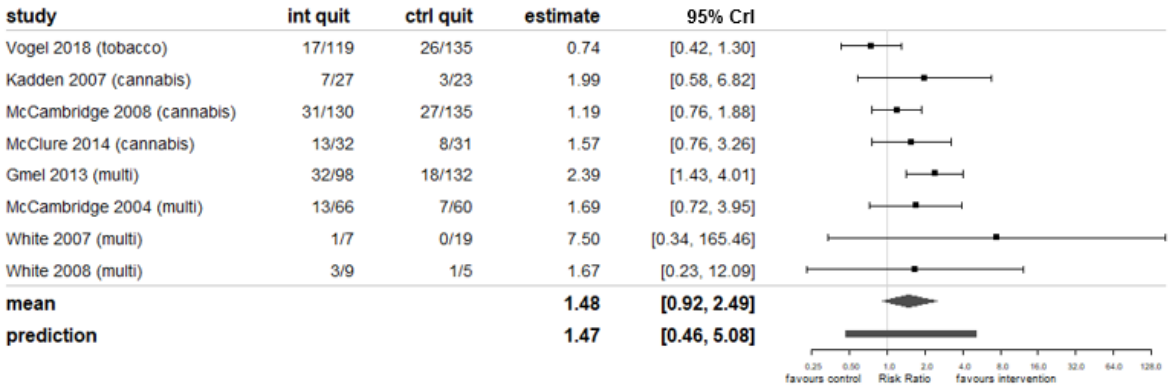
Tobacco cessation outcomes within the RCTs show no effect; and closer analysis of the forest plot reveals wide credible intervals of no significance. Although tobacco use may theoretically be included within MSI, it is noted that all of the included studies in this meta-analysis relate to MSI and cannabis. However, whilst classified as an MSI for the purposes of this review, Metrik et al's study (2011) delivered a non-brief smoking cessation intervention to both control and intervention groups; the intervention condition additionally received a brief alcohol misuse intervention. Therefore, only the intervention group received a multi-substance intervention; the control group received only a smoking cessation intervention.

Sub-group analysis by intervention target (i.e., tobacco, or cannabis, or multi-substance) showed little difference to the overall effect; the pooled risk ratio for cannabis-targeted interventions was 1.10, CrI [0.48, 2.85], and for multi-substance interventions 1.25, CrI [0.53, 2.94].

Frequentist meta-analysis for cessation outcomes was performed for comparison with BMA. Using a random effects model, tobacco cessation risk ratio was very similar, at 1.07; confidence interval (CI) [0.76, 1.52], p=0.69.

2.4.4.1.2 Cannabis cessation

Figure 11 Forest plot showing intervention effects on cannabis cessation



Heterogeneity: Q=11.35, df=7, p=0.9, I^2=0.41, n=1028

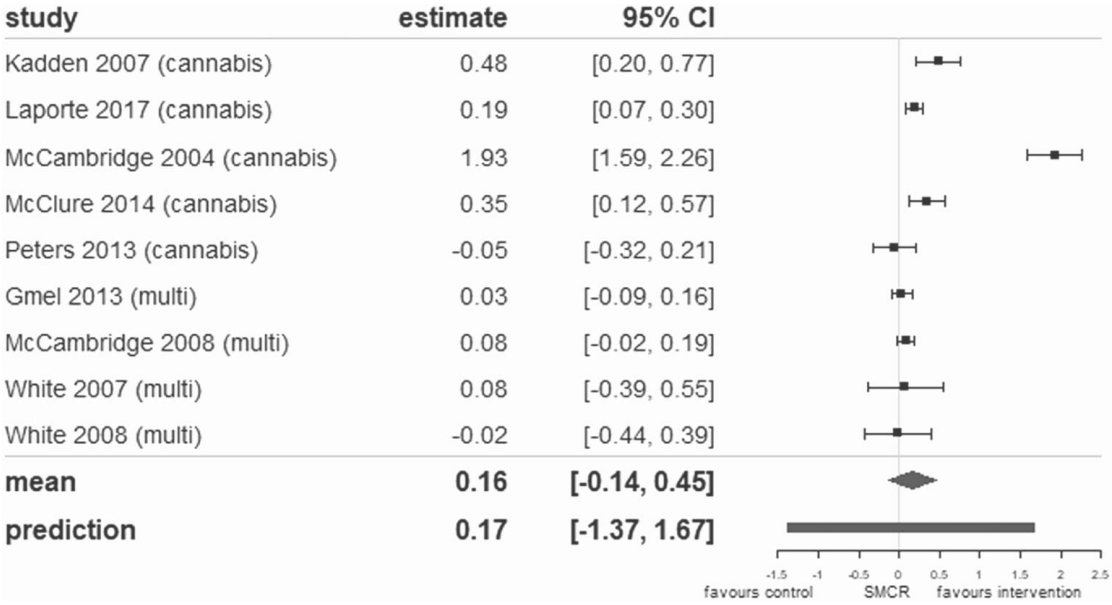
Analysis of studies shows a small intervention effect on cannabis cessation (risk ratio = 1.48 CrI [0.92,2.49]) but which does not meet statistical significance. Metrik et al. (2011) and Peters et al. (2013) were excluded as data on cannabis cessation not collected in study. Heterogeneity measured using I^2 was moderate at 41%. Using frequentist methods, for cannabis cessation, pooled risk ratio was 1.46, CI [1.03, 2.09], p= 0.04 indicating almost no difference compared to Bayesian analysis outcomes.

Cannabis cessation outcomes indicate a small intervention effect overall, which may be clinically significant, although not within the margin of statistical significance. The credible intervals are smaller in comparison to the tobacco cessation analysis. This is mainly accounted for by two large studies; Gmel et al. (2013) and McCambridge et al. (2008). Gmel et al. (2013) delivered an MSI, whereas McCambridge et al. (2008) delivered a cannabis intervention; though the risk ratio for Gmel's study is significant, McCambridge's is not.

Sub-group analyses of cannabis cessation outcomes indicate a difference by intervention target however; multi-substance interventions showed a significant effect, risk ratio = 2.19, [1.10, 4.36], whereas cannabis-targeted interventions did not, with a risk ratio of 1.39 [CrI [0.75, 2.74].

2.4.4.1.3 Tobacco reduction

Figure 12 Forest plot showing intervention effect on tobacco reduction



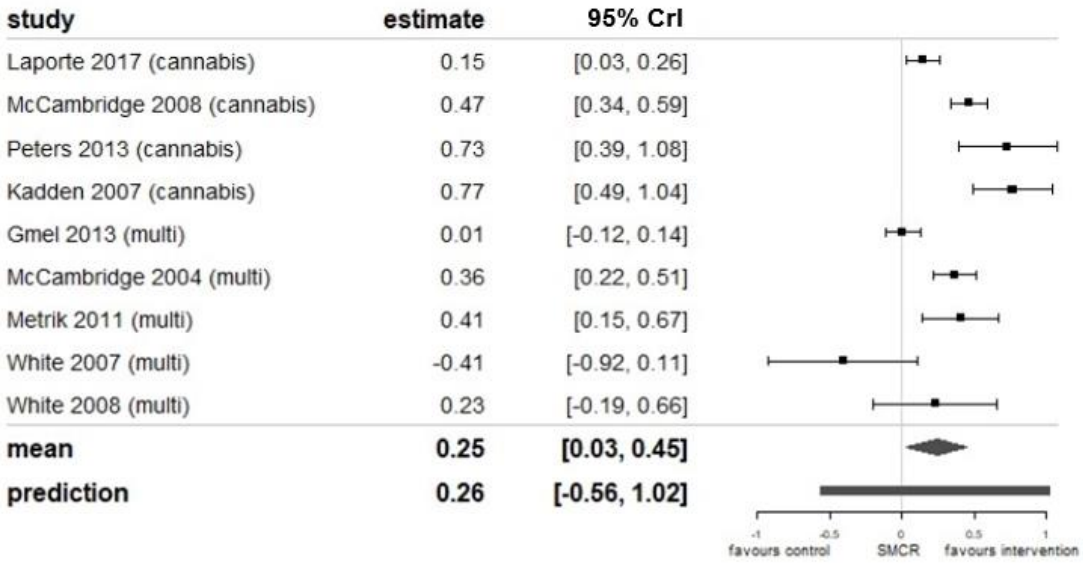
Heterogeneity: Q = 121.86, P = 0.9, I2 = 0.98, n = 1068

Meta-analysis of standardised mean change in CPD shows no intervention effect (n=1068, estimate =0.16, [-0.14, 0.45]). Metrik et al. (2011), Peters et al. (2015), McClure et al. (2014) didn't collect tobacco reduction data, Heterogeneity measured by I^2 was very high at 98%.

Although the overall effect is not significant for tobacco reduction, it is notable that the first four studies listed in the forest plot, which all addressed cannabis use, reported a significant reduction. In McCambridge & Strang (2004) a large effect size was seen, although it is also noted that measurement had to be transformed from weekly to daily CPD in this study.

2.4.4.1.4 Cannabis reduction

Figure 13 Forest plot showing intervention effect on cannabis reduction



Heterogeneity: Q=59.76, p value = 0.8, I^2= 0.93, n=1103

Cannabis reduction pooled outcomes showed a small, significant effect of 0.25 [0.03, 0.45], although heterogeneity was very high at 93%.

2.4.4.1.5 Publication bias

Funnel plots using trim and fill are shown for tobacco and cannabis cessation analyses.

Figure 14 Tobacco cessation funnel plot including two added studies

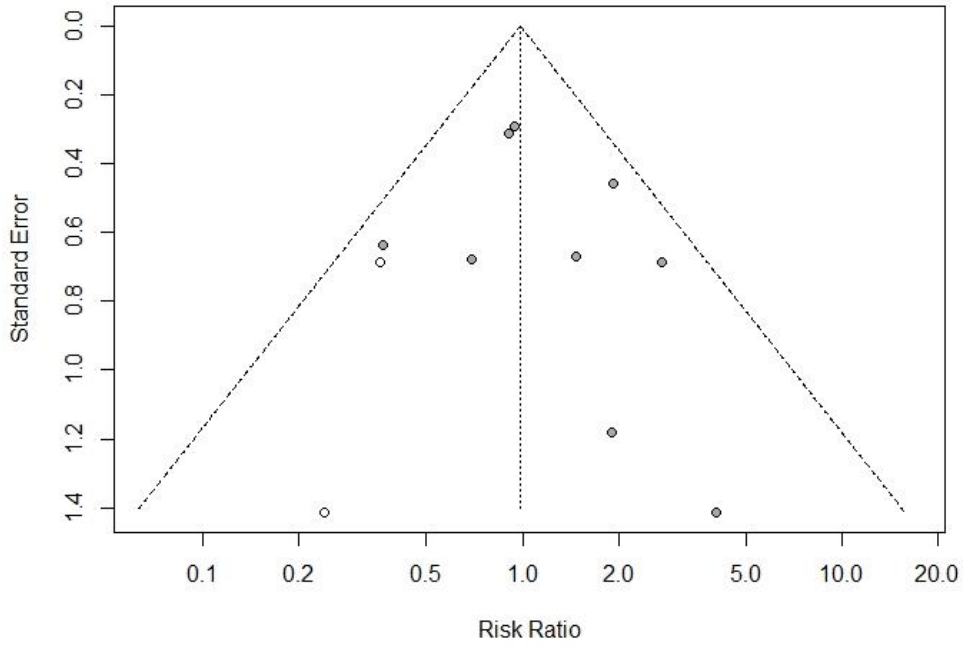
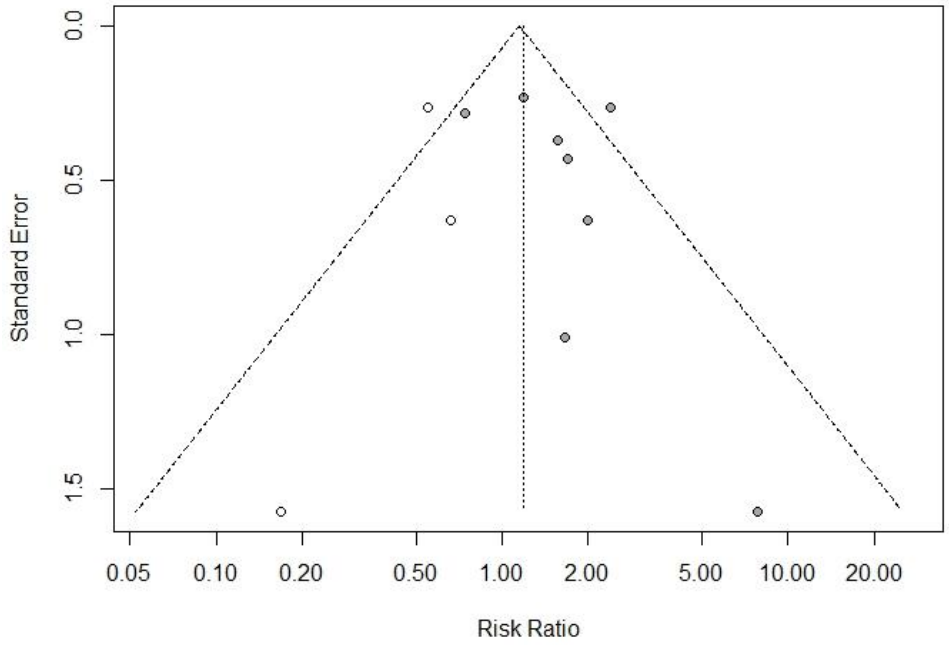


Figure 15 Cannabis cessation funnel plots including three added studies



The funnel plot for tobacco cessation showed no evidence of asymmetry. For cannabis cessation when three studies were added using trim and fill, then the risk ratio reduced from 1.46 to 1.18 (CrI 0.8, 1.77) suggesting some evidence of publication bias.

The same procedure for reduction analyses was carried out, but since no evidence of asymmetry was found, suggesting no evidence of publication bias seen.

2.4.5 Outcomes of dual (uncontrolled) studies

Seven of the uncontrolled studies were dual studies and are shown in Table 4. Winstock et al. (2009) was also an uncontrolled study of a cannabis intervention, therefore details are reviewed separately below. Tobacco and cannabis cessation outcomes are included, to give an indication of overall size and direction of effect. Individuals counted as 'dual quitters' are not counted again in tobacco and cannabis quit data, although may have been by authors in original paper. Adams et al., (2018) provided data on the co-users only with their study.

Table 4 Outcomes of tobacco and cannabis cessation within uncontrolled studies

Study	Sample size	Length of follow-up	% quit tobacco and cannabis, (n)	% quit tobacco, (n)	% quit cannabis, (n)
Becker 2015	77	6 months	7.8 (4)	10.4 (8)	19.5 (15)
Lee 2015	32	12 weeks	0	12.5 (4)	44 (14)
Hill 2013	7	10 weeks	0	0	0
Adams 2018	6	8 weeks	0	0	14(1)
Buchowski 2011	6	4 weeks	0	0	0
Beckham 2018	5	6 months	20 (1)	0	20 (1)
Venner 2016	3	8 months	0	100 (3)	0
Total	127	-	n=5	n=15	n=31

The data presented shows overall that tobacco and cessation outcomes were relatively rare, apart from Becker et al. (2015) who demonstrated a positive outcome additionally over a

longer follow-up period in comparison to other studies. Reduction outcomes are not presented as measurement is not consistently comparable across studies; all studies indicated a small degree of reduction in both substances. These outcomes indicate that a dual intervention study has the potential to have a positive effect, even on dual quit attempts. The data also shows that a higher proportion of people appear to have achieved cannabis cessation than tobacco cessation.

All dual studies reported they were feasible, although three studies had very small sample sizes (Beckham et al. 2018, Hill et al. 2013, Adams et al. 2018). To address the potential for low motivation, Becker et al (2015) carried out a motivational intervention prior to the treatment intervention and succeeded in recruiting a significant sample to the treatment intervention (n=77). Adams et al. (2018) initially planned to recruit from a substance misuse service and found an unexpectedly low number of people meeting the criteria, so had to adjust inclusion criteria. All studies reported that participants found the intervention acceptable. Conclusions to be drawn from the feasibility findings indicate that particular attention must be given to the sampling frame, and that contrary to expectation, community settings rather than substance misuse settings may be more successful for recruitment. Motivation may be an issue and may require particular attention prior to commencing recruitment for a treatment intervention.

Winstock et al. (2009) provided data on the sub-group of co-users only. Although not a dual intervention, the authors reported that n=3 participants (total n=13 participants) quit cannabis, none quit tobacco.

2.5 Discussion

This systematic review sought to meet two aims. First, to explore the evidence base for interventions addressing co-use of tobacco and cannabis; second, to explore the evidence base for co-use outcomes amongst tobacco and cannabis interventions. Dual studies addressing both tobacco and cannabis were identified; although uncontrolled, these studies did demonstrate a greater impact on cannabis cessation than tobacco cessation and were found to be feasible. Meta-analysis of RCTs showed a small but not significant effect on cannabis cessation, but sub-group analysis indicated that multi-substance interventions did show efficacy in cannabis cessation (RR 1.66 [1.26; 2.19]). No effect on tobacco cessation

was seen (RR 1.16 [0.74; 1.80]). No statistically significant tobacco reduction effect was seen, but a small, significant effect on cannabis reduction was found of 0.25 [0.03, 0.45].

This is the first systematic review to look specifically at interventions addressing co-use, and interventions for tobacco or cannabis which have been delivered to co-users. The review has used a significant amount of unpublished data to report on the outcomes for co-users and has therefore identified a significant sample of co-users who were previously 'hidden' within intervention outcomes.

2.5.1 Overall completeness and relevance of evidence

Meta-analysis of cannabis cessation in MSI shows an intervention effect which is comparable to other reviews which have addressed cannabis cessation. The Cochrane review of pharmacotherapies for cannabis dependence found the likelihood of cannabis abstinence was low (RR= 0.82); the Cochrane review of psychosocial interventions identified low quality evidence on cannabis abstinence with a risk ratio of 2.55. The effect size in the current review is mainly accounted for by two large brief intervention studies (McCambridge et al., 2008, Gmel et al., 2013); neither of these employed biochemical verification of abstinence, although both had a six-month follow-up. This indicates that brief interventions may have an effect on cannabis use, but not on tobacco use, although the absence of biochemical verification limits this conclusion. It is further noted that the cannabis-targeted interventions showed no treatment effect, whereas the MSI did; this is a somewhat counterintuitive outcome, although may be explained by differences in population samples and/or levels of cannabis use. For example, people participating in cannabis treatment studies may do so because they recognise they have a problem with cannabis, whereas someone participating in a multi-substance intervention may have a different motivation relating to another substance or other factors, and use of cannabis may vary significantly across the sample. This finding requires further investigation in cannabis and multi-substance interventions, to explore reasons.

Meta-analysis of tobacco cessation outcomes showed no intervention effect. This effect was not unexpected given that the majority of analysed studies comprised cannabis interventions which were not aiming to address tobacco use specifically; but analysed studies also include MSI which in theory should address tobacco use. With the exception of Metrik et al., (2011) (a non-brief MSI) the MSI included in the tobacco cessation meta-

analysis are all brief interventions. Given that evidence indicates that most successful tobacco interventions include a form of pharmacotherapy (Stead et al., 2016), not provided in brief interventions which are typically a single session in duration, the meta-analysis findings of no effect on tobacco cessation are explicable. However, brief advice has been shown to have a positive impact on quit rates (Stead et al., 2013). Evidence on co-users has identified that tobacco addiction amongst cannabis users is likely to be higher in comparison to smokers who do not use cannabis; this may explain the lower tobacco cessation rates (Patton et al., 2005). Uptake of pharmacotherapy including NRT is important to monitor as a moderating effect in future studies, as this may explain some of the discrepancy between cannabis and tobacco outcomes.

The absence of an effect on tobacco cessation is replicated in a systematic review which considers smoking cessation outcomes within alcohol interventions (McCambridge & Jenkins, 2008). The review found no support was found for a 'sleeper effect', i.e., participants transferring behaviour change techniques from alcohol to smoking cessation, although the heterogeneity across the co-use spectrum may affect this. It is possible that specific types of co-use are more influenced by interventions than others; in addition, participant's awareness of the influence of tobacco use on their cannabis use may affect outcomes.

Meta-analyses of reduction outcomes show no significant intervention effect on tobacco reduction. Tobacco reduction outcomes are typically not considered clinically relevant, as health benefits are to be found from cessation, not reduction (Godtfredsen et al., 2002; Hackshaw et al., 2018). Similar to tobacco cessation outcomes, within a cannabis intervention it would not be expected that an effect on tobacco reduction would be seen; amongst MSI it appears there is a similar null effect (Brezing et al., 2018; Godtfredsen et al., 2002; Hackshaw et al., 2018; Sherman, Brian J. et al., 2017). The meta-analyses did show an effect on cannabis reduction, although very small. This finding is to be considered with caution however, reduction outcomes may be subject to even greater heterogeneity than cessation outcomes. They are self-reported and cannot be biochemically verified, detail of use may be challenging to recall bias in comparison to cessation, although frequency of use measures were used in the meta-analysis, volume of use is a complicating factor.

Further sensitivity analysis could explore potential impact of biochemical verification, length of follow-up, type of intervention and intervention components and age of target population, such as stratifying results for young adults only.

This review has also highlighted several methodological issues with the literature in this area.

First, measurement of co-use requires development. The term co-use encompasses a range of usage patterns which included studies did not report on, and which to date lacks accurate measurement within the literature. This is an important gap; participants in cannabis studies may under-report co-use, e.g., when asked about tobacco use may ignore tobacco in joint use. The number of co-users identified in cannabis or multi-substance use interventions included in this study may in fact represent an underestimation. Similarly, it is essential to understand whether co-use is concurrent or co-administered; this may well be a crucial distinction that dual interventions need to address (Walsh et al., 2017). Routine assessment of a variety of drug use, in sufficient detail, partly to reduce bias is recommended (Strain, 2003).

Measurement of cannabis itself also requires development and greater consensus within the literature. Frequency of use is significantly different to amount of use, and both subject to recall bias which impacts on the validity of study findings, although this is not unusual within the cannabis literature (Hindocha, Chandni et al., 2017; Hindocha, Chandni et al., 2018). Tobacco cessation reporting has been set out in the Russell standard and were adopted within some of the cannabis studies; cannabis studies which measure tobacco use would benefit from adherence to these guidelines (West, Robert et al., 2005), and from a set of cannabis reporting standards. Work has begun to identify standard measures of cannabis including potency (Lorenzetti et al., 2022).

The included studies also recruited a range of levels of use; some recruitment required participants to meet specific level of use of either substance, others specified the participant met criteria for cannabis use disorder (CUD) for example. The constructs of level of use versus dependence or addiction on cannabis are not necessarily comparable, as amount of use is not specified within CUD criteria. Brief interventions included in the studies were typically aimed at participants with any level of substance misuse, and therefore the range

of levels of use would vary significantly, although motivation to address use may not necessarily differ significantly. No studies reported measuring type or potency of cannabis use; literature indicates that potency of cannabis may play a significant role in the experience of adverse effects, if not the development of CUD (Freeman, T. P. & Winstock, 2015).

Similarly, the form of cannabis used, i.e., resin, herbal or high-potency; whether smoked, inhaled or used in other forms such as high concentrates requires greater methodological attention.

Though the significant variation of levels of use indicates that greater detail on levels and patterns of use in future intervention studies, this does not necessarily undermine the validity of the review findings. Transition from tobacco use to dependence to addiction is high; the same transition from cannabis use to CUD appears much lower, but there is also a possibility that a large number of cannabis users experience problematic use, even if this does not meet CUD criteria. Taking a pragmatic viewpoint, the included studies have managed overall to target those who self-identify, or who are diagnosed with problematic or disordered use.

Most of the evidence reviewed was carried out in the US. Patterns of both cannabis use, and co-use vary significantly worldwide, and US customs are not necessarily representative of the UK or European customs (Hindocha, C. et al., 2016). Without adequate measurement of types of co-use it isn't possible to determine how transferable these findings may be to other settings; thus, generalisability is limited and relevance of findings to those who co-administrate tobacco and cannabis unclear. One study adapted materials for a specific population (Venner et al. 2016) but overall, across all studies there is little discussion of how socio-cultural variances pertaining to tobacco and cannabis use may impact on intervention effect.

The theoretical basis of intervention studies has been described by some studies; most have adapted existing intervention materials for either substance. Amongst the dual interventions and MSI there is some discussion about tackling dual or multi-substance use and how this may differ from tackling single substance use. Most dual interventions appear to be single substance interventions which are delivered concurrently, rather than fully

integrated, although each refers to the impact of co-use. This review has also highlighted the extent of integration in dual interventions. Theoretical background to dual interventions is yet to be developed, it is not known whether delivering a tobacco intervention alongside a cannabis intervention results in a different outcome to interventions which seek to integrate treatment of both; greater resources need to be put into creating integrated intervention which take into account whether co-use is concurrent or co-administered.

The content of the interventions studied however indicates that a broad range of components have been tested, including combined pharmacological and behavioural interventions, though only a small number of digital components within studies were found. Most interventions comprise several elements, making it challenging to establish the evidence for each of these elements. A number of pharmacological studies have examined a single medication effect, although most contained an element of face-to-face counselling in addition, which has a potential (although unmeasured) impact.

The included studies have not explored sequential or simultaneous cessation attempts. It has not been possible to add to the literature on whether participants tend to quit both simultaneously, or sequentially, which would help in understanding the problem of co-use and importantly how to support a dual quit attempt.

Although the analysis indicates an intervention effect, there is still a range of factors that are uncertain; therefore, the findings must be interpreted with caution, within the context of the lack of detail describing co-use.

2.5.2 Quality of evidence

Appraisal of risk of bias across the eleven RCTs included in meta-analysis indicates similar outcomes; overall the quality is considered moderate; performance bias is inevitable in face-to-face interventions, and fairly low attrition rates were common, although McClure et al. (2014) scored more highly than others. Risk of bias is therefore considered as low across the RCTs, but quality of evidence is affected by issues of measurement (i.e., variation in use of cannabis measures as discussed) as well as the common use of self-reported measures to establish abstinence and reduction.

The quality of evidence across the dual intervention studies was considered to be high. The extent of biochemical verification used was higher than in the RCTs also appraised, and

intervention content was well-described. To date no formal consensus on measurement of cannabis use in studies exists; but dual intervention studies addressed some of the criteria of the Russell standard, underlining their validity.

The reduction outcomes indicate a high degree of heterogeneity, which may be explained by variation in reporting change of use in comparison to cessation of use, by slight variation in the methods used to calculate reduction and in a smaller number of smaller studies being included.

Study quality should not affect the interpretation of this review's findings, although other factors such as measurements challenges discussed earlier may do.

2.5.3 Potential bias in review process

The aims of this review were partly to identify outcomes for a nested group within the included studies, i.e., co-users, which required accurate identification within the screening process. There is a potential for selection bias present; in some cases, it was unclear whether a study had collected data at both time points; the majority of these were then checked with authors themselves but there may have been studies which did collect data and were not identified in screening process.

The search process aimed to identify studies which addressed or reported tobacco and cannabis use by using both substances as search terms; there may be studies which did report on both substance use, but which were not identified through the search process. Efforts were made to address any bias towards either tobacco or cannabis focussed studies by scrutiny of references lists from systematic reviews of co-use and of cannabis interventions excluded from initial screening.

The review contacted a large number of authors (n=25), of whom only thirteen provided data; this process is therefore biased towards more recent articles as older articles were more likely to include out of data author contacts (though efforts were made to locate authors via other means) and older datasets which were no longer available.

The review of uncontrolled studies indicates feasibility, including good levels of measurement of the outcomes. The dual intervention studies were notable for their superior levels of biochemical verification, again indicating that it is feasible for participants to engage in dual interventions which include dual biochemical verification, for example.

2.6 Conclusions

Dual interventions for tobacco and cannabis co-use have demonstrated feasibility; RCTs of dual interventions are required to adequately investigate whether this is an effective intervention for both substances for co-users, what format such interventions should take, how content relating to both substances should be integrated and take into account this review's findings that cannabis cessation appears more likely than tobacco cessation.

Outcomes for co-use of tobacco and cannabis need to be routinely addressed using standardised measurements in both tobacco and cannabis interventions, to fully understand the potential impact co-use has on single substance use outcomes, and again to further explore the potential for more success in cannabis cessation than tobacco cessation.

Methodological issues need to be addressed. We need more specific measurements of type and potency of cannabis used, to better understand what type of co-use is practiced and how we can measure co-use, and related use of two substances.

Chapter 3: Questionnaire survey study

3.1 Aim and Objectives

The survey aimed to explore experiences of, attitudes towards, and factors predictive of making a quit attempt of either substance amongst a sample of young adults reporting recent or current co-use of tobacco and cannabis.

The objectives were:

1. To provide a detailed picture of tobacco and cannabis use co-use and quitting behaviours of co-users

2. To identify individual factors within this sample predictive of quitting behaviours to inform an appropriate target group for a future intervention for co-users

The study aimed to answer the following detailed research questions:

a) What is the most frequent pattern of co-use amongst co-users, and what is the most frequently used type of cannabis and consumption method
b) For both tobacco and cannabis, what are the most frequent reasons for use, reasons to quit, methods used to quit and likelihood of substitution of one for the other during quit attempts
c) Which individual factors predict frequency of use and dependency on tobacco and cannabis, motivation to quit, previous quit attempts or quit success for tobacco and/or cannabis ('quitting behaviours')

3.1.1 Study rationale

Data are available on tobacco smoking prevalence and quit rates stratified by age and socio-economic status through the National Smoking Toolkit Study, a monthly survey carried out in England (West, Kock et al. 2021). Data describing cannabis use stratified by age are available from the Crime Survey for England and Wales, managed by the Office for National Statistics, reporting prevalence annually (Office for National Statistics,) but very little detail on the profile of cannabis users is available, and none on quit rates. Further, little data exist on the co-use of tobacco and cannabis in population-based surveys, and few studies have examined this in any detail, beyond estimating the rate of co-use (Hindocha, C. et al., 2016). Thus, a review of the literature on co-use did not provide sufficiently detailed evidence on

how to identify a potential target group for a proposed intervention. Objective one will therefore help to determine who, amongst people who co-used tobacco and cannabis, would be a priority target group for an intervention, based on prevalence, quit interest, and other personal characteristics.

Determining the criteria for an appropriate target requires careful consideration. For example, an appropriate group may consist of those with highest risk of dependence on either or both substances, highest rates of use of one or both (frequency and/or amount), greatest motivation to address one or the other, or those who had already sought support to address their use. It would be therefore important to understand whether co-users were more motivated to address their tobacco or cannabis consumption, were more likely to succeed in quitting or reducing one or the other, and whether amount or frequency of use influenced their attitude towards, or experience of quit attempts.

To define this group, a fuller understanding of the spectrum of co-use patterns was required. The study needed to fill this knowledge gap by providing an indication of the breadth of co-use and co-quitting behaviours.

3.2 Methods

3.2.1 Study design

Given so little data on young adult co-use in UK or Europe exist, a survey was selected as a means of gaining an initial understanding of the spectrum of co-use (i.e., range of frequency of use of both substances, co-use administration methods) and correlates of co-use.

Second, a survey enables data collection from a larger sample than would be possible using qualitative approaches (e.g., an interview study), allows for a mixture of closed and opened-ended questions, and is easily replicated across different settings. An online survey was selected for ease of use, reduction of administrative burden on those involved in distributing the survey, and reasons of privacy, particularly since the intended participants were asked to report details of illicit drug use.

3.2.2 Population sample

The survey aimed to provide data on a specific, non-probability sample. It was not aiming to identify prevalence of tobacco or cannabis use amongst a whole population, nor was it anticipated to be representative of tobacco and cannabis co-users.

3.2.2.1 Age

The study aimed to explore tobacco and cannabis use amongst young adults, as prevalence of both substances is highest within this age range. Tobacco smoking prevalence in the UK general population in 2018 was 14.7%, but amongst 16-24 year olds prevalence was higher at 16.8%. The highest prevalence is seen in the age group 25-34, which in 2018 was 19.2% (Office for National Statistics, 2019). Cannabis use statistics are provided through the Crime Survey for England and Wales; in 2018 7.6% of adults reporting use cannabis in the past year; this rises to 17.3% amongst young adults aged 16-24 (Office for National Statistics, 2020a).

These statistics indicate that young adulthood represents the life stage where people are most likely to use tobacco and/or cannabis; however, the survey also intended to capture experiences of quitting and attempting to quit. The percentage of adults up to the age of 24 who have previously smoked tobacco but have subsequently quit remains small (8.4% in 2018) but jumps to 43% amongst those aged 25-34, suggesting that changes in tobacco use, including quitting, are more likely to occur as someone ages through their twenties (Office for National Statistics, 2020a). A similar picture is seen for cannabis use. European Monitoring Centre for Drug and Drug Addiction (EMCDDA) data indicates that the average age of first using cannabis is 16, and the average age of first accessing treatment for this is 26 (Schettino et al., 2015). We can see that late teenage years to mid or late twenties may capture initiation of use, a shift to regular use, development of problematic use and help-seeking. For this reason, the age range extends from 16 to 30.

Within the survey, responses to age were grouped into four categories, as small differences between ages were not considered significant for the purposes of the study.

3.2.2.2 Inclusion criteria

In order to capture both use and quitting experiences, participants who reported either current or recent use of both tobacco and cannabis were sought. Recent use was defined as in the past six months. The inclusion criteria for the survey were therefore i) aged 16-30 and ii) current or recent use of both tobacco and cannabis. Recent use as well as current was included since one of the objectives was to include quitting experiences and was defined as within the past six months. No other inclusion criteria were set.

3.2.2.3 Further Education colleges as a setting

In order to sample young adults using a survey, educational establishments offer a convenient setting. In the UK, education post-16 is provided in either schools or Further Education (FE) settings. Post-18, education is provided in either FE or Higher Education (HE) settings, almost all of which (HE) are universities, and deliver undergraduate and graduate degrees. FE settings by contrast deliver a broad range of other types of educational qualifications, extending from Basic English and Maths up to degree level, and include vocational and applied courses (*Further education and funding.* 2021).

Although many studies of young adults recruit participants via the HE sector, i.e. universities, FE colleges were selected in this instance for a number of reasons. One of the overall aims is to target the potential intervention addressing tobacco and cannabis use at those most in need. In order to reach a more diverse sample of young adults, FE was selected in the hope it may provide a wider range of participant SES, since by definition it would include young adults with lower educational attainment. Evidence indicates that smoking prevalence and lower quitting rates are associated with lower socio-economic status (SES) (Hiscock et al., 2011). Compared to the data on tobacco use, less evidence exists on a potential association between cannabis use, cannabis use disorder and socio-economic status, and this evidence does not follow the same pattern as tobacco use. A French study found higher SES associated with higher cannabis prevalence, but lower SES associated with higher rates of problematic use (Legleye, Stéphane et al., 2012). Low SES criteria includes both lower educational attainment and lower level of income. Evidence of demographic divergence between HE and FE student populations is lacking, but it may be expected, given the broad range of vocational courses offered by FE in contrast to the more academically oriented curriculum offered by HE settings. Lastly, the question of representation of the evidence base used for many interventions and research conclusions was considered. University students are often selected as research participants, leading to concerns about a bias in the evidence base (Hanel & Vione, 2016). Using FE instead was an attempt to reduce this bias, and a wide range of personal characteristic questions were used to further describe the sample. Although not a specific study aim, it is hoped that this approach demonstrates the feasibility of using FE settings in future research and attempts to shift the default sample for young adult research away from universities.

3.2.2.4 Determining the size of the underlying population

The total population either across participating colleges or within individual colleges was unknown at the design stage, and it was not possible to estimate the proportion of students who would be eligible based on the inclusion criteria, i.e., use of tobacco and cannabis in the past 6 months. For this reason, it would not be possible to calculate a response rate for the survey.

3.2.2.5 Sample size calculation

A total of 384 respondents would be sufficient to estimate percentages with a margin of error of ±5% based on a 95% confidence interval. Since it was not possible to calculate a sample size for statistical modelling purposes due to lack of *a priori* data, this part of the analysis was treated as exploratory.

3.2.3 Ethical approval

Ethical approval was sought from King's College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittee and granted on 20th September 2018, reference number HR-17/18-7583. The approval included both the questionnaire survey and qualitative interview study. Minor alterations were required by the subcommittee which were addressed; the approval letter is included in appendix 1. A request for amendment was later made to the subcommittee to expand the range of personal characteristic questions to include sexuality and disability, and approval for this amendment was given on 1st November 2018.

3.2.4 Recruitment incentives

A prize draw was used as a means of encouraging students to participate and set at a relatively high amount of three prizes of £50 in comparison with other surveys advertised in the author's (HW) university, with the intention of maximising response rates. Motivation to participate was expected to be lower than for other health related surveys, and several factors were anticipated to contribute to this. These included concerns about confidentiality and disclosure of illegal drug use, and low investment in addressing the issue of young adult substance use due to a possible perception that it poses low risk. This contrasts with other health related surveys which may seek to recruit people with a specific health issue who are motivated to address this at a wider level by sharing their experiences.

3.2.5 Data storage

Questionnaire and interview data was stored only on the university cloud-based platform, as described in the ethical approval, and suggested by the university research support team. All identifying, personal data were removed from the files once no longer required, i.e., all eligible participants had received vouchers as a thank you for participation, and the six-month period post interview had elapsed. Identifying data were removed from the results stored on the original online platform where the survey was hosted at the same time.

3.2.6 Development of questionnaire

3.2.6.1 Questionnaire content

A review of existing tobacco and cannabis use surveys within the literature and discussion with colleagues from several institutions was undertaken to inform the development of the questionnaire.

A search of peer-reviewed literature was carried out to identify firstly tools which might explore and measure co-use. The questionnaire 'Nicotine and Marijuana Interaction Expectancy', (NAMIE) (Ramo et al., 2013) was considered. This explored thoughts about tobacco and cannabis and their potential interaction, but not current use of either. It was developed in the US where concurrent co-use is more common than co-administration (Hindocha, Freeman et al. 2016), and this pattern of use is reflected in the questions used, making it less applicable to UK young adults. It was not selected for these reasons.

Two further sources were also reviewed. First, a PhD thesis which explored young people's use of tobacco and cannabis was accessed (Tyler, 2015). The author identified the challenge of surveying co-use, including identifying co-administration; they did not locate any suitable validated tools within the literature and so created their own survey. However, the survey used in Tyler's thesis was aimed at youth, not young adults, and did not cover quitting behaviours.

Second, a research report into the importance of identifying tobacco use amongst young cannabis users was identified and formed an important source for questions to include in the questionnaire subsequently developed, but still did not cover co-use or quitting in any detail (Belanger et al., 2013) . The apparent absence of a detailed co-use questionnaire

relevant for the UK which included questions around quit attempts was also confirmed in discussion with several researchers in the same field from other institutions.

A questionnaire therefore had to be designed specifically to meet the aims of this study. It needed to include details of current use of each substance and of co-use, attitudes towards and experience of quit or reduction attempts for both substances, as well as consequences such as compensatory use of the other substance. The questionnaire sought to strike a balance between detailed responses and minimising respondent burden.

3.2.6.2 Questionnaire structure

The first section started with the screening question which was used to identify only those who fit the target population, i.e., recent use of both substances and within age range. All respondents who passed the initial screening were then asked detailed questions on tobacco and cannabis (Section 1). The questionnaire then filtered respondents into one or two sets of questions based on whether they have recently quit both substances, continue to use both, or have stopped or attempted to stop one or the other (Section 2). All those who had not made any quit attempts were asked questions about whether there was any reduction in their use of both substances. Though respondents may have tried to both reduce and quit, quit experiences were considered of greater value for this study, therefore anyone who had made a quit and a reduction attempt of either substance was only asked about their quit attempts, i.e., quit attempts for a substance took precedence over reduction attempts. The final section (3) asked detailed demographic questions and some general health related questions.

The questionnaire structure and question sets are shown in Table 5.

Table 5 Questionnaire content and structure

Section	*Content*	*Who completed this section?*
Introduction	Brief information about the survey Screening questions	All who clicked on link to access survey
Section 1	Current tobacco and cannabis use details	Participants who meet inclusion criteria only, i.e., 'screened in'
	Filter question	All
Section 2	ONE or TWO of the following sets: 1) Both Quit Success (BQS) 2) Both Quit Tried (BQT) 3) Tobacco Quit Success (TQS) 4) Tobacco Quit Tried (TQT) 5) Cannabis Quit Success (CQS) 6) Cannabis Quit Tried (CQT) 7) Either Reduction Tried (ERT) 8) No Reduction Tried (NRT)	Each participant completed either ONE or TWO of these question sets depending on their response to the filter question; e.g. *either* 1, or 2, or 7, or 8 which related to both substances *or* 3 + 5 or 6 *or* 4 + 5 or 6 which related to tobacco then cannabis
Section 2	Future quit intention tobacco (FT) + Future intention to quit cannabis (FC)	All *except* those who completed 1) BQS; those who completed 3) TQS who were not asked FT; and those who completed 5) CQS were not asked FC
Section 3	Demographic and personal questions;	All

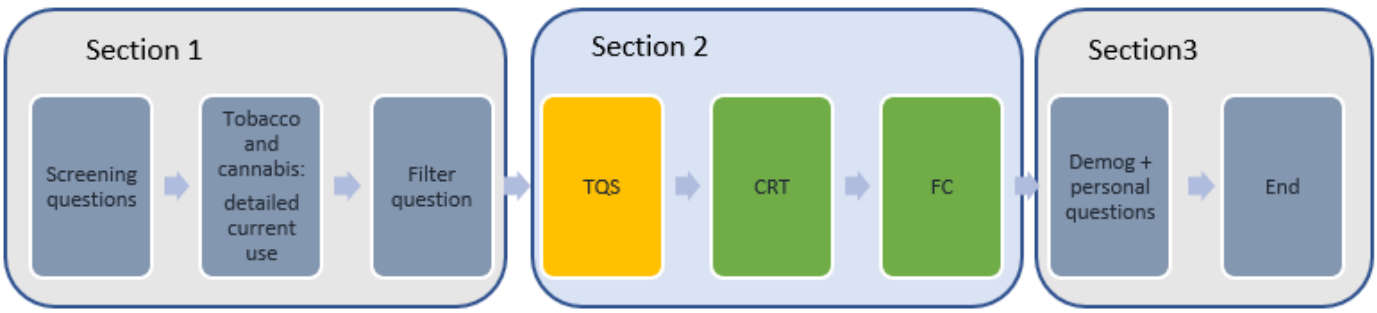
	information on accessing services; invitation to leave contact details for participation in interview study and/or prize draw	

The diagram in Figure 16 shows the route through the survey for a hypothesised respondent. In the route shown here, the individual selects the following statement in response to the filter question:

"I have stopped tobacco; I have also tried to reduce my cannabis use but I still smoke cannabis".

They were therefore asked about their tobacco quit success (3; TQS), such as what methods had they used and what had motivated them. They were then asked about their cannabis reduction attempt (CRT, contained within 7; ERT), and then questions about a potential future cannabis quit attempt (FC).

Figure 16 Potential route through questionnaire



Section three was asked of all respondents, and posed personal questions about socio-economic status, disability, ethnicity, sexual orientation, gender identity and experience of a mental health problem. These were kept deliberately to the end to minimise non-response,

as we anticipated that respondents would feel more accustomed to being asked personal questions at the end rather than the beginning of the questionnaire.

3.2.6.3 COM-B and TDF

The Theoretical Domains Framework, TDF and the COM-B model were used to inform the development of both the questionnaire and the qualitative interview schedule. The questionnaire was designed to ask questions relating to each element of the COM-B and TDF, and this was used to guide the initial development of question content. After the first draft was created, a mapping exercise was carried out to ensure as many elements were included as possible the elements are shown within the questionnaire content, in appendix 4. If a specific domain of the TDF did not map to a survey question, these were highlighted and later added to the qualitative interview schedule. The questionnaire section references in this mapping exercise (e.g., C2, BQS1 etc) relate to the structure used in the full questionnaire, which is in appendix 4. Table 6 shows the elements of the COM-B required, and the corresponding survey questions.

Table 6 TDF components and questionnaire section

		TDF components	**Questionnaire section**
Capability	Physical	Physical skills	-
	Psychological	Knowledge	
		Cognitive + interpersonal skills	-
		Memory, attention + decision processes	C2, BQS1
		Behavioural regulation	D4, D8
Opportunity	Social	Social influences	D2, D6, BQS2, BQS3
	Physical	Environmental context + resources	D6, BQS2, BQS3, TQT4
Motivation	Automatic	Reinforcement	TQT4
		Emotion	
	Reflective	Identity + social/professional role	TQT4
		Beliefs about capabilities	D4, D8, NRT1
		Optimism	D8
		Intentions	C2, D1, D5, D7, D8
		Goals	D7, NRT1
		Beliefs about consequences	C2, D3, BQS2, BQS3, NRT1

In addition to elements of the COM-B, the questionnaire survey also asked about reasons for use, and substance- specific reasons to consider quitting; although general reasons to quit may also be covered in the 'Intentions' element, since these may provide potential content for a proposed intervention and would indicate potential differences between substances in motivation to use and to quit, which would add to the understanding of how

young adults may conceptualise co-use. The list of reasons to use and quit was guided by a fellow researcher undertaking a similar study in Spain (data not published).

3.2.6.4 Demographic and personal characteristics

3.2.6.4.1 Age, gender and sexual orientation

Participants were asked to provide their current age in years. The wording for questions on gender identity and sexual orientation were taken from Stonewall's recommendations (Stonewall Scotland, 2017).

3.2.6.4.2 Course level

Participants were asked to list their course level from the following list:

- Entry level (e.g., Skills for Life, English for Speakers of Other Languages)
- Foundation/Level 1
- GCSEs,/NQ2/BTEC National/Access/Level 3*
- Foundation degree/HNC/HND/Level 4/Undergraduate qualification
- Apprenticeship
- Other.

**Level 2 omitted in error*

3.2.6.4.3 Mental health

Experience of a mental health condition was explored using two questions: self-reported experience of a problem, and service contact ("Did you see someone about this?"). Although contact with a service does not necessarily indicate either diagnosis of a mental disorder, level of severity or receipt of treatment, it does indicate a certain threshold of need which warranted contact with a service, whether this was prompted by the individual themselves or by someone else. It is therefore included as an additional question to self-reported (i.e., subjective) experience, and may be considered a form of proxy for severity of the condition.

The aim of the survey was not to elicit the range of potential mental health conditions found in this population, but rather to elicit the frequency of any type of problem. A literature search was carried out for a short scale listing only the most frequently experienced mental health conditions, but no suitable scales were found. Rather than formal diagnoses, a short

list of the most common conditions likely to be experienced amongst young adults was developed based on the author's (HW) clinical experience, and using person-centred language expected to be more familiar to participants.

3.2.6.4.4 Socio-economic status

Three measures were selected to identify socio-economic status; two individual level measures and a third relating to the area each respondent resided in.

3.2.6.4.4.1 Subjective social status (SES) and academic achievement

Although SES is a relevant and useful concept in smoking cessation research as it has a significant impact (Hiscock et al., 2011), it is a challenge to select appropriate measures of SES for a young adult age group. SES indicators often make references to financial or familial circumstance, and therefore do not fully capture the young adults' own individual circumstance or status. Additionally, young adults are at a life stage of increasing independence, so some within this age group will still live with family, others will live with friends, partners or alone so there is a wide degree of variation in home and financial circumstances within this age group. For this reason, personal rather than family indicators were preferred for the two individual level factors. Participants were therefore only asked questions which directly related to themselves. Maternal level of education is often used as an indicator for SES, but was not selected for this study, as there was a risk this may seem an unfamiliar and potentially intrusive question, especially in a situation where someone did not have contact with their mother. Previous research has also identified the risk of poor completion of this question amongst adolescents with lower SES, thus creating a bias in responses (Wardle et al., 2002).

The two individual level SES indicators were selected on the basis of their relevance for smoking status in previous research (Moor et al., 2019). Subjective Social Status (SSS) and academic achievement (AA) were both found to be the strongest predictors of self-rated health and smoking status and were included for these reasons.

The SSS measures asks individuals to rate their social status in relation to others on a scale of 1-10 (known as the 'ladder' question), where ten represents the most well off, successful people, and 1 the least (Goodman, E. et al., 2001). The AA asks respondents whether they consider their academic achievement to be above, below or matching the average in class,

an approach used and supported in previous publications (Gagné et al., 2018; Kuipers et al., 2014).

3.2.6.4.4.2 Index of Multiple Deprivation

The third measure selected was the Index of Multiple Deprivation, IMD. The IMD is used to identify the most deprived areas in England according to a number of criteria including income, employment, health, deprivation and crime (Smith et al., 2015).

The IMD indicates deprivation at a localised level, known as a Local Super Output Area (LSOA), which is a collection of approximately 1500 households. There are 32,844 LSOAs in England, and each is ranked according to its' IMD, and then placed into ten equal groups, i.e., IMD deciles. The IMD score for each LSOA is generated from data provided by the 2011 UK Census. It is standard practice to report LSOA in deciles according to the most deprived, i.e. to give the proportion of your sample whose LSOA falls into the 10% most deprived in the England (Smith et al., 2015).

Postcodes are required to estimate the IMD. Given that this survey asked people to disclose illegal drug use, it was not considered acceptable to ask respondents to give their full postcodes and may have reduced completion of the questionnaire. The UK Data Service, Census Support, provides an alternative method using a tool called GeoConvert. Each respondent was asked to provide their postcode sector, which is the first section of their postcode followed by the first digit of the second half, e.g., SW2 1. GeoConvert then generates a list of the full postcodes within that postcode sector. The full postcodes are then matched with their LSOA, and the IMD score for each LSOA is identified using data from Census Support. There are usually around 200 postcodes per postcode sector, so these data provide only an estimation of IMD within a given sample (*GeoConvert.*). The IMD scores relating to each individual's LSOA were then collated.

3.2.6.5 Variables relating to tobacco and cannabis use

3.2.6.5.1 Tobacco use and tobacco dependence measures

Tobacco use was explored using two initial questions. The screening question asked participants when they last used tobacco, and anyone reporting use in 'the past 6 months' or 'the past week' was included in the survey. The second question within Section 1, the main body of the survey, asked how often a respondent smoked cigarettes; possible

responses were ‘not in the past month’, ‘less than once per week’, ‘once or twice a week’, ‘three to five times per week’, or ‘everyday’.

For participants who reported regular smoking, a third measure of frequency of use was employed, cigarettes per day, which also formed part of the measure of dependence. Participants were only asked about measures of dependence if they reported past month smoking, since an assumption was made that those who did not smoke daily were likely to experience minimal risk of dependence.

The most frequently used measure within smoking cessation literature is the Fagerstrom Test for Nicotine Dependence (FTND) (Okuyemi et al., 2007) (Heatherton et al., 1991). However, the cigarettes per day (CPD) question contained within the FTND includes as the lowest option, ‘less than ten’, which was considered too wide a category for this population. Young adults tend to report lower tobacco use and dependence compared with tobacco smokers across all age ranges (Park et al., 2012). It was anticipated that respondents within this survey who smoked daily may smoke fewer than ten cigarettes, therefore any granularity within this lower category would be lost. An alternative test for nicotine dependence was identified, and the shortened version of the Cigarette Dependency Scale (CDS-S) was selected for its brevity, and because it is found to provide a higher sensitivity amongst lighter smokers (Etter et al., 2003; Okuyemi et al., 2007) .

3.2.6.5.2 Cannabis use and cannabis dependence measures

Cannabis use was explored using two questions. The initial screening question asked participants to indicate when they last used cannabis, and anyone selecting either ‘in the past 6 months’ or ‘in the last month’ or ‘in the last week’ was invited to complete the survey.

The second question invited participants to state how many days in the past month they have used cannabis, grouped into categories; ‘none, I stopped over a month ago’, ‘1-5 days’, ‘6-10 days’, 11-20 days’, 20*-25 days’, ‘everyday, or almost everyday’. (*Author’s error, should have read ’21-25’).

Measuring cannabis consumption poses a significant challenge in practice and in research studies, since the variety of routes of administration, potency, frequency across a given time period and the capacity to share products are all highly variable (Cuttler & Spradlin, 2017) .

Self-report measures of cannabis use commonly use 'Time Line Follow-Back (TLFB) as a structure (Lee et al., 2019; Robinson, S. M. et al., 2014) , and use in the past thirty days is the commonly adopted time period, hence chosen for this study. Unlike tobacco use, this measure does not fully capture an individual's exposure to cannabis and is therefore a less consistent measurement compared to CPD although both are subject to recall bias; this limitation is commonly acknowledged in the literature.

A variety of measures are available within the literature to measure cannabis dependence, or risk of dependence. Tools cover both screening for potential, or 'at risk', cannabis smokers as well as diagnostic instruments (López-Pelayo et al., 2015), although the definition of 'at risk' is an ongoing discussion (Casajuana et al., 2016).

For the purposes of this study, a screening tool to identify potential risk rather than dependence was considered preferable and sufficient and would minimise respondent burden. Literature evaluating a number of tools was reviewed, and the 'Cannabis Abuse Screening Tool' (CAST) was selected.

CAST (Legleye, Stephane, Kraus, Piontek, Phan, & Jouanne, 2012) is identified as valid and reliable in a number of studies (Bastiani et al., 2013; López-Pelayo et al., 2015; Thanki et al., 2013) and recommended by the European Monitoring Centre for Drugs and Drug Abuse (Beck & Legleye, 2008) although the latter also indicates no single tool is described as optimal. CAST is intended to identify adolescents and young adults who might have a problem with cannabis use, who would then require further assessment to determine presence of a cannabis use disorder. It focusses on behaviours and action, rather than views of cannabis use, which could be considered more objective (Legleye, Stephane et al., 2012).

3.2.6.6 Variables relating to quit attempts and quitting experiences

3.2.6.6.1 Motivation to quit

The survey aimed to measure both motivation to quit and plans to quit. These two related but separate concepts have been incorporated into a single scale, Motivation to Stop Smoking (Kotz et al., 2013). To allow for a comparison between the two substances, this scale was adapted for cannabis use in this work and is referred to subsequently as Motivation to Stop Cannabis, MTSC. It was not feasible to validate the use of MTSC within the scope of this thesis.

3.2.6.7 Pilot questionnaire development process

A pilot of the questionnaire was developed and circulated amongst the personal network of the researcher to seek feedback on the type and wording of questions. Conducting a pilot questionnaire process with the intended college students was considered, but it would not have been possible to seek feedback from participants on their experience of completing the questionnaire without compromising their confidentiality, and it was not considered appropriate to request this additional burden of both the intended sample and of the college administration. The group who completed the pilot (n=10) were all above the age of 30 thus older than the intended audience, but all had experience of using both tobacco and cannabis. The feedback they provided led to several changes in the wording of questions to improve clarity.

The most significant of these changes entailed altering the wording for a question within the Cigarette Dependency Scale (CDS-5), as the original required a calculation of the number of minutes until first cigarette of the day. The feedback given in the pilot process indicated that the use of digits might be off-putting for some, as it posed what appeared to be a mental arithmetic challenge. This was altered to include wording instead of digits, and therefore remove the apparent need to make that calculation. The two versions are shown below in Table 7.

Table 7 Changes to CDS-5 questions

Original version		*Altered version*	
0-5 minutes	5 points	in the first 5 minutes after waking	5 points
6-15	4 points	In the first 15 minutes	4 points
16-30	3 points	In the first 30 minutes	3 points
31-60	2 points	In the first hour	2 points
61 +	1 point	Within 1-5 hours	1 point
		Over 5 hours after waking	1 point

An extra category of ‘over 5 hours’ was added since the survey was exploratory, and this might have demonstrated a useful differentiation, especially in a group of younger smokers who may be less dependent. The original version does not differentiate beyond the first hour.

Although this presented a slight change to the scoring system the revised question structure was considered more straightforward and would result in more accurate responses. In addition, the change in scoring was considered to have a low impact since it was anticipated that few smokers of this age would be highly dependent and therefore most overall scores would be relatively low.

Other changes made in response to the pilot feedback related to minor changes to wording and are not detailed here.

The questionnaire was uploaded to the ‘Online Surveys’ website which King’s College London was licensed to use at the time of the survey. The website allows the user to create their own survey, and to store their data securely, in compliance with General Data Protection Regulation. Once the questionnaire had been uploaded to the platform, colleagues within the researcher’s department carried out a review of the process of navigation through the survey to provide feedback on issues relating to the flow and routing of the questionnaire. As a result of this feedback minor changes were made to the structure and order of the questions, but not the content.

3.2.7 Data collection

3.2.7.1 Procedure

As the questionnaire study was used to also recruit respondents for qualitative interviews, the researcher needed to be able to meet potential respondents for a face-to-face interview. Since the researcher was based in London, FE colleges in Greater London were identified using the list collated by the Association of Colleges organisation (Association of Colleges, 2018). Twenty-seven colleges were contacted in the first instance. A letter detailing the project including the rationale and study procedure was sent to the principal of each college, along with a copy of the survey. The study procedure was designed to require only minimal input from each college and therefore maximise college response rate. The initial letter was then followed up by a phone call to the principal’s office to prompt a

response. When only two colleges from the original list responded positively, the sample was extended to colleges within the home counties, i.e., those within reasonable travelling distance for students who might participate in the qualitative interviews. FE colleges within each county surrounding London were located through an online search, and a letter was sent to a further eighteen colleges. From this list, one college responded positively. To summarise, three colleges from a total of forty-five contacted agreed to distribute the survey.

Two colleges were in inner-city London, and the third in a town outside London. The inner-city colleges were located in areas of higher deprivation and greater ethnic diversity compared to the national average.

Each of the three colleges agreed to send out an email direct from the college, which included text written by the researcher. This text explained the purpose of the research, described the criteria and included a link to the online survey. It was made clear in this text that the survey was not being carried out by the college, and respondents could not be identified in any way by the college. One of the colleges offered to send the email out to only those students meeting the age requirements. Two of the colleges were able to provide an indication of the number of students who received the email; n=3376 in one case, over 7200 in the other. Each college agreed to send a reminder email out several weeks after the first email. The email invitation included the study criteria and respondents were asked to confirm they met these criteria in the screening section of the survey. Study information was provided in the first part of the main survey, and consent implied by participants' continuing with the survey.

The survey was available online from 8th November 2018 till 25th April 2019. The survey was left open for a several months as responses continued over this period and was closed once the responses had slowed to around one per week for a number of weeks.

3.2.7.2 Use of personal data

To reduce the likelihood of anyone being 'screened out' and returning to the survey to try again with changed responses, it was not made explicit that the respondent had been 'screened out', they were simply thanked for their participation after the screening

questions and invited to leave their details for entry into the draw. These details were not used when selecting recipients of the prize draw; all these processes were agreed by ethics.

No specific measures were available via the platform to ascertain whether anyone completed the survey more than once, to maintain the confidentiality of respondents on the platform. However, for each respondent who did provide personal details such as email or phone number, a check was carried out to see whether there were any repeat phone numbers or email addresses.

It was not possible to ascertain which college respondents attended, and no potentially identifying information such as name or home address was required as part of the survey. To maintain confidentiality of respondents, the platform used does not collect data on anyone who has started but not completed the survey.

At the end of the questionnaire respondents were invited to leave an email address if they wished to be entered into the prize draw. Once the survey had closed, three respondents were selected at random to receive a prize of a £50 shopping voucher. When all three respondents had received their emailed prize voucher, all contact details provided for this purpose were then deleted.

Respondents were also invited to leave an email or phone number if they were happy to be contacted for an interview (see Chapter 4).

3.3 Analysis

3.3.1 Analysis plan

Planned data analyses were pre-registered before commencing the analysis process at the Open Science Framework (OSF) website, osf.io/fs62j. This is included in appendix 6.

The software package SPSS (v26) was used to analyse the data, and a statistician within the university faculty assisted with the analysis process.

3.3.2 Data processing

Data were downloaded from the Online Survey platform and transferred into SPSS where it was sorted and cleaned.

3.3.3 Primary outcome

At the end of Section 1, participants were asked to select the most appropriate description of themselves at that point in time, ranging from 'I have stopped both tobacco and cannabis' to 'I have not made any attempt to quit either tobacco or cannabis', referred to as the 'filter question', comprising seven options. Responses to this question were used to produce a four-level ordinal variable for each substance, 'quitting behaviour'. The four levels comprised: quit; quit attempt made; reduction or reduction attempt made; no quit or reduction attempt made.

These two variables were created for several reasons. It was anticipated that use of tobacco and cannabis, and therefore 'smoking status' would fluctuate significantly for this population, and that successful and sustained quit attempts for both substances were likely to be infrequent (Hair et al., 2017; Hughes et al., 2016; Patton et al., 2007). The behaviour of interest in determining who might benefit or make use of a co-use intervention was whether someone had demonstrated an interest or motivation to quit by making an attempt. Therefore, in order to gather data describing who might be ready to receive an intervention, quitting behaviour was considered a more informative indicator than smoking status or successful quit attempt. The variable 'quitting behaviour' attempts to elucidate the extent to which someone has changed their use, thus the extent of behaviour change is of interest, rather than a binary outcome.

Additionally, 'use status' on a particular day may not capture risk exposure. As an example, someone might use cannabis when it was made available to them, rather than regularly seeking it out. If they had not been offered any for the past month, then they have remained abstinent for a month but may not consider themselves to have 'quit', since their intention has not changed, but rather their behaviour only. Similarly, they may consider that they have 'quit', because they have not used cannabis recently, but when in a situation where cannabis was made available, may then use again. Hence, they remain 'at risk' to further use, and may benefit from an intervention.

The outcome (dependent) variables were subsequently used to determine associations between likelihood of making a quit attempt and individual characteristics, or patterns of co-use.

3.3.4 Explanatory variables

Some of the explanatory variables were grouped for analytical purposes. Age was grouped into four categories ('16+17', '18-20', '21-24', '25-30'). Other variables were dichotomised where it made sense to do so or the number of respondents choosing a certain category was small. Gender was dichotomised into female and other or male, ethnicity into BME or non-BME, sexual orientation into not heterosexual or heterosexual. Disability was unchanged i.e., presence or absence of disability. Any experience of a mental health problem including ever and recent and whether treatment was received (i.e., saw someone about it) or not were aggregated and compared with no experience of a mental health problem.

Subjective social status and IMD deciles were used as continuous variables. Academic performance was grouped into three ordinal categories either below average, average or above average. The Cigarette Dependence Scale (CDS-5) was not included in either model, since it was not asked of the whole sample, only of those reporting past month tobacco use.

3.3.5 Descriptive analysis of sample

Descriptive statistics were presented for the sample as a whole, with a focus on patterns of use and co-use of each substance, and experiences of quitting using the 'frequencies' and 'crosstabs' procedures in SPSS.

3.3.6 Statistical modelling

A test of parallel lines was applied to both the tobacco and cannabis quitting variable, to determine whether the data supported the ordinal logistic regression assumption. This was supported for tobacco quitting behaviour but not for cannabis quitting behaviour. This meant that the cannabis quitting behaviour variable categories were re-arranged from four into two categories: quit/attempted to quit/reduction attempt made vs no change made.

Ordinal logistic regression was therefore used to model the association between demographic and personal characteristics and the ordinal dependent variable 'tobacco quitting behaviour'. Logistic regression was used to model the association between demographic and personal characteristics and the reconfigured two category dependent variable 'cannabis quitting behaviour'.

Frequency of tobacco use was not used in the tobacco quitting behaviour model because these concepts – frequency and quitting behaviour - were considered too similar. Likewise, frequency of cannabis use was not used in the cannabis quitting behaviour model.

The ordinal regression model was fitted using the SPSS procedure 'plum' and the logistic regression model using the SPSS procedure 'logistic regression'. For both tobacco and cannabis quitting models the test of parallel lines for an ordinal regression model was calculated (χ^2, degrees of freedom, p-value). Odds ratios with 95% confidence intervals and the Cox & Snell R^2 (measure of model fit) have been presented in the tables. For academic achievement, which has three categories, the overall test of effect (χ^2, two degrees of freedom, p-value) was calculated using the SPSS 'genlin' Procedure. P-values (probability of a false positive/type I error) are shown to two significant digits and <0.001 used for those less than 0.001.

The number of respondents with missing data for each variable used in the modelling was as follows: mental health problem (n=1), use of cannabis 11+ days/month (n=1), academic performance (n=2), disability (n=2), SSS (n=3), sexual orientation (n=4), CAST (n=5), IMD (n=18). This caused a loss of 26 (18%) of cases from the multivariable ordinal and logistic regressions. Imputed datasets were therefore created using all the variables from the modelling to assess the impact of missing data on the odds ratios and 95% confidence intervals. A total of 30 imputed datasets were created which exceeds the threshold of 14 datasets based on the largest fraction of missing information value (tobacco, IMD 0.139; cannabis, IMD 0.140) multiplied by 100 (UCLA). Models were refitted using these imputed data and compared with the results from the complete case modelling.

3.4 Results

3.4.1 Sample size and demographic data

In total 400 students completed the screening questions, and of these, 142 respondents met the screening criteria and were invited to complete the full questionnaire. Of these 142, 138 left an email address for entry into the prize draw. Two participants' email address were noted to be almost identical, so the assumption was made this was a repeat entry by the same person, and the second of these responses was deleted, leaving n=141 as the final sample.

Table 8 indicates the numbers of respondents who answered the various sections of the questionnaire. Selected data are presented in this chapter, where there were sufficient responses to question sets to provide meaningful insights.

Table 8 Respondents to questionnaire sections

Section	**Content**	**Who completed this section?**	**Number**
Introduction	Brief information about the survey Screening questions	All who click on link to survey	400
Section A	Current tobacco and cannabis use details	Participants who meet inclusion criteria only, i.e., 'screened in'	141
Section B	Details of co-use	All	141
	Filter question	All	141
Section C	ONE or TWO of the following sets of questions depending on answer to filter question: 1) Both Quit Success (BQS) 2) Both Quit Tried (BQT) 3) Tobacco Quit Success (TQS) 4) Tobacco Quit Tried (TQT) 5) Cannabis Quit Success (CQS) 6) Cannabis Quit Tried (CQT) 7) Either Reduction Tried (ERT) *(*within NQT group)*	Each participant completed either ONE or TWO of these sections	1) BQS: 11 2) BQT: 17 3) TQS: 18 4) TQT: 29 5) CQS: 18 6) CQT: 5 7) NQT: 43 8) ERT: 17*

Section D	Future quit intention tobacco (FT); Future intention to quit cannabis (FC)	Participants NOT asked if they completed BQS. Those who completed TQS were not asked FT and those who completed CQS were not asked FC	FT: 106 FC: 105
Section E	Demographic and personal questions Information on accessing services Invitation to leave contact details for participation in interview study	All	141

3.4.2 Demographic data & personal characteristics

Most participants were aged between 16 and 20 years old (90%), and over half (58%) were female. The majority were of white ethnicity (57%), and most of the remaining students were evenly distributed between mixed ethnicity, Asian and Asian British, and Black, African, Caribbean and Black British. Whilst most students described themselves as heterosexual (67%), a proportion described themselves as bisexual (21%), a small number as gay men or lesbian (5%) and the remainder preferred either not to say, to self-describe or selected 'other' (4%). A small number (8%) stated they had a disability. Most students were completing Level 2 and 3 courses, which includes GCSEs and A Levels (58%). 15% of respondents were completing either an apprenticeship or an entry level, foundation or level 1 course, and a small number (3%) completing the highest level of study at level 4.

Table 9 describes the demography of the sample, including level of course attended. All percentages have been rounded up to nearest whole number. Missing data are shown when applicable.

Table 9 Sample demographic and personal characteristics

		number (%)
Age	16+17	76 (54%)
	18-20	51 (36%)
	21-24	9 (7%)
	25-30	5 (4%)
Gender	Male	57 (40%)
	Female	81 (58%)
	Prefer to self-describe	3 (2%)
	Other	0
Ethnicity	White	80 (57%)
	Mixed	17 (12%)
	Asian/Asian British	16 (11%)
	Black, African, Caribbean, Black British	21 (15%)
	Other	7 (5%)
Sexual orientation	Heterosexual	95 (68%)
	Gay man	5 (4%)
	Lesbian	2 (1%)
	Bisexual	29 (22%)
	Prefer not to say/to self-describe/other	6 (4%)
	Missing	2 (1%)
Disability	Yes	17 (12%)
	No	113 (80%)
	Prefer not to say	9 (6%)
	Missing	2 (2%)
Course level	Level 1, entry level, foundation	14 (10%)
	Levels 2 + 3, GCSEs + A Levels	82 (58%)
	Apprenticeships	6 (5%)
	Level 4, degree (foundation or undergraduate)	5 (3%)
	Other	34 (24%)

3.4.3 Socio-economic status

Table 10 and Table 11 show two of the three measurements of socio-economic status: academic achievement in comparison to peers, and subjective social status.

Table 10 Academic achievement

Academic achievement in class	**Frequency (%)**
Above average	38 (27%)
Average	92 (65%)
Below average	9 (7%)

Table 11 Subjective social status

Subjective social status	**Frequency (%)**
1	1 (1%)
2	3 (2%)
3	9 (6%)
4	16 (11%)
5	40 (28%)
6	35 (25%)
7	17 (12%)
8	10 (7%)
9	4 (3%)
10	3 (2%)
Missing	3 (2%)

Most students rated themselves as average (65%) or above average (27%) in terms of academic achievement in comparison to their peers and only a small number as below average (7%). In the second measure, when asked to rate themselves on a ladder of comparative social status, where 1 is the lowest, the responses followed a 'normal

distribution curve', with most in the middle, and smaller numbers at either end of the scale. More than half (53%) rated themselves at the midpoint of the ladder, rung 5 and 6.

3.4.4 England Index of Multiple Deprivation, EIMD

Table 12 shows the proportion of the sample living in each decile, where the decile indicates local areas ranked according to multiple indices of deprivation. Each participant was identified as living in a particular postcode sector, which was then associated with a number of local super output areas, LSOAs, an area of around 1500 households. The total number of LSOAs generated by this sample is shown in the table. Each of the LSOAs generated are then shown according to the decile into which they fall, the percentages are shown alongside. All LSOAs in England have been previously ranked and assigned to a decile, the total number across England is 32844.

Table 12 Index of Multiple Deprivation

IMD decile of LSOA (1= 10% of most deprived LSOA)	**Frequency of LSOA in sample (% of whole sample)**
1	2375 (11 %)
2	4745 (22%)
3	4071 (19 %)
4	2531 (12 %)
5	1643 (8 %)
6	1294 (6 %)
7	1191 (6 %)
8	1353 (6 %)
9	841 (4 %)
10	1171 (6%)

A third of the sample (33%) live in areas which are located within the two lowest deciles of LSOAs in England, and 11% of the sample in the most deprived decile, when ranked according to the (English) Index of Multiple Deprivation, IMD. Across all ten deciles, 72% of the sample lived in the lower half of all ranked LSOAs in England, i.e., deciles 1-5.

3.4.5 Self-reported mental health problems within the sample

Table 13 shows responses to the questions about mental health problems. Each participant was asked to indicate whether they had experienced a mental health problem, and if so, had they seen anyone about this problem, what was the nature of the problem and whether it occurred in the past 6 months or not. All percentages shown are of the total sample of 141 participants. There is some inconsistency in responses across the questions. For example, the number of people who reported experiencing a mental health problem is 108. Although they were not expected to respond to subsequent questions if they answered no to any mental health problem, in some cases they did, so the number of people who answered the next question about whether they saw anyone for this is 110, i.e., higher than the number of people who reported any mental health problem. Since it might be the case that participants were comfortable answering some but not all questions, the responses have been presented in full, despite the apparent inconsistencies. For this reason, all percentages shown are relative to the total sample of 141 participants, and therefore do not always sum to 100% for each sub-question.

Table 13 Self-reported mental health problems

	number (% of whole sample)
Any experience of a mental health problem?	
yes	108 (77%)
no	29 (21%)
prefer not to say	3 (2%)
Did you see anyone about this?	
yes	60 (43%)
no	50 (35%)
Type of mental health problem	
Anxiety	
- in past 6 months	69 (49%)
- over 6 months ago	18 (13%)
Depression	
- in past 6 months	65 (46%)
- over 6 months ago	24 (17%)
- Psychosis	
- in past 6 months	8 (6%)
- over 6 months ago	11 (8%)
- Self-harm	
- in past 6 months	22 (16%)
- over 6 months ago	23 (16%)
- Substance misuse (other than cannabis)	
- in past 6 months	21 (15%)
- over 6 months ago	16 (9%)
- Other	
- in past 6 months	9 (6%)
- over 6 months ago	4 (3%)

Multiple responses possible

Over three quarters of the sample (77%) reported experience of a mental health problem at any time point, with almost half reporting anxiety (49%) or depression (46%) in the last 6 months. Of the whole sample, 43% had seen someone about their mental health problem. Smaller numbers of respondents reported experience of self-harm (16%), substance misuse other than cannabis (15%) psychosis (6%) and any other problem (6%) in the past 6 months.

3.4.6 Descriptive data

3.4.6.1 Tobacco and cannabis use

Use of tobacco and cannabis was investigated using several questions. Table 14 shows responses to the initial screening question and subsequent questions relating to frequency of use for both substances.

Table 14 Frequency of use: tobacco and cannabis

Frequency of use		*number, (%)*
Tobacco	**Initial screening (introduction)**	
	past week use	30 (21%)
	past 6 month use	111 (79%)
	Main survey (section 1) - Frequency of tobacco use	
	Over a month ago	38 (26%)
	Less than once per week	15 (11%)
	Once or twice a week	12 (9%)
	3-5 times per week	20 (14%)
	Everyday	56 (40%)
	Main survey (section 1) – CPD, cigarettes per day	
	(total=102*)	
	0-5	65 (46%)
	6-10	28 (20%)
	11-20	6 (4%)
	21-29	2 (1%)
	30+	1 (1%)
Cannabis	**Initial screening**	
	past week use	77 (55%)
	past 6-month use	64 (45%)
	Main survey (section 1) - Frequency of cannabis use, days used in past month	
	none, stopped over a month ago	20 (14%)
	1-5	49 (35%)
	6-10	12 (8%)
	11-20	13 (9%)
	20**-25	16 (11%)
	daily or almost daily	28 (21%)
	missing	1 (1%)

**question asked of recent tobacco users only (i.e., those reporting smoking tobacco within last month)*

***error in survey text, should have read 21*

The tobacco use responses across the three questions demonstrate evidence of apparently inconsistent responses, although each question is worded a little differently. The initial screening question was intended to elicit the most recent use of tobacco, and results indicate only 30 (21%) respondents had smoked tobacco in the past week, the remainder (n=111, 79%) in the past 6 months. However, when asked about frequency of use, 56 (40%) participants reported daily smoking, and a further 32 (23%) at least weekly; answers to this may have indicated 'usual practice' rather than actual use in past week. Results of the later cigarettes per day (CPD) question indicate that most participants (n= 65, 46%) smoked up to 5 cigarettes daily, and 28 (20%) between 5 and 10. Only a small number smoked over 10 cigarettes per day (n=9, 6%).

In the initial screening question relating to cannabis, 77 (55%) reported using cannabis in the past week. Most respondents indicated that they used cannabis between 1 and 5 times a month (n=49, 35%), although 28 (21%) reported daily, or almost daily cannabis use.

Table 15 shows answers to a single question intended to elicit current status at the time of the survey, the 'filter' question. Responses to this question then determined which subsequent questions participants were invited to answer, for example anyone indicating they had quit both tobacco and cannabis was not asked about future motivation to quit tobacco or cannabis.

Table 15 Responses to 'filter' question

Response to multiple choice filtering question on current status	Number (/141)
Quit tobacco AND cannabis	11
Quit tobacco, continued to use cannabis	18
Quit cannabis, continued to use tobacco	18
Attempted to quit one or both	51
Attempted to reduce one or both	24
Not tried to quit or reduce either	19
	total = 141

The filter question responses indicate that most participants had made some form of change in the past six months, or attempted change to their use of tobacco or cannabis, with only 19 stating they had not attempted to quit or reduce either. Most had made either a quit or reduction attempt (n=51, n= 24), with 11 stopping both tobacco and cannabis, and 29 indicating they had stopped one substance.

There is some suggestion of inconsistent responses across the cannabis use questions. For example, in the frequency of use question in section 1, n=20 participants stated they had not used cannabis in the past month. However, in response to the filter question (Table 15), 11 indicated they had stopped tobacco and cannabis, and a further 18 reported they had stopped cannabis, i.e., 29 in total indicated they had stopped cannabis. Given the wording of each question is slightly different, all results are presented as answered, despite the inconsistences. No single question was assumed to elicit a more 'accurate' response than any other.

3.4.6.2 Co-use

Table 16 includes questions from across the survey which relate to patterns of co-use. These include specific questions about co-administration and more general questions about the potential for substitution between tobacco and cannabis. Both sets of questions were asked of all participants, regardless of whether they indicated they had recently stopped both or either substance.

Table 16 Co-use questions

	number (% of whole sample)
Co-administration	
- I smoke tobacco in cigarettes AND in joints	88 (62%)
- I only smoke tobacco in joints (I don't smoke cigarettes)	37 (26%)
- I smoke tobacco cigarettes but I don't smoke tobacco in joints	16 (11%)
Substitution between substances	*(multiple answers possible)*
- If I drink alcohol, I want a joint too	46 (33%)
- When smoked a lot of cannabis, find I smoke fewer cigarettes	43 (30%)
- Smoked cigarette to avoid smoking a joint	25 (18%)
- When smoked a lot of cannabis, find I smoke more cigarettes	23 (16%)
- After a cigarette felt the need for a joint	18 (13%)
- Smoked a joint but mainly wanted the tobacco hit	8 (6%)
- None of these	31 (22%)

Most respondents indicated that they usually smoked both tobacco in a cigarette and also in a joint with cannabis (n=88, 62%), with a quarter indicating their only tobacco consumption was in a joint with cannabis but not cigarettes (n=37, 26%). A small number of people indicated they only smoked tobacco in cigarettes, and not in joints (n=16, 11%), these may be participants who had stopped cannabis altogether, or who used it without tobacco .

In response to questions about tobacco and cannabis substitution, or 'compensatory effects' (Table 16), most responses indicate an association with drinking alcohol and wanting to smoke a joint, and a reduction in tobacco cigarette use when smoking a lot of cannabis. Some also endorsed smoking cigarettes in order to avoid smoking a joint, and that cannabis use increasing their concurrent cigarette use. A smaller number stated they smoked a joint mainly for the tobacco effect, or that after a cigarette they wanted to smoke a joint.

3.4.6.3 Cannabis consumption methods and reasons for use

A third of participants reported most commonly using high potency cannabis (33%), and a quarter low potency (26%). A proportion were unsure (17%) and a smaller number used resin most frequently (14%). Only a small number reported their most common type was concentrates (7.5%). Three quarters of the sample stated that the most common route of administration was in a joint with cannabis, and very few used alternative methods such as edibles, or electronic devices. The majority of the sample (86%) reported sharing joints with others at least half of the time, and only 4% stated they always smoked joints alone. The proportion of tobacco and cannabis in a typical joint varied from 25-100%, although most reported using 75% or 50% cannabis (49%, 25%).

The most frequent reason for using cannabis was for relaxation and enjoyment (86%, n=121), and 63% (n=88) reported using it to 'cheer myself up when feeling bad'. Around half of the sample reported cannabis to manage mental health symptoms, for socialising and to 'see things differently'. A smaller number cited creative reasons, and only a small number because they found it hard to stop. Other reasons included pain management and sexual experience enhancement. Table 17 shows details of cannabis use.

Table 17 Cannabis use details

Cannabis details consumption methods	**Frequency**
Cannabis type, most common	
High potency, 'skunk'	46 (33%)
Low potency, 'herbal'	36 (26%)
Not sure	24 (17%)
Resin/hash	19 (14%)
Concentrates	7 (5%)
Other	6 (4%)
Missing	3 (2%)
Route of administration, most common	
In a joint with tobacco	106 (75%)
In a joint without tobacco	17 (12%)
Pipe, waterpipe or bong	5 (3%)
E-cigarette without nicotine	3 (2%)
Edibles	3 (2%)
E-cigarette with nicotine	2 (1%)
Missing	5 (4%)
How often do/did you share joints with others?	
Always	52 (36%)
Most often	41 (30%)
Half the time	28 (20%)
Most often alone	15 (10%)
Always alone	5 (4%)
Proportion of tobacco and cannabis in a typical joint	
100% cannabis	13 (9%)
75% cannabis	69 (49%)
50% cannabis	35 (25%)

25% cannabis	9 (6%)
don't know	4 (3%)
someone else rolls	8 (6%)
missing	3 (2%)
Reasons for use (multiple answers possible)	
To relax and enjoy myself	121 (86%)
To cheer myself up when feeling bad	88 (63%)
To be social and enjoy myself with others	55 (39%)
To manage my mental health symptoms	47 (33%)
To see things differently	44 (31%)
To be more creative and original	34 (24%)
It's what I usually do, there's no reason	21 (15%)
Because I find it hard to stop	16 (11%)
Other*	5 (4%)

*Reasons given within the 'other' category were: to gain ideas for books, to try it, to manage pain, to aid sleep, to enhance sexual experiences.

3.4.6.3.1 Maximum used on a single occasion

Participants were asked to use free text to describe the maximum amount of cannabis they had used on a single occasion. From 89 free text responses provided, 56 could be interpreted and collated. The majority referred to the number of joints, followed by number of grams. Participants reported several large amounts of cannabis use on a single occasion, e.g. a single joint containing 9g, although this was shared, and smoking 3 'spliffs' in just 30 minutes. This is shown in Table 18.

Table 18 Maximum amount of cannabis used on a single occasion

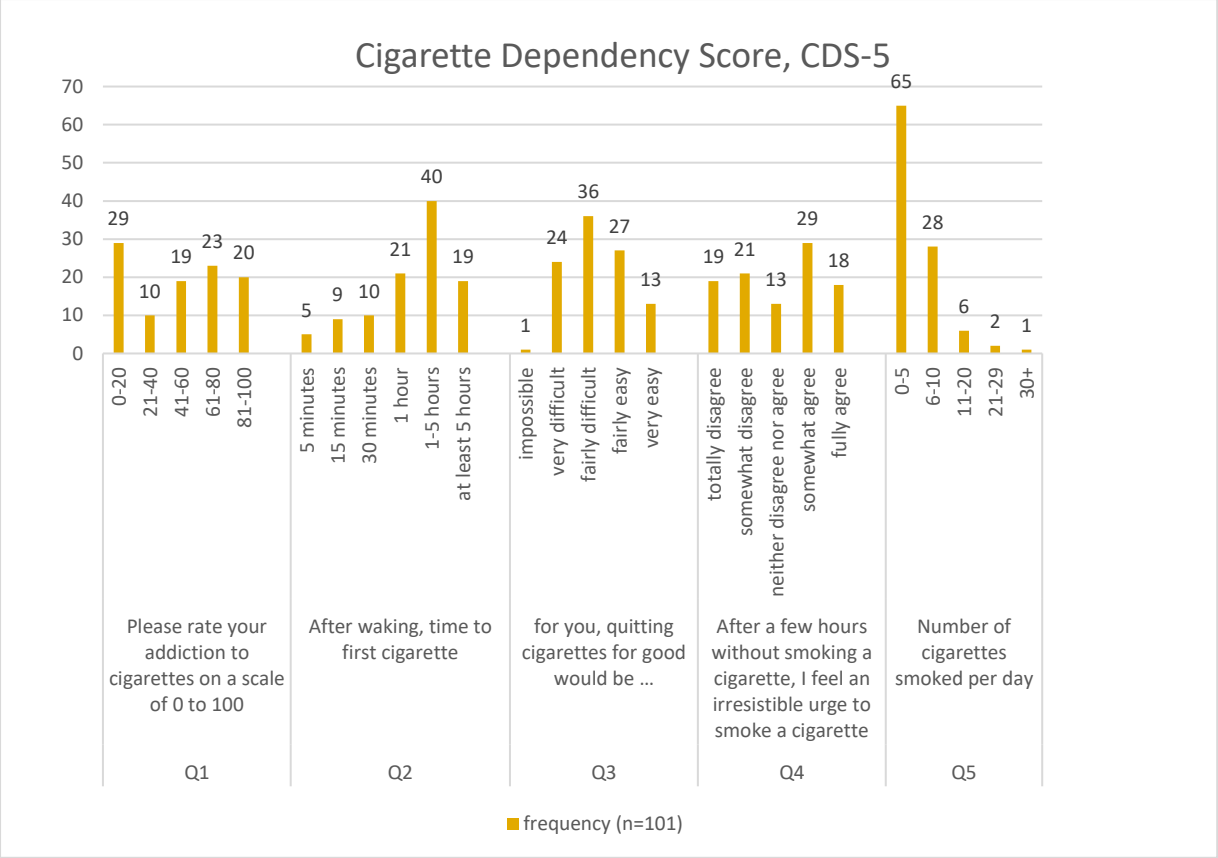
	Lowest ranked response	Highest ranked response	Number of responses	Selected quotes
Number of joints	Very little – shared one joint with two people	'~30 joints'	33	'when I was on a comedown from MDMA, I smoked 3 spliffs in 30 minutes' 'a large pure joint' 'can't remember exact number but more than 10'
Number of grams	1 gram	'+60 g'	15	'28g in 6 hours' '14g in one night' 'multiple occasions when I smoke 7g in one day' 'I smoked a 9g joint with friends last week, but normally I smoke one or two joints'

3.4.7 Dependency measures

3.4.7.1 CDS-5

Figure 17 shows the results for the cigarette dependency measure CDS-5 (shortened version) across all five questions. Only participants who indicated they had smoked tobacco in the past month were invited to respond to the CDS-5, since it asks about cigarettes per day and therefore assumes regular use. The total number included is therefore 101 participants. Individuals are scored according to their answers to each of the five questions. The minimum score possible is 5, maximum is 24. The mean score of cigarette dependence was 12.6 (SD 5.6, n=101), suggesting a moderate level of tobacco dependence across the sample as a whole. For the purposes of the CDS-5 scoring, CPD were grouped into categories in the questionnaire, hence it is not possible to determine a mean CPD for the sample, but the mode is 0-5 CPD.

Figure 17 Cigarette Dependency Score

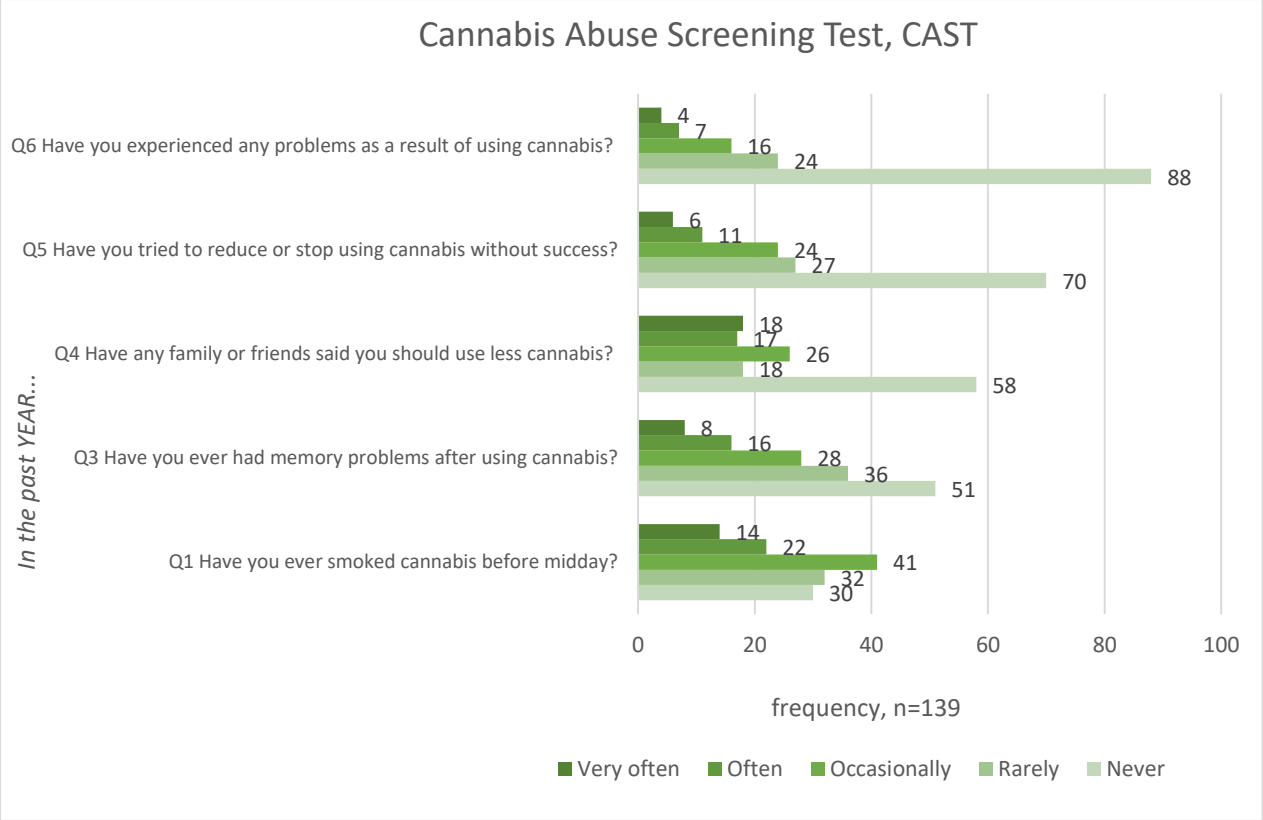


Percentages are not shown since the number is so close to 100.

3.4.7.2 CAST

All participants in the survey were asked to complete the Cannabis Abuse Screening Test, CAST, shown in Figure 18. CAST comprises six questions; however question 2 ("Have you smoked cannabis when you are alone?") was omitted in error in the survey. An overall score for each individual was calculated, the minimum score is 0 and the maximum is usually 24, but since question two was omitted the maximum score in this instance is 18. A score of 7 and above indicates a 'high dependence risk'. The mean CAST score was 6.1 (SD 4.2, n=136), and n=56 (41%) of participants had score of 7 or over, indicating they were at risk of cannabis dependence.

Figure 18 Cannabis Abuse Screening Test



Question 6 in full reads "Have you had any problems because of your use of cannabis (argument, fight, accident, bad results at school etc.?)

3.4.8 Quitting behaviours and experiences

Data presented in Figure 19 and Figure 20 show the variable "quitting behaviour" created for each substance. Figure 19 shows responses to the overall tobacco and cannabis use status question Q11, presented in Table 15. Each participant is represented twice in these figures; by their tobacco quitting behaviour and by their cannabis quitting behaviour. In Figure 20, the same data are presented as a percentage for each substance, to show the range of quitting behaviour for each substance. Inconsistencies are noted in responses to Q11 in comparison to earlier frequency of use questions.

For both tobacco and cannabis, the majority of participants had not attempted any change in their use, although a higher number of participants had made no attempt to change their cannabis use (n=77) compared to the number who made no attempt to change their tobacco use (n=50). A higher number of participants had made a tobacco quit attempt (n=46) compared to those who had made a cannabis quit attempt (n=22). However, a similar number of participants had quit tobacco as had quit cannabis (n=29 for both substances), and a similar number of participants had either reduced their use of tobacco (n=16) or cannabis (n=13).

Overall, a greater proportion of the sample had made an attempt to change their tobacco use (65%) compared to their attempts to change their cannabis use (46%).

Figure 19 Quitting behaviours 1

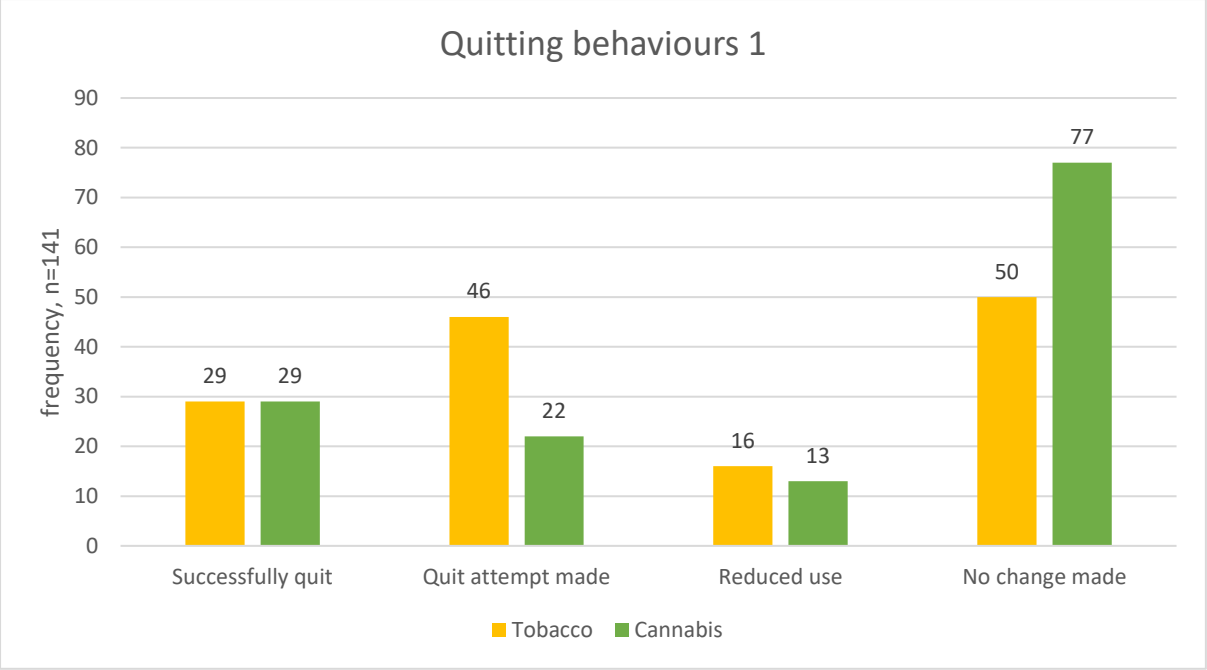
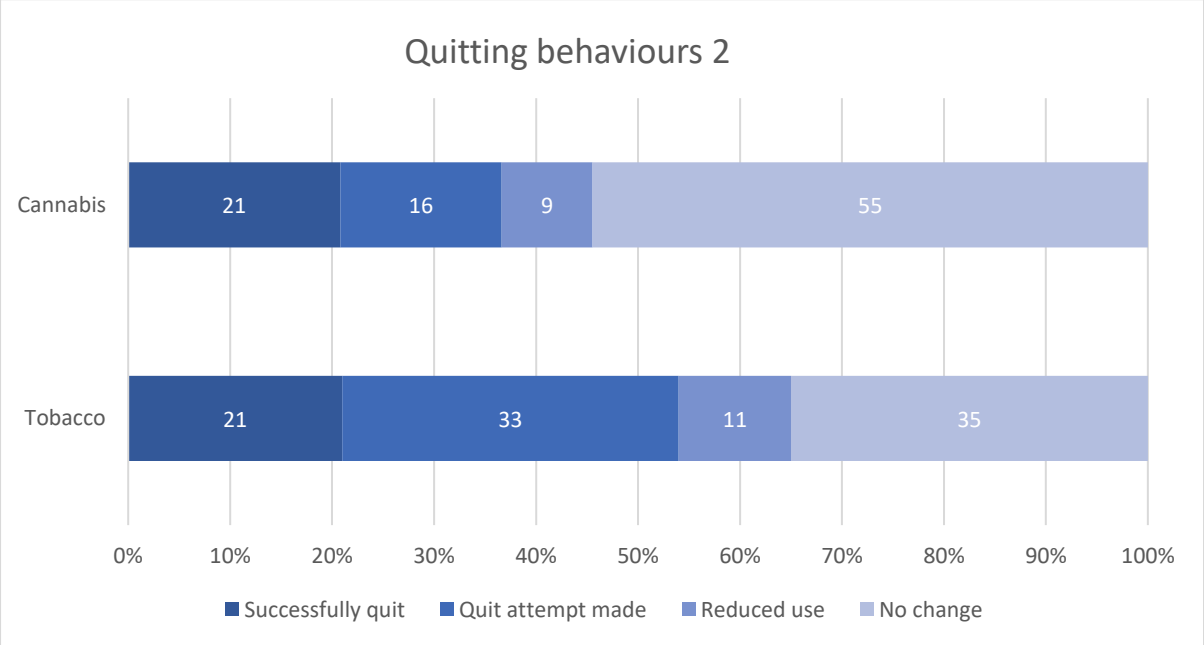


Figure 20 Quitting behaviours 2



3.4.8.1 Motivation to stop each substance

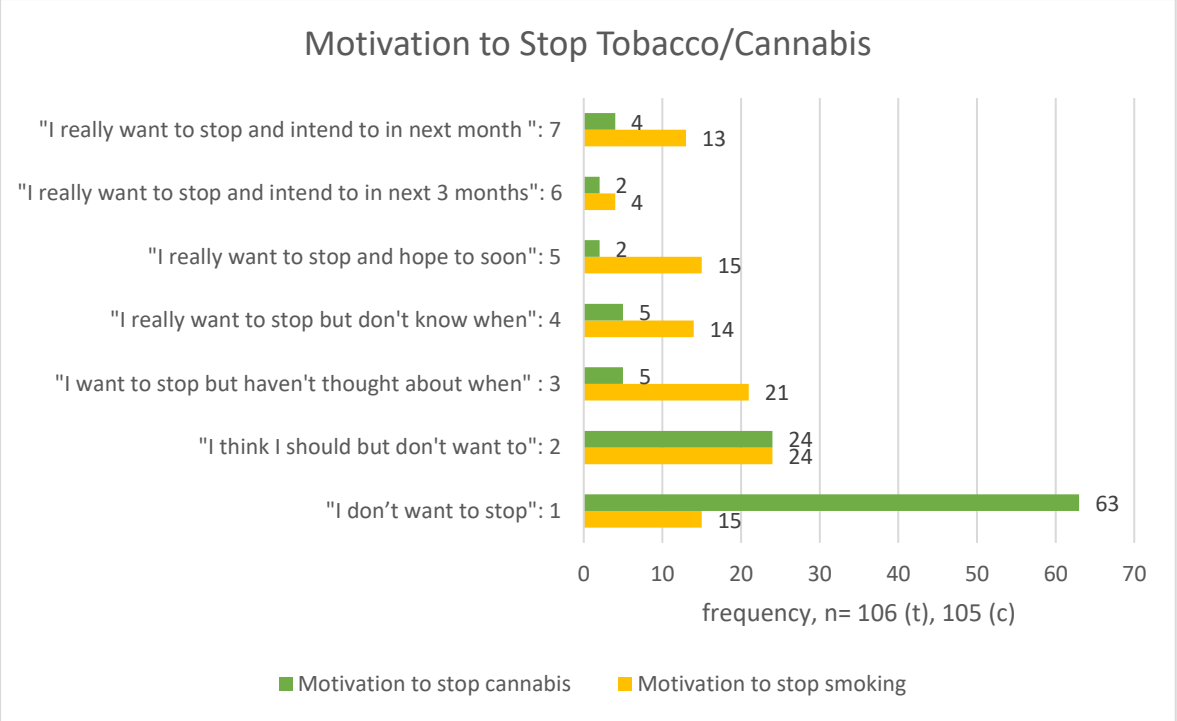
Motivation to stop smoking (MTSS) and Motivation to Stop Cannabis (MTSC) are presented to show the pattern of motivation to quit amongst participants who indicated they continued to smoke tobacco, or cannabis, when asked in the single use status question, filter question number 11.

For MTSS, 106 participants responded to the question. Of the remaining 35 participants from the total sample, 3 responses were invalid or missing, and 32 participants were not invited to answer the MTSS as they indicated they no longer smoked tobacco. As noted earlier, participants were asked about their current use a number of times throughout the survey using slightly different wording. As an example, the 35 participants who indicated they no longer smoked tobacco does not align with responses given earlier in the survey which indicated the number who had stopped as 29. This demonstrates either an inconsistency in response throughout the survey, or alternatively that participants considered themselves to have stopped, even though they very recently had used tobacco.

For MTSC, 105 participants responded to the question. Of the remaining 36 participants, 6 responses were either missing or invalid, and 30 were not asked as they stated they no longer used cannabis. Again this indicates a degree of inconsistent responses in the survey, although an alternative explanation is that despite very recent use, had now decided they had stopped.

MTSS mean score is 3.5 (SD 1.9, n=106), indicating a moderate level of intention to quit. MTSC mean score is lower at 1.9 (SD 1.5, n=105), with the majority (n=63, 60%) stating they had no intention or motivation to quit. Motivation to stop is shown in Figure 21.

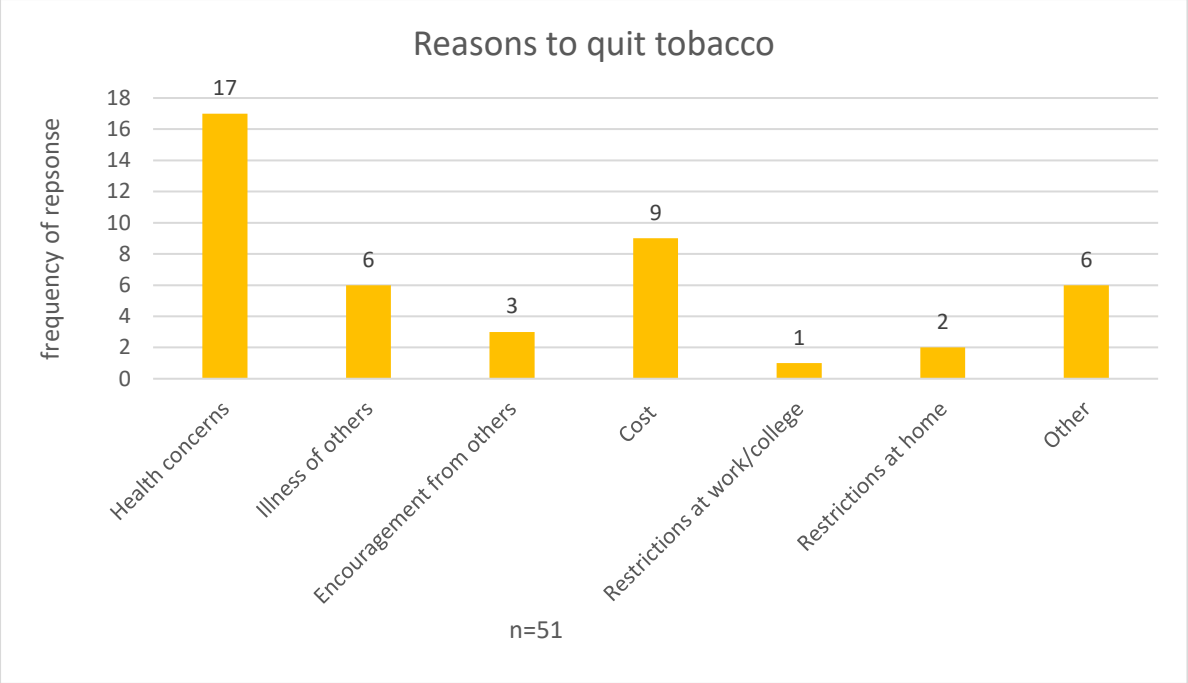
Figure 21 Motivation to stop tobacco/cannabis



3.4.8.2 Reasons to quit each substance

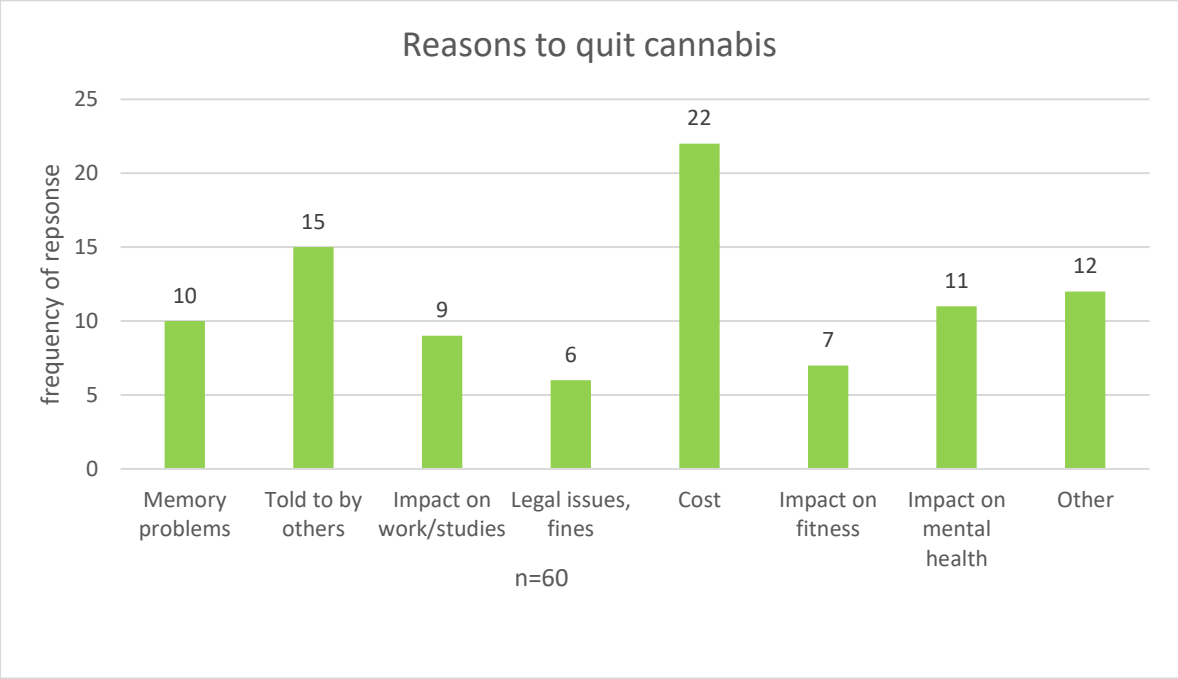
Reasons to quit tobacco and cannabis were asked since they may elicit motivating factors which could be used in intervention content. Participants who reported having either quit or tried to quit or reduce tobacco or cannabis were asked what their reasons were and multiple responses were possible. Health concerns was selected most frequently as a reason to quit tobacco (n=17) whilst cost was mentioned less often (n=9) and encouragement from others (n=3) was apparently less salient a factor. Reasons are shown in Figure 22 and Figure 23.

Figure 22 Reasons to quit tobacco



The most frequent reason for quitting cannabis was cost (n=22), followed by 'told to by others' (n=15), 'impact on mental health' (n=11) and memory problems (n=10). All other reasons were mentioned by fewer than 10 respondents (6 to 9).

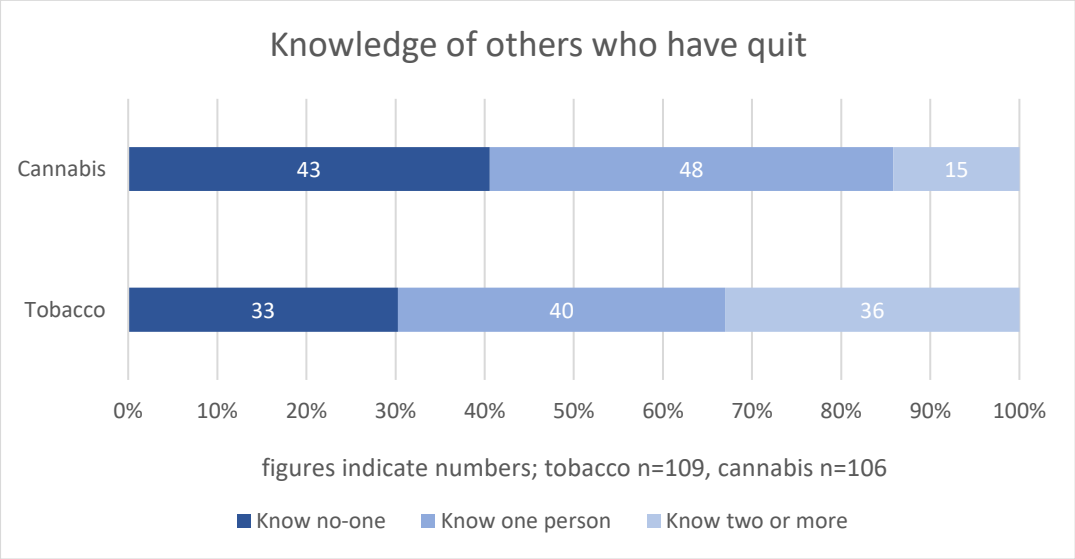
Figure 23 Reasons to quit cannabis



3.4.8.3 Knowing someone else who has quit tobacco and/or cannabis

Knowledge of someone else who has quit is a factor included in the COM-B framework, whereby 'opportunity' (i.e., knowing someone else who has done the same) appears to be a facilitating factor, perhaps by demonstrating the target behaviour is a real possibility. Participants were asked if they knew of anyone else, and if so how many, who had quit either each substance. Almost a third of respondents to this question stated they knew no-one who had quit tobacco, and almost half of respondents knew no-one who had quit cannabis. These questions were not asked of those who indicated they had stopped both tobacco and cannabis. Percentages are shown since the numbers asked are slightly different across substances but are close to 100.

Figure 24 Knowledge of others who have quit



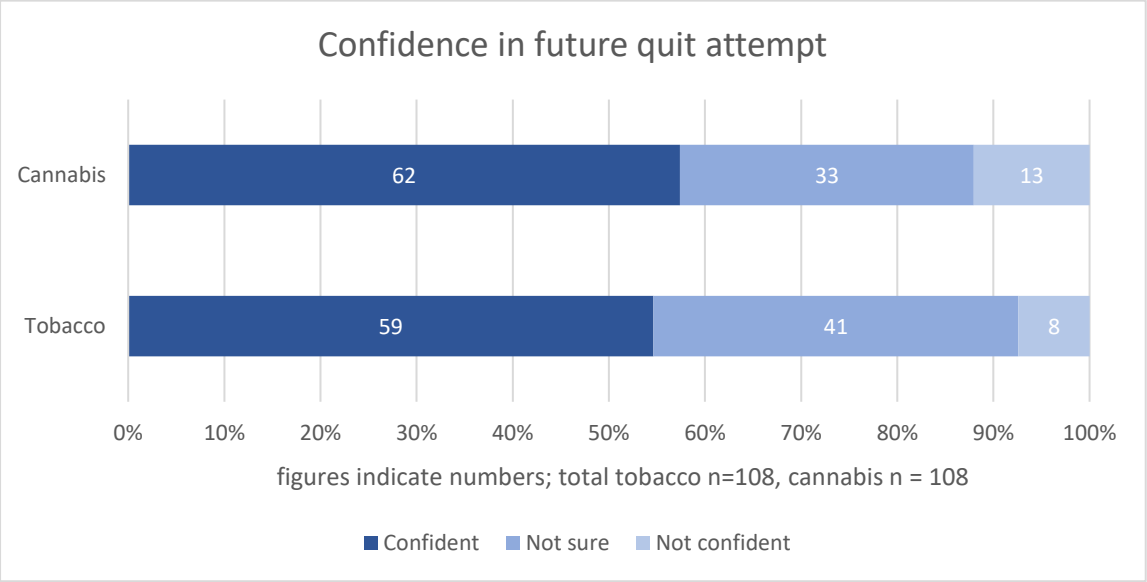
3.4.8.4 Confidence in future quit attempt

This question was asked of all participants who indicated they continued to use tobacco or cannabis, regardless of motivation to quit. Participants were asked to rate their confidence in quitting if they decided to quit for any reason in the future.

Over half of the responses to this question for both tobacco and cannabis were confident they would be able to successfully quit when they decided to, and only a small number (approximately 10% for both substances) did not feel confident. The remainder indicated

they were not sure. These questions were not asked of people who stated they had stopped tobacco and cannabis. Percentages are shown since the numbers are close to 100.

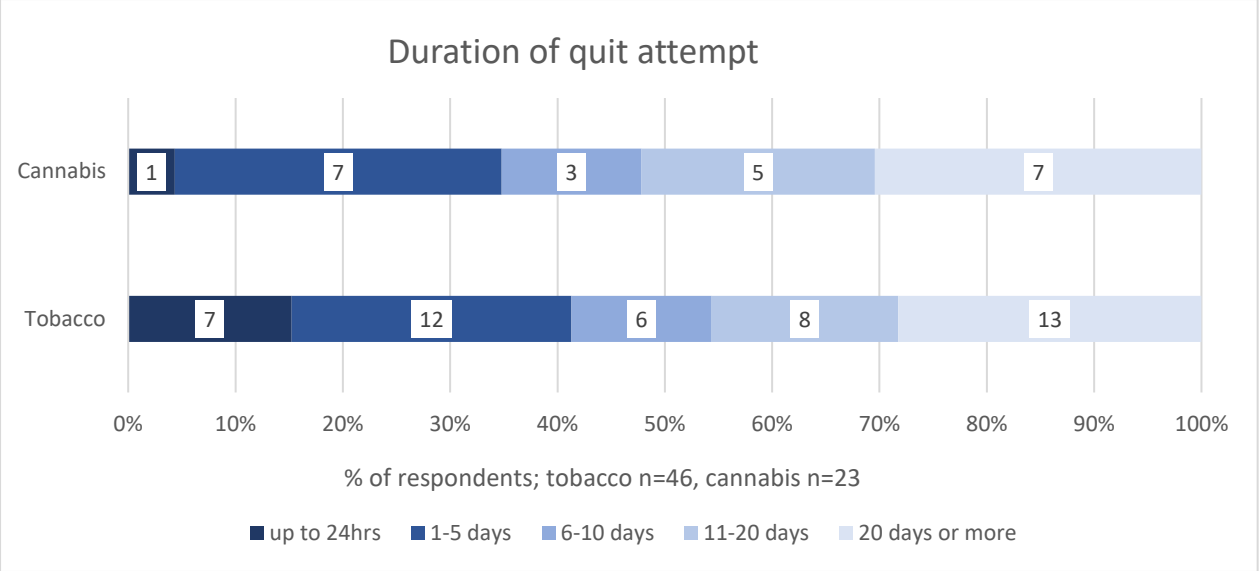
Figure 25 Confidence in future quit attempt



3.4.8.5 Duration of quit attempt

Duration of quit attempts were fairly evenly balanced across each time interval and across each substance, although a greater number of respondents reported only achieving a 24hr tobacco quit attempt (n=7) compared to cannabis (n=1). A similar percentage achieved a quit attempt of 20 days or more (tobacco 28%, cannabis 30%). These were only asked of people who had made a quit attempt, and not those who had successfully quit. Percentages are shown to allow for comparison between substances as well as numbers in Figure 26.

Figure 26 Duration of quit attempt

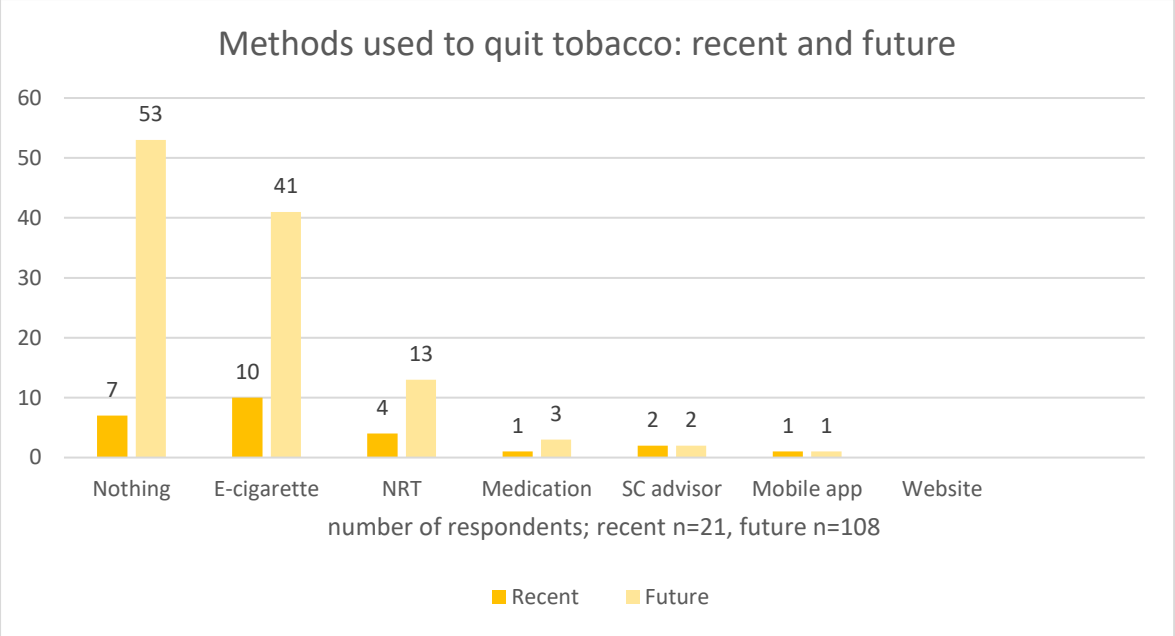


3.4.8.6 Methods used to make a quit attempt

3.4.8.6.1 Tobacco: recent and future attempts

All participants were asked about quit attempt methods and the responses for those who had made an attempt and those who imagined a future attempt are shown in Figure 27. Multiple responses were possible. Most participants who had made a tobacco quit attempt reported using either an e-cigarette (n=10) or nothing (n=7) and very few used any other method. When asked about potential future quit methods, the majority reported they either did not expect to use any form of intervention or support (n=53), or they would use an e-cigarette (n=41); very few expected to use any other intervention.

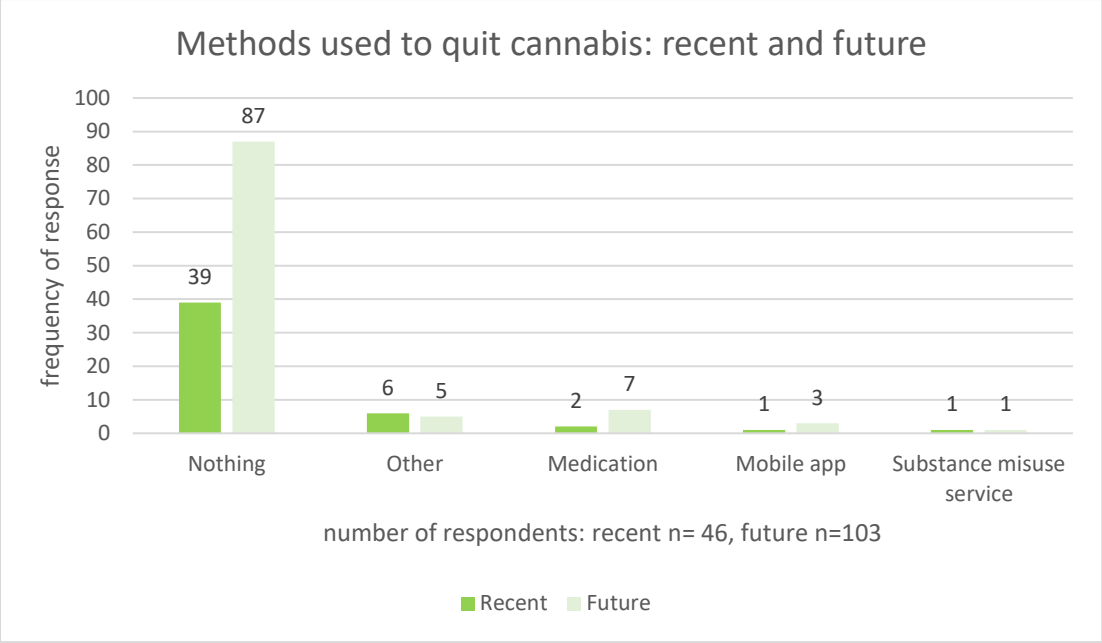
Figure 27 Methods used to quit tobacco; recent and future



3.4.8.6.2 Cannabis quit attempt: recent and future

The same questions for cannabis are shown in Figure 28. Of those who had made a cannabis quit attempt the majority reported they had not used any intervention or support (n=39/46). When asked about a future quit attempt, the majority (n=87/103) indicated the same intention not to use any specific method. For both recent and future, very few had used or expected to use any other method.

Figure 28 Methods used to quit cannabis: recent and future attempts



3.4.8.6.3 Co-quitting behaviours

Responses to questions relating to co-quit attempts and compensatory use of the second substance during a single quit attempt are grouped together and are shown in Table 19 in three sections.

Eleven participants reported they had successfully quit both substances (a), and 36 participants indicated they had successfully stopped either tobacco or cannabis (b) and so were asked whether they had considered a co-quit attempt (b). A further 46 participants indicated they had made an unsuccessful attempt to quit tobacco but an omission in the survey script meant that only 29 were asked about this (c). 22 participants were asked about their unsuccessful cannabis quit attempt (c).

Responses by participants who had made a successful co-quit attempt (n=11) indicate that most respondents gave 'other' reasons for making a co-quit attempt, and only three of them did so because they thought it would be easier. Half of this group quit both substances within the same week, and all indicated they would possibly, or were likely to advise others to also make a co-quit attempt.

Participants who had successfully quit either tobacco or cannabis were asked whether they had considered a co-quit attempt; most (21/36) reported that either they didn't want to or it hadn't occurred to them.

Participants who had made an unsuccessful quit attempt of either tobacco or cannabis were asked about compensatory use of the other substance. Amongst respondents who had made a tobacco quit attempt (n=29) the majority (n=13) indicated their cannabis use increased at this point, although ten stated their cannabis use decreased; the remaining six reported it had not changed. Respondents who had made a cannabis quit attempt (n=20) were asked the same question regarding their tobacco use; half (n=10) stated it had increased, but six stated it had decreased and four stated it did not change.

Table 19 Co-quitting behaviours

Co-quitting and co-use behaviours	**Number of responses (/total)**
a) Reasons for co-quit attempt	(/11*)
Expected it to be easier to stop both at same time	3
Advised to stop both at same time	1
Had tried before, learned it was better to co-quit	1
Other	5
Order of substances in recent successful co-quit attempt	
Both at same time, within same week	5
Stopped tobacco first, then cannabis	2
Stopped cannabis first, then tobacco	3
"Are you likely to advise a friend to make a co-quit attempt?"	
Very likely	4
Quite likely	3
Possibly	4
Not likely	0
Unlikely	0
**1 missing*	
b) Views about co-quitting "Did you consider making a co-quit attempt?"	(/36)
No, I did not want to	14
No, it did not occur to me	7
I did try and stop both at same time	5
Yes but I thought it would be too difficult	7
Yes but I thought it would be a bad idea	1
Other	3
c) Compensatory use following quit attempt	

After tobacco quit attempt…	(/29)
cannabis use increased	13
cannabis use decreased	10
cannabis use did not change	6
After cannabis quit attempt…	(/22*)
tobacco use increased	10
tobacco use decreased	6
tobacco use did not change	4
**2 missing*	

3.4.8.7 Modelling tobacco and cannabis quitting behaviour

A four-level ordinal variable, 'quitting behaviour' was created to capture any change that an individual had made to their tobacco substance use and a two-level dichotomous variable for change in cannabis use.

3.4.8.7.1 Tobacco quitting behaviour

Table 20 shows results of univariable and multivariable models used to ascertain which individual characteristic(s) or factor(s) predict the likelihood of making a positive change in tobacco smoking behaviour. The multivariable model fulfilled the assumption of parallel lines (p>0.05). Three factors were shown to be statistically significant predictors. First, being LGBTQ+ decreases the likelihood of making any changes to tobacco smoking behaviours (OR 2.60, (95%CI 1.14-5.93, p = 0.023). This suggests that an individual who is LGBTQ+ is 2.6 times more likely to make no change to their tobacco smoking behaviour compared to someone who identifies as heterosexual.

Two further factors were found to predict changing tobacco smoking behaviours. Living in an area which has a high Index of Multiple Deprivation (IMD) decreases the likelihood of making any changes to tobacco smoking behaviour (OR 1.31, 95%CI 1.09-1.57, p = 0.004) whilst rating yourself as comparatively lower in social status (subjective social status) decreases your likelihood of making any changes to tobacco smoking behaviours (OR 1.43, 95%CI 1.14-1.79, p=0.002).

No other personal factors appeared to be predictive of tobacco quitting behaviour.

Table 20 Tobacco quitting behaviours

	n	***Univariable***		**Multivariable**	
		OR (95% CI)	p	OR (95% CI)	p
Female/non-male	141	0.98 (0.53-1.81)	0.96	0.83 (0.39-1.78)	0.63
BME	141	0.61 (0.33-1.12)	0.11	0.79 (0.37-1.66)	0.53
Not heterosexual	137	2.37 (1.20-4.68)	**0.013**	2.60 (1.14-5.93)	**0.023**
Disabled	139	1.68 (0.66-4.30)	0.28	0.74 (0.23-2.33)	0.61
Mental health problem	140	0.65 (0.31-1.34)	0.24	0.67 (0.28-1.61)	0.37
Uses cannabis 11+ days/month	140	0.61 (0.33-1.13)	0.11	0.64 (0.28-1.46)	0.29
CAST	136	0.97 (0.90-1.04)	0.34	0.98 (0.89-1.08)	0.66
IMD decile	123	1.23 (1.06-1.43)	**0.007**	1.31 (1.09-1.57)	**0.004**
Subjective social status	138	1.27 (1.05-1.53)	**0.015**	1.43 (1.14-1.79)	**0.002**
Academic performance	139	χ^2 = 1.44, 2df, p=0.49		χ^2 = 1.85, 2df, p=0.40	
Below average		0.60 (0.16-2.25)	0.45	2.53 (0.49-13.01)	0.27
Average		1.23 (0.62-2.44)	0.56	1.64 (0.74-3.63)	0.23
Above average		1.00 (-)		1.00 (-)	
Cox and Snell R^2				0.21	
Test of Parallel Lines				χ^2 = 24.14, 22df, p=0.34	

3.4.8.7.2 Cannabis quitting behaviours

Table 21 shows results of univariable and multivariable models used to ascertain which individual characteristic(s) or factor(s) predict the likelihood of making a change in cannabis use. The test of parallel lines for the ordinal variable cannabis quitting behaviour (X^2=102.491, 22df, p<0.001) was statistically significant and therefore did not meet the assumptions required to fit the ordinal regression model. A logistic regression was used instead where the first three levels of the dependent variable (quit success, quit attempt, reduced) were aggregated into one group and compared to no change made.

No factors were shown to be statistically significant predictors of cannabis quitting behaviour in the multivariable model. However, academic performance (OR 0.43, 95%CI

0.17 to 1.08), p=0.072) and disability (OR 3.13 95%CI 0.84-11.72, p=0.090) provided an indication, albeit not statistically significant, of a potential negative association.

Table 21 Cannabis quitting behaviours

		Univariable		**Multivariable** (n=116)	
	n	OR (95%CI)	p value	OR (95%CI)	p value
Female/non-male	141	1.11 (0.56-2.18)	0.76	1.63 (0.68-3.90)	0.27
BME	141	1.17 (0.60-2.27)	0.65	0.95 (0.40-2.23)	0.90
Not heterosexual	137	1.32 (0.64-2.73)	0.46	1.19 (0.47-2.99)	0.72
Disability	139	3.23 (1.07-9.74)	**0.037**	3.13 (0.84-11.72)	0.090
Mental Health problem	140	0.80 (0.36-1.76)	0.58	0.74 (0.28-1.98)	0.55
Frequency of tobacco use	141	χ^2=3.39, 2df, p=0.18		χ^2=1.82, 2df, p=0.40	
Over 1 month ago		0.64 (0.27-1.56)	0.33	0.70 (0.23-2.14)	0.53
Daily smoker		1.43 (0.66-3.11)	0.37	1.42 (0.56-3.59)	0.46
Non daily but past month(ref)		1.00 (-)		1.00 (-)	
CAST	136	1.02 (0.94-1.10)	0.65	0.99 (0.90-1.09)	0.84
IMD decile	123	1.04 (0.89-1.21)	0.65	0.96 (0.79-1.17)	0.68
Subjective social status	138	1.10 (0.89-1.34)	0.38	1.18 (0.92-1.51)	0.21
Academic performance†	139	0.51 (0.23-1.11)	0.089	0.43 (0.17-1.08)	0.072
Cox and Snell R^2				0.10	

† categorised into two groups: below average/average (ref) and above average

3.4.8.8 Missing data

The dataset contained a number of missing socio-demographic and personal characteristic items. Multiple imputation was used to determine whether the missing data had an impact on the results.

For the tobacco quitting behaviour variable, imputation had an impact on three items. The effect size and significance of the result increased for sexual orientation from OR=2.60 (1.14-5.93), p=0.023 (complete cases) to 3.02 (1.40-6.54), p=0.005 (pooled cases). The effect size and significance decreased for IMD from 1.31 (1.09-1.57), p=0.004 (complete cases) to

1.22 (1.02-1.45), p=0.028 and for subjective social status the effect size and significance decreased from 1.43 (1.14-1.79), p=0.002 (complete cases) to 1.32 (1.07-1.62), p=0.008.

For the cannabis quitting behaviour variable, imputation had an impact on only one single item, disability. The OR increased from 3.13 (0.54-11.72), p=0.090 (complete cases) to 3.80 (1.08-13.35), p=0.037 (pooled cases). In conclusion, imputation has had only a small impact on a small number of variables. Overall, the missing data do not appear to have had a meaningful impact on the results.

3.5 Discussion

3.5.1 Aims, objectives and research questions

The study aimed to provide a detailed picture of tobacco, cannabis and co-use, and quitting behaviours, and to identify individual factors predictive of likelihood to change use of tobacco or cannabis. The study has answered the research questions posed; identifying a detailed picture of co-use patterns, the range of cannabis use including maximum usage on one occasion, and the spectrum of tobacco use. It has demonstrated the range of quitting behaviours and compared motivation to quit across substances. Reasons to use, quit and methods chosen or anticipated were investigated as well as substitution during a quit attempt. Individual factors influencing tobacco and cannabis quitting were identified using statistical modelling.

3.5.2 Summary of findings

This is one of the first studies to have surveyed young adults who co-use tobacco and cannabis with a focus on their quitting attitudes and experiences. It has used data from students in further education settings to describe tobacco, cannabis and co-use in context, and provides insights into motivation, methods and expectations of quit attempts, and investigates which personal factors may impact likelihood of making any changes to tobacco or cannabis use.

The demographic data provides rich detail on a sample which is diverse in ethnicity, sexuality, disability, socio-economic status and gender identification. Experience of a mental health condition is explored, and findings indicate high rates of anxiety and depression amongst the sample.

Tobacco, cannabis and co-use data indicate that rates of daily or near daily tobacco and cannabis use are relatively high at 40% and 21%. Co-administration was the most common form of co-use (75%), and high-potency cannabis the most common type used by a third in this sample. Most common reasons to use cannabis included for pleasure and to enhance a negative mood. Risk of dependency on tobacco appeared fairly high across the sample at a mean of 12.6/24, but almost half of the sample appeared to be at risk of cannabis dependence (i.e. scored 7 or more, 7 being the threshold for being classified as at high risk of dependence).

Attempts to quit tobacco were significantly higher than attempts to quit cannabis and most had made no attempt to change cannabis use at all. Motivation to quit tobacco was significantly higher than for cannabis, and health and cost the most frequent reasons cited for tobacco quit attempts. Cost and encouragement from others were most frequent reasons to make a cannabis quit attempt. A significant proportion of the sample knew no-one who had already quit either tobacco or cannabis, but most were confident they would be able to quit both when the time came; although this may not translate into future success. Very few had used any form of support or treatment for either tobacco or cannabis quit attempts, and the vast majority did not anticipate using any in a potential future attempt. Very few had attempted to quit both at the same time, although those who had done mostly stated they would advise others to do the same.

A multivariate model of tobacco quitting behaviour (a four-level ordinal variable moving from no change made to successful quit attempt made) indicated that being non-heterosexual, living in an area of high deprivation and rating oneself lower in subjective status were all statistically significantly associated with a lower likelihood of making any change to tobacco use. No variables were found to be significantly associated with cannabis quitting behaviour in a second multivariate model.

The findings in this study correspond to questions raised and elements within the Theoretical Domains Framework (TDF), this is discussed further in the synthesised findings in Chapter 5.

3.5.3 Strengths and limitations

This study has a number of significant strengths. As described, it has used a novel setting (FE colleges) in seeking to recruit a diverse sample, and to centre the study on a population who might be at higher risk of harmful and problematic substance use and living with a number of complex social and health-related challenges. The sample recruited appears to be representative of the student population in FE colleges nationally. Demographic information collated by the FE sector indicates that amongst 16-18 years olds, 27% were of minority ethnicity, 46% were female, 26% reported a disability; amongst adults 34% were of minority ethnicity, 60% were female and 17% reported a disability (Association of Colleges, 2022) . When comparing these national data with the study sample, the sample was broadly representative of this population sample, and therefore unlikely to contain obvious biases.

The study has examined a range of personal, individual factors and provided a detailed picture of the intersection of factors which contribute to the significant challenges faced by young adults. It depicts a nuanced profile of the challenges faces by young adults for whom mental health problems, socio-economic challenges and returning to education intersect with substance use.

The study is one of the first to investigate quitting behaviours for both substances in any depth. It has provided a broader understanding of how young adults might go about a quit attempt, what quit methods seem relevant, effective, and accessible to them. To date, studies on co-use in young adults have focussed on initiation, prevalence, and frequency of use; this study adds to the literature by expanding the scope of knowledge beyond use and toward intervention.

The study only succeeded in recruiting three colleges to distribute the survey, and consequently the sample of students is small. The complexity of the survey structure and questions, which were investigating two substances as well as co-use, meant that in a small sample, sections of these data, especially those answering detailed questions, were too small to be of any meaningful use in analysis. This means it serves as an exploratory investigation and restricts the validity of findings made. This must be taken into account when drawing conclusions from these data. Research into substance use raises challenges for reasons of confidentiality; concerns about this might have affected both the interest from colleges in distributing and the response rate from students.

Tobacco use in joints remains hard to quantify and has demonstrated the potential for inconsistent responses. Despite careful wording of questions, and the use of a number of questions to explore tobacco use, these inconsistent responses indicate that the use of tobacco in joints likely remains under-reported. A proportion of respondents indicated they did not use tobacco then subsequently reported using cannabis with tobacco in a joint. The distinction between tobacco for joints and tobacco for cigarettes previously identified persists and suggests a detailed co-administration measure is required (Tyler, 2015). The fact that young adult substance use is subject to significant fluctuation which renders 'smoking status' or 'cannabis status' hard to capture is already established, and time spent trying to establish the precise details in an assessment or intervention might be better spent exploring their concept of risk and establishing a shared understanding of potential risk. However, it does mean that it remains a significant challenge to be able to measure exposure to tobacco for this group of co-users, many of whom do not consider themselves to be tobacco users.

Alongside this, measurement of cannabis use remains a challenge, and whilst the findings of this study have helped to show the potential range of use, including demonstrating just how much someone might use in a single occasion, again measuring exposure to harm is a challenge. This has been reported elsewhere too (Goodman, S. et al., 2019) and work initiated to formalise measures (Lorenzetti et al., 2022).

Exploring quitting experiences was an important study aim; the sample recruited were mostly aged between 16-19, and few had made or considered quit attempts. The intention had been to include young adults up to their late twenties, in expectation they were more likely to have experience of quit attempts, but very few were recruited. This may reflect the age distribution within colleges, and perhaps younger students were more likely to be full-time and hence had more time to complete the survey without other time pressures such as employment, and/or the incentives may have held greater appeal for them. Expanding the evidence on detailed, spontaneous quitting experiences particularly of cannabis may require a more targeted approach.

3.5.4 Discussion of findings

3.5.4.1 Sample, demographic and personal characteristics

The sample recruited to the survey was notably diverse across a number of personal characteristics, with the exception of age; the vast majority of the survey was aged 16-20, and very few over 20 years old. The proportion of participants who were of a minority ethnicity was 43%; this represents a higher proportion than the national average (14%), but is very similar to the proportion in the main city (40.2%) where two of the three participating colleges were located (Office for National Statistics, 2018). This suggests that the sample comprised a representative range of ethnicities, although the breakdown across ethnic groups has not been explored here as the sample is small but would add further insight into representation.

The study sample included almost a third who reported they were not heterosexual (32%); the majority describing themselves as bisexual (22%). This figure is notably higher than the average identified in statistics collected in the Annual Population Survey (8.0% of 16-24 year olds in 2020, of which 5.3% were bisexual) although it is acknowledged that sexual orientation statistics collected from household surveys may demonstrate an underestimation of non-heterosexuality (Cooley, 2020). It may be that since the current survey was completed not as a household but by individuals this permitted a greater degree of disclosure of sexuality and is therefore closer to the actual proportion in the population (Office for National Statistics, 2022b). As the study sample appears to include an over-representation of non-heterosexual students, it is also possible this indicates that a higher prevalence of tobacco and cannabis use is found within non-heterosexual populations; although it seems more plausible that the response rate is close to the actual profile of sexual orientation in this population.

FE student population statistics indicate that 17.3% declare a disability (learning disability included); this represents a higher proportion than found in the current survey (12%) suggesting that those with disabilities are underrepresented (Office for National Statistics, 2022a). The survey did not make any specific accessibility adaptations, and therefore may not have been universally accessible.

Socio-economic status was partly represented by using the IMD profile of the sample, which demonstrated that 33% of the sample lived in the most deprived quintile. This contrasts with national figures on the numbers of FE students aged 19 and under living in the most deprived quintile, which in 2019/20 was reported as 19.3%. This difference may be partly explained by the location of two of the colleges, in inner city areas of higher deprivation (Office for National Statistics, 2022a).

A significant proportion of the sample reported experiencing a mental health condition (77%), and 43% of the whole sample saw someone about this. The majority reported recent anxiety (49%) and depression (46%), and a small proportion indicated they had experienced psychosis at some point in their life (14%). Almost a third (32%) reported self-harm at some point in their life, a quarter (24%) substance misuse other than cannabis, and 9% stated 'other'. The rates of self-reported mental health conditions appear particularly high. The 2014 Adult Psychiatric Morbidity Survey (APMS) used a household survey to estimate rates of mental disorder, and found that amongst 16-24 year olds, rates of self-harm (at any time) were between 13 and 14%; anxiety 9%, and depression between 2 and 3%, and that 6.1% of this age group access treatment (McManus et al., 2016). The APMS represents the largest population-based sample in the UK and provides a robust estimation of presence of mental disorder, although the data is not recent and prevalence and disclosure of mental health disorder in this age group may have increased since. The variation in data found in the current survey may also be explained by differences in measurement, since the APMS uses detailed clinical interview questions, and therefore may elicit a more objective and accurate measure of mental disorder. The degree of agreement between self-report and clinical diagnosis of a mental disorder is unclear (Eaton et al., 2000; McGrady et al., 2010) , and may explain some of the difference seen here. Self-report of anxiety or depression may plausibly include experience of mental distress, or one or two symptoms only, which would not necessarily meet the threshold for a clinical diagnosis. Alternatively, the high rates might be explained by higher levels of social deprivation in the current study. Although the APMS did not identify associations between prevalence of mental disorder and deprivation, it did find higher levels of unmet need in lower income households, whereas the current study did not use household income as a measure; this seems possible but perhaps less likely than other explanations. The high prevalence of LGBTQ+ within the sample may partly explain this;

rates of mental disorder for those under age 35 were found to be 1.78 times higher amongst the LGBTQ+ community (Semlyen et al., 2016).

High prevalence of tobacco smoking amongst people with mental disorders is well-established (Brose et al., 2020); and evidence relating to co-use and mental disorder is also found (Hindocha, Chandni et al., 2021; van Gastel, MacCabe et al., 2013). The debate about cannabis use and mental health in the literature includes an increasing body of evidence supporting an association, but the direction of this remains unclear. Whether people with mental disorders are more likely to use cannabis, and/or whether cannabis has a causal relationship with mental disorder is uncertain. Of note, there is an increasing recognition that cannabis is not only associated with psychosis, but also with anxiety, depression and psychological distress (Hines et al., 2020; Lev-Ran et al., 2014; van Gastel, Tempelaar et al., 2013; Weinberger et al., 2019).

To conclude, a plausible explanation for the high rates of mental health problems reported in this sample is that a combination of factors is responsible. The high rates may reflect the co-occurrence of both tobacco and cannabis use in this sample, the high numbers of LGBTQ+ respondents, the rates of deprivation and the effect of self-reporting a mental health condition rather than using a clinical diagnosis.

3.5.4.2 Tobacco and cannabis and co-use

A key feature of the data in this survey is the inconsistency across responses to smoking status questions. Use of tobacco and cannabis was explored using several different questions, each with a slightly different focus. For example, ‘when did you last use tobacco’, ‘how frequently do you use tobacco’, ‘number of cigarettes smoked per day’, and ‘have you recently quit tobacco’ can all be answered with precise accuracy, but nevertheless may still appear to conflict, and ascertaining a smoking status on a particular day does not give the whole picture. Use of tobacco alongside cannabis elicited a further complex representation; in the main filter question 29 people reported having quit tobacco, but when asked about co-administration, 87 people reported they smoked cannabis with tobacco; perhaps the latter referring to their usual practice when/if they consume both. The challenges in identifying point prevalence i.e., use at a specific time versus ‘usual practice’ were reflected throughout the dataset. The challenge of eliciting a meaningful quantification of use and the

need for multiple questions about this was also found in a similar doctoral study which explored tobacco and cannabis co-use and identified that youth consider 'tobacco for joints' separately to 'tobacco for cannabis' (Tyler, 2015).

Use of tobacco across the sample was explored in several questions, the commonly used 'Cigarettes per Day', CPD being one of these. The n=102 participants who were asked to report their CPD did so in grouped categories, which demonstrate that two-thirds of the respondents, 66%, smoked between 1 and 10 CPD. Young adults may use fewer CPD than the estimated average of 14.3 estimate found in a cohort of middle-aged people (Peters, S. A. E. et al., 2014). Data from the US indicates that amongst a sample of young adult daily smokers, the majority smoked less than 10 CPD, suggesting that CPD amongst this age group is typically lower than other (Halperin et al., 2010)(Halperin et al., 2010). It is unclear whether the level of tobacco use within this sample is a typical or representative sample but appears to fit with previous evidence.

Use of cannabis was measured using past 30 days use, amongst other measures. Findings from this sample indicate that the majority (35%) used between 1 to 5 days per month, but a similar proportion (32%) used between 20 to 30 days per month, including 21% who used daily. Data relating to UK population cannabis prevalence are limited; a study of adolescent regular cannabis users reported an average of 3.7 days/week, which roughly correlates to 20 days in 30 (Lawn et al., 2022). It seems likely that the level of use found in the current study is not unusual.

Detailed questions on types of cannabis products and route of administration were asked; and indicated that the majority of participants used herbal cannabis, either high or low potency (33% and 26%); and that almost all typically used combustible routes of administration (75% + 12% + 3%, total = 90%). Detailed exploration of typical use is important for several reasons. Use of cannabis appears to be expanding worldwide, including the UK, and changes in potency and routes of administration all add to the complexity of understanding the nature of current cannabis use, not least the challenges of measurement (Lorenzetti et al., 2022). This is relevant for example in considering potential harm reduction messages, e.g., selecting non-combustible routes of administration; and in understanding how potential interventions might take into account the context of use for

example availability or prevalence of non-combustible means of consumption for a young adult co-user.

Co-administration was the most common method of co-use; as found in earlier UK studies (Hammond et al., 2021; Hindocha, C. et al., 2016). Hi-potency was the most commonly used type of cannabis in this sample, which corresponds with other literature on UK adolescents (Lawn et al., 2022). The least frequently used mode of cannabis consumption in the current study was concentrates, with only 5% reporting this was their usual method; this contrasts with Hammond where 12.5% respondents in England reported having used this in the last month, although this is not the same concept as most frequent method and may have changed between the two surveys over time (Hammond et al., 2021). It appears that whilst other methods of cannabis consumption (i.e., vapourisers) might have gained in popularity elsewhere, in the UK in 2019 co-administration using joints in a sample of young adults remained the predominant method, in keeping with the Global Drug Survey data published earlier (Hindocha, C. et al., 2016).

Use patterns in the current study appear typical and characteristic of young adult use, where high-potency is the most common type, co-administration the most common route of administration, and daily or frequent use is common. Contrasts to other literature may be seen in the use of other ROA such as vapourisers or in different types such as concentrates, which might be more readily available to a higher income sample. All of these factors indicate that this sample appears to be at higher risk of health consequences of cannabis use including use of combustible cannabis, all of which are higher amongst daily users.

Analysis indicated that relaxation and enjoyment were the most common reasons given for cannabis use; but to improve mood or management mental health symptoms were also common. Other research supports the finding that pleasure is a predominant reason for use, but that coping is also significant (Buckner et al., 2016; Hartmann & McLeish, 2022; Shrier & Scherer, 2014).

Risk of dependency on tobacco and cannabis were assessed using two scales, CDS-5 and CAST. Amongst the respondents screened for cigarette dependence who indicated past month smoking, the mean CDS-5 score was 12.6, indicating a moderate level of

dependence. Risk of tobacco dependence amongst tobacco users is high; estimates suggest that around two thirds of 'non-smokers' who use occasional cigarettes will progress to daily smoking, used in this instance as a proxy indicator of dependence (Birge et al., 2017). A study of nursing students in Catalonia identified that 71% of the sample of tobacco smokers had low levels of dependence (Martínez et al., 2019); so the dependence in this current sample may be considered to be reasonably high; but perhaps explained by the characteristics within the sample. In a longitudinal study identifying risk factors for moving from occasional to daily smoking, other drug use and intermediate (i.e., lower) educational qualifications were referenced (McDermott et al., 2007).

The mean CAST score for the sample was 6.1, close to the threshold of 7 considered to constitute a risk of dependence, and 41% of respondents had a score of 7. However, due to the missing item in this scale, interpreting this result must be approached with caution and is a limitation. In a similar cohort of 76 adolescent regular cannabis users, presence of 'severe' cannabis use disorder (CUD) was identified amongst 50% of the cohort, although using a lengthier diagnostic scale, rather than CAST which is a risk screen (Lawn et al., 2022). Notably, Lawn et al's study identified that adolescent cannabis users were much more likely to experience CUD than adult cannabis users, indicating that adolescence is a high-risk period for the development of CUD (Lawn et al., 2022). This supports the findings in the current study; that risk of CUD in this age group is significant; and associated with greater degree of mental health problems as discussed earlier. Other evidence indicates that risk of developing a CUD is high during adolescence (Englund et al., 2017). A strong dose response rate is shown between level of use and risk of CUD, and daily cannabis use is associated with 17 times the risk of CUD compared to no use (Robinson, T. et al., 2022). Given the common use of high potency cannabis, and the known risk of developing a CUD during adolescence, then the findings from this study seem to reflect existing evidence.

3.5.4.3 Quitting tobacco and cannabis

Across both substances, few respondents indicated they had recently quit, and only a small number successfully quit both substances, although it is important to note that the sample was not recruited for their interest in quitting.

Tobacco quit attempts were more frequently reported than cannabis quit attempts, around half the sample (53.2%) had made a quit attempt, within which 20.5% of the whole sample were successful. In other literature, across all age ranges, 52.7% of smokers describe an intention to quit (Office for National Statistics, 2020a). Smoking Toolkit data indicates that 45.5% of 18-24 year old smokers tried to quit in past year, the success rate was 25.4% (West, Robert et al., 2022); and an international survey showed a similar rate amongst 18-24 year olds of 49.6% having made a quit attempt (Arancini et al., 2021). The findings from this study appear to be in keeping with existing literature, although intuitively the concurrent cannabis use within this sample might have been expected to influence tobacco quit attempts. Concurrent cannabis use was not found to affect intention to quit in low socio-economic status smokers in Australia (Twyman et al., 2016). It is plausible that differences across age ranges and between tobacco only smokers versus co-users of cannabis are seen in successful quit attempts, rather than quit attempts made. Cannabis quit intention and attempts were consistently low; this corresponds with previous research indicating that cannabis users do not typically intend to quit, in contrast with tobacco users (Fernandez-Artamendi et al., 2013); or may set reduction as a goal instead (Hoch et al., 2016).

This study showed a large difference between motivation to quit tobacco versus cannabis. Across research on co-users which have investigated intention or interest to quit, similar large differences were seen between tobacco (higher interest) and cannabis (lower interest) (McClure, Erin A., Tomko, Salazar, Akbar, Squeglia, Herrmann, Carpenter, & Peters, 2018; Ramo et al., 2010). The significance of this finding in the current study is that this shows differences in the same individuals. It is not the case that this sample was unmotivated to address risky health behaviours, because there is a degree of motivation to change tobacco use; this suggests that the motivation is centred around the substance itself, and not the person. This has important implications for intervention development; it may indicate that pre-existing motivation to address tobacco could be explored and adapted or enhanced to also address cannabis use.

The findings from this study suggest that although motivation to quit tobacco was notably higher than motivation to quit cannabis, confidence in a future potential tobacco quit attempt was similar to that of cannabis; just over half of the sample expected to be able to

quit when they wanted to. Confidence in future tobacco quit attempts is identified in prior research in young adults (Poole et al., 2022). Ramo et al found a greater difference between expected tobacco cessation success- although participants reported greater motivation to quit tobacco compared to cannabis, they did however have lower expected success in this (Ramo et al., 2014). Interestingly McClure (2018) found similar levels of confidence in quitting tobacco as cannabis (McClure, Erin A. et al., 2018) so the picture remains somewhat unclear.

The literature on relationship of self-confidence (or self-efficacy) to making a quit attempt, or sustaining a period of abstinence is limited, but it is an important question to raise in this study when considering future intervention design. A high expectation of being able to quit when ready may affect how a young adult conceptualises their exposure to risk – for example, if someone is aware that they are at risk, but expects to be able to reduce or eliminate this risk when the time comes, then they may feel less concern about that risk. Without wishing to deter confidence in capacity to quit, ensuring young adults are aware of the challenges of quitting may in fact elicit more help-seeking behaviour when considering or making a quit attempt.

Methods used to quit tobacco and cannabis were separated into actual methods they had used and methods they would potentially use in quit attempts in the future; giving insight into what young adults might expect to do, which proves useful when considering a planned intervention. For example, for both tobacco and cannabis potential future attempts, the majority expected to not use anything to support their attempt. A small number of respondents had used familiar methods to quit tobacco (e.g., e-cigarettes, NRT), but very few had used any methods to quit cannabis. This is unsurprising in the context of a wide array of well-evidenced, readily available products and (though to a lesser extent) services to support smoking cessation compared with the minimal service provision, located predominantly in substance misuse services, and absence of pharmacological support for cannabis cessation. Despite readily available support, data suggest that around a third of tobacco users who make a quit attempt do so without any support; so the findings here in a young adult group are perhaps unsurprising (Gravely et al., 2021)

Little data are available on potential cannabis methods; it seems that the majority who do quit do so without formal support or intervention, and that it may not occur to those seeking to reduce or quit cannabis that formal support is either available or more effective than nothing. A US study of cannabis quit attempts used Ecological Momentary Assessment to investigate unsupported cannabis cessation attempts; this found that most continued to use during the study period, and that participants adopted behavioural strategies to maintain abstinence, which were similar to those used during tobacco quit attempts (Buckner et al., 2013).

A small number of participants in this study had successfully quit both products; and a small number indicated they might consider this; overall interest in co-quitting appeared very limited, as found elsewhere (Ramo et al., 2014). As also noted elsewhere, if interest in cannabis quitting remains low, then it follows that co-quitting may also (McClure, Erin A. et al., 2018).

A novel variable, "quitting behaviour" was created to explore the extent to which someone changed or attempted to change their behaviour. This variable permits consideration of interest in quitting without focussing on the success of that attempt, which is important to investigate given quitting rates are typically low for both substances. It also offers an alternative to motivation to quit, taking this one step further by measuring action taken. Modelling tobacco and cannabis quitting behaviours showed that being LGBTQ+ and in a lower socio-economic status (using two separate measures) were associated with fewer tobacco quitting behaviours, i.e., you were less likely to change your tobacco use if you were LGBTQ+ or had lower SES. Previous research has indicated higher prevalence of smoking amongst LGBTQ+ and lower SES, but evidence pertaining to quit attempts is less easily found. Recent evidence from England suggests that the disparities in smoking prevalence pertaining to sexual orientation have narrowed, and that gay men and lesbians are now no more likely to smoke than heterosexual people; of note, the disparity in prevalence remains amongst bisexual men and women, but no differences were found in quit attempts according to sexual orientation in that study (Jackson et al., 2021). Evidence of smoking prevalence being higher amongst lower SES has been long established (Hiscock et al., 2011); one study shows an increased prevalence in relation to the Townsend deprivation index;

this study incorporated a complex set of social disparities to demonstrate the association (Sharma et al., 2010). However, this finding again relates to only prevalence rather than quit attempts. A US study of young adults, SES and barriers to quitting found no significant association between these factors (Carlson et al., 2018). SES amongst young adults may play out differently than in adults; as previously described it is a challenge to assess SES amongst young adults, because measures typically refer to household status, and young adults may be still in their family homes, or moving into their own homes, and the influence of family income is unstable. An older US study found that individual smoking-related factors such as addiction level were more significant in predicting quit attempts amongst a young adult sample of daily smokers; but differences amongst nondaily smokers according to socio-demographic factors were seen; to summarise, nicotine addiction predicted quit attempts amongst daily smokers, and other factors including employment status influenced nondaily smoker quit attempts (Fagan et al., 2007). These findings are difficult to compare with the current study, since we did not stratify participants into daily vs non-daily smokers, although this was used as a variable in the quitting behaviour modelling. The findings add to the picture that the relationship between SES and young adult smoking patterns is unclear and warrants further investigation. Of note, the Sharma paper (2010) used a variety of factors to build a picture of the interrelationship of factors which contribute to lower socio-economic status, and this may be a useful way of considering the fluctuations and variability in demographic factors as we pass through young adulthood.

Cannabis quitting behaviour modelling indicated no significant factors. This outcome may be a result of the low numbers of people motivated to address cannabis use in any way, and in a larger sample this might change. Evidence pertaining to cannabis use and cannabis quitting behaviours is limited in comparison to tobacco, it is unsurprising that little is known about who is more likely to quit or change their behaviour.

3.6 Conclusions

The study has provided answers to the three research questions identified at the start of the chapter: a) pattern of co-use, type of cannabis used; b) reasons to use and quit, methods used and c) individual factors predicting quitting behaviours. Patterns of use are a challenge to capture but indicate that young adults are at risk of both tobacco and cannabis

dependence or addiction, and high risk cannabis use is prevalent. Treatment was not often referenced, and this leaves a cohort of co-users at risk, unaware of these risks and without accessible interventions. The co-occurrence of mental health problems, the identification of higher risk among LGBTQ+ and more deprived areas indicates a complex intersection of risk factors which requires careful consideration.

The findings raise further questions and identify areas for investigation, including the co-occurrence of mental health conditions, disparity in motivation to quit and treatment or support sought. The next chapter presents and discusses the qualitative interview study, which uses different methodology to explore these questions raised.

Chapter 4: Qualitative interview study

4.1 Chapter Overview

This chapter describes the aims, objectives, methods, results and discussion of the qualitative interview study. This forms the final study within the thesis and sits with the MRC guidance framework as an important research process to better understand the context in which a potential intervention will operate.

4.2 Aims and Objectives

Aim: To explore how young adults experience and conceptualise tobacco and cannabis use and co-use

1. To explore attitudes towards and experiences of quitting either tobacco and/or cannabis use
2. To identify barriers and facilitators of quitting

Objectives:

- Through semi-structured interviews, develop an understanding of the context of co-use of tobacco and cannabis
- To explore how (or whether) young adults conceptualise co-use.
- Using the TDF as a structure, explore the capability, motivation and opportunity described by young adults in relation to quitting either tobacco, or cannabis, or both.
- To investigate how participants may view future quit attempts, and how motivation to quit both may overlap and differ between tobacco and cannabis use.

4.3 Methods

4.3.1 Recruitment

Participants were recruited using the sample from the earlier survey study. At the end of the survey all participants were invited to take part in an interview to discuss their use of tobacco and cannabis, for which they would receive a £25 shopping voucher. Participants left either a phone number or an email address in the survey response to express interest.

4.3.2 Sampling

A purposive sampling process was used to maximise the inclusion of participants who had experience of a quit attempt, since one of the study aims was to explore such experiences.

Each participant who expressed an interest in an interview was grouped, with reference to the information given in their survey responses, according to whether they reported having successfully quit either substance, having made a quit attempt, or having made no attempt to change use of either. In the first instance, participants from the first group were contacted. A text message was sent to the students, stating they had expressed an interest in an interview following a survey they had completed at college, and inviting them to get in touch. In the event of no response, a second follow-up text message was sent around two weeks later. Once all of these participants had been contacted, and a number of interviews carried out, then the next group of participants were contacted and the process repeated. When this group had been exhausted, the final group who had not made any quit attempts were contacted. Throughout the recruitment process the gender balance of respondents was monitored, to allow for purposive sampling of a specific gender, although this was not required.

4.3.2.1 Determining sample size

The concept of 'saturation' is commonly referenced in deciding an appropriate sample size for qualitative studies. Saturation as a concept originated with grounded theory analysis, in which a new theory is sought, and the expectation made explicit that there will come a point when no new information relating to this topic is found. However, the current thesis assumes a social constructivist perspective, within which there is not a single reality, or theory, but rather that each participant may continue to produce new ideas. From this perspective, the researcher will interpret meaning from these ideas from a range of possibilities for making meaning, which is a subjective process. Therefore, it is not possible to reach a final point, or a point of no further ideas (i.e., saturation) within this constructivist perspective.

The concept of 'information power' as an alternative to saturation in qualitative research has been proposed. This uses a model of five criteria to determine the amount of 'information power' a sample holds (Malterud et al., 2016). Figure 29 shows an adapted format of this. This demonstrates that your sample size should be determined by the 'information power' it contains. The greater the information power, which is determined by the attributes of each element on the left hand side, then a smaller sample size is sufficient.

If some or all of these central elements are 'weaker', i.e. the attributes on the right hand side, then a larger sample size is required.

Figure 29 Information power; adapted from Malterud 2016

<- higher information power

Narrow <-	Breadth of **AIM**	➔ Broad
Dense <-	**SPECIFICITY** of target sample	➔ Sparse
Applied <-	Use of established **THEORY**	➔ None
Strong (rich) <-	Quality of interview **DIALOGUE**	➔ Weak
Case <-	Case or cross-case **ANALYSIS**	➔ Cross-case

➔ Larger sample size (n)

After each interview, the cumulative dataset was reviewed with the supervisory team, and the characteristics of the participants considered. Taking into account the focussed aim, the use of theory and the specificity of the target sample (see central elements of Figure 29), and in addition the richness of the dialogue and breadth of sample characteristics, it was decided that after the eighteenth interview the dataset was sufficient for a meaningful analysis.

4.3.3 Conduct of the interviews

An initial phone call was made to each participant who had responded to the text or email to explain more about the study and what it would entail, to answer any questions and to arrange a date if they were interested. During this phone call, the information included in "Study 2 information for participants" (included in appendix 3) was conveyed to the participant.

Participants were given the choice of either a face-to-face or phone interview. The incentive received was the same for both modes, and the researcher discussed travel with participants who chose to meet face-to-face to ensure they would be able to travel without incurring further cost to themselves.

The choice of either phone or face to face was provided for two main reasons. Given the nature of the topic, use of a recording device and the relative youth and inexperience of participants, it was anticipated that a face-to-face interview may appear off-putting for some. Second, for those participants who lived some distance from the location of the

researcher, then a phone interview may be the most practical. Finally, to ensure the required sample size, it was also considered useful to offer the choice of mode.

The use of two different modes of data collection may produce differences in the data itself, for example the depth or richness of data collected may vary. The primary researcher had worked as a mental health nurse conducting mental state assessments with new clients using the phone, so was experienced in establishing a good rapport and making use of the privacy offered by using a phone (Sturges & Hanrahan, 2004)Prior research has found no major differences in the quality of the interview across both modes and indicates the use of phone interviews may allow for the inclusion those who were otherwise reluctant to participate in research (Sturges & Hanrahan, 2004). Following discussion with the supervisory team it was agreed that any potential differences could have an impact in both a positive and negative direction, for example, it may be easier to establish a rapport with some participants face to face, but it could be easier for others by phone. We concluded this was not expected to introduce any particular bias or 'skew' in the data.

The venue for the face-to-face interviews was the university department of the primary researcher. Although a location in either the student's college, or the community may have provided a more informal, familiar environment, it was not considered practical to arrange this given the need for privacy, a quiet setting for the recording of the interview, and potential burden on the recruiting colleges.

Before each interview began, the researcher went through the consent form (included in appendix 7) and answered any questions the participant may have had; verbal or written consent was then confirmed. Once recording had begun, the interviewer started with a few informal questions about the participants' course at college, to develop a rapport, before starting the interview.

4.3.4 Interview structure

The semi-structured interview format began with introductory questions about current tobacco and cannabis use. The topic guide for the interview schedule was informed by the COM-B and TDF model of behaviour change (Michie, Susan et al., 2011). The COM-B model comprises three domains, each of which is considered necessary for behaviour change to occur. Each domain has both a physical and psychological component, thus comprising

psychological and physical capability, psychological and physical opportunity and psychological and physical motivation and along with the Behaviour Change Wheel (BCW) and TDF is presented in chapter 1.

Table 22 shows the TDF components. An attempt was made to investigate all components using either the survey or the interview, or both. The table indicates where components which did not readily fit into the survey were included in the interview schedule, and where it was not possible to include a component in either format. The interview schedule is included in appendix 7.

Table 22 TDF components in survey and interview

TDF components			Survey section	To include in qualitative interviews
Capability	Physical	Physical skills	-	-
	Psychological	Knowledge		Ask “what support do you think is available if you wanted to quit?” Ask about nicotine vs tobacco, cannabis knowledge
		Cognitive + interpersonal skills		Ask about understanding of dependence and risk perceptions
		Memory, attention + decision processes	C2, BQS1	Ask about how choices of reduction/quit method were made
		Behavioural regulation	D4, D8	
Opportunity	Social	Social influences	D2, D6, BQS2, BQS3	Ask about peers, family, who they know who have quit
	Physical	Environmental context + resources	D6, BQS2, BQS3, TQT4	Ask about who with and how they use either substance; where they would go to seek support to quit
Motivation	Automatic	Reinforcement	TQT4	
		Emotion		Ask about what motivated them to consider quitting/reducing

	Reflective	Identity + social/professional role	TQT4	Ask about their attitudes towards quitting and how this may relate to their identity
		Beliefs about capabilities	D4, D8, NRT1	Ask about efficacy and expectations of process of changing/quitting
		Optimism	D8	Ask about efficacy and expectations of process of changing/quitting
		Intentions	C2, D1, D5, D7, D8	
		Goals	D7, NRT1	Ask about quitting/reduction/changing future goals
		Beliefs about consequences	C2, D3, BQS2, BQS3, NRT1	Ask about expectations of quitting/reduction/changing

Where participants reported something of interest which was not covered by the topic guide, they were prompted to elaborate on this. It was anticipated that participants may wish to seek information regarding making a potential quit attempt; this information was provided at the end, in order not to influence their responses during the interview.

At the conclusion of the interview, each participant was asked if there was anything that had not been discussed which they felt was relevant, then the recording was switched off. There followed a brief concluding discussion, where the researcher may have signposted the participant to services to support a quit attempt if requested, and took the opportunity to thank the participant, and check how they had found the process of being interviewed. The participants' postal address was requested for the purposes of sending the voucher.

4.3.5 Data collection

The interviews took place over a number of months due to interruptions in the main researcher's work. The first interview took place in February 2019, and the final interview in December 2019.

The interviews were recorded using a dictaphone, which was connected to the phone for the phone interviews. The audio recordings were then downloaded onto the university file storage system.

The first four interviews were transcribed by the main researcher, as a means of reviewing the process of the interviews and becoming familiar with the data at an early stage (Srivastava & Hopwood, 2009). Subsequent interviews were transcribed by a transcription company. A service agreement between the company and the university was set up in advance, and a confidentiality agreement was signed.

4.3.6 Pilot interview

The first interview served as a pilot interview. This was transcribed by the primary researcher and reviewed and discussed in detail with the supervisory team before any further interviews took place. This review considered the approach of the interviewer, the range and depth of questions, the use of follow-up questions or prompts and issues raised by the responses given. No major changes were made to the topic guide as a result of this pilot interview, but it did throw up an unexpected challenge. Part way through the pilot interview, the interviewee disclosed that he was currently under the influence of cannabis.

The interviewer was careful not to react to this in a noticeable way, and simply asked if he felt comfortable to continue and gave him the option of continuing the interview another day. The decision was taken to continue the interview, since the interviewee appeared able to engage as expected and at ease. Termination of the interview prematurely may have been perceived as a judgement, and somewhat counterintuitive – after all the interviews were seeking to understand young adults' experiences of using cannabis, including daily users, so it did not feel right to exclude someone who had just used it. After the dictaphone was switched off, the participant disclosed that he had deliberately wanted to be 'high' at the time – and that this was part of his agenda in demonstrating that in his view, cannabis was not harmful.

The pilot interview raised an unexpected situation, and I used the research group (researcher and two supervisors) to discuss this, and to reflect on actions to take forward. We agreed to include the data from that interview, and discussed criteria to use in future if this arose again; to offer the participant the option of returning or continuing by phone, and also to use my own judgement about whether they were too 'high' to continue. One further student disclosed the same after his face-to-face interview (via a text message sent the next day) which was similarly intentional – that he had wanted to demonstrate that his cannabis use did not have a negative impact. Again, this data was included. Neither student was obviously intoxicated during the interview, although once they disclosed they were, it did explain their particular 'intensity' of affect during the interview.

4.3.7 Reflexivity during the interview process

Reflexivity is defined as process of internal dialogue in which the researcher considers their own position and identity and explicitly reflects on how this might shape the research process (Berger, 2015). The research process and need for reflexivity begins at the framing of the study and how it is introduced to the sample. This will have an influence which continues right through to the analysis and discussion phase, and reflexive discussions took place with the supervisory team throughout the process of the research study.

Prior to the interviews I reviewed the question schedule from the perspective of the participant and considered my approach. I was aware that I was asking participants to disclose illegal activity and to talk about personal experiences which they might have found challenging in some way. My experience as a mental health nurse meant I was familiar with

the process of asking personal questions relating to a potentially difficult or painful experience and using my communication skills to develop the rapport required. I felt comfortable and confident in asking difficult questions and expected to be able to manage the process of the interview, including with interviewees who were more withdrawn.

I introduced myself as a mental health nurse to the interviewees since this is my standard phrase of introduction. However, I reflected on this as an introduction, since I was conscious this might add a particular framing to the content; they may anticipate mental health being the focus, so it could be misleading. On the other hand they might find it reassuring that I was a trained health professional who had previous experience of working with people like them, and it might allow them to understand the context of the interview a little better, in that the focus was on health and wellbeing, rather than illegal activity, or a more 'scientific' conversation about the specific effects of cannabis on the brain. On balance, I decided it was likely to be more useful than not, so I continued to introduce myself as a nurse.

I was aware of being considerably older than the students, and that they were unlikely to see me as someone they could relate to. At times they asked personal questions of me, including whether or not I had ever smoked tobacco or cannabis, which might have been their way of trying to understand who I was, or what my perspective on this was. Although I felt uncomfortable not being fully honest, I used my prior experience as a mental health nurse to respond not directly to the question, so as not to get drawn into a conversation about me, but nevertheless to offer something about myself and my perspective in order not to cut the conversation short. I was also conscious that they might feel judged by me in some way, and I was careful to reference my interest in working with young adults who experienced difficulties in life, and that I was seeking ways to assist those who might need it, rather than persuading young adults to stop using either substance or making a judgement about that.

4.4 Analysis

4.4.1 Rationale for Framework

Framework was selected as a method useful for analysis which would inform the process alongside the theoretical background, i.e., the COM-B model. Framework permits data to be analysed both on a case-by-case basis and by topic. It was anticipated that the data collected may benefit from analysis both case by case topics, given the span of data across

two substances, and across a wide range of user experiences, e.g., cases where the participant had only used both substances briefly, to cases where participants reported significant, dependent use of one or both substances. It was therefore anticipated that useful findings from the analysis would be produced by looking at both the span of experience by person, and by substance, for example (Parkinson et al., 2015). Framework provides both a useful method for sorting data and a process for analysis, beginning with description and moving towards inductive findings. The author (HW) undertook training delivered by the National Centre for Research Methods (UK) in using Framework and had prior experience of using it (Walsh et al., 2018).

4.4.2 Analysis process

The software package NVivo (released 2020) was used to organise the analysis process, as it allows for the production of the matrices used in Framework. The process comprised five stages (Spencer et al., 2014) which are detailed below and shown in Table 23.

Stage 1: Familiarisation

Each transcript was read closely, and notes made of initial impressions. Some notes related to the individual, i.e., a reflection on their specific experience, or something about their expression, and other notes detailed initial thoughts of potential codes, or comparative observations. Reflections on reflexivity also began at this stage and continued throughout the analysis process.

Stage 2: Indexing

Each transcript was uploaded into NVivo, and a 'case' created for each interviewee. NVivo provides simple steps to creating 'codes' which can be cross-referenced across each case, and the content of the codes then collated. A 'code' is a small piece of raw data, usually a short phrase comprising a single idea which the author wishes to highlight. Codes may be linked to the data from a pre-set framework of codes (deductive) or created according to the author's ideas throughout each transcript (inductive). The indexing stage entails the coding process, but in this instance the thematic framework was developed simultaneously with the first coded transcripts.

Stage 3: Identifying a Framework

Though each stage is described sequentially, in practice the analysis process required moving between the indexing stage and the framework stage. An initial thematic framework was created based on the interview schedule structure. This comprised seven categories: experiences of use; choices re use; consequences of use; views of use; experiences of abstinence; process of quitting; other. The first transcript was then coded according to this framework. This process was reviewed by the author HW and supervisory team MD, AM. Although the COM-B structure was used to develop the topic guide of the interviews and anticipated to be used for the analysis, at this stage in the process it did not appear to be a good fit. The interviews began with a personal history of tobacco and cannabis use, and moved on to a discussion about current use. This generated a great deal of content about what influences current use, before the discussion turned to making changes or quitting use. It was obvious that these data were significant, but did not fit clearly into the COM-B categories. It was therefore decided to reserve the COM-B process for the subsequent stage of synthesising the quantitative and qualitative data, where it might fit as an outcome.

In order to capture these data and include them in the analysis, deductive or 'open' coding was employed instead of continuing with the first version of the thematic framework. The next transcript was reviewed and coded according to the author's observations. This second transcript was also coded by one of the supervisory team separately. The two 'open' coded transcripts were then compared, and a new thematic framework based on these codes developed, comprising seven categories. This framework was applied to the third transcript and following some minor alterations after a review with the supervisory team, the revised framework was used to complete the remainder of the coding for all 18 transcripts.

Stage 4: Charting

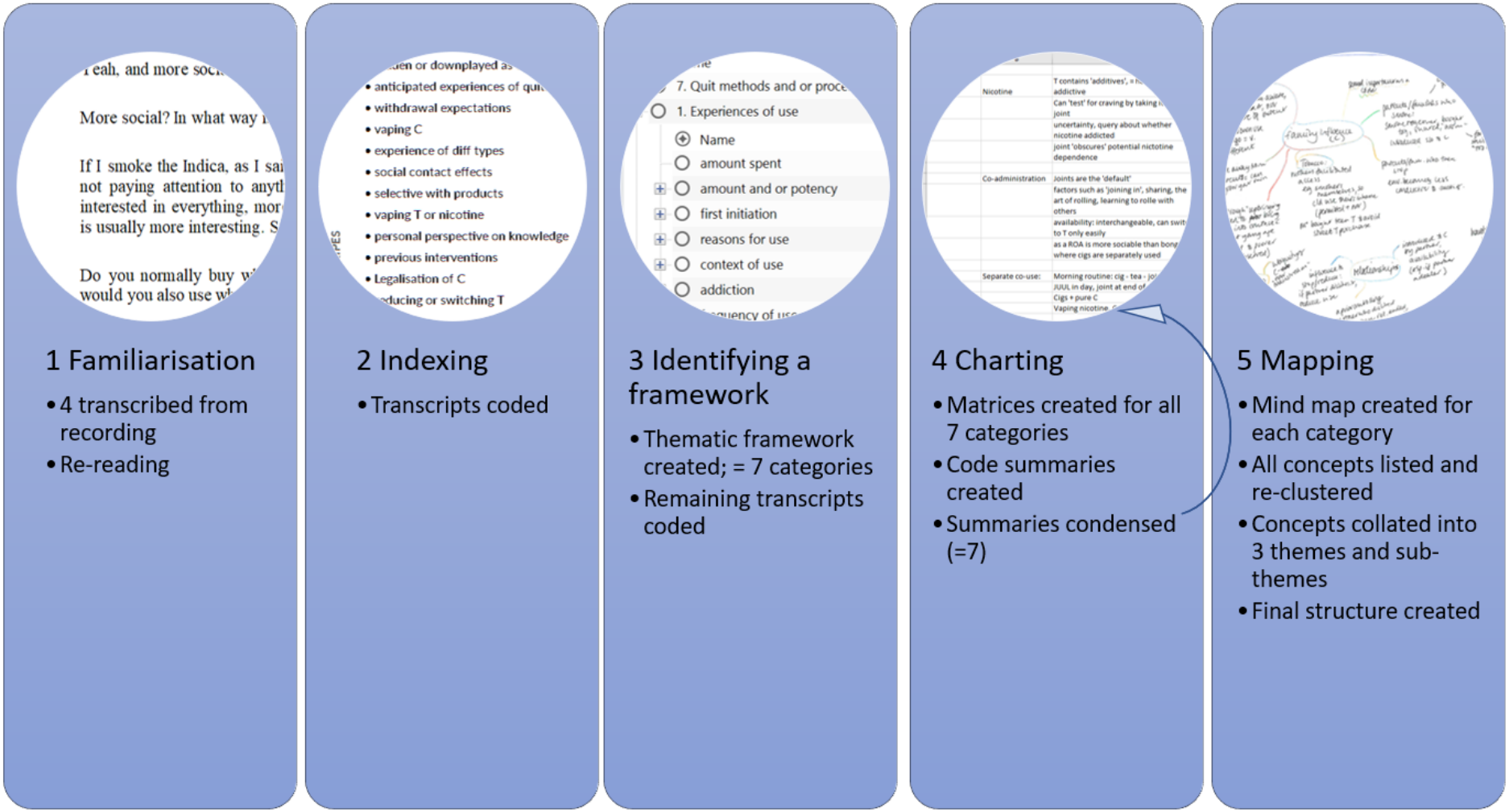
Once all codes had been collated by NVivo into the final thematic framework, the dataset was beginning to take shape. In order to permit the scrutiny of each case (i.e. person) and what they had said about a particular topic, a matrix was created in NVivo for each category. The matrix comprised a chart including all the data for each category, so seven matrices were created. All the codes from each case which related to that category were included in a single matrix, although not all cases would feature in each category and vice versa. An example of a matrix is included in appendix 8. The original intention had been to then summarise the codes within each box of these matrices, so that each case had a summary of

their data on each sub-category. However, the volume of codes created overall was prohibitive. Instead, each code was summarised across all the cases. Although the links to individuals within the dataset had been lost, during the process of summarising by sub-category rather than case, an effort was made to retain the spectrum of views and experiences of each sub-category. In this regard, the range of experiences held within the dataset remain a significant feature, though the differences between cases could not be reviewed.

Stage 5: Mapping

The matrices were moved into Excel spreadsheets at this point, to allow for easier formatting and to move the text around more easily. A further process of summarising the seven categories was undertaken, resulting in seven different Excel spreadsheets. The next step was to distil and condense the data further and move away from description towards abstract interpretation. The condensed summaries were moving towards concepts, rather than descriptive paragraphs, and the data were moved into Word. Each of these newly created concepts was then used to create a mind map for each of the categories. An example of a summary and mind map is shown in appendix 8. In order to allow the findings to be configured in a different way, and not to simply follow the descriptive structure that the initial thematic framework followed, I wanted to be able to elicit alternative ways of interpreting the data, and look for patterns, features and ideas which could be found across the whole data set. To allow for this, each element of the condensed concepts of the mind map was taken out of that context, and put into a list on paper, which allowed each element to be cut out and sit alone. Each element was then moved around, and a process of looking for clusters began. At this stage, I was seeking to cluster the data into an overarching structure, demonstrating the interpretation process. This review led to the creation of a new structure, and the final outcome comprises the data organised into themes and sub-themes.

Table 23 Stages of analysis undertaken



4.4.2.1 Establishing trustworthiness

Throughout the analysis attention was given to ensuring the trustworthiness of the process and therefore the consequent findings. Four elements relating to trustworthiness are described by Shenton (2004): credibility (internal validity); transferability, dependability and confirmability (Shenton, 2004). The analysis process used is described with relation to each of these concepts in turn.

The credibility of the author as a researcher and the chosen processes are supported by the choice of Framework, which is a well-established and well-described analysis process; and by regular discussion with 'critical friends', i.e. the two supervisors for the project, often using my own reflexive commentary which was made contemporaneously to the interviews.

Within this thesis efforts have been made to provide a rich description of the characteristics of the sample and to demonstrate the range of personal circumstances, attributes and experiences and a rich description of the concept of co-use itself; therefore allowing the reader the opportunity to make their own judgement about transferability.

Similarly, to demonstrate dependability of the results (i.e., that the same outcomes might be found if the process were repeated) a detailed description of the process, including the several steps within Framework, is provided in this thesis. Again the reader may make their own judgement as to the dependability of the results by scrutiny of the process described.

Finally, the decisions made at each stage are made explicit within the analysis methods; to make transparent the journey from participant quote to final constructs; images from the process were included in the appendix for this purpose and support the confirmability of the findings.

4.5 Results

4.5.1 Participants

A total of 111 students expressed an interest in participating in an interview, and 18 students participated in a semi-structured interview. These were held either in person or on the phone, at the participant's choice, and ranged in duration from 21 minutes to 1 hour.

Participant information is show in Table 24; pseudonyms have been used throughout this work.

Table 24 Participants characteristics

Pseudonym	Mode	Gender	Age	Ethnicity	Current use *(see key)*	Quit attempt history	Future quit intention
Ivan	In person	Male	17	White British	T+C	Tried to quit T	To quit T, but not C
Imani	Phone	Female	21	Black African	T+C	Periods of abstinence from both	Intends to quit C when older (and therefore T + cigs)
Sinead	Phone	Female	17	White British	T+C	Quit T for 1 week 2 years ago	No plans to quit
Jamie	Phone	Male	24	White British	T+C	Reduced T for health reasons; reduced C due to work testing	Does not want to quit C, would like to reduce/quit T
Lewis	In person	Male	17	White	T+C	No previous quit attempts	No current quit intention to quit either, expects to stop or reduce C when older
Efua	Phone	Female	17	Black African	T+C	Periods of cessation	Would like to stop tobacco for health reasons, but expects to continue it; sees no reason to stop cannabis now or on future
Marius	Phone	Male	19	White European	T+C	Quit T in past, occasional C abstinence breaks	Intends to stop T imminently, expects to continue C until has children

Jason	In person	Male	20	White British	T+C	Abstinent from C for 2 months	Would like to stop tobacco, and continue cannabis
Laura	Phone	Female	17	White British	T+C	No periods of abstinence from either	Would like to stop T one day, no plans to stop C
Demetrios	Phone	Male	17	White European	Ct	Periods of abstinence from both	At end of the month intends to quit both
Kelly	Phone	Female	17	White British	Ct	Stopped T passively without intent or effort	Unsure if will start T again
Catrina	In person	Female	18	White Irish	Ct	No previous quit attempts of either	Does not wish to use T again, though uses in joints; will continue C
Gemma	Phone	Female	17	White British	C	Reduced in frequency	No plans
Miriam	Phone	Female	17	Asian + Central American	C	Stopped tobacco use	Sees no reason to stop C until has children
Damian	Phone	Male	19	White British	T	Stopped C as didn't' fit with work ethos, and impact on relationship.	Does not have any motivation to quit T, anticipated it would be too difficult
Danielle	In person	Female	20	White British	T	Previous T quit attempts, longest duration ~4 months	Wants to stop T, but has found it very hard to quit

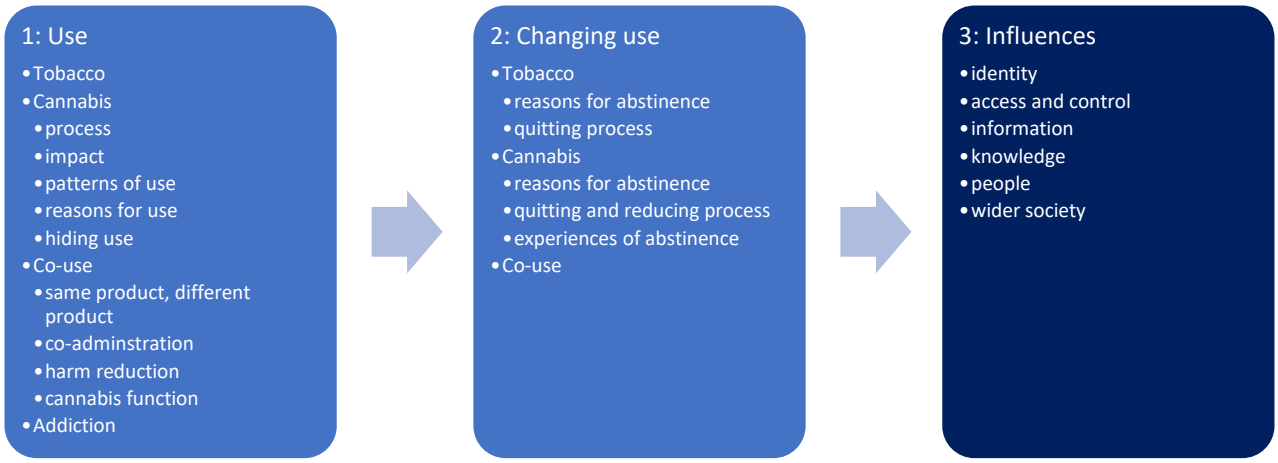
Jemila	Phone	Female	18	Black African	X	Stopped C first, and by consequence stopped T	-
Owen	Phone	Male	17	White British	X	Stopped cannabis as didn't fit with work ethos and relationship Never a regular T user, put off by parents smoking and motivated by his own fitness	NA

Key: T = tobacco cigarette use; C = cannabis use; Ct=cannabis use with tobacco, but no additional cigarette use; X = stopped both

4.5.2 Presentation of findings

The initial structure of the thematic framework comprised seven categories in total: experiences of use; choices re use; consequences of use; views of use; experiences of abstinence; processes of quitting; other. The analysis process developed away from these seven descriptive categories as described in 4.4.1. The final structure of the findings comprises three parts shown in Figure 30, and these are described as follows; 1) use 2) changing use and 3) influential factors. Part one describes use of tobacco, cannabis and co-use; what characterises this use and how participants conceptualise co-use. Part two describes processes and features of changing use, and quitting or co-quitting, and part three describes the factors which appear to influence both use and changing use.

Figure 30 Final presentation of findings: structure



4.5.3 Part 1: Use

Although the same questions were asked about tobacco use as cannabis, the length and breadth of responses about cannabis was significantly greater, and consequently there is a larger volume of analysis relating to this. This in itself is a significant finding; despite attempts to balance the discussion, when both substances are discussed, cannabis tends to dominate.

4.5.3.1 Use of tobacco

Descriptions of tobacco use were sparse, and patterns of use varied; some smoked daily, some at 'convenient points' during the day, and others only a few times per week. Use was

often associated with alcohol, and a strong relationship between the two noted, although not always - in one case someone found it made their head spin too much to smoke at the same time as drinking, so they would leave their cigarettes at home when out.

Initial access to tobacco for some was gained via their family. This could be endorsed use, for example family members would give them cigarettes, or otherwise facilitate their smoking, and in one case a participant described their mother buying them cigarettes, in order that they would not purchase illegal or fake tobacco on the street. In other cases, this access was 'hidden', i.e., participants described taking cigarettes from their family members who were not aware, and hiding their consumption of these from the family in the home.

4.5.3.2 Use of cannabis

4.5.3.2.1 Patterns of use

Typical patterns varied, with some indicating they used cannabis throughout the day, whereas a few stated they would only use at night, last thing to aid sleep. Others used only with friends, or when they had the money, and it was most convenient.

Smoking cannabis with friends was characterised as more sociable, and as a way of helping to manage potential negative experiences or thoughts. Some would smoke alone only as a last resort. For a few, smoking alone meant being able to ensure they knew exactly what they were using; so, making that choice acted as a safety measure, or a means of risk reduction.

Daily use was discussed in some detail, referred to by some as 'wake and bake' ('bake' is slang for being high). Daily use meant cannabis consumption first thing for most, often before other daily activities such as washing or breakfast. Although most described smoking a joint, no association was made with the potential for nicotine withdrawal driving the wish to use first thing in the morning. The idea of starting the day with smell of a 'fresh' joint was enticing. For others, they described daily use as associated with a difficult period in life and that daily use pattern indicated that someone had a problem with their cannabis use. Some disapproved of daily use and considered that cannabis should be used as a reward for hard work only.

Participants were asked to describe what they considered 'overuse' of cannabis. They described using too much as being irresponsible with it, getting 'high' before all activities

including lessons, and all socialising, and when others, for example mothers, would tell you are using too much. It was possible to identify your limits, and not go beyond this, and this was described as a means of being more responsible with use. Others felt that as there were no harms from cannabis, therefore overuse was not possible,

> *Weed is literally the most harmless drug that is illegal. It literally all – oh my God, all you can do from it is smoke too much and throw up. There's literally nothing wrong with it. (Laura).*

> *It isn't possible to smoke too much cannabis, like, you can never do that. I could like smoke one then another and I wouldn't ever get to the point of too much (Jemila).*

4.5.3.2.2 Amount of use

When participants were asked to describe how much they used, in addition to frequency of use other categories referenced were monetary cost, weight and for a few, potency. Across all categories, descriptions were vague and uncertain, and it was pointed out that being high made it hard to know how much you had used.

The amount spent ranged from typically £10-25 per day to £60 in one example, although it was noted that potency could also influence the cost. The cost of a gram was noted to change frequently. Some reported use in 'bags' (this might contain four buds of cannabis plant), so some described using perhaps one bag per day, or ten joints per day. Potency was used as a reference point also, and skunk noted as much more potent. Although some stated they did not notice any variation in potency, others were clear that it determined the intensity of the experience of use.

Peers often acted as a reference point for amount of use (e.g., 'I smoke more/less than them'), and in what appeared to be exaggerated estimates of use, i.e. 'I smoke more than anyone I know'. For others, they noted their own changes in use, such as an increase in tolerance meant they needed more. Tolerance as a concept was referenced often, characterised as a learning process, of becoming familiar with your own response to cannabis, and others noted that if you used less cannabis, it would have a better effect.

4.5.3.2.3 First use, shift to regular use

First use often comprised tobacco and cannabis co-use, but it was the cannabis that participants were drawn to. It could be quite unpleasant in terms of taste or smell, and for some the experience was very intense, for others, it was unremarkable. Initial access to cannabis was provided by older family members at home, or older students in school or on arrival at college. It might also coincide with other cultures, for example skateboarding or rock music, so cannabis use came with the territory.

The shift to more regular use was driven by various factors, including increased access such as getting your own income through work, meaning you could purchase it for yourself. A change in friendship groups, which commonly coincided with the move from school to college meant that both prevalence and ease of cannabis use increased. Alcohol was mentioned occasionally, and for some, cannabis provided an alternative to alcohol use.

> *No, it's [cannabis] not harmful. Not like alcohol. Like if you drink you forget things, you get into trouble you get into arguments. But cannabis doesn't so that, it makes you calm (Jemila)*

Others made reference to the 'usual jump from tobacco to cannabis', although this could also operate in the other direction. Someone who described trying a joint enjoyed the head rush from tobacco so much that they continued with tobacco only.

4.5.3.2.4 Type of cannabis used

Participants varied in their understanding of what type of cannabis they used. For some, their dealer would send a long list of various names, sometimes with photos, and they would choose from this list. A spectrum of belief in the validity of this selection process was expressed. Some expressed scepticism about the actual differences between types, whereas others had a sense of pride in in knowing which flavour they preferred, and therefore committed to the process of purchase being meaningful, as if identifying themselves as a knowledgeable and selective customer.

> *'It feels not less intense, but for example, Californian flavour doesn't really help my anxiety because it makes it feel a lot more intense, but with the lemon flavour, it feels less like that and it feels more calming' (Efua)*

Others acknowledged they made little choice about the type, or that it was not possible to distinguish between types, strains or effects in any case.

> *'…there were some weird dumb names in my opinion, so like the most recent one I had … was called Glorilla Glue…before that it was Blueberry Lemon or something. I feel it's made up on the spot half the time….they'll give all these fancy names but they all look, smell, smoke, taste the same. It's a plant, it's a leaf' (Jamie)*

Flavours were often referenced, and commonly had names relating to sweets, or sweet items, such as forbidden fruits, gelato, strawberry, lemon. The lemon type did not actually taste of lemon, but it was usually a cheaper option.

> *'Lemon was the most usual, but you have to pay more for flavours. Like you'd buy like £10, or £20, but if you want like a flavour like strawberry then you have to pay, like £15' (Jemila)*

Knowledge and experience of THC level in the products purchased varied, with some acknowledging that outside of a laboratory setting it wasn't possible to determine the level of THC;

> *'I wouldn't say I was getting deep into the THC content or how finding them out... You need equipment to find stuff like that out. I don't know anyone who has it' (Marius)*

By contrast, others described an intricate process of examining the product, partly for quality, and partly for an estimation of potency. The smell, 'look', or wet or dry appearance of the cannabis bud was used by some to ascertain whether it was 'good', which appeared to correlate with high potency.

> *'Realistically, I know when bud is safe' (Lewis)*

High potency, or 'skunk' was described as worse for mental health, and led to users becoming more dependent, and acting more recklessly. However, for some it was the only type of cannabis which had any effect for them.

> *'The hash really does mellow you. I started on the hash, and then obviously I went to the skunk, and I think that's what made me turn a bit cuckoo, the skunk' (Danielle)*

'You're more likely to be at risk of um you know kind of like, what's it, psychosis and all that stuff. But it gets you fried. If I smoke normal weed it won't get me high at all, it don't matter how much I smoke, it just doesn't get me high' (Demetrios)

Product type was heavily influenced by supply sources. The dealer featured in discussion about skunk, with some noting that their dealer would reassure them it was not skunk, though the user later realised it was. Dealers generated trust if they were considered to be 'good' people, and the users who felt they knew them implied trust in them, also boosted by dealers selling 'on dot', i.e., goods at the weight expected. Dealers who didn't use cannabis themselves were also noted to be more reliable. Dealers were not the only source of supply; others included friends, partners, or for an exchange such as babysitting.

Production methods of cannabis were frequently cited as a means of determining quality, and as a key influencing factor to the 'safety' of cannabis. Participants made reference to the production of cannabis and had understood that chemicals were often sprayed onto the plant during the growing process, which either boosted growth, or added 'extra' THC.

'So basically they'll grow it, they'll grow the plant by itself, but then they'll have like chemicals that they spray on to give it a certain taste, a certain like, 'highness' as well' (Imani)

'If you get good weed, that's either clean or import from somewhere, like it's proper good stuff. It's not sprayed with bad chemicals…' (Lewis)

Participants saw growing your own supply as offering a means of improving the quality of cannabis and avoiding 'crap'. Cannabis grown without additional chemicals added was considered preferable and described as coming from a 'good' environment. It wasn't clear where the ideas about additional chemicals such as 'extra THC' came from; it may have been a selling point used by dealers, or perhaps a misunderstanding based on the known practice of chemicals being sprayed onto plant matter in the production of synthetic cannabinoids (i.e., spice).

'homegrown cannabis is not actually sprayed too much with THC, because it already produces so much that it will be fine to smoke. That's the difference between strains and home grown' (Sinead).

4.5.3.2.5 Route of administration

Multiple routes of administration were described, although joints (including tobacco and cannabis) appeared most common. Participants seemed to use what was available, rather than making a specific choice, and this was usually dependent on what their friends or peers were using at the time. Mostly participants said peers used joints, but they were exposed to a range of options via friends, and choices made depending on the amount of effort required, and the amount of cannabis available. Joints were described as the easiest, cheapest form of cannabis consumption.

> *'If I'm smoking a joint, right, rolling it in paper with tobacco in a roach, I just think that's the classic way to smoke. It's just the 'go to', you know? Roll it up, spark it up, you smoke it, you know, it's just simple right' (Lewis)*

Notably, blunts (small cigar, where tobacco content is removed and cannabis inserted instead) were also referenced, although they required an adult to purchase them, friends could do this for those under 18, and therefore were used by some young people. These had a small cost attached but were positively endorsed as providing a quick route to intoxication. Whether or not you were with friends had a significant impact on ROA; you may be less likely to try something unfamiliar if alone, and a means of reducing risk was to stick to the familiar routes.

Bongs were considered a cleaner, healthier option since they were not combustible, although they were 'fiddlier', and less sociable. The motivation to use them differed, since greater effort was required to use them, then users tended to be those seeking the bigger 'hit' they provided. Edibles required specific knowledge to make, which acted as a barrier to use.

Vaping or vapourising cannabis was observed, and participants were introduced to this by their peers; for example, those who had been to Amsterdam. This route of administration was considered healthier, and vapourisers in particular worked more quickly and lasted longer than joints. However, some stated they disliked the taste, and missed the act of rolling a joint. The cost was considered prohibitive, so whilst it might be available to try, few were able to purchase for themselves.

4.5.3.3 Co-use

4.5.3.3.1 Same product, different product

For some, the two substances were largely synonymous, 'smoking is smoking, it's all the same', whereas for the majority, the two products were very different, and they described very different motivations for using each. It was assumed that both tobacco and cannabis had harmful chemicals added to them during production, and although they were both plants, cannabis was also described as 'purer' in comparison to tobacco. The cravings and effect of each substance were noted to impact different bodily systems; cravings for tobacco were physical, cravings for cannabis were psychological, and consequently tobacco was seen to cause only physical harm, not mental harm. Tobacco produced no 'buzz' for some, suggesting that they might have expected some sort of psychoactive impact comparable with cannabis. Some did identify an impact of both tobacco and cannabis on their mood, however,

> *'So cannabis made me more paranoid and tobacco made me more depressed' (Imani).*

4.5.3.3.2 Co-administration

The use of joints (i.e., co-administration) appeared to be the default means of cannabis consumption. It was considered the most sociable route of administration, in comparison to bongs, for example, and the process of rolling a joint then sharing it acted as a social facilitator, as it became a communal activity. Learning to roll a joint, observing others rolling techniques, a sense of accomplishment when the skill was mastered were positively described as it if were an art form. Co-administration in a joint was also the most available; apart from papers, no equipment was required, and a joint could contain a variable amount of tobacco and cannabis, therefore whatever quantity of each you had, it could be consumed somehow.

Joints were also interchangeable with a rolled tobacco cigarette; one could be substituted for the other when not available, or if the circumstances dictated, a cigarette could be consumed instead of a joint. This was seen as a 'poor person's option', when no money was available for cannabis.

'obviously a lot of people like to roll joints because the tobacco makes the weed burn slower and it has more of an impact, due to the fact it's going in with the smoke of the tobacco. It enters your lungs a bit quicker, it gets you high a bit faster. Whereas a blunt, it burns too quick and then obviously it doesn't gradually hit you, it hits you all at once. The difference between a joint and a blunt as well is that obviously tobacco burns slower and doesn't hit you as fast' (Sinead)

Tobacco added to a joint was sometimes looked down upon,

'I've noticed as well, around other friendship groups, the same thing happens, people are just made fun of for putting tobacco in'. (Gemma)

Along with joints, other patterns of co-use were described, switching between the two throughout the day. For example, a morning routine of 'cigarette, cup of tea, joint'; or using an e-cigarette throughout the day, then a joint last thing at night.

4.5.3.3.3 Harm reduction as a function of co-use

Attempts were made to reduce the harm of both tobacco and cannabis and switching between products acted as a form of harm reduction for some. An example given was restricting the use of joints to once per day and using e-cigarette instead.

Tobacco was also described as a 'mixer', where its' function was to moderate the effect of cannabis. This was described in two ways. The first was by diluting the potency, and therefore intensity of effect of cannabis, and reducing the 'harshness' of cannabis, although some also considered the tobacco as a means of enhancing the effect of cannabis. Tobacco also allowed participants to ration their cannabis use and therefore reduce the cost. The tobacco in a joint was looked down on, considered 'dirty' but necessary, and the amount used was often downplayed in descriptions of how much was used in a joint, i.e., 'only a pinch', or 'a chip, not a full fag'. The taste and smell of tobacco was considered unpleasant but ameliorated by the pleasant taste and smell of cannabis.

4.5.3.3.4 Legality of each product

The legality of tobacco as opposed to cannabis also drew a contrast between the two substances. For some, the legality of tobacco led them to wonder why they should stop, as if the legal status somehow permitted, or even endorsed its' use, in contrast to cannabis

which the government did not want them to use, as they had made it illegal. However, others disregarded the illegal status of cannabis, and were much more influenced by their personal experience of using it.

The illegal status of cannabis was however cited as a factor which inhibited discussion, especially with health professionals, with some fearing disclosure since they didn't know what consequence this might lead to.

4.5.3.4 Impact

4.5.3.4.1 Mental health

The relationship described between cannabis use and mental health was complex, and multi-directional, although not all participants saw a connection. Some felt there was little impact of cannabis use on mental health, for example only a short-term impact on 'tetchiness'.

Many felt that cannabis had a positive impact and was a useful factor in managing their mental health. It helped to create a distance between them and their problems, it lifted their mood and made them feel more cheerful, positive and creative. It acted as a coping mechanism, as a buffer between the self and difficult emotions, and allowed escape, putting them into their own world. It also helped to manage experiences such as intrusive thoughts, anxiety, low mood, and took them 'away from yourself'. It could help to 'balance out the drama' in life.

> *'The reason why I started smoking weed was cos I was in a bad place. So that's the only reason I was smoking as much as I was smoking, and I thought that was the only thing that could like calm me down. Like that's what I thought at the time' (Imani)*

> *'I think it's like an escape for some people, when real life gets too much for them. It's a bit like sleeping but you still function' (Miriam)*

For anxiety in particular, it could make participants feel more relaxed, but it could also lead them to feel more anxious, and physical experiences such as faster heartbeat, increased alertness level were described, although these were temporary.

> *'when I use that [Californian] my heart starts to beat really fast and I just get really worried about things, like what is going on at home or college…It's kind of like when I use it I have two conflicting feelings, so on one hand I feel really chilled out and like*

I'm zoning out and what not, but on the other hand, the anxious bit is also there, like it's present. I get that.' (Efua)

On the other hand, it was acknowledged that cannabis may also have a detrimental effect on mental health, and some had used this as a factor in their decision to delay cannabis use until older. For some, it was seen to exacerbate suicidality, but for others it could also be a protective factor. Psychosis was noted as a potential outcome, although whilst some had been explicitly made aware of the link, others were sceptical, and considered this mostly 'word of mouth'. Participants had used their observations of peers' experiences of cannabis to make up their mind about the relationship with mental health.

'I remember one of my neighbours saying 'Anyone who smokes weed gets schizophrenia and goes crazy' but that's not exactly how it is. Then I looked more into the scientific aspect compared to my neighbour's point of view, and I looked at my friends who were smoking at the time as well, and how regularly they were smoking, and I made my decision based on that'. (Catrina)

Potential impact on experiences of depression was also identified, and the complexity of the relationship with cannabis was also explored,

I think perhaps for some people … I think if you already have a pre-existing mental health condition, some of them [friends] had quite bad depression, some of them had all kinds of different things they had on, and I feel like sometimes it can have both a positive and a negative effect (Jamie)

4.5.3.4.2 Cognitive impact

Cognitive effects of cannabis use are inter-related with mental health, but there are distinct impacts described on thinking, cognition, mood and sociability.

The effect on thinking processes appeared to be significant. For some, it allowed for focus, a depth of experience. This clarity of focus was multifaceted; it allowed for better concentration on studies, the mind was uncluttered and could concentrate, and reflect. Deep discussions with others were enabled by cannabis use. This 'bubble effect' was an important feature.

'It keeps you focussed on one thing, and literally just get it done. Because there's an option for you to block stuff out, so if you just block out your distractions it just gets done quicker.' (Miriam)

This same focus and depth of thinking could stray into overthinking; you could become low, too quiet, the impact may be 'too much'. Using in the company of others was suggested as a means of managing this risk;

'It [cannabis] really helped. It was a real escape. I could forget about everything, temporarily. (Jemila)

Cannabis use was also described as enhancing all senses and heightening all experiences which could then be both positive and negative.

'All your senses become more heightened, if that makes sense. Every environment that you're in, you'll only see the best aspects of it' (Miriam)

Heightened, or 'extra' perceptions were a significant feature, and hallucinations were described by some. The negative impact of these heightened experiences was described by some as paranoia, and a range of views and experiences of this were described. Some felt since they hadn't seen it as a consequence of cannabis use, it didn't exist as an effect. For others, they had observed or experienced paranoia. It was identified as worse when alone and led to an increase in stress over seemingly minor issues, and could linger for days after use, and some consequently sought reassurance from others to manage this. It was also experienced when others might see them under the influence of cannabis, and this could lead to experiencing paranoia with fear of being judged.

'it makes me very anxious as well…'cos when you smoke you're kind of, you're very alert and because you're very alert you pick up on small things, like if someone's looking at you too long you think oh my god are they looking at me because I look a certain way or…you get a bit paranoid … you get very paranoid' (Imani)

Sociability was affected as use may enhance your existing mood, so if the atmosphere was negative, then cannabis use might lead you to withdraw into yourself, to go on a 'bad trip.' On the other hand, it may facilitate social interaction. It provided an opportunity to meet others, for example those with a similar lifestyle, and promoted confidence, for example

with potential romantic partners. However, it also removed a filter, so you had to be careful of what you said.

4.5.3.4.3 Reasons for use

Multiple reasons for use were given, across all the participants, but individuals also had multiple reasons. These reasons fell into four categories; pleasure, enhancement of other activities, as a means of escape and lastly as a tool to manage something.

Pleasure experienced through cannabis was described in some detail by some participants, although they tended to be more expansive when talking about the process or their views of use, as if perhaps they were reluctant to describe the direct pleasure experienced to another person. Pleasure derived from cannabis use included getting a 'hit' (i.e., immediate 'rush' of sensation) from the tobacco use; feeling very relaxed and for some 'giggly', an elevated mood.

The idea of cannabis enhancing other activities was richly described, with many examples given, including watching TV shows, listening to music, making images and creative writing. They were all described as improved, enhanced, better whilst high, as if brain activity increases when intoxicated, therefore experience of these activities is heightened. Whatever you were already likely to be doing was going to be better when high. For some, there was a religious, almost spiritual aspect to this whereas for others they used this focus to enable them to concentrate on college work.

> *'What's better than Netflix and getting high?' (Demetrios)*

The other two categories were as a means of escape, to seek the 'bubble' effect. For example, if low in mood, being high would allow you to forget this for a period of time, and allow you to stop thinking about something, especially in anxiety management, for example.

> *'You kind of think of it as protection, a seal keeping out all the bad things in your life' (Miriam)*

> *It made me feel just drowsy and not – anything that was going on around me I just didn't feel like it mattered at all. I was just happy to just stay where I was and let the world go by. I wasn't bothered about anything (Owen).*

The last category is as a means of managing something, the current state you were in. This might be to aid sleep, to aid social contact when feeling 'awkward', as a muscle relaxant especially after manual labour, and to avoid using other medications, for example to manage pain and reduce pain relief medication.

4.5.3.4.4 Hiding use

Although some felt there was no need to hide their use, that 'no-one cared', others described a more nuanced situation where someone such as their parent probably knew they did use it, but this wasn't openly acknowledged. There was a difference between someone being aware of your use, and you actually telling them, and in these situations cannabis use was neither condoned, nor banned. Mothers were referenced in these situations, whereas fathers were not referenced in any interviews. Participants disliked hiding their use.

> *'…you know when everyone goes to bed, like [I would put] towels to block my doorways, and open a window. It was like that' (Imani)*

Others felt a stigma attached to cannabis use, which meant that whilst they could discuss alcohol use, and going to parties, they couldn't share their cannabis use with family. This stigma also meant some were reluctant or unwilling to seek help because of the fear of being judged; by peers, colleagues or parent, or fear of some sort of consequence.

> *'Cannabis isn't legal. Smoking is much easier to go to your GP about, and talk about…but cannabis on the other hand, you never know what the doctors might – they might send you to a mental health – I don't know what they'd do' (Danielle)*

4.5.3.4.5 Cannabis compared to other substances

Cannabis was seen as different to other drugs, and some felt that everyone should try it at least once. Others thought it was like a 'trap', and best not to start at all as it can 'take you away'. The fact that cannabis could also be used as a medicine, helpful for those with cancer, seemed to add to the idea that it is a different type of substance altogether, and gave credence to the idea that it was safer than other substances.

4.5.3.4.6 Addiction

Addiction was characterised differently across each substance.

Tobacco was seen as the more 'addictive' of the two, sometimes on account of the additives included in the production process, which were thought to be what rendered tobacco harmful.

However, the role of nicotine in use of joints, or a wish to use, was queried. Some were unsure whether nicotine addiction existed, whereas others wondered if a using a joint might 'obscure' potential nicotine addiction,

> *'We probably subconsciously don't even know it, but when we're putting it [tobacco] in our weed, it's like the nicotine addiction is still there, but it will be in a joint, so you think you're smoking a joint and it's not a cigarette but you're still experiencing that same like craving as someone who's smoking a cigarette, but if you cut that out, you can see if the weed makes you…if the weed makes you craving as if you would smoke it with tobacco' (Imani)*

The idea of whether it was possible to be addicted to cannabis was a rich source of discussion. A range of views were expressed from not at all, to definitely, and some questions raised about the potential mechanism for this addiction.

> *'You could take it once or twice …and you could instantly just click with is. It's known as the gateway drug; it could end up making people want to try more and more, and just not be satisfied with what they have' (Owen)*

The qualitative experiences of craving, either observed or experienced, were used to understand craving for cannabis as operating like craving for tobacco, and a mental preoccupation with cannabis noted. This generated an uncomfortable feeling, a sensation of your 'brain' wanting it, and not feeling oneself without it. Cannabis addiction occupied the day, and determined your routine, and was strongly characterised by a lot of time spent using it.

For some, they felt it possible to not realise you were addicted, since it starts as a hobby, and becomes your whole world. For others, they were confident they would stop at any point, suggesting even if it were addictive, they were not addicted to it. For many, the idea of addiction was inherently negative, and exemplified by the view stated that cannabis itself is not what causes harm, but the addiction to it.

I think the aspect of smoking I am more tied to, than just smoking weed, because tobacco is addictive, weed as a substance isn't. (Catrina)

Cannabis addiction was mostly characterised as a physical experience, with intense withdrawal, comparative to those with cocaine use. However, some uncertainty was still expressed about whether it was a 'true' addiction. Some gave the example of peers being prompted to smoke (cannabis) when they saw others doing so, for example at the end of class which led them to query whether this qualified as evidence of addiction. This suggests that these participants identified the visual prompt as simply a behavioural cue, meaning they considered addiction operated through a physical craving rather than a behavioural cue. This may suggests that addiction is observed to be a physical experience, rather than a psychological one.

But that's the weirdest thing, like it's a psychological thing. Like if I'm watching a TV show and a character on the show starts smoking on the screen, it triggers something, I'm like, 'ok, now I want a cigarette just because I'm watching them smoke on the screen'. It's just a character on TV, it's so weird. But … if like one of them starts smoking weed, it doesn't make me go 'oh crap, now I really want a spliff'. That's what I always found quite odd' (Jamie)

Dislike of being addicted to tobacco was often described, and a reluctance to acknowledge someone was, alongside a reluctance to acknowledge that cannabis use might be driven by nicotine addiction.

'but when I started smoking [both] again in the back of my head there was a thought of was it maybe the nicotine in the tobacco that made me want to go back to it?' (Demetrios)

*'*Interviewer*: Do you also smoke cigarettes?*

No. Never. To me that's disgusting' (Lewis)

Sources of knowledge about cannabis addiction varied, from the statement that scientific evidence indicating it is addictive, to 'common knowledge' showing it is not. The witnessed experiences of others were often referenced in justification of why it was, or why it was not.

Additionally, a disbelief of others stating they were addicted was also noted – some people might say they are, but this is an exaggeration, for effect only.

> *'I think it's just the nicotine isn't it? The nicotine and all the kind of additives you get in tobacco, that I don't think you would get stuff like that in cannabis. It lingers about in your brain and just keeps, even now … I'm at college … I've just seen one of my friends come out and have a cigarette and I can just go and have a cigarette' (Jamie)*

4.5.4 Part 2: Changing use

4.5.4.1 Tobacco

In contrast to part one where tobacco use was not much discussed, tobacco harms and quitting process were a rich source of discussion.

4.5.4.2 Reasons for tobacco abstinence

Health-related harms to individuals and other family members were the main reason given for either previous or planned tobacco abstinence. Both acute, short-term and longer-term health risks were identified.

Tobacco related harms were described as relating primarily to lung health such as impact on breathing, or exacerbation of asthma symptoms. Harms to lung health in general were noted, and tobacco described as having a negative impact on shortness of breath, causing coughing, making you less fit and, exacerbating asthma symptoms. The effects of tobacco use were also thought to build up over time, therefore the duration of use also has an impact. Cannabis was considered to have less impact on lungs than tobacco,

> *I think if anything cannabis is more safer than tobacco. Even if you have tobacco in a joint it's still not as bad as actually having a full fag (Sinead).*

There was a range of understanding of the specific harms of tar and nicotine, and an indication that nicotine was considered as harmful as tar. An example was given of using 'alternative tobacco' (i.e., plant-based material marketed as herbal tobacco, containing no nicotine) with the assumption assumed that because it contained neither tar (or was understood to contain no tar), nor nicotine, then it must be safer.

Longer term harms were mostly well understood, and cancer was often referenced. It was identified as the most common disease caused by smoking, and there was a range of expectations about cancer; you may smoke and not get cancer; if you get continue to smoke you are likely to get it and may die by the age of 60 years old. Some gave specific examples of being aware of the risks, referencing picture warnings displayed on cigarette packets. Others said their parents had told them not to smoke because of the risks. It was considered to cause harm to unborn babies, and tobacco use was something you'd 'probably regret later in life'. Projections about personal use varied, some looked towards their future risks, and others didn't appear to consider their future health at all.

'It's a plant for crying out loud. Eat it. It's completely safe on a physical level' (Lewis)

Whilst most referenced their own health and fitness, others identified the health of their family as reasons to quit, both actual , e.g., a new-born baby in the house acted as a quit prompt, or potential, e.g. 'I'd quit if someone in my family developed cancer'.

Fitness was a rich and important topic and appeared to be a great motivator for abstinence. Some noted their fitness to be worse than their peers and attributed this to their tobacco use. They weren't able to achieve what they considered their peak physical fitness, or had lost their muscular physique, and missed this. Some described playing football for a club especially as a reason not to use. For others, they used going to the gym as a replacement activity for smoking.

4.5.4.2.1 Tobacco Quitting processes

Multiple attempts were described, and some felt there was little point in trying again, since they 'always' failed. Previous episodes of abstinence were described, sometimes associated with planned quit attempts, such as knowing you were going on a long bus journey and using that opportunity of enforced abstinence. For one person, morning sickness during pregnancy was the only thing that stopped her use of tobacco, and for a few others they noted the experiences of others, for example one had witnessed their mother quitting tobacco 'cold turkey', so assumed they would also be able to do this.

Cravings were described as a significant barrier, and examples given of trying to quit 'cold turkey' but relapsing to use soon after,

'…there was just so much information given to me, my heart was saying 'you really do need to stop, really, really, do'. It's just the addiction, I just couldn't stop. (Danielle)

Some had tried vaping, found it successful, and that it helped with managing cravings.

'I have the e-cigarette which is what generally, if I really feel like I need a cigarette I'll reach for that before even attempting to go out and get any [tobacco]. I try not to buy any, because if you buy a packet just to have one, you've then got 19 more just in your pocket ready to go. Then if you buy an actual pack of tobacco you can roll up loads of fags. So I try just not to buy it full stop because that makes it easier' (Jamie).

Many participants had views and experiences of NRT. First, access was not straightforward. For some parents bought it, but for others who understood there was no free NRT available, it was not possible to continue as it became too expensive. It was helpful for some (e.g. someone tried patches whilst still smoking pure cannabis), others managed three months of abstinence, whereas others stated it had helped, but not enough. Some found it unhelpful, despite trying a variety of products including spray and gum, and others didn't even try because they knew it wouldn't work. Some experienced negative side effects, such as nausea and sleep walking.

Few had accessed a tobacco cessation service, unless in a specific circumstance, for example receiving quit support from a healthcare professional during their child's early years. Tailored support from someone who knew the participant well was valued. Others described how they had been referred somewhere by their GP, but lost the phone number, and another described how the service was not located in the surgery, so they didn't follow up the referral. Some recalled seeing smoking cessation available at the family planning clinic, and thought this was a useful and appropriate location.

Willpower was mentioned, and an acknowledgement that it required 'daily effort' to sustain a tobacco quit attempt. There were few well developed strategies – for example some reported they simply 'tried not to think about it'.

Although mental health was discussed as a significant factor in relation to cannabis, apart from fleeting references, it did not feature in relation to tobacco use, or quitting, in any way.

4.5.4.3 Cannabis

4.5.4.3.1 Reasons to change or quit

Some participants saw no reason to make a conscious decision to quit, either now, or in the future. Others had a sense that cannabis had served its purpose in their life, it had been helpful but was no longer, whereas others had reasons to stop that were in response to a particular experience, or state.

Some described reasons to quit cannabis as psychological, and reasons to quit tobacco as physical, which aligns with the discussion about physical and mental health harms associated with tobacco and cannabis respectively.

4.5.4.3.2 Harms and risks

Potential cannabis harms were a rich source of discussion, although a lot of uncertainty, and a wide variation was expressed about the extent of these harms. Some participants had used personal experiences to inform their understanding, others sought knowledge from various sources. Same had seen no ill effects on anyone at all after cannabis use, therefore concluded there were no harms.

> *Because when people are stoned, at the end of the day they're not in the mood to fight, they're just in the mood to eat. That's not harming anyone, so I don't know. Obviously some people do think that when you smoke it your brain becomes deprived of its cells. I don't believe that (Sinead).*

> *I'm a pretty informed guy, I could tell and I'd looked it up before that there's nothing really that damaging about it (Jamie)*

Not all participants were aware of such a variation in views, and there was a degree of assumed understanding, an expectation that 'everyone knew' it was not that bad for you.

Those who were more ambivalent thought it had some impact, but were not sure what, and expected it to be 'bad' but not sure how. Some felt that risks had been exaggerated, that responses to use should be more moderate and that, it is not that bad, only for some people.

> *I think people need to stop seeing it so much as a really bad thing, because I don't feel it is that bad. It's just it's not for everyone, you know? (Owen).*

Relative to other drugs, cannabis harms were considered to operate at a slower pace, for example, although there are disadvantages to all drugs, cannabis use does not kill you instantly. There is always the risk with any drug, and there are risks of the gateway effect to other substance use. The personal health effects are only harmful if you are driving, for example.

> *I don't think it has the potential to be harmful, unless of course you're driving, if you're doing something that affects other people, if you're in charge of them, if you have a responsibility that's a negative thing (Miriam).*

For some, they had established parameters to manage the risks. For example, 'rules' about using, i.e. not before school lessons. For others, it does not sit well with their course (related to public service), and they risk losing their driving licence, so they had decided to stop for a period of time.

To manage short-term risks such as being uncomfortably high, having a 'whitey', 'greening out' (an episode similar to fainting, which could include vomiting), this led people to avoid that particular strain, or to manage this better next time. There was only minimal risk of intoxication described, and this happened less when more mature or experienced, and could be easily learnt to manage.

4.5.4.3.3 Future reasons for abstinence

Future reasons were often referred to with richness and depth, although some didn't plan to stop cannabis but they usually did intend to stop tobacco.

Some planned to stop cannabis when they were older and had greater responsibilities in life. Examples of this included parenthood – the only time some envisaged stopping – and for others, an increase in responsibilities,

> *'I'm just kind of realising that with that, it [cannabis] makes me lazy and it's expensive and it makes me unfocussed. And I am obliged to cut it out of my life. So I just have to. With age comes these choices' (Imani).*

4.5.4.3.4 Cannabis quitting and reducing process

Several strategies and processes were described to either quit, reduce use or reduce harmful cannabis use. In contrast to tobacco quitting processes described which tended to focus on the tobacco product itself, and on seeking substitutions for this, the cannabis quitting process appeared to focus mainly on how the participant spent their time, and the social context in which they used. In this sense, tobacco quitting appeared to be about changing or eliminating the product, cannabis quitting about changing the context.

4.5.4.3.5 Help seeking

Participants had not sought help for cannabis use from any formal sources and were mostly uncertain where to begin looking for this. Some did acknowledge this would be useful,

I just feel like there needs to be, rather than penalties for it, or – maybe not punishment but more support in certain areas. Like, in the colleges I don't feel like there's enough support (Owen)

Well, apart from my friends, in my life I can't really talk to adults about it because my family is quite strict with it, but I have searched online for websites that have information. I try to do that on the incognito tab. Things like Reddit, YouTube, I've seen some helpful YouTube videos (Efua).

Whereas another felt it wasn't really necessary,

I know there are helplines and I've seen a couple of advertisements for people to talk about addictions. I have thought about it, but I don't necessarily see my cannabis use or tobacco use as an addiction, due to the fact that I know I can quit. It's just deciding when's the right time (Sinead).

Another participant described how much the identity of the person providing help mattered, and how important it was that the young adult could relate to them,

When it comes to counselling they need to be like getting more people that like we can relate to, to talk to us about it. When it's someone else and you look at them and you know they've had it good all their life and you know you feel like you're being judged, I mean you just you just feel uncomfortable talking to them about it, like even saying that you've got a habit. (Imani).

4.5.4.3.6 Substitution

Achieving abstinence was described as a very hard process by some, since cannabis use was such a big part of their life. The need for a good substitute was highlighted, which consisted of something else to do, to take that place. Activity was a significant feature in this discussion, and a number of alternatives were described to fill the time spent otherwise engaged in cannabis use. These included joining a gym, a choir, engaging more in hobbies, and finding a way to put the same energy used on cannabis use, towards something else. One person used the money saved to purchase unusual fruit and nuts, which were 'fiddly' to eat, and therefore occupied hands and time.

'You just have to time other ways that doesn't involve smoking to make yourself happy and when you manage to do that you'll realise 'Oh I didn't actually need it'. I

think most people think the world ends … if they stopped smoking weed and stuff, but it's really, like it's hard but once you find something else do it makes up for it' (Imani)

One described a friend who sees no alternative to use, cannot quit because they do not know what else they would do with their time, and felt 'there is nothing else to do'.

4.5.4.3.7 Willpower

The 'social' side of quitting was identified as just as important as the 'medical', and strategies required to learn to say no. It was important to be able to decline the offer of cannabis from friends in particular. Friends were also identified as an important source of support in making a quit attempt.

Similarly to quitting tobacco, multiple attempts to quit cannabis were made. Specific barriers to quitting included managing sleep without cannabis use, and strategies required to address this.

4.5.4.3.8 Cannabis reduction

Harm reduction practices were employed. These included using a lower potency, so you didn't feel so 'bad', e.g. low in mood, or using CBD as an alternative in order to experience a different sort of 'high', and to avoid feeling so 'high mentally'. For some, they observed that cannabis reduction had occurred naturally, without effort, as their responsibilities in life had increased, such as college studies, or job responsibilities. Others found that since working full-time, they tended to only use at the weekend and therefore their use had decreased.

4.5.4.4 Experiences of abstinence

4.5.4.4.1 Previous and episodic abstinence

Some episodes of abstinence occurred through circumstances, for example if someone was travelling, visiting family, or was not through choice, for example they could not access cannabis, they didn't have enough of their own income, or they were not near a dealer.

Other reasons for abstinence could be intermittent, for example during a particular activity, or whilst with partner at weekends. For others, they took regular intentional periods of abstinence from use, and for others these were circumstantial. It was suggested that there could be someone at college who could talk them through their own journey from use to quitting.

Some took a tolerance break, for their mind, and to clear their lungs of the tar they believed cannabis left in there. For some when they realised their college attendance was poor, or they noted they were beginning to lose the capacity to form a conversation, they would take a break.

> *Most often the reason I usually take a break for is sometimes I go out with friends and smoke a joint and I just can't think of anything to say. It's antisocial. When it gets like that, I take a break because it's not really fun* (Marius)

4.5.4.4.2 Expectations of abstinence

Quitting cannabis was expected to be a challenge, as cannabis use formed such a large part of someone's life, and especially from a social perspective, since many described how all their friends used cannabis. Withdrawals were also experienced and expected, including finding it hard to sleep, experience of frustration and even anger.

4.5.4.4.3 Co-use

Most participants had only considered or attempted to quit a single substance, not both together. On occasion learning from one substance was transferred to the practice of quitting the other, and some distinctions were made between the two substances in terms of harm reduction.

Some identified that combustion is the harmful aspect of cannabis use and smoking tobacco, and that using alternative routes of administration for cannabis, such as in a water-based bong, would reduce this, since the water vapour could 'dilute the harm'.

Others made the distinction between the two substances very clear,

> *'I think because maybe tobacco is more common in a way, and obviously there's more things like nicotine in tobacco. Without tobacco I get the nicotine cravings, whereas without the cannabis, there's not really much in my brain going 'you need this, you need this, you need this'. (Jamie)*

Some had knowledge of those who had stopped cannabis for periods of time, and this was observed to be much easier process compared to abstinence from tobacco.

Overall, co-quitting did not feature in the discussion in any meaningful way, with most stating this hadn't occurred to them.

4.5.5 Part 3: Influences

4.5.5.1 Identity

Cannabis use generated more discussion than tobacco use and appeared to be a more compelling topic for participants to share. Identity as a cannabis user was described as mostly positive or equivocal, whereas identifying as a tobacco smoker was mostly negative.

Perceptions and experiences of cannabis harms were described in individualistic terms, i.e. overuse of cannabis was defined by what appeared to be too much for a particular individual, whereas tobacco harms were universally experienced and did not relate to individual behaviours or risk factors. In this way cannabis related harm was highly personal, thus cannabis use could be both 'cool' and 'uncool' (i.e. appropriate or inappropriate) depending on the individual.

> *I think people need to stop seeing it so much as a really bad thing, because I don't feel it is that bad. It's just it's not for everyone, you know? (Owen)*

By contrast, participant views about tobacco and being a tobacco smoker were more cohesive. There was a clear reluctance to acknowledge they were, strictly speaking, a tobacco user. Others firmly rejected that identity, stating that although they did use tobacco (e.g., in their joints) they were definitely not a tobacco smoker. Despite the utility of tobacco in joints, there was a strongly expressed negative experience of tobacco as 'does nothing for you', as if the expectation was that it might produce a similar effect to cannabis, or alcohol. In this way, tobacco was seen as functional, rather than pleasurable in and of itself. Using tobacco in a joint or using too much in a joint was a reason for criticism from peers, and some questioned why anyone would ever use tobacco, considering it has no benefits at all. Tobacco was seen as a poor substitute for cannabis use.

Some expressed a wish to be discreet about their cannabis use because of a feeling of judgement from those around them about their cannabis use, both from individuals in their life but also from society. This led some to hide their use.

4.5.5.2 Access and control

Access to cannabis appeared to be dependent on having the cash available or being with those who were also willing to purchase an amount. For some, if they had no cash, then this meant they would not use but for others if their friends had some, they would use that. Access to cannabis did not appear to depend on how easy it was to access cannabis – this

was described as straightforward, a text sent to a dealer who would usually respond very quickly.

Learning to roll your own joint marked a shift to independent use for some – they were able to facilitate their own use as and when they chose. For some, this meant they began to use alone.

Participants identified that cannabis use could, and sometimes needed to be controlled, or moderated. However, it was noted that it was much easier to exert this control when or if they felt 'ok', mentally, since they had greater influence over their use in that case.

Practical means of reducing potential harm from cannabis use included being selective about products, for example avoiding hi-potency, or types which were new to the user, and sometimes changing the type of cannabis they were using having noted the impact on others, keeping safe in company of friends, or ensuring they didn't drive. Psychological forms of managing use included using it as a reward, only on occasion, and ensuring other means of relaxation were also practised.

> *So it's just I don't like it when it's too potent, cos when it's too potent, like day to day I can't be like, do you know what I mean, I can't like, smoke and go to work, or I can't just smoke it and watch TV, or go party with my friends, I get too paranoid, I just like to keep it just at a normal level (Imani).*

Other participants describing making accommodations for the potential impact of use in their life. They were not seeking to reduce use but had made allowances for cannabis to take up time, and to have an impact. Some for example briefed their friends on how they might support them in the event that cannabis made them paranoid, and others described making sure they made the same effort in other parts of their life, as they did towards cannabis use. This was a means of striking a balance; the amount of time and effort spent using cannabis and managing the after-effects was often referenced.

> *Because my asthma's got quite bad, so I made a promise to my girlfriend that I can't break, at the very end of next week I'm going to stop smoking. It's not gonna be forever. I know I know I'm going to smoke in summer especially (Demetrios).*

4.5.5.3 Rationing

Rationing of both tobacco and cannabis was carried out, mostly for reasons of cost. Difficulties in rationing use were described, in comparison to cannabis use. For example, since if you purchased cigarettes it had to be a whole pack, this meant that even if you only wanted one, you were left with the remaining 19 which you had to get through. In practical terms, rationing cannabis over a period of time was practised by some, but for others they also stated if it was in the house, they would just use it till it had finished.

4.5.5.4 Information

Information and knowledge were significant topics in conversation with participants, and they are distinguished within this context in relation to cannabis as follows; information is considered static, and fact-based, whereas knowledge is considered broad-based, multi-faceted and constructed by participants themselves.

Information is sought about the harms and impacts of cannabis use by many, although not all cannabis users. Some seek no scientific information, they are happy to know very little, and simply trust the dealer to provide what they purchase. For those seeking more information, sources included the internet), but also talking to peers, and from dealers. Some sought information but did not find any, others identified particular pieces of useful advice,

> *'I was just on there one day and there was like a whole little sub-reddit dedicated to it [cannabis vapourising]. So I was kind of like, "Okay, what's this all about?" and I started looking into it and I went, okay, so you can do this and do that. And then I just found a link and ordered one'. (Jamie)*

A variety of sources were frequently identified as valuable. These included people such as peers and dealers, personal experience, internets sites as well as traditional news channels. Balance gave credibility, and unlikely or extreme statements (an example given by someone of reading about someone who became addicted to cannabis after using it once) were dismissed. NHS information sites were noted to provide no balance.

> *'You can say something is credible when you've heard it enough times, and with things online, like you've googled it and it comes up with it' (Lewis)*

To summarise, information was sought and located, but was not found equivocal in value in comparison to personal experience.

4.5.5.5 Knowledge

The nature of knowledge regarding tobacco and cannabis contrasted significantly.

Tobacco 'knowledge', that is an understanding of the nature of tobacco use, and the harms of tobacco use, was described as taught in schools, so there were few if any opinions on this knowledge, it was largely accepted as fact. By contrast, cannabis knowledge is created by self, peers, through observations and opinions are made, and the validity of this opinions are not questioned. It is created by individuals, taking scientific knowledge into account, but not only reliant on this.

> *'It's not like I sit in a school and get taught about weed. If I did then that would be great. But you've got to learn it yourself' (Demetrios).*

For example, with reference back to the concept of cannabis addiction as discussed earlier, the existence of this was called into question. Although some had an awareness of scientific evidence this existed, they also described using a combination of 'common knowledge', personal experience and witnessed experience of others which led them to their sceptical views on the existence of cannabis addiction.

> *'I trust my shotters [dealers] that I know, because they have knowledge, but if they're some random guy I don't know, then obviously that's different' (Demetrios)*

Some were aware of limits of cannabis knowledge and identified gaps in their own knowledge. Others felt adequate information is available, accessible, therefore their knowledge was 'complete', they know all there is to know.

4.5.5.6 People

4.5.5.6.1 Family

The impact of family on both use and changing use, or quitting, seemed significant, and was often referenced. In some cases participants were first introduced to tobacco or cannabis through a family member.

If it was less available then I would smoke less, it's as simple as that. It is as simple as that, my parents smoke obviously as well, so it's just one of them things, where it's quite obvious how it's played out (Lewis).

Where families smoked either tobacco or cannabis, this created a pro-smoking, or sanctioned environment, even when the participant did not smoke with their parent, they knew it was acceptable. Where the family did smoke but then stopped, this created an environment which was less conducive to continued use, as if witnessing a parent stopping was an important event. In other families where the parents did not smoke participants would describe how their parents knew they smoked or used cannabis, and this was to some degree tolerated, but they usually didn't know the extent of it. Some parents would talk about their own use when younger, and participants were aware of this but since this happened a long time ago their use seemed to follow a very different pattern.

'I think it does help if you come from a home where others are like smokers, then like, your parents, like the adults lead by example. I think when, you know, you have someone that you can look up to, a friend of yours that's stopped … and to see them do it, it kind of made me feel like ok, I wanna stop as well, I'm getting there' (Imani)

Mothers in particular were mentioned, including their own current use of both tobacco and cannabis. Some participants smoked with their mother, it brought them together, and became a 'norm'. For tobacco specifically, mothers were cited as providing access, for example by purchasing it so the teenager avoided buying illegal tobacco on the street; but also through mothers being smokers themselves. This meant tobacco was in the house and could be accessed (whether this use was sanctioned or not), and that smoking in the house was possible because the mother also smoked, whether they smoked together or not.

Interviewer: so you found some cannabis in your house?
Respondent: Yeah, my mum used to smoke it for pain relief, due to the fact that she was disabled (Sinead).

4.5.5.6.2 Friends, peers, friendship groups

This was a rich and detailed topic, and participants spoke at length about their peers.

Individual friends, peers and friendship groups were significant in enabling initiation and ongoing access to both tobacco and cannabis, and in setting the norms for use.

For many, their first encounter with cannabis was through friends, and subsequently to greater variety of cannabis types, more routes of administration. Cannabis could be cost-free if you were friends with a dealer. A gender difference appeared here, with references made to initiation to cannabis occurring through boys rather than girls typically.

Friends provided a regular source of cannabis, and use might increase once friendship groups used more, as it would become the 'norm' in a particular group of people. So, use was then reinforced, and cannabis came to dominate friendships. This created some ambivalence, there was some dissatisfaction, or discomfort about the extent to which cannabis led some friendships.

> *My friendships did change once I started smoking, because there are people who are totally against it. So they didn't want to be my friend (Gemma)*

The ubiquity of cannabis was apparent. 'Most' friends did this, and those who did not were the exceptions, many people would smoke together in groups, and at break time in college there would always be someone who would want to smoke cannabis on a break. Smoking cannabis was sometimes part of a 'scene', for example specific music genre and other associations with elements of this 'scene'.

> *I started doing it just socially because my friends around me were doing it, so I was doing it as well. I wouldn't ever buy it (Gemma).*

Peer influence seemed important; there was always someone nearby who would act as a prompt to smoke. This influence was described not as a pressure, but operating more through proximity or availability. When you saw someone else smoking either tobacco or cannabis, you would want to join in.

> *Interviewer: What would prompt you to have a cigarette?*
> *Respondent: I think it's just it's in a setting where other people are doing it. I don't really feel like doing it myself (Efua).*

Behaviours were linked to friends, and groups; for example, prompts to use would come from friendship groups, and it was easier to avoid use when alone.

'With cannabis, I believe that there are the three main aspects of how people will quit. I had the motivation to do it. I had the information. I had the support network, I had someone that helped me, 'stop being a dickhead, get on with it'. And because I had that I was very lucky…I saw that person every day, it kind of pushed me…' (Damian)

When it came to changing cannabis use, friendship groups were an important factor. It was difficult to imagine maintaining friendship groups without cannabis use. If you decided to stop using cannabis, some felt they would need to develop new friendships with non-smokers, which would take time, they would have to pretend to be busy, rather than state they had stopped using cannabis. Participants would risk rejection from friends, either because you did smoke cannabis and they did not like it, or because you didn't smoke cannabis. In this way, a change in peers could prompt a change in use.

It's to do with the people that you hang out with. Obviously, you're going do whatever everybody around you is doing. When my friendship group changed, so did my habits. I think it's just to do with that. Like if I was just hanging out with people that I was with when I didn't smoke, I probably wouldn't have started smoking again. It's just to do with the company you keep (Miriam).

4.5.5.6.3 Relationships

Some were introduced to cannabis by a partner, and this might provide easy availability, especially if they were a dealer.

When I was 14, 15, I think I was going out with someone that sold it. So that's why I tried it. And then when I was 16, I think it's the same, yes, I was with someone that sold it. And it was there. I used to pay for some of it, but some of it would be free (Danielle)

For others, their partner disliking their use of cannabis may be a reason to reduce or to stop use, or it might the reason a relationship ended, and so in this way partners may encourage abstinence. Some made promises to partners they would abstain now, or at a certain point in the future.

For another, the end of a relationship with a partner who did not like them using represented the opportunity to use – it was an expression of freedom, autonomy and choice, away from that control and disapproval.

4.5.5.6.4 Encouragement from others

This was an important influence in changing or stopping use for some. For example, encouragement/disapproval from a mother could persuade someone to stop, others disliked the discomfort of other people, especially family not knowing they smoked cannabis, as there was a dishonesty in this. The memory of a late relative, or encouragement from an important friend inspired abstinence for others.

> *'rehab…I don't think I'd need to go that far … I think mostly I'd just need the support of my friends. Like 'I could just smoke this one', if they were like 'but you're trying to quit' then I'd say 'you're right. Let me back up that thought' (Catrina).*

Some denied that someone else telling them to stop had any impact, whereas others would state this was specifically what led them to stop.

4.5.5.7 Race

A distinct relationship between the Black community and tobacco and cannabis was described; with the community looking down on tobacco use, but favouring cannabis use

> *well in the black community or more like my age kind of black people, smoking cigarettes is not, it's kind of frowned upon. It's like 'eurgh, why are you smoking cigarettes when you could smoke a joint'? (Imani)*

In another example, a participant described their Black boyfriend decided not to use cannabis anymore, as he was so frequently stopped in their car, the risk of being found with cannabis was considered too high and not worth it.

4.5.5.8 Work

A pro-tobacco culture in the workplace had a big impact. One participant described his experience on starting a new apprenticeship alongside others, and the conversation the team leader had with them all;

> *"How many of you smoke?" Hands up. "How many of you don't smoke?" "How many of you quit?" He turned around and said, "The ones that don't smoke, give it two*

weeks, you will. Same with the ones that quit smoking. The ones that do smoke, you'll be smoking a hell of a lot more." (Damian).

In a stressful environment, then smoking tobacco and/or cannabis together after work was the norm, for example those working in hospitality would wish to unwind together after a late night and when the venue had closed. For manual work which participants found unrewarding, cannabis would provide relaxation, respite from boredom, and a means of de-stressing. Moving to more meaningful work for some meant less cannabis use, whereas for others the increase in income led to increase in use.

Others were regularly urine drug tested at work. The rationale given was that this was for the safety of others, and whilst this rationale was understood, it was disliked, as some felt they should be able to choose whether they used or not, and they were able to make safe choices.

4.6 Discussion

4.6.1 Summary of findings

This study is the first to our knowledge to explore tobacco and cannabis co-use in the context of changing and/or quitting behaviours amongst young adults in the UK. It provides novel findings on the context of use of tobacco, cannabis and co-use and the experiences of, and attitudes toward quitting either or both. It also identifies a range of key influences on both use and quitting behaviours which provide further insight into the findings identified in the online survey and set the scene for potential intervention development.

In reviewing the four study objectives, we can see that the findings have provided detailed and novel insights into the context of tobacco, cannabis and co-use amongst young adults, although with greater emphasis on cannabis use. Second, the findings have shed some light into how young adults might conceptualise co-use, and into the variety of ways in which this happens. Co-use was not a relevant concept for everyone, and it might be that this reflects the reality that it remains a concept primarily relevant and salient to clinicians and researchers only. The COM-B model provided a useful structure to explore quitting behaviours for both substances, some of which appeared more relevant than others. Lastly,

the study has provided in-depth and nuanced insights into future quit attempts and provided a better understanding of differences in motivation between substances.

This interview study has demonstrated how complex descriptions of cannabis use are in comparison to tobacco use, and how broad and rich these are. Findings about cannabis use included the use of a range of products, types, and a wide variety of decision-making processes. Choices were made based on availability but also on participant understanding and knowledge about cannabis use. Joints were the predominant route of administration, and peers provided occasional exposure to new routes or delivery products, although these were often viewed as costly. Daily use appeared familiar and common, and meant that cannabis use took up a great deal of time. Overuse of cannabis was shown by the impact on someone's life, but views on the potential harms of cannabis varied widely. Views about differences between tobacco and cannabis also varied widely, and significant differences in the conceptualisation of addiction to either substance were identified. Co-administration appeared to function in some circumstances as a means of harm reduction.

The next section considers the findings in relation to the research literature.

4.6.2 Discussion of findings

4.6.2.1 Use

Tobacco use findings were limited in scope in comparison to cannabis use, and the breadth and depth of the discussion more limited. Prior research used mixed methods to explore tobacco and cannabis co-use identified a greater sense of pleasure in cannabis use compared to tobacco use (Seaman et al., 2019); this differential may partly explain the findings in this study, where cannabis use generated more discussion than tobacco use perhaps because cannabis use was associated with greater pleasure as in the current study, but in addition the current findings demonstrated a greater degree of uncertainty about cannabis as a product, which generated more discussion in comparison to tobacco. Cannabis appears to be a more ambiguous, diverse product than tobacco.

Complex findings about cannabis use and context, choices made and reasons to use were identified in this study and are broadly reflected in the literature. Comparisons with existing literature are limited since research on cannabis consumer choice is predominantly carried out in North America where consumption is increasingly legalised, and choice of cannabis

product will be significantly influenced by location. A systematic review of influences on purchase choice found a number of themes from qualitative literature, including cannabis users' assessment of quality (Donnan et al., 2022). The review found factors influencing quality such as strain, aroma and look were identified as relevant to some but not all users and were more prevalent amongst more experienced users and male users. These findings are partially reflected in the current study findings, where an assessment of quality was undertaken by some purchasers; however this process was significantly determined by availability of product, and in the absence of tested THC (or other quality measures) in contrast to North American cannabis purchasers. The concept of cannabis consumers wishing to demonstrate that they are 'discerning consumers' appears to be a novel finding not otherwise located in the literature.

The reference to use of blunts by participants in this study is an important finding since they are considered most common in the US and North America, and evidence had suggested rates were low in the UK (Hindocha, C. et al., 2016). We therefore did not include this in the survey conducted as part of this thesis, but it might be that use is more widespread than previously understood. The reference to blunts in the interviews demonstrates the benefit of using qualitative studies which allow for novel findings which reach beyond the researchers' expectations and extant research.

Discussion around types of cannabis product used and context of purchase and use is novel, and provides rich insights which could be made use of in intervention design. For example, harm reduction messages may encourage the selection of low potency cannabis; the findings in this study demonstrate the extent to which young adults may, or may not, have the opportunity to make such choices. Similarly, these findings support the growing recognition that cannabis is a complex product; it comes in many forms, methods of consumption and switching between these all add to the challenges in conveying risk information and addressing harmful use.

Reasons for use were grouped into pleasure, enhancement of other activities, as a means of escape and lastly as a tool to manage something. Similar findings were identified in the literature, including enhancement of other activities, facilitating social interaction, as a means of improving focus and attention (Dumbili et al., 2021); but also to manage mood or as

a coping strategy (Banbury et al., 2013; Chabrol et al., 2017; Friese, 2017; Lemyre et al., 2019). It seems clear that cannabis is use for a wide range of both positive and negative reasons.

The relationship between mental health and cannabis use was a significant feature of the current study; cannabis appeared to act as both a source and salve of mental health problems. This 'dual' role is identified elsewhere (Whiteley et al., 2021), including in managing difficult emotional states (Seaman et al., 2019). A discussion around the positive and negative relationship between cannabis and psychosis is also found (Childs et al., 2011); within the current sample reference was made to the onset of psychosis related to cannabis use, but not to the managing of psychotic symptoms. Notably, there was extensive discussion of the relationship between mental health and cannabis, but not tobacco, suggesting young adults hadn't made the link to tobacco as readily as with cannabis.

Contrasting concepts of addiction on tobacco versus cannabis were a significant feature of the study outcomes. Highet also found that young people understood tobacco to foster addiction, but cannabis to be a much safer and less addictive substance; it is notable that the same view has persisted in the intervening years during which awareness of cannabis as potentially problematic has increased, but also that these views remain into young adulthood, as indicated by the current study (Highet, 2004). Cannabis addiction, or problematic use, was characterised in the current study by excess use of time spent using cannabis.

A reluctance to acknowledge addiction on tobacco was identified in the current study which partly reflects the views identified by Poole et al although in the current study young adults were reluctant to acknowledge tobacco use at all, let alone potential addiction, as they considered themselves primarily cannabis users (Poole et al., 2022). Poole also describes a stigma associated with being addiction, which mirrors the current study finding of an expression of disgust toward tobacco and being a 'smoker', and reluctance to acknowledge addiction, or risk of addiction, despite ongoing use (Poole et al., 2022).

4.6.2.2 Changing use

Reasons to quit tobacco were broad and methods tried or planned included a variety of products, but only minimal use of treatment services. Fewer reasons were identified to quit or change cannabis use, but reduction and episodic, planned and unplanned abstinence

were commonly reported. Few wished to identify as a tobacco user, and tobacco was construed in mainly negative terms. Harm reduction practices were employed for both tobacco and cannabis, although depended on constructed knowledge about cannabis production and constituent elements, which was not evidence based. Information on cannabis use and associated harms was sought but not found in critically evaluated sources.

Processes for quitting and/or changing tobacco use in comparison to cannabis were found to vary significantly; from motivation to quit, aims of quitting or changing, understanding of the process and forms of support sought. Changes made to tobacco appeared to focus on stopping using the product itself, whereas the process of changing cannabis use encompassed more domains of young adult life, such as social context, use of time and occupation, and managing mental health and wellbeing.

Risk and harm perceptions of both substances played an important role in changing use and comprised a significant finding of this study. Risk perceptions of tobacco were mostly consistent between participants, whereas perceptions of cannabis harm varied widely. This reflects the lack of empirical evidence on cannabis harms in comparison to tobacco harms, and the lack of widely available comprehensive health information relating to cannabis use and harms. Broadly speaking the young adults in this study considered cannabis less harmful than tobacco – or rather, views of tobacco harms were more consistent and widespread than those relating to cannabis use. Similar findings were described by Highet (2004) in which participants considered tobacco harmful and cannabis relatively benign; and by Seaman (2019) where participants tended to underestimate the risks of cannabis use per se, but also underestimated the harms of tobacco use in comparison to cannabis use. Banbury (2013) highlighted the perception of cannabis as 'natural' and therefore less harmful than tobacco as did others (Akre et al., 2010; Haines-Saah et al., 2014); this was also found in this current study.

Young adults in the current study described multiple attempts to quit tobacco, with a clear recognition that treatment and support was available, even though not all had made use of this. Participants who had made use of treatment services included those with specific needs, i.e., post-natal, indicating that those with a broader range of needs, or more specific needs, were likely to be targeted for intervention. This contrasts to some extent with findings from Poole where young adults considered smoking cessation treatment services

were not aimed at them (Poole et al., 2022); the young adults in our study who had a particular need appeared to have made good use of such services. Participants had made use of some quitting aids such as NRT, pharmacotherapy and e-cigarettes, and had certainly witnessed others' use of these. Similar to the findings in Poole (2022) participants reported expecting to quit in the more distant future, perhaps at 'milestones' in life, and anticipated being able to when they were ready.

Although some participants in the current study referenced use of e-cigarettes, it did not stand out as a significant feature in quitting behaviours and the product was often cited as too expensive an initial outlay. Other research on UK young adults from deprived areas suggests e-cigarette experimentation is not sustained, although use of e-cigarettes amongst youth may have increased since (East et al., 2021). This may be a finding pertinent to a sample population which has lower socio-economic status, and therefore worth investigating further to understand whether e-cigarettes are widely used as a quitting aid across all parts of society.

Harm reduction practises were often described and constitute a significant finding of this study. Co-administration was observed to act as a potential method for harm reduction; by using more tobacco in a joint then co-users considered this a means of using less cannabis, or less harmfully, also identified elsewhere as a means of conserving cannabis supplies (Highet, 2004) but also as a means of managing potency of cannabis. Participants reported using multi-faceted strategies to reduce the risk of cannabis-related harm, including but not limited to reduced potency, reduced frequency of use, episodic abstinence ('tolerance breaks') and selecting a product they believed to be 'safer'. This raises a lot of questions about the validity of such actions, since participants relied on their own perception of potency, or quality (for example, selecting a product they considered more 'natural') and reflected inaccurate understanding of cannabis production methods. This creates a scenario where young adults believe they are making sensible attempts to reduce harm, but in fact there is no appreciable reduction in harm, such as the use of co-administration as a means of reducing cannabis use but without acknowledging the tobacco harms. This highlights both a willingness to engage in harm reduction, and secondly the need for evidence-based, accessible and credible health information about cannabis harms. Prior research has referenced the practice of constant adaptation to use (Banbury et al., 2013; Hughes et al.,

2016; Korf et al., 2007); this was also seen in the current study and indicates a potentially useful avenue to intervene by provide credible sources to inform these small adjustments to use.

4.6.2.3 Influences

Despite using tobacco with cannabis, a rejection of the identity as a (tobacco) 'smoker' was identified. This was actively rejected by some, and not fully acknowledged by others, leading to concerns that this cohort of co-users may remain hidden, in both population and clinical research or practice. This has been previously identified (Hindocha, Chandni et al., 2021) but the extent of the dissonance reported by co-users may be a novel finding. It appeared to be not just a case of young adults not recognising their tobacco use as 'smoking', but an active rejection of that identity, which may lead to a reluctance to consider nicotine addiction and a reluctance to seek support in tobacco use.

Race was found to have a distinct relevance in relation to the Black community and both tobacco and cannabis. Tobacco smoking was described as stigmatised in favour of cannabis smoking. The current analysis did not explore this further, and had only a small number of Black participants, but it points to an important avenue for further research, which takes into account intersectionality and how inequity, race and gender, as identified in the reported experience of a young Black male earlier, may shape experience of smokers in low-income communities. Some of these have been explored elsewhere (Antin et al., 2017), and further research specifically with the Black community may be appropriate to inform the development of culturally informed interventions; for example within Rastafari spiritual practice, cannabis and tobacco have specific functions; this isn't widely addressed in cannabis and health related literature in UK literature (Waldstein, 2020).

Participants described an almost constant process of control and evaluation of their cannabis use. This suggests that instead of a hedonistic, reckless approach to cannabis consumption, use was more about escaping, managing a challenging life situation and not necessarily, or solely, pleasure seeking. Episodic abstinence did occur, and harm reduction was practised even amongst those with no intention of stopping cannabis; these findings are reflected to some extent in the literature (Jouhki & Oksanen, 2022; Liebregts et al., 2014); though the description of episodic abstinences is novel.

Employment had an important influence, and especially for those looking at work in the public sector, or in roles which had a public safety element where drug testing formed part of the role, also identified elsewhere as an influence (Chauchard et al., 2013; Friese, 2017). This may be a finding which shapes the experience of cannabis use in particular employment sectors more than others and warrants further investigation. Cannabis and tobacco were both readily available within the social network and even family home of the participants, as also found by Seaman (Seaman et al., 2019).

One of the important findings was about how knowledge was constructed by young adults about both tobacco and cannabis, and in the case of cannabis, in the absence of available information relating to cannabis harms. Young adults use contextual information (i.e. experiences of peers, witnessed experiences) to inform their choices, also found in a recent Spanish study (Alvarez-Roldan et al., 2022) .This indicates that credible, critically evaluated sources of information are required, and to date are not found easily, a finding also mirrored by Kvillemo (2022) who also identified that young adults sought credible information which did not focus only on harms of cannabis use (Kvillemo et al., 2022).

4.6.3 Strengths and limitations

The study has been carried out in further education, which is an under-researched setting and has demonstrated the complex challenges facing this group of young adults who co-use tobacco and cannabis. Examples of the circumstances which were discussed in the qualitative interviews include periods of time in prison, teenage pregnancy, experiences of mental health problems, family breakdown and low academic achievement, which have all contributed to a richly diverse study sample. The courses studied within the FE colleges have a strong vocational element, therefore the current and future employment context for the study sample is very different to those from a traditional academic background. This context has allowed for novel findings about co-use against a background of low socio-economic status and multiple challenges.

The interviews were lengthy, and a good rapport established with all participants, including those interviewed by telephone. The interviewer's prior experience as a mental health nurse appeared to facilitate this rapport, and participants were able to discuss illegal drug use without concern. The dataset created from these interviews is rich, in-depth and nuanced. The interviewer was able to probe into participants' views and experiences, and

elicited significant novel findings, in particular around sensitive topics and mental health difficulties, suggesting that participants felt comfortable with the interviewer.

No discernible disadvantages were noted from allowing participants the choice of either face to face or telephone interviews, and in some cases telephone interviews appeared to enable more personal disclosures. This supports the case for allowing participants to make the choice themselves, but also demonstrates the validity of telephone interviews. The use of telephone interviews may allow for greater reach into under-researched communities, allows people to participate without having to show their face which especially for young people or adults unfamiliar with research procedures may feel less intimidating. In addition, the use of telephone interviews does not require a stable internet connection and allows the participant to find a suitable private location of their choice since only a mobile phone signal is needed.

Although the dataset is described as rich, it is noticeably dominated by discussion about cannabis. This is unsurprising, given cannabis is a complex product, and descriptions of use must contain a large number of variables, e.g., route of administration, type of cannabis, amount of use, frequency of use. Second, in comparison to tobacco, we lack a cohesive body of evidence which describes knowledge and understanding of cannabis from a critically evaluated research perspective. The body of knowledge exists amongst users developed predominantly from peers and online sources. This therefore creates a greater degree of heterogeneity, in that there is more to speculate about because less is 'known'. Whilst understandable, this is a limitation of the dataset, and could have been addressed in the interviews by returning to probe more regarding tobacco use.

The nature of recruiting for interviews is that you seek people who are willing to talk about a particular topic, and the focus on cannabis in particular as described above may well be a result of specific wish to talk about cannabis, and therefore creates the potential for bias. Participants who had especially positive or especially negative experiences of using cannabis may have been motivated to respond to the interviews, thus creating views at either end of the spectrum. However, it was noted in the dataset that whilst there were certainly participants who were keen to do all they could to further the case for decriminalisation of cannabis, there were also those who remained fairly neutral about their cannabis use and did not express strong negative or positive views.

4.7 Chapter summary

This chapter has described the methods and findings from the qualitative interview study, the final of the three presented studies. This thesis aims to develop the evidence base for a potential intervention or interventions, and so the findings from each three studies will now be synthesised in order to establish and describe how they might be used in the next stage of said intervention development.

Chapter 5: Synthesis of findings

5.1 Introduction

The data from all three studies vary in nature, depth and application. The systematic review and meta-analysis has provided some indications for future interventions, and also identified the gap in the research literature. The survey has provided data about who might benefit from or be motivated to receive an intervention or interventions by looking at quitting behaviours for tobacco and cannabis and risk of addiction across both. The survey and qualitative interview studies have also provided data about the context of tobacco, cannabis and co-use which benefits future intervention development, but also furthers understanding the nature of tobacco and in particular cannabis use in this age group.

Data from each three studies has been presented in Chapters 2,3 and 4. The thesis has used mixed methods to develop the evidence base, and as such each chapter constitutes a study which makes a unique contribution. As an extension to this work, one of the aims of the thesis is to develop the evidence base for a potential intervention or interventions, and so to this end where data from all three studies could meet this aim, it has been synthesised, and its' application to an intervention setting considered.

The synthesised findings presented in this chapter along with the proposed intervention/s are intended as a starting point for this discussion, and to inform the subsequent stages of the MRC intervention development framework.

The findings from this thesis propose only to inform the initial stages of intervention development. Further intervention development has not been possible within the scope of this work, but any subsequent work should be carried out with a stakeholder group including young adults who have experience of co-use as a minimum, in line with the MRC Complex Interventions Framework (Skivington et al., 2021). Any potential intervention or interventions ideas which are generated from this process could then be co-developed with co-users using a suitable structure for such work.

This chapter discusses the structure and process of the synthesis, returns to the Theoretical Domains Framework to consider the findings, then presents and discusses intervention opportunities.

5.2 Synthesis process used

As described in Chapter 2, mixed methods research combines both qualitative and quantitative studies, and the researcher makes a choice in the final stage about how to integrate the findings. This might include triangulation of convergent, divergent or complementary findings, using triangulation from both data sources, and theoretical propositions which are supported by the triangulation process (Östlund et al., 2011).

In the current thesis, the study order was specific; the responses to the quantitative findings were reviewed and used to inform the structure of the qualitative interviews, for example where motivation to quit cannabis was observed to be very low, this topic was specifically explored in the interviews. When considering how to synthesise these data, this lead naturally to the interview findings providing an expansion, or explanation of the quantitative findings. For example, low motivation to quit cannabis was partly explained by the finding that participants already practised episodic abstinence, or reduction, or simply enjoyed cannabis to the extent they did not wish to stop. In this sense, the findings from both have been combined sequentially in narrative form as a first step. The next step was to review the findings within the TDF, since this was used as a structure for both the quantitative and qualitative studies, shown in Table 25. This may be considered a form of triangulation; the theoretical background (TDF) was considered in light of both quantitative and qualitative findings.

Since the aim of the thesis was to provide evidence for potential interventions, then the natural next step in reviewing these narrative findings and the TDF inputs was to consider where an intervention could address the behaviour(s) identified. The production of these 'intervention opportunities' as outcomes allowed for a range of potential behaviours to be included which might fit into a number of domains flexibly, and for breadth in this range.

5.2.1 Structure of synthesised findings

This synthesis chapter intends to show how the data from all three sections has been synthesised and where possible has been applied to potential intervention opportunities. Integrated findings from the TDF framework (Table 25) and intervention opportunities (Table 26) have been reviewed and an intervention structure is produced (Figure 31) which shows how these findings could be applied in a clinical or non-clinical setting.

5.2.2 Evidence base to date

The evidence base extant prior to this thesis was evaluated using a systematic review and meta-analysis. The review demonstrated that co-use interventions have been developed although not tested in controlled studies. These demonstrated feasibility, and usually comprised form of tobacco intervention and a form of cannabis intervention, rather than integrating these. Some encouraged sequential quit attempts, others simultaneous. Controlled studies of interventions which addressed either substance and measured both pre and post were evaluated, and showed no treatment effect on tobacco cessation, and a small treatment effect on cannabis cessation. These findings demonstrate there is a gap in the development and testing of co-use interventions.

5.2.3 Theoretical Domains Framework

The MRC framework for complex intervention development provided the overall structure for the studies within the thesis; as a theoretical basis the TDF has been used throughout the thesis and formed the initial structure for the survey and interview. Table 6 showed how each element of the TDF could be mapped to either a survey or interview question, with the objective of providing a response to each element of the TDF across the two studies. The majority of the elements have been explored, and Table 25 shows these; separated into tobacco and cannabis (with one reference to co-use) and initially separated into survey and qualitative findings, then integrated in the final column for each substance.

The integrated findings can then be used to inform the specific mechanisms of a co-use intervention, or interventions which may be aligned to existing interventions for single substance use.

Table 25 Findings from survey and interview study mapped onto TDF

Theoretical Domain Framework components							
		Tobacco findings			**Cannabis findings**		
		survey	**interview**	**integrated/ summarised**	**survey**	**interview**	**integrated/ summarised**
CAPABILITY							
Physical	Physical skills	-	-		-	-	-
Psychological	Knowledge	-	Some knowledge about available products (e.g., NRT, e-cigarettes) but less knowledge about or use of treatment services, or about process of quitting	Knowledge mostly about quit products rather than process or treatment	-	Knowledge about cannabis and potential quitting process sought from official sources but not found and therefore constructed by YA from experience/peers/online fora	Knowledge of quit process gained through peers, though limited in scope

			Co-use: minimal understanding/ conceptualisation about co-use, and potential process of co-quitting				
	Cognitive + interpersonal skills	-	Limited understanding of skills required in cessation, although some witnessed family members quitting process. Some with specific personal circumstances had made use of	Limited understanding of skills required in quit attempt	-	Minimal understanding of skills required to quit or change cannabis use, some suggestions about peer involvement as a means of support	Limited understanding of skills required in quit attempt

			specialist SC treatment				
	Memory, attention + decision processes	-	-		-	-	
	Behavioural regulation	Confidence in future quit capability was relatively high at 55%, only 8% expressed uncertainty	Some contingency planning evidenced, and experiences of those around them used	High level of certainty in capability to quit, with some contingency planning	57% indicated confidence in ability to quit	Very limited detail on how to manage a change/quit process	High level of certainty in capability to quit, though very little details on managing process
OPPORTUNITY							
Social	Social influences	30% knew no-one else who had quit	Witnessed experiences of quitting were a	Most had witnessed	39% indicated they knew	Peers were identified as a key risk in returning to	Most knew someone who had quit

			significant source of information to evaluate the products or processes of quitting, mostly from family (especially mothers) but also peers	someone else quitting	no-one who had quit	use post quit/abstinent period	
Physical	Environmental context + resources	Restrictions at home or college were cited by only a very small number as a reason to quit (n=3); and none indicated lack of access to	Access to resources were described, for example NRT or e-cigarettes specially to manage cravings, and some had accessed	Access to quit resources was straightforward	Legal concerns were cited by only n=6 as a reason to quit	A change in location (trip abroad or staying with family) could provide the right context for episodic abstinence. Lack of access and availability of cannabis could elicit	A change in context or location was often useful in quitting

		NRT/medication was a reason for relapse	treatment services.			unplanned episodes of abstinence	
MOTIVATION							
Automatic	Reinforcement	-	Fitness acted as an incentive to quit/reduce, since tobacco use had a direct, tangible impact. Proximity of peers/society use of tobacco acted as cues to continue use	Fitness was a facilitator to change, peers were a barrier	-	Peers/partners acted as incentives to quit/reduce. Ubiquity of cannabis use (in immediate surroundings and in media) acted as barrier to continued abstinence and cues to continue use	Peers could be both a facilitator and a barrier to change, and ubiquity also a barrier
	Emotion	-	-		-	Cannabis described as both inducing and reducing difficult	

						emotional states such as anxiety, distancing from surroundings, and low mood	
Reflective	Identity + social/ professional role	-	Many expressed negative views of being seen as a 'smoker' and rejected this identity		-	For those in training for public safety management roles, regular drug testing meant they either abstained entirely or for planned periods of time, which acted as a facilitator for abstinence	Cannabis used in managing emotional states
	Beliefs about capabilities	See 'optimism'	-		-	-	
	Optimism	55% indicated they were confident they could quit when they wanted to	Some ambivalence as previous quit attempts proved challenging	High confidence expressed, although	57% indicated they were confident they could	Most expected to be able to when and if they chose in the future without any difficulty	High confidence expressed

				challenges also noted	quit when they wanted to		
	Intentions	MTSS includes intention; 17/106 expressed intention to stop in next 3 months	Most had tried to quit at some point, intended to again but without specific time point	Most intended to stop in the near future	MTSC; 6/106 expressed intention to stop in next 3 months	Most saw little reason to quit now, but identified life stages when they would; i.e. becoming a parent, moving in with partner	Most anticipated stopping later in life
	Goals	-	Goals mostly related to cessation	Goals set were linked to cessation		Goals were more varied; included being more selective about cannabis use (type, frequency); not using when low in mood; only using once a week when a parent; being able to use more	Goals set were about controlling use

						freely if legalised in future	
	Beliefs about consequences	-	Potential future harms were consistently understood	Understanding of future potential harm expressed	-	Potential harms were questioned, ranging from use having no consequence to the potential for mental health related harm.	Understanding of potential future harms varied widely

5.3 Intervention opportunities

In order to consider how to make use of the findings from the three studies within this study, Table 26 shows significant findings which lend themselves to a consequent response or action, which are referred to here as 'intervention opportunities'. The findings have been listed with indicated intervention opportunities alongside, although some of the opportunities may be informed by more than one finding. These opportunities may be used across a number of domains (for example both public health interventions as well as individual) and are suggested ideas, intended to act as a starting point for discussion of next steps in intervention development. These intervention opportunities may be further developed as 'stand-alone' interventions, or as part of a toolkit of interventions and could be delivered in a number of settings, formats (including digital) and meet a wide range of needs. The process of determining what these might be, and how they could be designed might include a combination of methods with a variety of stakeholders; e.g. use of Delphi groups, treatment practitioners and young adult co-users, as seen elsewhere (Neale et al., 2016).

As a means of providing an overview of where the findings from this thesis may prove useful, these intervention opportunities are synthesised further in Figure 31.

Table 26 Intervention opportunities linked to integrated findings from all three studies

	Findings from each study	**Intervention opportunities**
Systematic Review	NO RCTs, but co-use intervention seemed feasible; unclear findings re single/dual substance focus	• Development of co-use intervention with consideration of context, and including the option of single/dual substance focus within
	Potentially better outcomes for cannabis reduction not cessation, and better outcomes for cannabis than tobacco overall	• Setting outcome of potential intervention as 'change/reduction in cannabis use' rather than cessation
	Intervention components described included NRT, contingency management, integration of tobacco/cannabis elements unclear, extent of co-use discussed unclear	• Develop toolkit of essential elements for tobacco and cannabis interventions, including the requirement to fully assess use of both; consider role of co-use and co-administration.
Integrated survey+ interview findings	High rate of mental health problems; relationship between cannabis and mental health is significant	• Screen and/or assess for mental health problems amongst cannabis users and for cannabis use amongst those with mental health problems • Develop intervention (or element of an intervention) specifically for cannabis use + mental health • Explore relationship with mental health for individual – cannabis use may function as source or salve of problem

		• Ensure relationship between tobacco and mental health is included given previous evidence indicating a link
	Lower likelihood of change in tobacco use if LGBTQ+ or lower socio-economic status	• Explore identity and role of tobacco/cannabis in lifestyle/individual circumstances • Consider targeted interventions for these groups/areas
	More co-users appear to be dependent on tobacco than cannabis, and the nature of addiction on each substance appears to have very different impacts; and is differently conceptualised	• Provide information on the process of addiction including physiological and psychological aspects, withdrawal symptoms from each substance • Explore experience of addiction for each substance
	Most had made changes and/or quit attempts with minimal/no treatment, support or intervention, and did not expect to require this	• Provide information on process of quitting and how treatment can support the process
	Motivation to change tobacco use appears higher than for cannabis; rationale for changing tobacco appears more consistent	• Explore basis of motivation for quitting each substance, including expectations of success and understanding of process
	Changes had been made to both tobacco and cannabis use; more frequently to tobacco use Co-administration used as a method of harm reduction	• Provide information and signposting for tobacco addiction treatment options; explore existing changes in use practice for both substances to enhance motivation and self-efficacy

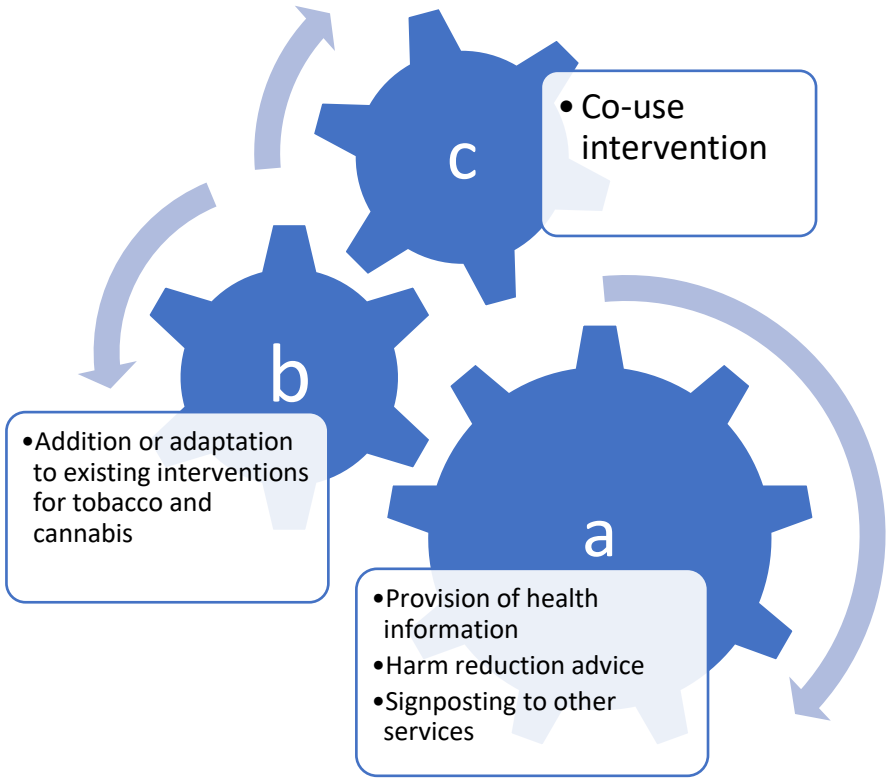
		• Identify existing harm reduction practices already employed; consider correction/exploration of erroneous beliefs

5.3.1 Grouped intervention opportunities

As a final outcome of this synthesis chapter, a diagram indicating possible interventions arranged into three sections has been presented in Figure 31. This diagram is produced because the findings from all three studies have indicated evidence across a range of domains including, but not limited to, a potential co-use intervention. This diagram makes use of findings from both the TDF framework and the integrated findings (Table 25 and Table 26) to demonstrate how these could be used in applied intervention development or discussed as a next step with relevant stakeholders.

Intervention options vary in intensity (i.e., duration and/or complexity), training or expertise required for delivery, availability, access and are grouped in such a way as to align with existing 'tiered' health services, i.e. the more specialised services are not universally available. However, it is important to note that a person who has identified a problem with their tobacco and/or cannabis use, or who has been identified by someone else as having a problem may well benefit from a specialised intensive service, even though they have not received a universally accessible service first. The options are not intended to be passed through sequentially; rather they could in theory all be available to anyone.

Figure 31 Grouped intervention opportunities



Section A of Figure 31 describes interventions which could be easily accessed by all young adults irrespective of level of co-use or current smoking status, and available across a number of settings. These may include face to face interventions, for example harm reduction advice given by a practice nurse during a GP visit, a leaflet describing risk of addiction on tobacco amongst cannabis users available in a college communal area, or training delivered to careers advisers on how to signpost co-users to access further information. Although these interventions are easily accessible and do not require specialist training, they may nevertheless prove the catalyst for an individual recognising that they are at risk of addiction or problematic use, or recognising they need further support with their use, and seeking a further intervention. In this study few young adults indicated they would, or had, sought out treatment for either tobacco for cannabis use, but they did indicate they had received other health treatment, social support and other services, which could provide the option for raising the topic of co-use.

Section B indicates adaptations which could be made to existing tobacco and cannabis interventions. Given so few integrated co-use interventions have been identified within the systematic review, it is acknowledged that most co-users, if they seek treatment, will likely

see treatment for a single substance. This may be the substance they feel causes the greatest harm, or the substance which they are more motivated to address. Future research on co-use interventions may demonstrate their efficacy over single substance use interventions, but until that point and even after many co-users will continue to access either tobacco or cannabis use interventions, and as noted in the findings of this thesis, may not take into consideration, or may not wish to change their use of the second substance. It is important therefore that tobacco and cannabis use treatment takes into consideration the other substance, through thorough assessment, harm reduction advice, and discussion regarding impact of co-use on successful treatment outcome. As an example, tobacco treatment providers may benefit from including cannabis use screening questions in their treatment protocols; cannabis use treatment services may require integrated smoking cessation treatment available at the same location and same time. Digital interventions addressing either substance could include a section on addressing co-use and provide easy access to both.

Section C interventions comprise a specific co-use intervention, which the evidence provided in this thesis could inform. Co-use interventions were found to be feasible and acceptable within the systematic review (study 1); however few have been tested using robust measurement, and none were identified specifically addressing the needs of young adults. It was notable in the survey and interview findings that few young adults had considered any intervention for their substance use, or co-use, therefore intervention development may need to consider addressing motivation initially. Peers were identified as significant both as facilitators and barriers to quitting, but also as an important source of experience, and as someone to identify with. Peer delivered or supported interventions may be a useful avenue to explore, based on the findings of this thesis.

5.4 Summary of synthesised outcomes presented

This chapter has considered the findings from all three studies in two stages; first by considering the survey and interview findings from a behavioural perspective by mapping them onto the TDF. This demonstrates both where gaps exist in our knowledge that the current thesis did not fill, but most importantly gaps in the experience, understanding or access that may act as barriers to co-users seeking to addressing their co-use.

The second part of the synthesis has provided a list of potential intervention opportunities which range from public health interventions to individual interventions; these have been collated into similar opportunities and presented in a simple final diagram.

The chapter provides a practical application of the findings thus far; and the beginning of the subsequent stage of intervention development, which this thesis builds up to.

The final chapter of this thesis discusses the process, findings and application of these findings and considers these in relation to existing evidence and seeks to demonstrate the novel contribution made by this thesis.

Chapter 6: Discussion & Conclusions

This chapter provides a summary of the overall findings, and then reviews the findings with reference back to the aims and objectives outlined in Chapter 1. Strengths and limitations of the study overall are discussed, and implications for future research, practice and policy are described. The chapter concludes with a final summary before conclusions are drawn.

6.1 Summary of thesis findings

This thesis used mixed methods to investigate the existing evidence base for tobacco and cannabis co-use interventions, to investigate patterns of use, co-use and quitting amongst a sample of young adult co-users, and to explore attitudes towards and experiences of co-use and co-quitting. The thesis used the MRC Framework for complex intervention development as an overarching structure, and the BCW and TDF as a theoretical basis for the studies. The overall aim was to establish the evidence base for an intervention seeking to address tobacco and cannabis co-use.

The systematic review and meta-analysis found co-use interventions were reported to be feasible and acceptable, but none had been tested in controlled studies. Controlled studies of single-substance interventions were explored, and data sought on the outcomes of co-users within these studies. These outcomes were then meta-analysed using Bayesian methods (n=11), and a small effect found for cannabis cessation outcomes, but not for tobacco cessation outcomes. These findings indicate that co-use interventions are warranted and required further development and testing; and that single substance interventions should measure both tobacco and cannabis use pre and post intervention, in order to build the evidence base on the impact of co-use on single substance cessation attempts.

The survey data of a sample of young adults attending FE colleges in a UK urban area (n=141) demonstrated that current and recent co-users experience high levels of self-reported mental health conditions, and daily use of both tobacco and cannabis is fairly common. Co-administration is the most common method of co-use, high-potency cannabis use is the most common type of cannabis used, and young adults appeared to be at some risk of both tobacco and cannabis addiction. Motivation to quit tobacco and quit attempts

made were much higher than those of cannabis, and most young adults did not use or seek out support or treatment to make quit attempts.

The qualitative interviews of young adults from the same sample (n=18) demonstrated a complex picture of co-use and construction of co-use as a concept. Co-use and quitting, including co-quitting, was influenced by identity, including whether or not someone identified as a tobacco user despite co-administration of tobacco, perceptions of relative harms and the nature of addiction on either substance. Knowledge and information relating to cannabis was created by young adults, sourced from peers and informal online sources, and this was used to inform harm reduction practices. A rich and complex, multi-faceted relationship between mental health and cannabis use mostly, and tobacco use to some extent, was described and explored. Peers and family formed a significant factor in determining initiation, maintained use and cessation for both substances, and college and work contexts also shaped use and quitting.

The findings from all three studies have been synthesised and intervention opportunities presented, alongside future directions for research, policy and practice.

The thesis objectives are now considered and reviewed in turn.

6.2 Review of aims and objectives

The overall aim of the thesis was to develop the evidence base for an intervention which addresses the co-use of tobacco and cannabis amongst a young adult population. The four objectives are now considered in turn in relation to the findings described in detail in chapters 2-5.

6.2.1 Objective one

'To identify, evaluate and synthesise existing research findings on evidence for co-use interventions'

Chapter two described the systematic review (n=20) and meta-analysis (n=11) of interventions which addressed either tobacco and/or cannabis, and which reported pre and post intervention use of each substance. This was one of the first reviews to explore co-use interventions in depth, and used novel methodology (Bayesian meta-analysis) to provide a

useful foundation for future co-use intervention reviews. The systematic review showed that dual studies were located and were found to be feasible and acceptable to participants. However, to date dual studies have not explored the theoretical basis for addressing two substances in conjunction, whether simultaneous or sequential quit attempts were encouraged, and most combined existing interventions for tobacco and cannabis, rather than creating an integrated intervention. The systematic review has identified that despite identifying feasibility, the theoretical basis for co-use interventions is sparse, and that further development is required to explore delivery, content and goals of such interventions, as identified in a recent review of the treatment focussed co-use literature (McClure, E. A. et al., 2020).

The meta-analysis of controlled trials conducted showed no treatment effect on tobacco cessation or tobacco reduction outcomes whether in cannabis targeted interventions, multi-substance interventions or tobacco-focussed interventions. This may be explained by the duration of interventions (all except one were brief), a factor also relevant in the lack of pharmacotherapy supported cessation interventions. A moderate treatment effect was seen on cannabis cessation for multi-substance interventions and for cannabis-targeted interventions; but somewhat surprisingly no effect on cannabis reduction outcomes. Methodological issues including the challenge of measuring cannabis use were identified.

The findings demonstrate the scarcity of evidence using robust controlled study designs which investigate the efficacy of co-use interventions. The review also highlights the gaps in the evidence base for the impact of tobacco use on cannabis cessation trials, and vice versa. It would be relatively simple to measure co-use pre and post intervention in single substance intervention trials and would allow for much wider understanding of the impact of co-use on treatment interventions (McRobbie et al., 2021). The use of cannabis cessation as a treatment outcome warrants further consideration. There may be important differences between the degree of risk posed by low frequency cannabis use compared to low frequency tobacco use; tobacco reduction is not typically considered to provide significant health effects and means tobacco smokers remain at risk of increasing their use as they experience nicotine withdrawal, whereas the differential in terms of positive health impact between cannabis cessation versus cannabis reduction may be smaller and in any case reduction may well be a more meaningful goal, or outcome, for cannabis users.

Although the meta-analysis in this study found an effect on cannabis cessation and not reduction; the use of cannabis use reduction as an outcome warrants further investigation (Sherman, Brian et al., 2021).

Nguyen et al (2020) reviewed the literature on digital assessment and intervention on co-use, and despite limited evidence to date, methods such as Ecological Momentary Assessment (EMA) demonstrate promise since they reduce recall bias and allow for detailed assessment (Nguyen et al., 2020). Digital interventions may also offer a treatment option to co-users who are unlikely to access existing services, provide immediate support to co-users at risk of relapse, may reach populations otherwise hidden and can be co-produced with relevant stakeholders.

The work in this thesis has shown that co-use interventions are scarce and remain untested in controlled studies. Alongside the development of co-use interventions, consideration of the theoretical basis for such interventions as well as better measurement within existing studies will enhance the evidence base for co-use interventions.

6.2.2 Objective two

'To gain a detailed understanding of the spectrum of co-use patterns and quitting behaviours amongst young adults'

Chapter three described the findings of the survey of young adults in FE settings (n=141) in three urban areas.

The findings demonstrate that amongst a diverse, representative sample of young adults who co-use, or recently co-used, co-administration in a joint remains the most frequently used route of administration. High potency cannabis is most commonly used, and a significant proportion in this group were at risk of both tobacco and cannabis addiction. Motivation to quit tobacco was higher than motivation to quit cannabis, and tobacco quit attempts were more likely than cannabis. Factors predictive of tobacco quitting behaviour included being LGBTQ+ and from a lower socio-economic background. Over three-quarters of the sample reported a mental health condition, at a notably higher than comparable populations. The relationship between mental health and both tobacco and cannabis is

apparent; this finding adds to the evidence base indicating that co-use appears to be an important factor in the experiences of those with mental health conditions.

The spectrum of co-use has been described, and ranged from occasional to daily use of both, although a larger sample size would have enhanced these findings and allowed for more distinct patterns to become visible. Quitting behaviours were investigated in some depth, and useful insights into the use, or lack of use, of quit support methods demonstrated the differences between substances. Reasons to use and reasons to quit offered insight into motivating factors for this age group and demonstrate the differences in perceived function of each substance. These findings differ somewhat to a recently published study of cigarette risk perception among cannabis users in the US, which found they rated the risk of heavy tobacco smoking lower compared with non-cannabis users (Goodwin, Renee D. et al., 2022). The current study found a consistent view that tobacco smoking was harmful, and much more so than cannabis; there was no suggestion of a decreasing view of tobacco-related harms. Relative risk perceptions of both tobacco and cannabis should be evaluated within UK population samples also, in order to monitor potential shifts which might affect quitting behaviours, but also to inform prevention and treatment interventions.

6.2.3 Objective three

'To explore the views and experiences of co-use patterns and quitting behaviours either or both substances amongst young adults'

Chapter 4 described the findings from qualitative interviews (n=18) with young adults in FE settings which explored their views of tobacco, cannabis and co-use, how they conceptualised co-use, and how they understood the risks of both substances. Experiences of and attitudes towards quit attempts, quit behaviours and expectations of quitting processes were investigated, and rich descriptions given of the context of co-use, and how the concept of addiction is differentially understood across both substances. A complex relationship between mental health and cannabis use was illustrated with depth and nuance.

Co-use as a concept was not readily recognised by participants in this study, despite the majority reporting co-administration of tobacco and cannabis. This may be explained by a

reluctance by some to consider themselves tobacco smokers, therefore the idea of tobacco as being somehow linked to their cannabis use may not be palatable to them.

Where the survey in Chapter 3 described the low levels of quitting behaviour and motivation to quit in particular for cannabis use, the data in Chapter 4 began to explain some of these findings, including differences between substances. The data showed that factors influencing both use and quitting behaviours included identity, access and control, information and knowledge, and people and social context. These factors indicate that in addition to the characteristics of each substance, the context of use is crucial to understanding how use is initiated, maintained and then changed. An application of these factors will be required in any subsequent intervention development.

The findings from this chapter paint a complex picture of young adult substance use. Since ever use of either tobacco or cannabis leads to continued or problematic use in only proportion of cases and may be higher for tobacco than cannabis (Mayet et al., 2011), then it may be easy to dismiss the use of tobacco and cannabis in this age group as 'par for the course', or a common rite of passage which has no lasting negative effects, and quickly resolves (Ball et al., 2022). The findings from this chapter paint a more complex picture and demonstrate how intricately embedded both tobacco and cannabis use is within the home, within the peer group, college and working environment and how use of both pervades through generations. Use of both embodies the challenges faced by young adults such as economic hardship, mental ill-health; namely intersecting vulnerabilities. Tobacco and cannabis provided pleasure and relaxation, but the function of both went beyond this; use was also a facilitator of social connectedness, embedded in daily life but also community, a means of managing stress and pain and a tool to control which could then become controlling.

6.2.4 Objective four

'To identify relevant target behaviour(s) and develop the theoretical basis for an intervention(s) to address these target behaviours in young adults'

Chapter 5 describes potential intervention opportunities indicated by the synthesised findings from all three studies within this thesis. The synthesis did not clearly identify a

single intervention, as it became clear throughout the analysis process that multiple potential target behaviours were apparent. The process of identifying target behaviours is an essential step when using the TDF to develop an intervention, but the findings did not readily indicate a specific co-use behaviour, or even a small number of co-use behaviours to address. Instead, the findings indicate that addressing two substances requires further work, since the motivation to address each is likely to be significantly different. It seems likely that tailored interventions which match the action to the motivation are required, and therefore target one substance more assertively than another, hence the range of intervention opportunities presented in Chapter 5. The question of simultaneous or sequential cessation is explored within the co-use literature and it seems intuitive that the option for either, as well as the option for cessation of one and reduction of the other may be required in a suite of interventions. There is a balance to be struck between offering what is requested or seems achievable to participants and providing information on the optimum methods as demonstrated by the evidence base. Becker's 2014 study of a co-use intervention required use of an additional preliminary intervention designed to improve motivation to address cannabis use, which was successful (Becker et al., 2014) and which could be evaluated on a larger scale.

The proposals in Chapter 5 indicate where existing interventions may be adapted, new interventions developed, and harm reduction information provided. Currently in the UK the National Health Services (NHS) provides a dedicated website on smoking providing information on the benefits of quitting, means of increasing motivation and options for quitting, including a free app as well as providing evidence to support each of the options (www.nhs.uk/better-health/quit-smoking/). The equivalent for cannabis use is provided by the website 'Talk to Frank', an independent government funded website. It provides concise information on what cannabis is, its' likely effects and risks. Although there is a dedicated section on seeking help for substance misuse, this is not specific to cannabis, and contains no cannabis harm reduction advice. The contrast between the depth and breadth of government funded sources of information for each substance is striking, and further work is required to address this disparity. There are many reasons for this difference in levels of information, and government funding allocation is a major one, but the paucity of evidence in addressing cannabis use is evident, and the effects seen in the findings of this synthesis

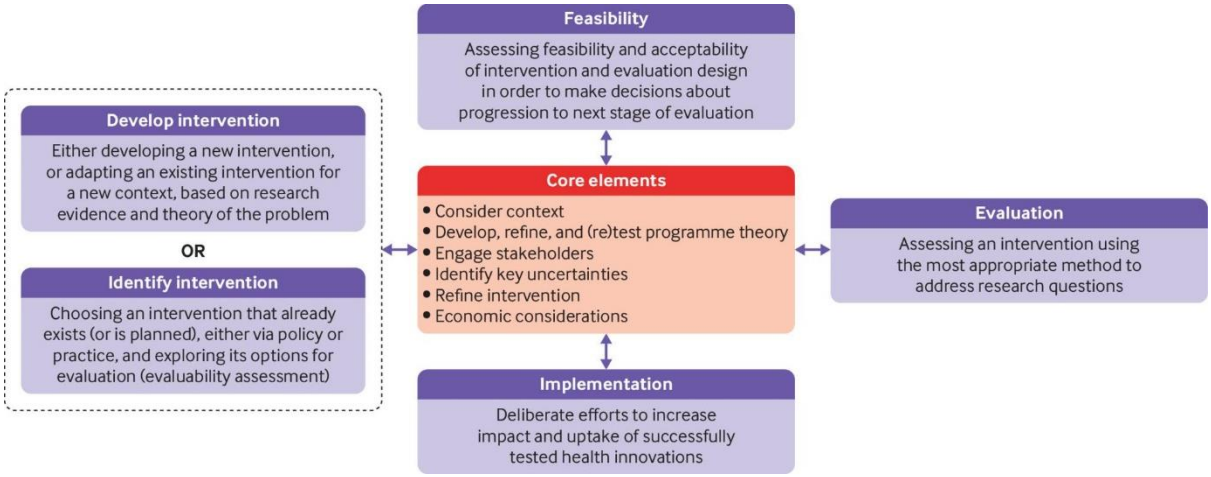
are striking. Where a vacuum of evidence exists, young adults have filled this themselves, using their own experiences and online fora to inform their harm reduction practice. This is replicated in a large report on substance use in youth; which found that internet, TV, parents and teachers were the most likely sources of helpful information about drug use, and FRANK listed as the least likely (NHS Digital, 2018).

6.2.5 Methodological approach

6.2.5.1 MRC and COM-B

The methodology used the MRC complex intervention guidance as an overarching structure, which was updated in 2021 (Skivington et al., 2021). The original framework described four stages of development and evaluation; within the development stage it listed 'identifying the evidence base; identifying or developing theory; modelling processes and outcomes' as key elements. The updated version makes reference to this development stage in greater detail and identifies core elements which should be considered throughout the development and evaluation process, as shown in Figure 32.

Figure 32 MRC Framework for developing and evaluating complex interventions; updated 2021 (taken from Skivington 2021)



The evidence provided in this thesis, and the intervention opportunities are considered here in light of the updated guidance. Two of these elements which appeared most relevant to the work in this thesis are further considered here; 'develop, refine and (re)test programme theory'; and 'identify key uncertainties'. We can see that the work of this thesis has provided insights into these two core elements which can then inform further development work.

The use of the COM-B model and the TDF as a theoretical basis was a test of using this model with two substances. It demonstrated that rigorous application of the same questions for both substances provided useful insights into how they contrasted, and how they were similarly understood. However, using 'making a quit attempt' as the intended behaviour change was one of the key challenges; use of the theory demonstrated just how different the process of quitting each substance might be. The COM-B model encourages intervention developers to be precise about the behaviour change sought, by defining when it occurs, where, with whom and how; this proved a challenge given the diversity of co-users and co-use practice.

It seems likely that the COM-B model provides a useful starting point for re-considering an appropriate theoretical basis; COM-B may require adaptation, refinement or an alternative theory sought. Discussion of whether dual substances are best addressed in a multi-substance intervention, or two parallel or sequential interventions is ongoing (Hyman et al., 2007); and questions remains as to whether risky health behaviours are well served by using a health behaviour theory which may focus only on a single behaviour, whether there is sufficient overlap between behaviours to be encompassed by a single theory, or whether more than one theory is required (Noar et al., 2008).

The outcomes of research often include identification of knowledge gaps as much as identification of knowledge; this is highlighted as a key consideration in the updated MRC guidance, which lists identification of key uncertainties as a requisite next step. The findings from this thesis have identified several key uncertainties which would require further investigation in development of an intervention. As an example, the application of theory to the use of two substances as described above is a key uncertainty. Another significant finding within the thesis was the lower likelihood of engaging in tobacco quitting behaviour found amongst LGBTQ+ and lower SES students within the sample, without any similar difference in cannabis quitting behaviour. This would require testing in a larger sample; and if the difference is maintained, then further research work is required to explore this further. Whilst differences in tobacco smoking prevalence within marginalised groups is well established, it is less clear that this translates into differences in quitting attempts or success, as described in Chapter 1. Future research which explores the intersection of

vulnerabilities and how these might interact to influence substance use and misuse is warranted, and in larger samples may highlight other underlying differences.

6.2.5.2 Paradigmatic approach revisited

A critical realist perspective which recognised the contribution of multiple perspectives was adopted; this allowed for the combining of different ways of asking questions, and different responses found to similar concepts. As an example, the survey used several questions to determine co-use status, and apparently contradictory answers were given; this was further explored in the qualitative studies, and co-use measurement discussed in the systematic review chapter. The synthesis of findings attempted to include this multiplicity of constructs, without determining whether one response or approach was more 'accurate' than another. The use of the completed TDF allowed for the synthesis of different perspectives on a single topic and demonstrated the shortcomings of the theory. Rather than restricting or compromising the findings, the use of a critical realist perspective allowed all of this knowledge to be compared and contrasted and viewed as multiple perspectives on a whole, rather than contradictions.

6.3 Strengths and limitations

The work in this thesis has a number of strengths and limitations, some of which are closely related, discussed below by topic. Each study chapter also comprises a discussion section which includes a consideration of strengths and limitations. Therefore, strengths and limitations of the thesis as a whole are considered here.

6.3.1 Balance of two substances

In painting, the term 'simultaneous contrast' is used to describe the phenomenon of two colours which when placed next to each other appear lighter or darker in tone than they do in isolation, or next to a different colour. For example, when placed next to the colour black, the colour yellow may appear brighter or more vivid than if observed in isolation, or if observed next to the colour white.

By examining the use of tobacco and cannabis, and the conceptualisation of both, this thesis sought to draw out a similar effect of simultaneous contrast between the two substances, during both the data collection and analysis process. For example, when asked to compare motivation to quit tobacco and then cannabis, participants may have become aware of a

greater contrast between their relative motivations, by dint of being asked the two questions consecutively. This creates the potential for a more extreme positioning on a spectrum but has also provided greater clarity about why and how the two substances are conceptualised so differently. This is one of the first studies to look at quitting experiences from co-users, rather than of tobacco users and then cannabis users; this provides unique insight into the interaction between the two, as well as relative experiences of both.

Throughout the studies, the author sought to ask all questions in relation to both tobacco and cannabis, without prejudicing responses by making prior assumptions about likely differences between the two substances. For example, during qualitative interviews, participants were asked about their access to both tobacco and cannabis. Access to cannabis rather than tobacco may have appeared to be a more pertinent question since cannabis is illegal. However, by applying the rigour of asking the same questions about both substances, novel findings emerged such as mothers purchasing tobacco for their teenager, to avoid them purchasing illegal tobacco. This was mirrored by the finding that for some their first access to cannabis was within the family home, either endorsed or not, using a family member's supply.

The qualitative analysis process demonstrated the weighting of discussion for both substances; whilst tobacco use elicited far less discussion than cannabis use, tobacco quitting processes however were a rich source of discussion compared to cannabis quitting processes. The highlighted contrasts between two substances when looked at through the same lens and within the same individual at the same point in time, and the meta-analysis findings demonstrating differing intervention outcomes, are one of the key strengths of this thesis.

6.3.2 Recruitment

The second two studies in the thesis recruited participants from a relatively under-explored setting, Further Education colleges, and used a range of personal questions which revealed a richly diverse sample. Recruitment of young adults into research is challenging; since it is a period of transition where some continue to full time or part time education, employment, and may move away from the family home, or may return to live there episodically. This thesis has demonstrated that using FE colleges as a recruitment setting provides a population perhaps more representative of the general population as a whole, compared to

higher education students, and is worth pursuing in future health related research. However, a very small number of colleges agreed to participate despite a large number being approached. This suggests that more preparatory work may be required with the sector as a whole, and that alternative approaches in addition to writing formally may be required in order to encourage participation.

6.3.3 Complexity of questionnaire

The relatively small sample size may be considered a limitation of the questionnaire survey. Whilst the sample size was reasonable considering it was seeking quite a specific population, the complexity of the survey limited the analysis and interpretation possible. The survey aimed to investigate the details of use and quitting behaviours across two substances, necessitating a complex survey structure. This meant that for some questions about a specific scenario, the numbers were often too small to produce a meaningful result. In a larger overall sample, the size of these smaller groups of responses would have increased; but the relative size of some of the detailed questions would have remained less than the survey as a whole. There is a balance to be struck between detail and 'power' in survey design, and future surveys exploring tobacco and cannabis use might benefit from using a 'think aloud' preparatory study as part of a process of co-production. This may elucidate which details are more relevant than others, and may assist in addressing some of the apparently inconsistent responses seen to the frequency of use questions. Despite the small sample recruited to the survey, a reasonable sample size was recruited for the qualitative interview study.

6.3.4 Quitting experiences

The second limitation in terms of sample recruitment lies in the change behaviours seen in tobacco and cannabis use. The thesis sought to explore the experiences and attitudes of people who had considered, or made quit attempts, and extended the age range up to the age of 30 in an attempt to capture respondents who had started to make changes to their use. However, only a very small number of people over the age of 20 responded to the survey, and the majority were still using both substances. This limited the findings that could be inferred about the quitting processes in any detail, since very few had maintained cessation. The findings demonstrated that participants reported large fluctuations in use of both substances, which appeared to take place whether the young adult was considered

'quitting' or not, which raises the question of how useful the accurate smoking status of a young adult on any given day is, for example. To gain a detailed understanding of quitting processes which are maintained, a different strategy may be required, to capture the experiences of older participants, including those who have accessed treatment or support.

6.4 Implications for research, policy and practice

Chapter 5 has presented a synthesis of results and included suggested intervention opportunities, which already provides some policy and practice implications. The implications presented here are therefore summaries which aim to raise implications not previously discussed.

6.4.1 Research

The findings from the systematic review indicate that co-use interventions are scarce and require development and testing in controlled studies. The theoretical basis for addressing two substances additionally requires further work, in order to provide a foundation from on which to develop dual, simultaneous, sequential or multi-substance interventions to address co-use.

Future research studies which address either tobacco or cannabis should measure both, pre and post, in order to build the evidence base on the impact of one on the other.

The survey findings indicate that detailed questions about co-use are warranted, although a balance needs to be struck between complexity and recognition of the fluctuation in use seen in this age group. These findings showed most used herbal cannabis, but qualitative findings made reference to blunt use, which was not expected. A full range of types of cannabis including routes of administration should be investigated in future cross-sectional studies.

Accurate capture of co-use proved a challenge, and apparently inconsistent responses to questions about co-use were seen. Involving young adults in survey design is required to better understand how to ask such questions, and to address reasons for potential inconsistencies in responses. This thesis undertook the survey before qualitative interviews; carrying out the qualitative interviews first may have informed the process of survey design and addressed some of these issues.

Motivation to address cannabis was found to be much lower than tobacco. As described, the motivational intervention used by Becker (2014) prior to the co-use intervention warrants further attention (Becker et al., 2014). A similar motivational intervention may be useful as part of a brief intervention, a screening session, or to coincide with a tobacco use intervention when co-use is established. Research is required to develop such an intervention in the context of UK young adults.

6.4.2 Policy

Findings from all three studies indicate that routine screening for tobacco, cannabis and mental health disorders is warranted, given the co-occurrence and the complexity of the relationship. Where tobacco or cannabis use is assessed, the likelihood of co-use needs routine exploration, and should be built into clinical service policy. A process for ensuring practitioners are confident to ask and safely record use of cannabis, particularly in services which do not routinely monitor illegal drug use, should be established. Service users should be reassured they are able to disclose use without concern of unanticipated consequence, and with an understanding of how this information is shared across healthcare record systems (Sumodhee et al.,).

The dearth of accessible, credible, critically reviewed information on cannabis use, risks and harms including co-use of tobacco, and the contrast with the participants' understanding of tobacco related risks and harms is starkly described in the qualitative findings. The size of the evidence base relating to cannabis use including ways to address use and effective interventions when considered alongside the number of people who use it regularly, the potential for harm specifically among this age group at high risk of psychosis, and the increase in treatment demand as described in Chapter 1 is alarming. Establishing an evidence base relating to an illegal substance is challenging, but until means and resources are harnessed to address these challenges, young adults are likely to continue to use cannabis at a potentially increasing rate, and to practice harm reduction based on sometimes erroneous beliefs, having sought information from online discussion fora.

6.4.3 Practice

Findings from all three studies have highlighted the potential for tobacco used in joints with cannabis to be disregarded or not reported, and for co-users not to consider themselves as (tobacco) 'smokers'. Healthcare practitioners including smoking cessation practitioners and

substance misuse workers need to be aware of this; where cannabis is used, these findings demonstrate that it is most likely to be co-used with tobacco. Routine assessment of nicotine addiction alongside cannabis use assessment is warranted. Carbon dioxide monitoring may act as a tangible motivator for someone who uses cannabis and assumed their level will therefore be lower than a tobacco smoker; this may lead to an assessment of tobacco use not otherwise reported.

Where healthcare practitioners or other workers in a supportive role with young adults identify co-occurrence of mental health and tobacco or cannabis use, this warrants further exploration. The findings in this study indicate that the relationship between all three is multi-faceted and complex, and even multi-directional. Cannabis may be seen as either, or at times simultaneously, a source and a salve of mental health problems and this will affect risk perception, harm reduction practice and motivation to address use.

Findings from both the survey and interviews suggested that rather than being continuous, use of either tobacco and cannabis, and co-use, is characterised more by episodic fluctuations. Cannabis users who described themselves as 'still using cannabis' in fact described periods of abstinence sometimes, but not always, intentional. This suggests that harm reduction is practised by co-users, and this may be harnessed as useful motivation where problematic use is identified. This also presents an opportunity to correct erroneous beliefs, notably identified about the production of cannabis and assessment of THC.

6.5 Dissemination of findings

Findings from this thesis have been presented at academic conferences as listed at the start of the thesis, and in an academic journal (Walsh et al., 2020). Further dissemination is planned and described here, with a view to increasing the impact of the findings.

6.5.1 Academic domain

A journal paper combining findings from the survey and qualitative interview studies is planned, highlighting the use of mixed methods to produce novel findings in a unique and diverse sample of young adults. The communications department of the faculty will be contacted, to discuss options for broader dissemination, including making a short video.

The systematic review and meta-analysis has already been published in a high-impact journal, and part of the rationale for the use of Bayesian meta-analysis including

establishing a method for repeating the review, incorporating evidence from single substance interventions for tobacco and cannabis which measured use of both, as well as future co-use interventions in order to build the evidence base.

Findings from the quantitative study has been presented at five conferences, and qualitative findings will be presented at Lisbon Addictions 2022 as part of a structured session on co-use, which I have co-convened.

6.5.2 Clinical Practice

Throughout the thesis process, I have maintained regular contact with my local mental health trust where I previously worked for many years and have had the opportunity to present my study proposals and early findings to three difference services: the trust-wide tobacco dependence treatment team; the trust-wide Dual Diagnosis network and the Cannabis Clinic based in an Early Intervention Psychosis team. I will return to present the final outcomes to each service and will have the opportunity to discuss future directions for the research and practice implications within the Trust and potentially beyond.

Alongside the thesis, I was commissioned by NCSCT to write a briefing for smoking cessation practitioners on cannabis use, published in 2020; ongoing contact with the organisation will determine opportunities for dissemination of the thesis findings to smoking cessation practitioners.

6.5.3 Further Education Sector

As part of good research practice, a lay summary of the thesis findings will be sent to all participants who requested this, and to each of the participating colleges. Further, an offer to present the findings in more detail, either in person or online, will be made to each college.

In addition, a lay summary and thesis abstract will be sent to the Research Unit at the Association of Colleges. The Association is a non-profit membership organisation which seeks to provide a national voice for the FE sector, and to champion and support colleges. An offer to present the findings will be made in order to highlight the health issues raised in this thesis, the intervention opportunities which may include provision of substance misuse services including smoking cessation and lastly the value of representing the FE student body within research, and therefore potentially policy. This offer will be made in the hope

that this might lead to further opportunities for both dissemination, discussion about increasing the impact of the findings, and future collaboration opportunities.

6.6 Author reflections

The process of carrying out the research and writing up the findings of this thesis has been rewarding and enjoyable. The opportunity provided by a PhD programme facilitated by funding received is a privilege, and I have thoroughly appreciated the opportunity to focus and investigate a single topic in such depth and to work creatively to produce a coherent body of work on this.

As I conclude this piece of work I reflect on how little reference is made to the practice of nursing, and to typical nursing settings for clinical practice, despite being a nurse and carrying out the study in a nursing faculty. However, the experience I have gained as a mental health nurse, working with young adults and in particular those attending a cannabis clinic, has infused every aspect of how this research has been conducted. Mental health nursing in particular is delivered in a wide range of clinical and community settings, and requires creative, adaptive use of skills and knowledge. It is hoped that the work in this thesis is beneficial to mental health nurses, and anyone else working with young adults, or with co-users in any setting. The original idea for the study was based on a gap in evidence; the lack of co-treatment options for the common practice of co-use, and the paradox that in life people bring these two substances together, but this reality is not reflected by health and treatment services, which separate tobacco and cannabis in every way possible. Treatment for tobacco is resourced, provided and underpinned by a different model of practice, different funding streams and different commissioning structures to cannabis. As a health professional myself, I was struck by the way in which the tools and treatment models provided do not reflect the way these substances are used; i.e. the person and their way of using substances is not centred.

My experience and practise as a nurse also equipped me to feel confident in investigating experiences, thoughts, beliefs with young adults both on the phone and in person. Mental health nursing provides unique and privileged contact with others, and I was able to make use of my experience in developing meaningful, valid relationships in a short space of time, and to translate that into the research setting. I am also fortunate to have had the

opportunity to directly impact upon and learn from fellow health professionals practice, through my contacts in the local mental health Trust. This process has informed and greatly enhanced the work in this thesis. It makes for a richer, more rounded researcher, and a richer more rounded health professional, and I am grateful to have had that opportunity.

6.7 Conclusions

Co-use of tobacco and cannabis by young adults is a common yet complex phenomenon. The evidence base of interventions to address co-use is sparse, and remains untested. Despite co-administration being common, there are important differences in use and quitting expectations and experiences of both substances, indicating that assessment and better understanding of the impact of co-use is required to adequately address co-use. In the absence of a robust evidence base on cannabis risks, young adults use their own knowledge to adopt harm reduction practices, including management of mental health, which requires action from a range of settings. Tobacco-related harm through co-administration is under-played by young adults and under-recognised more broadly.

Interventions to measure and address co-use in a number of settings are required, including adaptations to existing interventions and new interventions which reflect the context of young adult use and are credible and acceptable to young adults.

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Chapter 8: Appendices

8.1 Appendix 1: Ethical approvals

Research Ethics
Office

Franklin Wilkins Building
5.9 Waterloo Bridge Wing
Waterloo Road
London SE1 9NH
Telephone 020 7848 4020/4070/4077
rec@kcl.ac.uk

KING'S College LONDON

Ms Hannah Walsh

20 September 2018

Dear Hannah,

Reference Number: HR-17/18-7583

Study Title: Co-use of tobacco and cannabis

Review Outcome: Approval with Provisos

Thank you for submitting your application for the above project. I am pleased to inform you that your application has now be approved with the provisos indicated at the end of this letter. All changes must be made before data collection commences. The Committee does not need to see evidence of these changes, however supervisors are responsible for ensuring that students implement any requested changes before data collection commences.

Please ensure that you follow all relevant guidance as laid out in the King's College London Guidelines on Good Practice in Academic Research (http://www.kcl.ac.uk/college/policyzone/index.php?id=247).

For your information, ethical approval has been granted for 3 years from 20 September 2018. If you need approval beyond this point, you will need to apply for an extension at least two weeks before this. You will be required to explain the reasons for the extension. However, you will not need to submit a full re-application unless the protocol has changed. If you have been granted approval for only 12 months, you will not be sent a reminder when it is due to lapse.

Ethical approval is required to cover the data-collection phase of the study. This will be until the date specified in this letter. However, you do not need ethical approval to cover subsequent data analysis or publication of the results.

For secondary data-analysis, ethical approval is applicable to the data that is sensitive or identifies participants. Approval is applicable to period in which such data is accessed or evaluated.

Please note you are required to adhere to all research data/records management and storage procedures agreed to as part of your application. This will be expected even after the completion of the study.

If you do not start the project within three months of this letter please contact the Research Ethics Office.

Please note that you will be required to obtain approval to modify the study. This also encompasses extensions to periods of approval. Please refer to the URL below for further guidance about the process:

https://internal.kcl.ac.uk/innovation/research/ethics/applications/modifications.aspx

Please would you also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

If you have any query about any aspect of this ethical approval, please contact your panel/committee administrator in the first instance (https://internal.kcl.ac.uk/innovation/research/ethics/contact.aspx)

We wish you every success with this work.

Yours sincerely,

Mr James Patterson
Senior Research Ethics Officer

For and on behalf of

Mr Chris Webb, Joint Interim Chair

PNM Research Ethics Subcommittee

Major Issues (will require substantial consideration by the applicant before approval can be granted)

Minor Issues related to application (the reviewer should identify the relevant section number before each comment)

1. Section C6 and Information Sheet: Provide consistent information about the prizes offered.

2. Section C7a: Please note that you are not required to issue the Study 1 participants with a consent form. Completion of a survey, in itself, implies consent.

3. Section C9 and Information Sheet: Specify an exact date in August 2019 as the deadline for withdrawal of participant data.

4. Section H6: Please ensure that gatekeeper permissions can be made available to the Research Ethics Office upon request.

Minor Issues related to recruitment documents

5. Information Sheets: Include departmental postal addresses within your contact details.

Advice and Comments (do not have to be adhered to, but may help to improve the research)

Research Ethics
Office

Franklin Wilkins Building
5.9 Waterloo Bridge Wing
Waterloo Road
London SE1 9NH
Telephone 020 7848 4020/4070/4077
rec@kcl.ac.uk

KING'S College LONDON

31/05/2019

Dear Hannah,

Reference Number: RESCM-18/19-7583

Study Title: Co-use of tobacco and cannabis

Modification Review Outcome: Full Approval

Thank you for submitting a modification request for the above study. This is a letter to confirm that your request has now been granted Full Approval.

If you have any questions regarding your application please contact the Research Ethics Office at rec@kcl.ac.uk.

Kind regards

Mr James Patterson

Senior Research Ethics Officer

on behalf of

PNM Research Ethics Subcommittee

8.2 Appendix 2: College distribution letter

Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care

James Clerk Maxwell Building
57 Waterloo Road
London SE1 8WA
Telephone 0207 848 3625

Principal's Office

College of Further Education

Date

Dear Principal,

Re: Tobacco and cannabis co-use study

I am writing to invite your college to participate in an important research study of young adult tobacco and cannabis co-use.

Rationale for study: Tobacco and cannabis are the two of the most frequently used substances by young adults and are frequently used in combination. Each substance poses significant harms to the developing brain and body, and early intervention is essential. Increasing numbers of young adults are presenting to substance misuse services requiring cannabis treatment, and evidence-based treatment is urgently needed to allow students to achieve their potential at this crucial age.

Why FE colleges? I am particularly keen to recruit young adults within further education settings, as this population is under-represented in research studies; the majority of research regarding young adult health and wellbeing takes place in university (HE) settings. It is vitally important that health and wellbeing interventions understand the needs of a diverse group of young adults, in order to target treatment to those who need it most.

About me: I am a mental health nurse and a PhD researcher at King's College London, and my research focuses on understanding young adult tobacco and cannabis co-use and developing interventions to help young adults address their tobacco and cannabis use.

The study: Tobacco and cannabis co-use: survey and interview study

Study 1: questionnaire survey

- This survey will recruit participants aged 16-30 who currently use both tobacco and cannabis, or who have used both in the last 6 months
- The survey is online, using Bristol Online Survey platform, regularly used within the university sector for research purposes.
- Respondents can choose to remain anonymous, or to leave their contact details for the purposes of entering a prize draw, as an incentive to participate
- Respondents can also choose to leave their contact details to participate in study 2

Study 2: interviews

- This survey recruits participants from study 1 who are willing to discuss their tobacco and cannabis use, and views and attitudes on stopping use, in more depth
- The interview would be carried out either in person or by telephone

Requirements: The online survey would ideally be sent out via email to all enrolled students, with the explanation that it is not related to the college in anyway. It would include the link to an external survey for students to click on.

Feedback: On conclusion of the study I would be more than happy to present the findings to the college, staff and/or students.

I have attached a copy of the survey itself. All responses will be kept securely on KCL servers, personal details will only be kept for as long as required and accessed only by the main researcher. Ethical approval from King's College London has been sought.

I hope that you will consider participating in this research study, which will provide important information about how to support young adults in developing healthy behaviours.

Please could you let me know via email: Hannah.walsh@kcl.ac.uk if you are willing to participate, and of course if you have any questions,

Yours sincerely,

Hannah Walsh

BA, MSc, MRes, RMN

PhD Student

hannah.walsh@kcl.ac.uk

https://kclpure.ac.uk/portal/hannah-walsh

Email content for colleges to distribute.

Calling all smokers – answer a survey for a chance to win £100 vouchers – Apple or Asos?!

A research team from King's College London want to know more about young adults and their use of tobacco AND cannabis, to understand how best to help people who smoke both.

We would love to hear from you!

✓ Aged between 16 – 30?

✓ Currently, or recently used tobacco AND cannabis?

✓ Enrolled as a student in the college?

Then click the link below to access the survey for your chance to win £100 vouchers!

LINK TO SURVEY HOSTED ON BOS

Want some more information?

- the link takes you to a separate website – it isn't possible for your college to know if you have accessed the survey or not, or your answers
- the questions are about you and what you think about using tobacco and cannabis – you don't need to give any details you don't want to
- the study has been given ethical approval AND your college has agreed to take part
- all information given is kept anonymously – none of your personal details will be shared
- Still not sure? There is more information in the first page of the survey – you can read this before you make up your mind

8.3 Appendix 3 Study information sheets + consent forms

INFORMATION SHEET FOR PARTICIPANTS

Ethical Clearance Reference Number: HR-17/18-7583

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Tobacco and cannabis co-use

I would like to invite you to participate in this research project which forms part of my **PhD** research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

The purpose of the study is **to understand more about how people use tobacco and cannabis together, and how best to help people stop using tobacco and cannabis.**

Why have I been invited to take part?

You are being invited to participate in this study because **you have stated you currently use, or have recently used both tobacco and cannabis, and are aged between 16 – 30 years old.**

What will happen if I take part?

If you choose to take part in the study you will be asked to **complete an online survey. You will be asked some questions about your age, and then about your tobacco and cannabis use, and your views and experiences of trying to reduce or stop. You won't be asked any details about where you use cannabis, or where you get it from. The survey might take around 20 minutes to complete.**

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in anyway. Once you have read the information sheet, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to indicate this in the survey.

Incentives

As an incentive to take part, you have the opportunity to win one of 3 prizes of £100, £75 or £50 vouchers, either for Apple or for Asos. You will need to give your contact details to enter the draw, but these will not be linked to your survey responses.

What are the possible risks of taking part?

There are no potential risks to taking part.

What are the possible benefits of taking part?

You might find it useful to help you think about your tobacco and cannabis use, and whether you would like to reduce or stop.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

- **All survey responses will be stored in secure online storage respositories. These will not contain any person identifying information.**
- **If you choose to enter the prize draw, or leave your details for participation in a future study, then your personal details will be kept securely in an online storage repository. These will be kept for as long required to facilitate contact, then destroyed.**
- **The response data which is anonymous will be retained until the completion of the study and then for up to 7 years. The data will be stored in a King's College London data archive.**
- **The data will be shared with the research team, and may be shared with other researchers who make a specific, formal request to access. This data is anonymous.**

Data Protection Statement

The data controller for this project will be King's College London (KCL). The University will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under GDPR is a 'task in the public interest' You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the King's College London Data Protection Officer Mr Albert Chan info-compliance@kcl.ac.uk. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

What if I change my mind about taking part?

You are free withdraw at any point of the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw from the survey whilst you are completing it by navigating away from the page, without pressing the final 'submit' button. After this point it is not possible to withdraw your data, as it isn't possible to identify who has provided which responses.

How is the project being funded?

The main researcher, Hannah Walsh, is funded by a PhD Nightingale scholarship, which was awarded by the Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care.

What will happen to the results of the study?

The results of the study will be published in the main researcher's PhD thesis. In addition, the results will be published in an academic journal, and presented at academic conferences. They may also be presented at participating colleges. The data presented will not be identifiable to individuals or to specific colleges in anyway.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

Hannah Walsh

Hannah.walsh@kcl.ac.uk

Tel. 0207 848 3625

Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care

57 Waterloo Road

London SE1 8WA

What if I have further questions, or if something goes wrong?

If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact King's College London using the details below for further advice and information:

Dr Maria Duaso, supervisor

Maria.duaso@kcl.ac.uk

0207 8484 3694.

Thank you for reading this information sheet and for considering taking part in this research.

INFORMATION SHEET FOR PARTICIPANTS

Ethical Clearance Reference Number: HR-17/18-7583

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

Title of study

Tobacco and cannabis co-use

I would like to invite you to participate in this research project which forms part of my PhD research. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

The purpose of the study is to understand more about how people use tobacco and cannabis, and how best to help people reduce or stop using tobacco and cannabis.

Why have I been invited to take part?

You are being invited to participate in this study because you have responded to an online survey, and indicated that you currently use tobacco and cannabis, or have recently used tobacco and cannabis.

What will happen if I take part?

If you choose to take part in the study you will be invited to an interview, either in person at a convenient location (i.e. your college, or at King's College London) or on the phone. The interviewer will ask you questions about your use of tobacco and cannabis. It is entirely up to you what information you share about yourself. You will not be asked for any details about where you access cannabis.

Do I have to take part?

Participation is completely voluntary. You should only take part if you want to and choosing not to take part will not disadvantage you in anyway. Once you have read the information sheet, please contact us if you have any questions that will help you make a decision about taking part. If you decide to take part we will ask you to sign a consent form and you will be given a copy of this consent form to keep.

Incentives

You will be given a shopping voucher worth £25 for taking part in the interview study.

What are the possible risks of taking part?

There are no foreseeable risks of taking part.

What are the possible benefits of taking part?

You might find it useful to discuss your use of tobacco and cannabis, and reflect on whether you would like to change your use.

Data handling and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

- The interview will be recorded, then transcribed (written up).
- The data you provide in your interview will be anonymised (given a pseudonym) and any identifying information removed from the transcript.
- The audio recordings and transcriptions will be stored in secure online repositories.
- The audio recordings may be sent to a professional transcription service, they will also be required to comply with GDPR 2016.
- The audio recordings will be deleted once transcribed. The transcriptions will be kept until the completion of the study, and then for a further 7 years, and stored in a secure online data archive managed by King's College London.
- Data will be shared with the research team, and on receipt of a formal request with other researchers, please note this data will be anonymised.

Data Protection Statement

The data controller for this project will be King's College London (KCL). The University will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under GDPR is a 'task in the public interest' You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments and requests about your personal data can also be sent to the King's College London Data Protection Officer Mr Albert Chan info-compliance@kcl.ac.uk. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

What if I change my mind about taking part?

You are free withdraw at any point of the study, without having to give a reason. Withdrawing from the study will not affect you in any way. You are able to withdraw your data from the study up until 31st August 2019 after which withdrawal of your data will no longer be possible as it will have been committed to the final report. If you choose to withdraw from the study we will not retain the information you have given thus far.

How is the project being funded?

The main researcher, Hannah Walsh, is funded through a PhD Nightingale scholarship from the Faculty of Nursing, Midwifery and Palliative Care, King's College London.

What will happen to the results of the study?

The results of the study will be summarised in the main researcher's PhD thesis. Additionally, findings will be published in an academic journal, presented at academic conferences and at participating colleges. No identifying information will be published relating to individuals or to colleges.

Who should I contact for further information?

If you have any questions or require more information about this study, please contact me using the following contact details:

Hannah Walsh

Hannah.walsh@kcl.ac.uk

07407 538127

Florence Nightingale Faculty of Nursing, Midwifery and Palliative Care

57 Waterloo Road

London SE1 8WA

What if I have further questions, or if something goes wrong?

If this study has harmed you in any way or if you wish to make a complaint about the conduct of the study you can contact King's College London using the details below for further advice and information:

Dr Maria Duaso (supervisor)

Maria.duaso@kcl.ac.uk

0207 848 3694

Thank you for reading this information sheet and for considering taking part in this research.

In the interviews we discuss topics that might get you thinking, so I've listed below some organisations in case you'd like to seek some support, or further information:

If you are concerned about your mental health, and would like more information, you can either:

- *go to www.mind.org.uk.*
- *You might also want to seek support either from your college health or welfare service OR*
- *via your GP. They can put you in touch with a mental health service if that's what you need.*

If you are thinking about reducing or stopping cannabis, and would like some more information and support, see below.

- ***www.talktofrank.co.uk** a website providing information about drug use and local services that can help*
- ***saferuselimits.co** a website providing guidelines on safer drug use*

*To talk to someone about your **drug use**, you can …*

- *ask your GP for more information*
- *ask your college welfare department for more information on local services OR*
- *look up a local service via this website: https://www.talktofrank.com/need-support?ID=108*

*If you are thinking about **stopping cigarettes**, see below for information and support*

- *ask your college health or welfare service;*
- *ask in your local pharmacy for support;*
- *search for information and support online https://www.nhs.uk/smokefree;*
- *for London services: https://london.stopsmokingportal.com/*

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: Tobacco and cannabis co-use

King's College Research Ethics Committee Ref: HR-17/18-7583

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

	Please tick or initial
I confirm that I understand that by ticking/initialling each box I am consenting to this element of the study. I understand that it will be assumed that unticked/initialled boxes mean that I DO NOT consent to that part of the study. I understand that by not giving consent for any one element I may be deemed ineligible for the study.	☐

	Please tick or initial
1. I confirm that I have read and understood the information sheet dated 24th September 2018, v1 for the above study. I have had the opportunity to consider the information and asked questions which have been answered to my satisfaction.	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason, until 31st August 2019.	
3. *I consent to the processing of my personal information for the purposes explained to me in the Information Sheet. I understand that such information will be handled in accordance with the terms of the General Data Protection Regulation.	☐
4. *I understand that my information may be subject to review by responsible individuals from the College for monitoring and audit purposes.	☐
5. I understand that confidentiality and anonymity will be maintained and it will not be possible to identify me in any research outputs	☐
6. I understand that the information I have submitted will be published as a report and I wish to receive a copy of it.	☐
	☐

7. I consent to my interview being audio recorded.

8. I understand that information provided in the interview will remain confidential, unless a very risk of harm is identified, in which case confidentiality may need to be broken. I understand that the researcher will inform me of this. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Researcher	Date	Signature

8.4 Appendix 4: Questionnaire

TDF domains shown in purple

Questionnaire on co-use of tobacco and cannabis

Developed by: Hannah Walsh, PhD student, King's College London, Hannah.walsh@kcl.ac.uk

Notes

- Content to be written into a Bristol Online Survey
- Navigation through questionnaire shown in table below

Section	Content	Which participants?	Additional notes
Introduction	Participant information and consent	All who click on link	
Section A	Screening questions, demographic information, current level of tobacco and cannabis use	All who click on link	Screened out participants complete intro + section A only, and are invited to provide details and enter into draw, they are not informed they haven't "passed" screening in case that encourages repeated completion of survey
Section B	Details of co-use	Screened "in" participants only	
Section C	Previous quit or reduction attempts	As above	Each participant then answers ONE of the following additional sets of questions, depending on their current use and previous quit/reduction attempts: **BQS**: Both quit success **BQT**: Both quit tried **TQS**: tobacco quit success **TQT**: Tobacco quit tried **CQS:** Cannabis quit success **CQT**: Cannabis quit tried **ERT**: Either reduction tried **NRT**: No reduction tried On completion, continue to section D

Section D	Future quit intention	All, unless they have indicated in NRT that they have no intention to quit	
End	Information provided on treatment services, invitation to give details for entry into prize draw and for study 2	All	

Introduction

Text:

This questionnaire is part of a research project being carried out at King's College London. The project is looking at tobacco and cannabis use amongst young adults, with the aim of finding out more about how young adults reduce or stop using tobacco or cannabis. You are invited to take part - it is completely up to you if you wish to do so or not. The following document provides more information about the research project.

AND

Study 1 information sheet content (see separate document attached)

AND

Study 1 consent form (see separate document attached)

Section A

A1	Please give your age		
A2	**When was the last time you smoked TOBACCO (either pre-rolled or hand-rolled cigarettes, or tobacco in a cannabis joint)?**	a. I have never smoked tobacco	*[exclude at end of this section]*
		b. Over 6 months ago	*[exclude at end of this section]*
		c. In the last 6 months	
		d. In the last month	
		e. In the last week	
A3	**How often do you currently smoke tobacco?**	a. Not at all	*[double checking if quit = <6m, if not, exclude]*
		b.Less than once per week	
		c. Once or twice a week	
		d. 3-5 times per week	
		e. everyday	
A4	**When was the last time you smoked CANNABIS?**	a. I have never smoked cannabis	*exclude at end of section*
		b. Over 6 months ago	*exclude at end of section*
		c. In the last 6 months	
		d. In the last month	
		e. In the last week	
A5	**How often do you smoke cannabis?**	a. Not at all	
		b. Less than once per month	

		c. More than once per month	
A6	**Please select your gender**	Male	
		Female	
		Other	
A7	**How would you describe your ethnicity?**	British	A
		Irish	B
		Any other white background	C
		White and Black Caribbean	D
		White and Black African	E
		White and Asian	F
		Any other mixed background	G
		Indian	H
		Pakistani	J
		Bangladeshi	K
		Any other Asian background	L
		Caribbean	M
		African	N
		Any other Black background	P
		Chinese	R
		Any other ethnic group	S
		Prefer not to say	Z
A8	**Please select which level you are studying at**	entry-level (e.g. Skills for Life or ESOL)	
		- Foundation/Level 1	
		- GCSEs/NVQ2/other Level 2 qualification	

		- A/AS-Levels/NVQ3/BTEC National/Access Course/Level 3 qualification	
		-Apprenticeship	
		- Foundation degree/HNC/HND/Level 4 qualification	
		- Undergraduate qualification (e.g. BA, BSc, BEd)	
		- Other …….	
		- I’m not sure	

Section B

Section B					TDF DOMAIN (NA)
B1		**Do you currently smoke tobacco cigarettes?**	yes/no I haven't smoked tobacco for at least a month	skip B2, go to B3	
B2	**a.**	**Please rate your addiction to tobacco cigarettes on a scale of 0-100, where 0=I am not at all addicted, and 100= I am extremely addicted to cigarette smoking**			
	b.	**On days that you do smoke, on average how many tobacco cigarettes do you smoke?**	0-5		
			6 to 10		
			11 to 20		
			21-29		
			30+		
	c.	**Usually, how soon after waking do you smoke your first tobacco cigarette on days that you smoke?**	.. .minutes		
	d.	**For you, quitting tobacco cigarettes for good would be**	impossible		
			very difficult		
			fairly difficult		
			fairly easy		

			very easy		
	e.	**“After a few hours without smoking a tobacco cigarette, I feel an irresistible urge to smoke a tobacco cigarette”**	totally disagree		
			somewhat disagree		
			neither disagree nor agree		
			somewhat agree		
			fully agree		
B3	**a.**	**How many days in the past month have you smoked cannabis?**	0 days		
			1-5 days		
			5-10 days		
			10-20 days		
			20-25 days		
			Every day		
	b.	**Please indicate which of these methods you have used to consume CANNABIS in the last 6 months. Tick all that apply**	Smoked in a joint with tobacco		
			Smoking in a joint WITHOUT tobacco		
			Smoked in a pipe		
			Smoked in a waterpipe or bong		
			Dabbing (concentrates)		
			Used an e-cigarette with cannabis but WITHOUT nicotine		
			Used an e-cigarette with cannabis and WITH nicotine		

			Inhaled using a cannabis vaporiser		
			Via an ingested (eaten) method such as cookies, sweets etc		
			Other		
	c.	**Which of the above is the most common method in the last month? Select one only**			
	d.	**Which days of the week do you usually smoke cannabis?**	Mostly Mon- Fri		
			Mostly the weekends		
			Any day of the week		
	e.	**Think about the time you smoked the most cannabis in the last 6 months. How much cannabis do you think you consumed at that time, or how many joints do you think you smoked?**			
				Yes/No	
	f.	**Thinking about the last 6 months, have you found yourself in any of these situations?**	a. I smoked a cigarette in order to avoid smoking a joint (i.e. tobacco and cannabis rolled together)		
			b. I smoked a joint in order to avoid smoking a cigarette		
			c. After smoking a cigarette, I felt the need for a joint		
			d. After smoking a joint, I felt the need for a cigarette		

			e. If I drink alcohol, I don't usually smoke joints		
			f. When I smoke a lot of cannabis, I find myself smoking more cigarettes than usual		
			g. When I smoke a lot of cannabis, I find myself smoking less cigarettes than usual		
	g.	**In the past month, when you have smoked joints (of tobacco and cannabis, or just cannabis), did you share the joints with other people?**	On all occasions I shared with other people	Create scale from "always share" to "never share"	
			Most often I shared with other people		
			Half the time I shared with others, half the time alone		
			Most often I smoked cannabis without sharing with anyone else		
			I always smoke cannabis without sharing with anyone else		
	h.	**When you smoke a joint, please indicate in what proportion you USUALLY add tobacco**	100% cannabis, no tobacco at all		
			75% cannabis, 25% tobacco		
			50% cannabis, 50% tobacco		
			25% cannabis, 75% tobacco		
			I don't know		

	i.	**Please indicate what type of cannabis you have USUALLY used in the past month. Select one only.**	Resin/hash		
			Low strength, “herbal”		
			High strength, high potency, “skunk”		
			Other (please state)		
			Not sure		
			Select only one for each question		
B3	a.	**In the last year, have you ever smoked cannabis before midday?**	Never/ Rarely/Occasionally/Often/Very often		
	b.	**Have you ever had memory problems after using cannabis?**	as above		
	c.	**Have any family or friends every day you should use less cannabis?**			
	d.	**Have you tried to reduce or stop using cannabis without success?**			
	e.	**Have you experienced any problems as a results of using cannabis (e.g. arguments, fights, accidents, poor results at school or college)**			
B4	a.	**Have you ever experienced a mental health problem? (e.g. depression, anxiety, psychosis, self-harm)**	yes, over 6 months ago/yes, in the past 6 months/no	If no, skip B4b	
	b.	**Have you ever been in contact with a mental health service before? (either a referral, a meeting with a mental health professional, or a hospital stay)**	yes/no		

B5		**Please provide the first half of your home postcode AND the first digit of the second half (nb your address cannot be identified from this, only the area in which you live). For example, "SE16 4", or "N6 8"**			

Section C

Section C: Thinking about stopping or reducing the amount of tobacco and cannabis you smoke			**TDF domain**
C1	**In the last 6 months, which of these statements are true? Select one only. (By stopping we mean not using at all for at least a month).**	a. Yes, I have stopped BOTH tobacco and cannabis, and no longer smoke either of them at all	
		b. I have tried to STOP both tobacco and cannabis, but I still smoke both	
		b. I have stopped tobacco cigarettes, but still smoke cannabis	
		c. I have stopped cannabis, but still smoke tobacco cigarettes	
		d. I have only tried to stop using cannabis and not tried to stop using tobacco, I still smoke both	
		c. I have only tried to stop using tobacco and not tried to stop using cannabis, I still smoke both	
		c. No I have not made any attempts to stop either	

C2	**Did you think about stopping tobacco and cannabis at the same time? Select one of the following.**	a. Yes, but I thought it would be too difficult	Memory, attention + decision processes (C, Psych) Intentions (M, Ref) Beliefs about consequences (M, Ref)
		b. Yes but I thought it would be a bad idea	
		c. Yes but I had been advised not to	
		d. No, it didn't occur to me	
		e. No, I didn’t want to	
		f. I did try to stop both at the same time	
		g. other (please explain)	
C3	**In the past 6 months, have you tried to REDUCE the amount of tobacco and/or cannabis you smoke?**	Yes	
		No	
C5	**In the last 6 months, which of these statements are true? Select one only.**	a. I have tried to reduce using BOTH tobacco and cannabis	
		b. I have tried to REDUCE the amount of cannabis I use, but not the amount of tobacco I use	

		c. I have tried to REDUCE the amount of tobacco I use, but not the amount of cannabis	

Section D

Section D Future quit or reduction attempts			**TDF DOMAINS**
D 1	**This question refers to TOBACCO use in cigarettes only, not the tobacco you put in a joint. Which of the following statements describes you best? Select one.**	a. I don't want to stop smoking tobacco	Intentions (M, Ref)
		b. I think I should stop smoking tobacco but don't really want to	
		c. I want to stop smoking tobacco but haven't thought about when	
		d. I REALLY want to stop smoking tobacco but I don't know when I will	
		e. I want to stop smoking tobacco and hope to soon	
		f. I REALLY want to stop smoking tobacco and intend to in the next 3 months	
		g. I REALLY want to stop smoking tobacco and intend to in the next month	
D 2	**Who do you know who has quit smoking tobacco?**	a. friend	Social influences (O, Soc)
		b. family member	
		c. Girlfriend/boyfriend/ partner	
		d. no-one close to me has quit smoking tobacco	

D3	**Which of the following would motivate you to try and STOP smoking tobacco?**	a. concerns about health	Beliefs about consequences (M, Ref)
		b. illness of friend/relative	
		c. physical fitness	
		d. encouragement from friend/relative	
		e. cost of tobacco	
		e. restrictions on smoking at work/college	
		f. restrictions on smoking at home	
		g. Other…	
D4	**How confident are you about being able to stop tobacco in the future?**	a. I am confident I will be able to stop when I plan to	Beliefs about capabilities (M, Ref), Behavioural regulation (C, Psych)
		b. Not sure - I expect to find it a challenge	
		c. I am not confident – I don't think I'd be able to stop if I tried	
D5	**How would you try? (please select all that apply)**	a. Nicotine replacement therapy	Intention (M, Ref)
		b. An e-cigarette (i.e. "vaping")	
		c. Medication (indicate which if you know)	
		d. A mobile app (indicate which if you know)	
		e. a website	
		e. Seeing a smoking cessation advisor	
		f. I would go "cold turkey", and not try anything specifically	

		g. Other (please describe)	
D 6	**If you do stop smoking tobacco, what will help you to not start smoking again?**	Please describe	Social influences (O, Soc), Environmental context + resources (O, Phys)
D 7	**This question refers to CANNABIS use only. Which of the following statements best describes you? Select one.**	a. I don't want to stop smoking cannabis	Intention (M, Ref), Goals (M, Ref),
		b. I think I should stop smoking cannabis but don't really want to	
		c. I want to stop smoking cannabis but haven't thought about when	
		d. I REALLY want to stop smoking cannabis but I don't know when I will	
		e. I want to stop smoking cannabis and hope to soon	
		f. I REALLY want to stop smoking cannabis and intend to in the next 3 months	
		g. I REALLY want to stop smoking cannabis and intend to in the next month	
D 8	**How confident are you about being able to stop cannabis in the future?**	a. I am confident I will be able to stop when I plan to	Beliefs about capabilities (M, Ref), Behavioural regulation (C, Psych), Optimism (M, Ref)
		b. Not sure - I expect to find it a challenge	
		c. I am not confident – I don't think I will be able to stop if I tried	
D 9	**Which of these best describes you? Select one.**	a. I plan to stop smoking cannabis as well as stopping tobacco in cigarettes AND in a joint	Intention (M, Ref)

		b. I plan to stop smoking cigarettes, but still use tobacco in my joints	
		c. I plan to switch from cannabis joints to another form of cannabis consumption (please list)	
		d. I plan to smoke cannabis in a joint without any tobacco	

End

End	Thank you very much for taking the time to complete this questionnaire. The information you have provided will go towards developing tools to help young adults think about their tobacco and cannabis use.		
E1	**The researchers are also looking for people to interview about their use of tobacco and cannabis. This would mean either a face to face or phone interview of around 30 minutes, and you would be reimbursed £25 for your time. If you are interested in this, please tick the box**	Yes/no	If yes, provide contact details. These will be kept securely, and destroyed when no longer needed.
E2	**If you'd like to enter the prize draw for the chance to win vouchers worth £100 for either Apple store or ASOS (your choice) then please leave your details below. There are 3 prizes in total!**	Yes/no	If yes, provide contact details. These will be kept securely, and destroyed when no longer needed
General information	**If you are thinking about reducing or stopping cannabis, and would like some more information and support, see below.**		
	www.talktofrank.co.uk a website providing information about drug use and local services that can help		
	saferuselimits.co a website providing guidelines on safer drug use		
	If you are concerned about your mental health, and would like more information, go to www.mind.org.uk. You might also want to seek support either from your college health or welfare service, or via your GP. They can put you in touch with a mental health service if that's what you need.		
	To talk to someone about your drug use, you can …		

	a) ask your GP for more information b) ask your college welfare department for more information on local services or c) look up a local service here: https://www.talktofrank.com/need-support?ID=108		
	If you are thinking about stopping tobacco smoking, see below for information and support		
	ask your college health or welfare service; ask in your local pharmacy for support; search for information and support online https://www.nhs.uk/smokefree; for London services: https://london.stopsmokingportal.com/		

BQS: Both quit success

BQS1	**Which of the following most accurately describes how you stopped using both tobacco and cannabis. Select one of a, b or c.**	**a. I stopped using tobacco and cannabis at the same time, i.e. within the same week**	**a.i. please list your reasons for stopping both at the same time, select all that apply**	**i. I thought it would be easier to stop both at the same time**
TDF domain:			Memory (C, Psych) Environmental context and resources (O, Phys)	i.i.i. I was advised to stop both at the same time
				i.v. I had tried to stop both before, and learned it was better to stop both together
				v. Other (please list)
		b. I stopped using tobacco first, and then stopped using cannabis at least a week (or longer) later	b.i. When you had stopped using tobacco, but still used cannabis, which of the following statements is most accurate:	i.i. I stopped putting tobacco into my joints, and smoked cannabis in a joint without tobacco at all
				i.i.i. I stopped smoking tobacco cigarettes, I stopped putting tobacco in a joint and switched to a different form of using cannabis (please list)

				i.v. I stopped smoking tobacco cigarettes but still used tobacco in my joints
		c. I stopped using cannabis first, and then stopped using tobacco at least a week (or longer) later		
BQS2	**What motivated you to stop smoking tobacco?**	a. concerns about health	Environmental context + resources (O, Phys) Beliefs about consequences (M, Ref) Social influences (O, Soc)	
		b. illness of friend/relative		
		c. physical fitness		
		d. encouragement from friend/relative		
		e. cost of tobacco		
		f. restrictions on smoking at work/college		
		g. restrictions on smoking at home		
		h. Other…		
BQS3	**What motivated you to stop smoking cannabis?**	a. memory problems	Environmental context + resources (O, Phys) Beliefs about consequences (M, Ref) Social influences (O, Soc)	
		b. I was told to by family/friends		
		c. It had become difficult to use less		

		d. It had a negative impact on my studies/work		
		e. Legal issues, fines, accidents		
		f. cost		
		g. impact on sporting and/or physical fitness		
		h. other		
BQS4	**What methods did you use to stop using cannabis? Select all that apply.**	a. I used a medication (indicate which)		
		b. I used an app (indicate which)		
		c. I went to see a substance misuse use service/drugs counsellor		
		d. I didn't use any specific method or support, just tried not to use it		
		e. Other (please describe)		
BQS5	**What methods did you use to stop using tobacco? Select all that apply.**	a. Nicotine replacement therapy	a.i. Please state which: gum/skin patch/spray/other	
		b. An e-cigarette (i.e. "vaping")		
		c. Medication (indicate which if you know)		

		d. A mobile app (indicate which if you know)		
		e. a website (please state which)		
		e. Seeing a smoking cessation advisor	e.i. GP; pharmacy; college; other	
		f. I went"cold turkey", and did not try anything specifically		
		g. Other (please describe)		

BQT: Both Quit Tried

BQT1	**Thinking back to your most recent attempt to stop using both tobacco and cannabis, which of the following most accurately describes how? Select one of a, b or c.**	a. I stopped using tobacco and cannabis at the same time, i.e. within the same week	a.i. please list your reasons for stopping both at the same time, select all that apply	i. I thought it would be easier to stop both at the same time
				i.i.i. I was advised to stop both at the same time
				i.v. I had tried to stop both before, and learned it was better to stop both together
				v. Other (please list)
		b. I stopped using tobacco first, and then stopped using cannabis at least a week (or longer) later	b.i. When you had stopped using tobacco, but still used cannabis, which of the following statements is most accurate:	i.i. I stopped putting tobacco into my joints, and smoked cannabis in a joint without tobacco at all
				i.i.i. I stopped smoking tobacco cigarettes, I stopped putting tobacco in a joint and switched to a different form of using cannabis (please list)

				i.v. I stopped smoking tobacco cigarettes but still used tobacco in my joints
		c. I stopped using cannabis first, and then stopped using tobacco at least a week (or longer) later		
BQT2	**What was the outcome of your most recent quit attempt? Select one only.**	a. I started to use both tobacco and cannabis again		
		b. I stopped using tobacco, but carried on using cannabis		
		c. I stopped using cannabis, but carried on using tobacco		
BQT3	**What motivated you to stop smoking tobacco?**	a. concerns about health		
		b. illness of friend/relative		
		c. physical fitness		

		d. encouragement from friend/relative		
		e. cost of tobacco		
		e. restrictions on smoking at work/college		
		f. restrictions on smoking at home		
		g. Other (please state)		
BQT4	**What motivated you to stop smoking cannabis?**	a. memory problems		
		b. I was told to by family/friends		
		c. It had become difficult to use less		
		d. It had a negative impact on my studies/work		
		e. Legal issues, fines, accidents		
		f. cost		
		g. impact on sporting and/or physical fitness		
		h. impact on my mental health		
		i. other		
BQT5	**What methods did you use to stop using cannabis? Select all that apply.**	a. I used a medication (indicate which)		
		b. I used an app (indicate which)		
		c. I went to see a substance misuse use service/drugs counsellor/ (where)		
		d. I didn't use any specific method or support, just tried not to use it		
		e. Other (please describe)		

BQT6	**What methods did you use to stop using tobacco? Select all that apply.**	a. Nicotine replacement therapy	a.i. Please state which: gum/skin patch/spray/other	
		b. An e-cigarette (i.e. "vaping")		
		c. Medication (indicate which if you know)		
		d. A mobile app (indicate which if you know)		
		e. a website (please state which)		
		e. Seeing a smoking cessation advisor	e.i. GP; pharmacy; college; other	
		f. I would go "cold turkey", and not try anything specifically		
		g. Other (please describe)		
BQT 7	**What led to you starting to use tobacco again? Select all that apply.**	a. craving tobacco		
		b. Couldn't access NRT/medication		
		c. Found it too difficult		
		d. peer/family influence		
		e.I continued to use tobacco in joints, then started smoking cigarettes again. Other (please list)		
		f. Other (please list)		

TQT: tobacco quit tried

TQT1	**What motivated you to stop smoking tobacco?**	a. concerns about health	
		b. illness of friend/relative	
		c. physical fitness	
		d. encouragement from friend/relative	
		e. cost of tobacco	
		e. restrictions on smoking at work/college	
		f. restrictions on smoking at home	
		g. Other…	
TQT2	**What methods did you use to stop using tobacco? Select all that apply.**	a. Nicotine replacement therapy	a.i. Please state which: gum/skin patch/spray/other
		b. An e-cigarette (i.e. "vaping")	
		c. Medication (indicate which if you know)	
		d. A mobile app (indicate which if you know)	
		e. a website (please state which)	
		e. Seeing a smoking cessation advisor	e.i. GP; pharmacy; college; other
		f. I would go "cold turkey", and not try anything specifically	
		g. Other (please describe)	
TQT3	**Think about the last time you stopped used tobacco, how long did you manage to stop for?**	a. 24hrs	
		b. 1-5 days	

		c. 10-20 days	
		d. over a month	
TQT4	**What led you to start using tobacco again?**	a. Craving tobacco	Reinforcement (M, Aut)
		b. Couldn't access NRT/medication	Environmental context + resources (O, Phys)
		c. Found it too difficult (please explain)	Reinforcement (M, Aut), Emotion (M, Aut)
		f. peer/family influence	Identity + social role (M, Ref)
		g. I still used tobacco in my joints so I started using cigarettes again	Reinforcement (M, Aut)
		f. Other (please list)	

TQS 1	**What motivated you to stop smoking tobacco?**	a. concerns about health	
		b. illness of friend/relative	
		c. physical fitness	
		d. encouragement from friend/relative	
		e. cost of tobacco	
		f. restrictions on smoking at work/college	
		g. restrictions on smoking at home	
		h. Other…	
TQS 2	**What methods did you use to stop using tobacco? Select all that apply.**	a. Nicotine replacement therapy	a.i. Please state which: gum/skin patch/spray/other
		b. An e-cigarette (i.e. "vaping")	
		c. Medication (indicate which if you know)	
		d. A mobile app (indicate which if you know)	
		e. a website (please state which)	
		e. Seeing a smoking cessation advisor	e.i. GP; pharmacy; college; other
		f. I would go "cold turkey", and not try anything specifically	
		g. Other (please describe)	
TQS 3	**Do you still use tobacco in a cannabis joint?**	a. yes	
		b. no, I smoke cannabis joints without tobacco inside	

		c. No, I have changed the way I consume cannabis so I don't smoke joints anymore (state which)	Smoked in a pipe
			Smoked in a waterpipe
			Dabbing (concentrates)
			Using an e-cigarette with cannabis but WITHOUT nicotine
			Used an e-cigarette with cannabis and WITH nicotine
			Inhaled using a cannabis vaporiser
			Via an ingested (eaten) method such as cookies, sweets etc
			Other

CQS: Cannabis quit success

CQ S1	**What motivated you to stop smoking cannabis?**	a. memory problems	
		b. I was told to by family/friends	
		c. It had become difficult to use less	
		d. It had a negative impact on my studies/work	
		e. Legal issues, fines, accidents	
		f. to improve my mental health	
		g. Other (please list)	
CQ S2	**What methods did you use to stop using cannabis? Select all that apply.**	a. I used a medication (indicate which)	
		b. I used an app (indicate which)	
		c. I went to see a substance misuse use service/drugs counsellor/ (where)	
		d. I didn't use any specific method or support, just tried not to use it	
		e. Other (please describe)	
CQ S3	**When you stopped smoking cannabis, what happened to your tobacco cigarette consumption?**	a. it stayed the same as when I smoked cannabis	
		b. It increased	from how many CPD to how many more?
		c. it decreased	from how many CPD to how many less?

CQT: Cannabis Quit Tried

CQT1	**What motivated you to stop smoking cannabis?**	**a. memory problems**	
		b. I was told to by family/friends	
		c. It had become difficult to use less	
		d. It had a negative impact on my studies/work	
		e. Legal issues, fines, accidents	
		f. cost	
		g. impact on sporting and/or physical fitness	
		h. Impact on my mental health	
		i.other	
CQT2	**What methods did you use to stop using cannabis? Select all that apply.**	a. I used a medication (indicate which)	
		b. I used an app (indicate which)	
		c. I went to see a substance misuse use service/drugs counsellor/ (where?)	
		d. I didn't use any specific method or support, just tried not to use it	
		e. I went to see my GP	
		f. I went to see a Smoking Cessation Adviser	
		g. Other (please describe)	
CQT3	**Think about the last time you stopped used cannabis, how long did you manage to stop for?**	a. 24hrs	
		b. 1-5 days	

		c. 10-20 days	
		d. over a month	
CQT4	**The last time you tried to stop smoking cannabis, what was the outcome?**	a. I successfully stopped, and I no longer smoke cannabis, but I do smoke tobacco cigarettes	skip CQT5
		b. I successfully stopped using cannabis, and I now smoke less tobacco	skip CQT5
		b. I successfully stopped using cannabis, and I now smoke more tobacco	skip CQT5
		c. I started to use cannabis again	
		d. I started to use cannabis again but less than previously	
CQT5	**What led you to start using cannabis again?**	a. Craving	
		b. Found it too difficult	
		c. peer/family influence	
		d. Other (please list)	

ERT: Either Reduction Tried

ERT 1	**Please tick which of the following most applies to you. Select one only.**	**a. I have tried to reduce how much tobacco I use, and now…**	**a.i. I smoke slightly less tobacco than before**	
			a.i.i I smoke much less tobacco than before	
			a.i.i.i. The amount of tobacco I use hasn't really changed	
			a.iv. Although I tried to reduce the amount of tobacco I smoke, I now smoke more than before	
		b. I have not tried to reduce how much tobacco I use		don't ask ERT5
ERT 2	**Please tick which of the following most applies to you. Select one only**	a. I have tried to reduce how much cannabis I use, and now …	a.i. I smoke less cannabis than before	
			a.i.i I smoke much less cannabis than before	
			a.i.i. The amount of cannabis I use hasn't really changed	
			iv. Although I tried to reduce the amount of cannabis I smoke, I now smoke more than before	
		b. I have not tried to reduce how much cannabis I use		don’t'ask ERT 3 + ERT4
ERT 3	**What methods did you use to try and reduce the amount of cannabis you were using?**	a. I used a medication (indicate which)		
		b. I used an app (indicate which)		

		c. I went to see a substance misuse use service/drugs counsellor		
		d. I didn't use any specific method or support, just tried not to use it		
		e. I went to see my GP		
		f. Other (please describe)		
ERT 4	**What motivated you to try and reduce the amount of cannabis you were using?**	a. memory problems		
		b. I was told to by family/friends		
		c. It had become difficult to use less		
		d. It had a negative impact on my studies/work		
		e. Legal issues, fines, accidents		
		f. to improve my mental health		
		g. Other (please list)		
ERT 5	**What motivated you to try and reduce the amount of tobacco you were using?**	a. concerns about health		
		b. illness of friend/relative		
		c. physical fitness		
		d. encouragement from friend/relative		
		e. cost of tobacco		
		e. restrictions on smoking at work/college		

		f. restrictions on smoking at home		
		g. Other (please state)		

NRT: no reduction tried

NRT1	**Which of the following statements most accurately represents your view. Select one only.**	a. I would like to smoke less cannabis and/or tobacco, but I don't think I'd be able to reduce the amount I use of either
TDF: Beliefs about capabilities (M, Ref) Goals (M, Ref) Beliefs about consequences (M, Ref)		b. I'm not worried about the amount of tobacco and cannabis I smoke, and see no reason to reduce or stop either
		c. I think it would be a good idea to use less tobacco, but I'm not worried about the amount of cannabis I smoke
		d. I think it would be a good idea to smoke less cannabis, but I'm not worried about the tobacco I use
		e. I will think about stopping when I'm older

8.5 Appendix 5 Systematic review + meta-analysis publication

ADDICTION
REVIEW
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A systematic review and Bayesian meta-analysis of interventions which target or assess co-use of tobacco and cannabis in single- or multi-substance interventions

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ABSTRACT

Background and aims Tobacco and cannabis are commonly co-used, and evidence for the influence of co-use on quit outcomes for either substance is mixed. We sought to determine the efficacy of tobacco and/or cannabis use interventions delivered to co-users on cannabis and tobacco use outcomes. Method Systematic review with meta-analysis and narrative review, using five databases and author requests for co-use data. Controlled and uncontrolled intervention studies focusing on treatment of tobacco and/or cannabis use assessing use of both pre- and post-intervention were included. Prevention interventions were excluded. Bayesian meta-analysis was used across four outcome measures: risk ratio for tobacco and cannabis cessation post-intervention separately; standardized mean change for tobacco and cannabis reduction post-intervention separately. Narrative reporting of the same outcome measures in non-randomized clinical trials (non-RCTs) and quality assessment of all included studies were conducted. Results Twenty studies (12 RCTs and eight uncontrolled) were included. Bayesian meta-analysis with informative priors based on existing data of 11 RCTs (six single-substance, five multi-substance interventions) delivered to co-users (n = up to 1117) showed weak evidence for an effect on cannabis cessation [risk ratio (RR) = 1.48, credibility interval (CrI) = 0.92, 2.49, eight studies] and no clear effect on tobacco cessation (RR = 1.10, CrI = 0.68, 1.87, nine studies). Subgroup analysis suggested that multi-substance interventions might be more effective than cannabis-targeted interventions on cannabis cessation (RR = 2.19, CrI = 1.10, 4.36 versus RR = 1.39, CrI = 0.75, 2.74). A significant intervention effect was observed on cannabis reduction (ES = 0.25, CrI = 0.03, 0.45, nine studies) but not on tobacco reduction (ES = 0.16, CrI = 0.14, 0.45, nine studies). Quality of evidence was moderate, although measurement of co-use and cannabis use requires standardization. Uncontrolled studies targeting both cannabis and tobacco use indicated feasibility and acceptability. Conclusions Single and multi-substance interventions addressing tobacco and/or cannabis have not shown a clear effect on either tobacco or cannabis cessation and reduction among co-users. However, dual substance interventions targeting tobacco and cannabis appear feasible.

Keywords Cannabis, cannabis use disorder, co-use, smoking cessation, tobacco, tobacco use disorder.

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INTRODUCTION

Tobacco and cannabis are two of the most commonly used psychoactive substances world-wide and are frequently co-used but rarely co-treated in clinical interventions [1].

Tobacco use remains the leading cause of preventable death and disease world-wide, and efforts are required to address the significant use disparity among people with co-occurring substance use in particular [2,3]. Cannabis use is also associated with significant harms, although the evidence base is not as established as that for tobacco-related harms [4]. Each substance poses distinct known harms but also potential aggregated harms [5], and the last few years have seen an increased focus on the relationship between tobacco and cannabis use.

Tobacco is used by more than 1.1 billion people world-wide [6], and cannabis by an estimated 188 million [7]. Although tobacco prevalence is decreasing globally, use is

increasing in some regions such as Africa [6]. Cannabis prevalence appears stable in most of Europe and Australasia, although there are early indications that it may be increasing in the United Kingdom and United States [8-11] and may change with increasing legalization. Co-use of tobacco among cannabis users is consistently two to three times higher than among tobacco-only users [12].

Co-use may comprise both substances in the same product i.e. co-administration, or sequential use in a given time-period, i.e. concurrent. Globally, types of co-use vary significantly; broadly speaking, tobacco and cannabis are commonly co-administered in Europe and Australia, whereas concurrent use has been more frequent in other parts of the world, although there are indications that co-use and co-administration are increasing in the United States [13]. Changing regulatory environments and the availability of electronic devices used to deliver both tobacco/nicotine and cannabis have created a rapidly evolving landscape for these two substances. It is important to understand how co-use is associated with risk of dependence and among which populations, and how co-use variation may influence cessation attempts for all types of combustible and other tobacco and cannabis products.

The relationship between tobacco and cannabis appears synergistic, operating on both physiological and psychological levels [14]. Tobacco use seems to feature in the development of cannabis use disorder [13,15] and to negatively influence outcomes of cannabis use treatment interventions [16,17]. Similarly, cannabis use is associated with higher nicotine dependence, although the influence of cannabis use on tobacco cessation is mixed [18-21]. Among single-substance interventions, little is known about the impact of co-use on outcomes, as studies may not measure use of both substances nor the type of co-use practised. For example, it is not known whether co-administration may lead to poorer outcomes for tobacco cessation in comparison to concurrent use [17]. Further research into the nature of the relationship between tobacco and cannabis use and its impact on cessation outcomes is warranted.

A significant body of evidence exists on tobacco cessation interventions, as indicated by the 82 Cochrane Reviews on the topic. Combining pharmacotherapy with behavioural support is likely to be the most effective tobacco cessation method [22]. By contrast, the evidence base for cannabis use interventions is limited: only two Cochrane Reviews have been published, investigating psychosocial and pharmacotherapy interventions. Evidence for the latter is incomplete and low quality [23]. Combining interventions such as motivational enhancement therapy (MET) or cognitive behaviour therapy (CBT) with contingency management (CM) shows some positive effects but, as for other substance use treatments, overall efficacy tends to be low and abstinence rarely achieved [24]. Systematic reviews of digital interventions for cannabis use have identified a small reduction effect [25-27].

Despite being commonly co-used, tobacco and cannabis use are rarely co-treated. Low rates of tobacco cessation in cannabis users may be partly explained by co-use; hence, in addition to addressing co-use within single-substance interventions, it is important to investigate what impact dual interventions may have on co-use. For those who co-administer tobacco and cannabis, the shared route of administration and overlapping withdrawal symptoms may act as cues to relapse of either substance, indicating that the efficacy of dual or multi-substance interventions in comparison to single-substance interventions warrants examination [14,28,29]. Additionally, compensatory use of one substance following cessation of the other is important to consider [30].

Reviews of co-use have considered the potential for pharmacological treatments in dual interventions for sequential or simultaneous interventions and the most relevant evidence from single-substance use interventions [1,14,28]. Although co-use interventions for African American populations have been reviewed [31], this is the first systematic review to date, to our knowledge, of interventions targeting or addressing co-use for all populations.

Objectives

This systematic review seeks to investigate the nature and strength of the evidence base for interventions which target both tobacco and cannabis use, or which assess change in use of both, and to estimate the efficacy of included interventions on cessation or reduction of both substances.

METHOD

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA) [32]. The protocol was registered prior to commencing the review [33].

Eligibility criteria

Studies were included if they published, or reported measuring, level of use of tobacco and cannabis pre- and post-treatment intervention. Controlled or uncontrolled pilot or feasibility studies of single, dual and multi-substance use interventions were included. Prevention interventions were excluded. No limits were placed on age, setting, duration or intervention type.

Identification of studies

Five databases were used: EMBASE, Web of Science, Medline, PsychINFO and CINAHL. Reference lists from included studies and cited literature reviews were also searched.

Search strategies were developed for each database using controlled vocabulary and keywords for a combination of terms relating to tobacco and tobacco use treatment and cannabis and cannabis use treatment. Articles published from January 1990 to March 2019 written in English, French and Spanish were included; 1990 was selected as older literature is less consistent in measurement, particularly of cannabis. The Medline search strategy is shown in the Supporting information, Data S1.

All searches and initial screening of abstracts for review were carried out by H.W. in July 2017 and repeated in January 2018 and March 2019. H.W. reviewed full articles and M.D. and A.M. reviewed potentially included articles. Discrepancies were resolved by discussion.

Quality assessment

The Cochrane Risk of Bias assessment tool was used to evaluate the quality of included randomized clinical trials (RCTs) [34]. Relevant items from the Russell Standard for tobacco studies were used to assess quality of tobacco use reporting [35]. Uncontrolled studies were reviewed using Law's Critical Review Form [36]. H.W. carried out the quality reviews and M.D. reviewed five of these.

Funnel plots, including trim and fill where indicated, were used to assess publication bias and potential missing studies.

Outcome measures

The primary outcomes were change in use of tobacco and cannabis, measured either by cessation or reduction in use. Each study therefore had potentially four outcome measures of interest: tobacco cessation rate, cannabis cessation rate, tobacco reduction rate and cannabis reduction rate. Some studies also reported a fifth outcome of dual tobacco and cannabis cessation. Each study required a measure of level of tobacco and cannabis use pre- and post-intervention.

When the article indicated that tobacco and cannabis use measures pre- and post-intervention were collected but not reported, authors were contacted to provide separate data for this subgroup of participants reporting co-use at baseline.

Contact with authors

A total of 25 authors were contacted up to three times. Of these, seven indicated that they did not have the available data or were unable to provide it, four did not reply and one provided data which could not be used as the format was incompatible with other data. Thirteen authors provided data, two of whom provided data on two studies [37-49]. Three authors provided the original anonymized data set for our analysis and the remainder provided analyzed outcome data.

Data extraction

Outcome data, characteristics of studies including location, study design, intervention content and whole sample demographics were extracted by H.W. using a data extraction form which was piloted, then adapted. Data were extracted from each study and data set by H.W. and entered into a comma-separated values (CSV) file. Where authors had provided raw data, the analysis of these data was carried out by H.W. and both extraction and analysis for each of the studies used in the meta-analysis was checked by M.D.

Meta-analysis

Criteria for inclusion in the meta-analysis were cessation or reduction outcome in an intervention and control condition. Meta-analyses using Bayesian and traditional frequentist methods were performed on 11 RCTs in RStudio [50]. Bayesian meta-analysis was selected as it provides complete information about the credible parameter values, and consequently the probability of any given value, and may be more appropriate for a smaller number of studies [51,52]. One limiting factor for Bayesian analyses is that they require a prior probability distribution for the parameter of interest. As this is the first review of this type, there is no existing empirically based prior distribution. Solutions to this include using broad prior distributions that have minimal effect on the data or use of data from the studies themselves to provide this [51,53]. The latter of these solutions was used in this case to maximize the information, which would be diluted by an uninformative prior distribution.

As this is a relatively novel approach to meta-analysis, traditional frequentist analyses were also carried out to allow for comparison and as a sensitivity analysis for the assumptions made in our models.

Cessation outcomes

The pooled risk ratio for cessation in the intervention group compared to the control group was calculated using the metafor package [50], then the bayesmeta package [50] for the Bayesian meta-analysis. For informative priors, 1 was used as the minimum risk ratio (RR) and 4 as the standard deviation (SD) [51].

Reduction outcomes

The standardized mean change (SMC) in use of each substance in each condition was calculated. The SMC was selected to allow for a variety of pre-intervention levels of use and measurement variation (i.e. frequency of use versus amount of use). An effect size was calculated then a Bayesian meta-analysis was carried out using bayesmeta. The median of the effect size and the SD of the median were used as weakly informative priors.

Subgroup analysis by intervention target was carried out as specified in protocol; intention-to-treat principles were applied throughout all the meta-analyses using the authors' raw data. Heterogeneity was measured using tau [54,55]. In all four meta-analyses, a conservative estimate of variance at 0.8 was applied, as variance was not available within the original study data. The code used for meta-analyses is presented in the Supporting information, Data S2.

Analysis of uncontrolled studies

Results of uncontrolled studies were extracted and are reported in Fig. 2.

RESULTS

Included studies

A total of 6288 study titles were identified through the search process. Duplicates were removed, titles reviewed

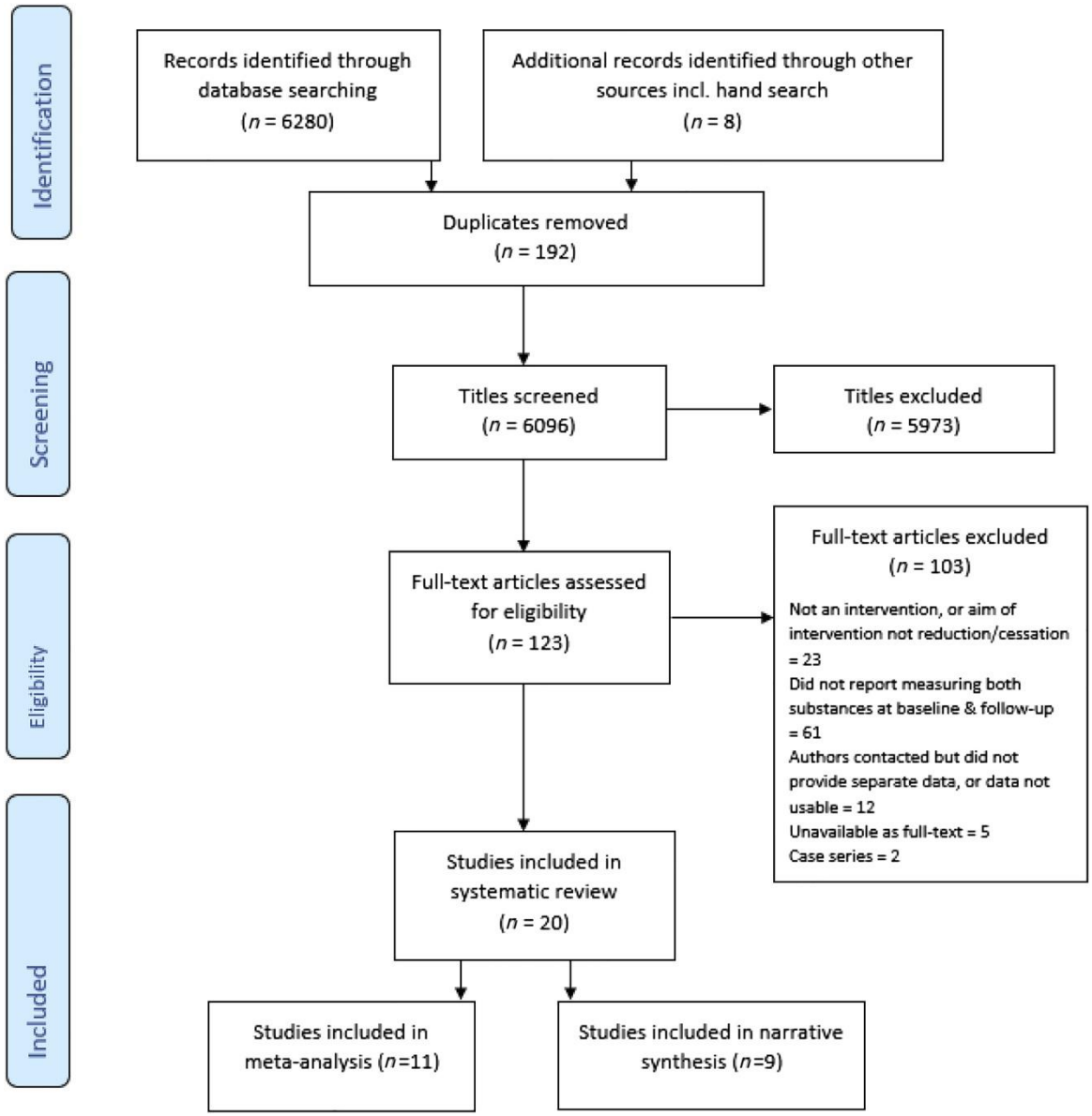

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram showing search and review process [Colour figure can be viewed at wileyonlinelibrary.com]

and 123 articles accessed for full-text review. Following the author data request process, 20 studies were included. The total number of participants within all 20 studies was 1599; an average of 34.5% were female. The selection process is shown in Fig. 1.

Selected characteristics of the included studies are presented in Table 1.

Study characteristics

Twelve studies were RCTs [39-45,47,48,60-62] and eight were pilot or feasibility ('uncontrolled') studies [37,38,46,49,56-59]. Fourteen studies were from the United States, two from Switzerland, two from the United Kingdom, one from France and one from Australia. Most participants were recruited from non-treatment settings, including colleges and community settings. Only five studies were located within substance use treatment settings; notably, none of these were cannabis treatment services. Of the total number of participants, 11% were daily tobacco users and 19% had either cannabis use disorder or frequent cannabis use (more than four times per week).

Intervention content

Six studies were dual interventions targeting tobacco and cannabis [37,56-59], seven targeted cannabis use [38,40-43,45,49], one targeted tobacco use [47] and six targeted multi-substance use [39,44,48,61,62], including one which focused on tobacco and heavy alcohol use [44].

Each dual intervention provided or offered pharmacotherapy in the form of nicotine replacement therapy (NRT) or medication such as varenicline alongside a behavioural component. Most dual interventions created new manuals for the delivery of co-use treatment, which were based on existing resources for both tobacco and cannabis behavioural treatment [56-60], although the extent of integration of these resources to address co-use varied. Two studies [56,58] set the same quit date for both substances, and one compared simultaneous with sequential quit attempts [60]. Most studies used contingency management in addition to other behavioural components; some used computer-delivered and mobile phone-delivered interventions [57,59,60]. With one exception [56], all interventions were individual. Only one dual intervention was an RCT.

Cannabis use interventions consisted mainly of behavioural interventions, with only two using pharmacological treatment, one of which was an in-patient study [42,49]. The single tobacco use intervention employed behavioural components only, delivered via Facebook in both individual and group format [47]. The majority of the multi-substance interventions (MSI) were brief, with two exceptions [44,46], one of which delivered a lengthy culturally adapted intervention.

Outcome measurement across all studies

Frequency versus amount. Measurement of tobacco use was relatively standard across all studies, most using cigarettes per day (n = 14). Measurement of cannabis use was more varied between frequency of use and amount used; frequency of days used in the past 30 was the most commonly used measure (n = 8).

Type of co-use. None of the dual studies reported any detailed measurement of co-use, i.e. whether participants used both concurrently or co-administered, although two studies targeting cannabis use asked about co-use [42,49].

Biochemical verification. All brief, single-session interventions as well as the single tobacco-targeted intervention used self-report as measures for tobacco and cannabis use at follow-up.

Of the six dual intervention studies, all used biochemical verification for tobacco cessation, and all except one [56] used biochemical verification for cannabis cessation.

Methods used to verify tobacco abstinence included carbon monoxide testing and saliva and/or urine cotinine analysis. Methods used to verify cannabis abstinence were more varied; most used urinalysis without specifying cut-off points for cannabis levels.

Meta-analyses of RCTs

Although intervention format in the 12 RCTs varied, all addressed the same clinical question, i.e. efficacy of intervention on change in use of tobacco and cannabis, therefore meta-analyses were conducted. One RCT was excluded from the meta-analysis and included in the narrative synthesis [60] as the two conditions tested were simultaneous versus sequential dual intervention, whereas all other RCTs measured intervention versus no intervention.

Measures used in meta-analyses

Each study measured two, three or four outcomes, as indicated in Table 2.

Cessation outcomes

Meta-analysis of tobacco cessation outcomes shown in Fig. 2 (nine studies) shows a pooled RR of 1.10 [credibility interval (CrI) = 0.68, 1.87]. There was little evidence of heterogeneity [Q = 8.57, degrees of freedom (d.f.) = 8, P = 0.6; $I^2 = 0.14$].

Meta-analysis of cannabis cessation outcomes shown in Fig. 3 (eight studies) shows a pooled RR of 1.48 (CrI = 0.92, 2.49), indicating a small effect which may be clinically significant. Heterogeneity throughout the nine studies was moderate (Q = 11.35, d.f. = 7, P = 0.9, $I^2 = 0.41$).

Table 1 Characteristics of included studies.

Study	Target substance	Location	Study design	Inclusion criteria	Intervention	Comparison/control	Length of follow-up	Duration of intervention	Sample size of co-users	Attrition rate (whole sample)
Becker 2015 [56]	Tobacco & cannabis	Switzerland	Feasibility	Age 18+; daily T smoker; weekly C smoker	GT, IT, NRT +V	-	6 months	5-6 weeks	77	24%
Beckham 2018 [57]		USA	Pilot study	Age 18-70; has CUD; 40/past 90-day C use; daily T use in past week and smoked for past year	ART, CM, CBT, NRT	-	6 months	6 weeks	5	0%
Adams 2018 [37]		USA	Within-subject cross-over; medication	Age 18+; C use 5 days/ past 7; positive urine C test	MAT, SCC, V	MAT, SCC (cross-over design)	8 weeks	4 + 4 weeks	6	0%
Hill 2013 [58]		USA	Pilot	Age 18+; meet DSM criteria for CUD + TUD	IT, CBT, NRT	-	10 weeks	10 weeks	12	42%
Lee 2015 [59]		USA	Single treatment with historical control	Age 18+; C use 45/past 90 days; daily T smoker	CAIT, MET, CBT, CM, NRT	Historical trial data	12 weeks	12 weeks	32	44%
Lee 2019 [60]		USA	RCT	Age 18+, has CUD, T use past 5 days	MET, CBT, CM, NRT	Sequential cessation	24 weeks	12 weeks	67	35%
Buchowski 2011 [38]	Cannabis	USA	Pilot	Age 18+, meet DSM criteria for CUD, non-treatment seeking, less than 10 CPD in past year	AE	-	4 weeks	2 weeks	6	14%
Laporte 2017 [41]		France	Cluster RCT	Age 15-25, C use 1 joint per month over 1 year	BI	Usual care	12 months	Single session	240	55.7%
Kadden 2007 [40]		USA	RCT	Age 18+, meet DSM criteria for CUD	CaseM or MET+CBT or CM or MET + CBT + CM	Each intervention	14 months	9 weeks	114	17%
McCambridge 2008 [43]		UK	RCT	Age 16-19; C use weekly	MI	DIA	6 months	1 hr	265	19%
McClure 2014 [42]		USA	Parallel double-blind RCT; medication	Age 15-21; C use 3× weekly	NAC, CM, IT	Placebo, CM, IT	8 weeks	8 weeks	68	28%
Peters 2013 [45]		USA	RCT	18+, met criteria for C dependence	CBT or CBT + CM or CM or CM + CBT	Each intervention	13 months	12 weeks	91	13%
Winstock 2009 [49]		Australia			Li	-	12 weeks	1 week	13	15%

(Continues)

Table 1. (Continued)

Study	Target substance	Location	Study design	Inclusion criteria	Intervention	Comparison/control	Length of follow-up	Duration of intervention	Sample size of co-users	Attrition rate (whole sample)
			Inpatient medication trial for safety + utility	Age 18+; met criteria for CUD in past year						
Vogel 2018 [47]	Tobacco	USA	RCT	Age 18-25; 1 CPD, 3× per week; current C use	OG, CBT	SC advice website	12 months	12 weeks	254	29.2%
Gmel 2013 [39]	Multi-substance	Switzerland	RCT	Conscripts to military service, interested in receiving intervention	BI	ASU	6 months	20 minutes	230	21%
McCambridge 2004 [61]		UK	RCT	Students reporting current drug use	BMI	'Education as usual'	12 weeks	Single session	19	10.5%
Metrik 2011 [44]		USA	RCT	Age 18+; 10+ CPD; heavy drinker	IT incl. alcohol; NRT	IT, NRT	26 weeks	4 weeks	57	15%
Venner 2016 [46]		USA	Pilot	DSM diagnosis of SUD, tribal enrolment, treatment-seeking	MICRA (culturally adapted MI + community reinforcement approach)	-	24 weeks	16-20 sessions	3	Not given
White 2007 [48]		USA	RCT	18+, students mandated to receive treatment	BMI	Written feedback	15 months	Single session	26	5.5%
White 2008 [62]		USA	RCT	18+, students mandated to receive treatment	Immediate written feedback	Delayed written feedback	7 months	Single session	14	4.8%

AE = aerobic exercise; ART = abstinence reinforcement therapy; ASU = assessment of substance use; BI = brief intervention; BMI = brief motivational interviewing; C = cannabis; CAIT = computer-assisted individual therapy; CaseM = case management; CBT = cognitive behaviour therapy; CM = contingency management; CPD = cigarettes per day; CUD = cannabis use disorder; DIA = drug information and advice; DSM = Diagnostic and Statistical Manual; OGT = online group; GT = group therapy; IT = individual therapy; Li = lithium carbonate; MAT = medication-assisted treatment (for opioid use); MET = motivation enhancement therapy; MI = motivational interviewing; NAC = N-acetylcysteine; NRT = nicotine replacement therapy; PPA = point prevalence abstinence; RCT = randomized controlled trial; SC = smoking cessation; SCC = standard clinical care; T = tobacco; V = varenicline.

Table 2 Outcome measures used for each RCT included in meta-analysis.

	Tobacco cessation Biochemically verified (BV) or self-reported (SR)	Cannabis cessation Biochemically verified (BV) or self-reported (SR)	Tobacco reduction	Cannabis reduction	Length of follow-up
Laporte 2017 [41]	-	-	Cigarettes per week	Joints per month	12 months
Kadden 2007 [40]	SR	BV	CPD	Joints per day	14 months
McCambridge 2008 [43]	SR	SR	CPD	Past 30 days	6 months
McClure 2014 [42]	BV	BV	CPD	-	8 weeks
Peters 2013 [45]	-	-	Days used in past 28	Past 30 days	13 months
Gmel 2013 [39]	SR	SR	CPD	Past 30 days	6 months
McCambridge 2004 [61]	SR	SR	Cigarettes per week	Frequency of use per week	12 weeks
Metrik 2011 [44]	BV	-	-	Past 30 days	26 weeks
White 2007 [48]	SR	SR	CPD	Frequency of use in past month	15 months
White 2008 [62]	SR	SR	CPD	Frequency of use in past month	7 months
Vogel 2018 [47]	SR	SR	-	-	12 weeks
Total number of participants	1117	1095	1068	1103	

Frequentist meta-analysis for cessation outcomes was performed. Using a random effects model, tobacco cessation RR was 1.07 (CI = 0.76, 1.52, P = 0.69). For cannabis cessation, pooled RR was 1.46 (CI = 1.03, 2.09), indicating almost no difference to Bayesian analysis outcomes.

Subgroup analysis

For tobacco cessation outcomes, subgroup analysis by intervention target showed very little difference; the pooled RR for cannabis-targeted interventions was 1.10 (CrI = 0.48, 2.85) and for multi-substance interventions 1.25 (CrI = 0.53, 2.94).

However, for cannabis cessation outcomes, subgroup analyses indicated a difference by intervention target. Multi-substance interventions showed a significantly positive effect (RR = 2.19, CrI = 1.10, 4.36), whereas the cannabis-targeted interventions mean estimate was similar to the all-studies outcome (RR = 1.39, CrI = 0.75, 2.74). Heterogeneity of subgroup analysis of each substance indicated that I^2 reduced to 15 and 26%, respectively, suggesting that it may be explained by differences in intervention target.

Reduction outcomes

Meta-analysis of standardized mean change (SMC) in tobacco use reduction as shown in Fig. 4 (nine studies) showed no intervention effect at 0.16 (CrI = 0.14, 0.45). Heterogeneity was high (Q = 121.86, d.f. = 8, P = 0.9, I^2 = 0.98).

Meta-analysis of cannabis reduction outcomes shown in Fig. 5 (nine studies) showed a small significant effect of 0.25 (CrI = 0.03, 0.45). Heterogeneity was also high (Q = 59.76, d.f. = 8, P = 0.8, I^2 = 0.93).

Frequentist meta-analysis for reduction outcomes was performed. Using a random-effects model, tobacco reduction effect size estimate was 0.34, P = 0.09 and for cannabis the estimate was 0.32, P = 0.001. This indicates no significant difference from Bayesian meta-analysis outcomes.

Subgroup analysis

For tobacco reduction outcomes, subgroup analysis by intervention target made little difference; the estimate for cannabis-targeted interventions was 0.19 (CrI = 0.18, 0.55) and for multi-substance interventions was 0.04 (CrI = 0.13, 0.169).

Similarly, for cannabis reduction outcomes, subgroup analysis did not show any meaningful differences by intervention target. For cannabis-targeted studies the mean estimate was similar to the all-studies outcome at 0.17 (CrI = 0.14, 0.45) and by multi-substance interventions at 0.26 (CrI = 0.03, 0.54).

study	int quit	ctrl quit	estimate	95% CrI
Vogel 2018 (tobacco)	16/119	20/135	0.91	[0.49, 1.67]
Kadden 2007 (cannabis)	5/25	3/22	1.47	[0.40, 5.44]
McCambridge 2008 (cannabis)	19/130	21/135	0.94	[0.53, 1.66]
McClure 2014 (cannabis)	2/19	1/18	1.89	[0.19, 19.13]
Gmel 2013 (multi)	3/98	11/132	0.37	[0.11, 1.28]
McCambridge 2004 (multi)	13/64	6/57	1.93	[0.79, 4.74]
Metrik 2011 (multi)	3/26	5/30	0.69	[0.18, 2.62]
White 2007 (multi)	3/7	3/19	2.71	[0.71, 10.42]
White 2008 (multi)	3/9	0/5	4.20	[0.26, 68.04]
mean			**1.10**	**[0.68, 1.87]**
prediction			**1.09**	**[0.36, 3.70]**

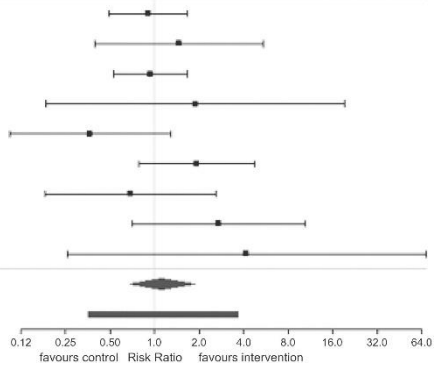

Figure 2 Tobacco cessation. Heterogeneity: Q = 8.57, degrees of freedom (d.f.) = 8, P = 0.6, I^2 = 0.14, n = 1050. 'Intervention' = number who quit in intervention group/total in group; 'control' = number who quit in control group/total in group; intervention target shown in brackets after study name; CrI = credibility interval. NB: not all studies targeted both substances

study	int quit	ctrl quit	estimate	95% CrI
Vogel 2018 (tobacco)	17/119	26/135	0.74	[0.42, 1.30]
Kadden 2007 (cannabis)	7/27	3/23	1.99	[0.58, 6.82]
McCambridge 2008 (cannabis)	31/130	27/135	1.19	[0.76, 1.88]
McClure 2014 (cannabis)	13/32	8/31	1.57	[0.76, 3.26]
Gmel 2013 (multi)	32/98	18/132	2.39	[1.43, 4.01]
McCambridge 2004 (multi)	13/66	7/60	1.69	[0.72, 3.95]
White 2007 (multi)	1/7	0/19	7.50	[0.34, 165.46]
White 2008 (multi)	3/9	1/5	1.67	[0.23, 12.09]
mean			**1.48**	**[0.92, 2.49]**
prediction			**1.47**	**[0.46, 5.08]**

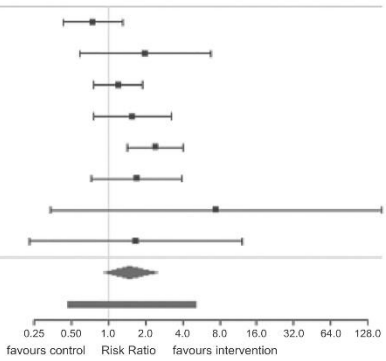

Figure 3 Cannabis cessation. Heterogeneity: Q = 11.35, degrees of freedom (d.f.) = 7, P = 0.9, I^2 = 0.41, n = 1028. 'Intervention' = number who quit in intervention group/total in group; 'control' = number who quit in control group/total in group; intervention target shown in brackets after study name; CrI = credibility interval. NB: not all studies targeted both substances

study	estimate	95% CI
Kadden 2007 (cannabis)	0.48	[0.20, 0.77]
Laporte 2017 (cannabis)	0.19	[0.07, 0.30]
McCambridge 2004 (cannabis)	1.93	[1.59, 2.26]
McClure 2014 (cannabis)	0.35	[0.12, 0.57]
Peters 2013 (cannabis)	-0.05	[-0.32, 0.21]
Gmel 2013 (multi)	0.03	[-0.09, 0.16]
McCambridge 2008 (multi)	0.08	[-0.02, 0.19]
White 2007 (multi)	0.08	[-0.39, 0.55]
White 2008 (multi)	-0.02	[-0.44, 0.39]
mean	**0.16**	**[-0.14, 0.45]**
prediction	**0.17**	**[-1.37, 1.67]**

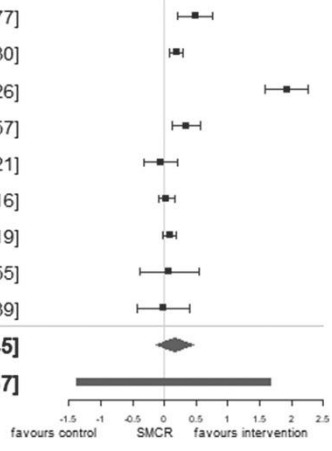

Figure 4 Tobacco reduction. Heterogeneity: Q = 121.86, P = 0.9, I^2 = 0.98, n = 1068

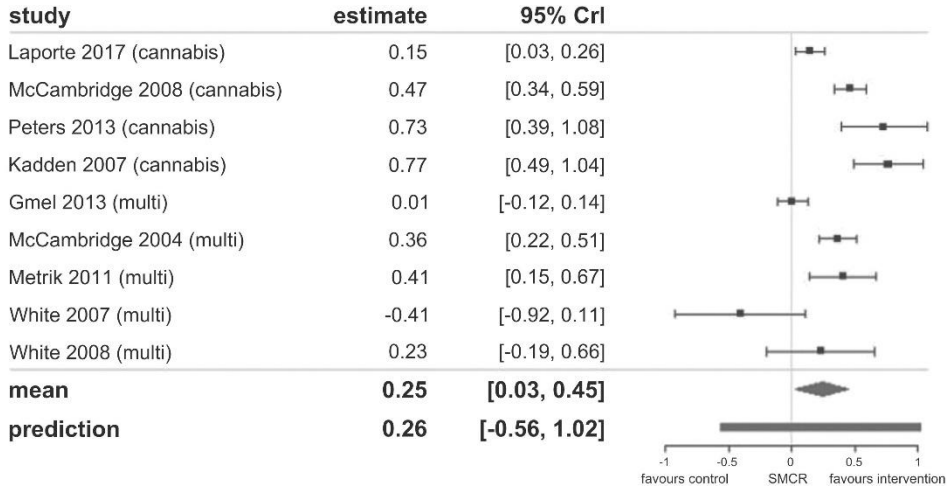

Figure 5 Cannabis reduction. Heterogeneity: Q = 59.76, P = 0.8, I^2 = 0.93, n = 1103

Table 3 Outcomes of tobacco and cannabis cessation within studies excluded from meta-analysis.

Study	Target	Sample size	Length of follow-up	Quit tobacco and cannabis, n (%)	Quit tobacco, n (%)	Quit cannabis, n (%)
Becker 2015 [59]	T&C	77	6 months	4 (7.8)	8 (10.4)	15 (19.5)
Lee 2019 [60]	T&C	67	12 weeks	-	6 (17.6)	7 (20.6)
Lee 2015 [61]	T&C	32	12 weeks	0	4 (12.5)	14 (44)
Winstock 2009 [49]	C	13	12 weeks	0	0	3 (23)
Hill 2013 [60]	T&C	7	10 weeks	0	0	0
Adams 2018 [37]	T&C	6	8 weeks	0	0	1(14)
Buchowski 2011 [38]	C	6	4 weeks	0	0	0
Beckham 2018 [59]	T&C	5	6 months	1 (20)	0	1 (20)
Venner 2016 [46]	MSI	3	8 months	0	3 (100)	0
n		127	-	5	21	31

T = tobacco, C = cannabis, MSI = multi-substance intervention.

Sensitivity analysis altering the variance in each analysis to 0.2 made no significant difference to any of the four outcomes.

Outcomes of uncontrolled and other studies

Table 3 shows tobacco and cannabis cessation outcomes for all studies not included in meta-analysis in order of sample size.

The data suggest that a higher proportion of people achieved cannabis cessation than tobacco cessation and that cessation of both tobacco and cannabis was relatively rare, even within dual studies. Reduction outcomes are not presented as data were incomplete, but all studies indicated a small degree of reduction in both substances.

Quality appraisal

Risk of bias summary

The Risk of Bias summary (Supporting information, Data S3) indicates that, overall, the RCT studies are of moderate quality. Appraisal of the uncontrolled studies indicates reasonable quality, including high rates of biochemical verification among the uncontrolled studies compared to RCTs.

Russell standard

Studies targeting tobacco, including the dual interventions, showed higher concordance with the Russell standard for tobacco abstinence. In the other studies, reporting of tobacco outcomes was inconsistent.

Publication bias

No evidence of asymmetry was seen when trim and fill was used on a funnel plot of tobacco cessation meta-analysis (see Supporting information, Data S5). However, for cannabis cessation, when trim and fill was used to add three studies, the RR reduced from 1.46 to 1.18 (CrI = 0.8, 1.77), suggesting some evidence of publication bias.

No evidence of publication bias for reduction meta-analysis was observed, as estimates within funnel plots were very close to original outcomes. Plots are not shown for this reason.

DISCUSSION

This is the first systematic review and meta-analysis to look at interventions for tobacco or cannabis which have been delivered to co-users. The review has reported on a population previously hidden within intervention findings by using unpublished data on co-users provided by authors. Using a novel analysis approach, Bayesian meta-analysis of RCTs delivered to co-users showed a small positive impact on cannabis cessation which approached significance (RR = 1.48, CrI = 0.92, 2.49), but a negligible impact on tobacco cessation (RR = 1.10, CrI = 0.68, 1.87). Subgroup analysis indicated that multi-substance interventions appeared to have a greater impact than cannabis-targeted interventions on cannabis cessation, which may explain the heterogeneity found in analysis. A small intervention effect was observed on cannabis reduction (ES = 0.25, CrI = 0.03, 0.45) but not tobacco reduction (ES = 0.16, CrI = 0.14, 0.45). Significant heterogeneity within reduction outcomes was not explained by subgroup analysis by intervention target.

The quality of evidence is considered moderate and, although heterogeneity should be taken into consideration, overall the quality of evidence should not influence the validity of the findings.

Our meta-analysis of tobacco cessation outcomes showed no intervention effect, irrespective of intervention target. This contrasts with a recent Cochrane Review of tobacco cessation treatment offered to people with a substance use disorder (SUD), which found positive outcomes overall [63]. Importantly, most of the interventions in our meta-analysis did not include evidence-based tobacco cessation treatment. This may partly explain the absence of an effect, in addition to the influence of cannabis use on tobacco cessation. An earlier systematic review considering tobacco cessation outcomes within alcohol brief interventions also found no intervention effect for tobacco cessation, although brief interventions may be less effective in targeting cessation [64]. In future interventions, greater attention to types of co-use practised is required; for example, co-administration of tobacco and cannabis may increase use of the other substance post-cessation in comparison to concurrent use.

Our meta-analysis of cannabis cessation shows an intervention effect lower than that found in the Cochrane Review of psychosocial interventions for cannabis use disorder (CUD) (RR = 2.55, CI = 1.34, 4.83), although the evidence in that review was considered low-quality [24]. The Cochrane Review of pharmacotherapies for cannabis dependence found mixed quality evidence (RR = 0.98, CI = 0.64-1.52) [23], comparable to the small effect we found. Evidence of asymmetry in the funnel plot for cannabis cessation may be explained by a non-reporting bias, although there were no obvious indications of such bias in the review process. However, the large number of authors who did not provide data for co-users, and the potential for interventions to have measured cannabis use but not reported this, especially in tobacco cessation interventions, may indicate a non-reporting bias. Analysis of future studies reporting fully on a range of substance use outcomes can address this potential bias.

Our analysis showed a small effect for cannabis reduction. Cannabis cessation or reduction among regular users has been characterized as challenging, requiring multiple attempts [65] and intervention effects appear small [23,25], in keeping with our findings. An effect on tobacco reduction was not seen in our analysis, although reduction in comparison to cessation is less commonly used within tobacco intervention studies.

This analysis has used both Bayesian and traditional methods of meta-analysis. Although the results are similar, their interpretation is very different: the Bayesian analysis gives both a point estimate and full distribution of the parameter in the form of a CrI. One of the obstacles to undertaking Bayesian analysis is the lack of informative prior distributions; here, we have demonstrated one solution to this, which is to use priors directly from the data. The more logical interpretation of the full posterior distribution may compensate for any limitation relating to the absence of prior information.

The findings from our meta-analysis do not clearly indicate whether single-substance use interventions are any more or less effective than multi-substance use interventions. Dual studies addressing both tobacco and cannabis were identified, although not included in the meta-analyses. These demonstrated feasibility and suggest a greater impact on cannabis cessation than tobacco cessation, comparable to our meta-analysis findings. Notably, adherence to tobacco cessation outcome standards was high in the dual studies, e.g. defining abstinence, which may explain some of the differences between tobacco and cannabis outcomes. Feasibility findings indicate that attention must be given to the sampling frame, as community settings appear to be more successful for recruitment than substance misuse settings. Motivation may be a barrier to recruitment; an intervention to address this prior to commencing recruitment for treatment appeared to be effective [66].

This review has also highlighted methodological issues with the literature. First, a large number of studies were excluded as they did not measure use of both substances pre- and post-intervention, or reported only presence/absence of cannabis, rather than level of use. Biochemical testing may be challenging on the basis of cost, but self-report measures are of value and easily obtainable. The availability of such data would allow for further investigation by secondary analysis of the role of co-use in single and multi-substance intervention studies, and would

strengthen the evidence base for addressing these commonly used substances.

Secondly, measurement of co-use, including whether concurrent and/or co-administered, would reduce potential bias and provide detail and context of use behaviours [67,68]. Participants in studies may under-report co-use; for example, when asked about cannabis they may ignore tobacco used in joints. Specific patterns of co-use may be associated with higher levels of dependency on either substance, and with varying success of cessation or reduction of either substance.

Thirdly, no studies within this review reported measuring cannabis type or potency. Literature indicates that potency may play a significant factor in the experience of adverse effects and the development of CUD [69]. Differences between frequency and amount of cannabis use presents a further challenge in reviewing studies, and both concepts are subject to recall bias [70,71]. Tobacco cessation outcome reporting has been set out in the Russell Standard; cannabis studies which measure tobacco use would benefit from adherence to these guidelines [35] and from a set of cannabis reporting standards. Measurement of cannabis use requires further discussion and consensus development within the field [72]; this process has begun [73].

This review contains limitations and has only partially met its objectives. The number of studies in the meta-analyses is small, most studies primarily targeted cannabis and most participants were male. The lack of tobacco-targeted studies is a significant limitation, and should be taken into account when considering the greater impact seen on cannabis-targeted studies. Future interventions which target either but measure both can be added to the data to expand on these conclusions. Unfortunately, no RCTs which targeted co-use could be included in the meta-analyses; hopefully, these will be developed. Evidence of potential compensatory use of the second substance post-intervention of the primary substance was not available, and also limits our ability to draw conclusions concerning the efficacy of single versus dual interventions on the use of both substances. These data should be made available in future intervention studies, allowing for an investigation of potential compensatory use.

Due to time constraints only one author conducted the initial screening process, potentially increasing the risk of selection bias. Additionally, we contacted a large number of authors (n = 25), only 13 of whom provided data. Older data sets were less likely to be available; however, changes in cannabis potency in the last few decades indicate that more recent data are likely to be most relevant [74].

Although heterogeneity of intervention targets has been explored within the subgroup analysis, other sources include variability of measurement, as discussed previously, differences in duration of intervention and biochemical verification of cessation. Further sensitivity analyses across other domains may indicate the source of the heterogeneity, although were not planned in this review.

Most of the evidence reviewed was from the United States, although patterns of both cannabis use and co-use vary significantly world-wide [75]. Inadequate measurement of types of co-use limits the transfer of these findings to other countries. One study adapted materials for a specific population [46], but further discussion of how socio-cultural influences pertaining to tobacco and cannabis use may impact upon intervention effects is required. Increasing variety in routes of administration for both tobacco, nicotine and cannabis in its many forms may elicit changes in co-use practices, such as co-administration, and future intervention studies need to take these complexities into account. This requires scrutiny across all populations, including those from more deprived populations where more harmful methods of tobacco and cannabis use may prevail.

Future research should consider the theoretical framework required for addressing use of two closely related substances. The theoretical basis of interventions was described by some studies in our review, but most dual interventions adapted existing materials for either substance, delivered concurrently. As the theoretical basis for dual interventions is yet to be fully developed, it is not known whether delivering a tobacco intervention alongside a cannabis intervention results in a different outcome to an intervention which seek to integrate treatment of both. The single study in this review to evaluate simultaneous versus sequential dual treatment was inconclusive. Further research using more intensive tobacco treatment interventions is also warranted.

CONCLUSIONS

Dual interventions for tobacco and cannabis co-use have demonstrated feasibility. Meta-analysis of treatment interventions targeting tobacco and/or cannabis use showed a small intervention effect on cannabis reduction but not on tobacco reduction. No significant effect was seen on tobacco cessation or cannabis cessation. Further research is required to extricate potential reasons for poor outcomes amongst co-users.

Outcomes for co-use of tobacco and cannabis need routine measurement to fully account for the potential impact of co-use in both tobacco and cannabis specific interventions. Interventions must collect details of type of co-use practised, as well as fuller details of cannabis use.

RCTs of dual interventions are required to address co-use. Future dual interventions should ensure that tobacco dependence is fully measured and that adequate tobacco cessation treatment is provided.

Declaration of interests

None.

Acknowledgements

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Data S1 Medline search strategy.
Data S2 Code used in cessation meta-analysis.
Data S3 Risk of bias summary: RCTs.
Data S4 PRISMA checklist.
Data S5 Funnel plots.

ADDICTION

Corrigendum

A systematic review and Bayesian meta-analysis of interventions which target or assess co-use of tobacco and cannabis in single- or multi-substance interventions

Hannah Walsh, Ann McNeill, Edward Purssell & Maria Duaso

In the article [1] published in the October 2020 issue of *Addiction*, an error in one of the plots was identified, and therefore all analyses for the tobacco reduction outcome (Fig. 4) were repeated. Although the new results differ from the original, the overall conclusions in relation to this outcome remain the same as in the original publication. Each reference to these results in the article text has been altered

The corrected Fig. 4 is as follows:

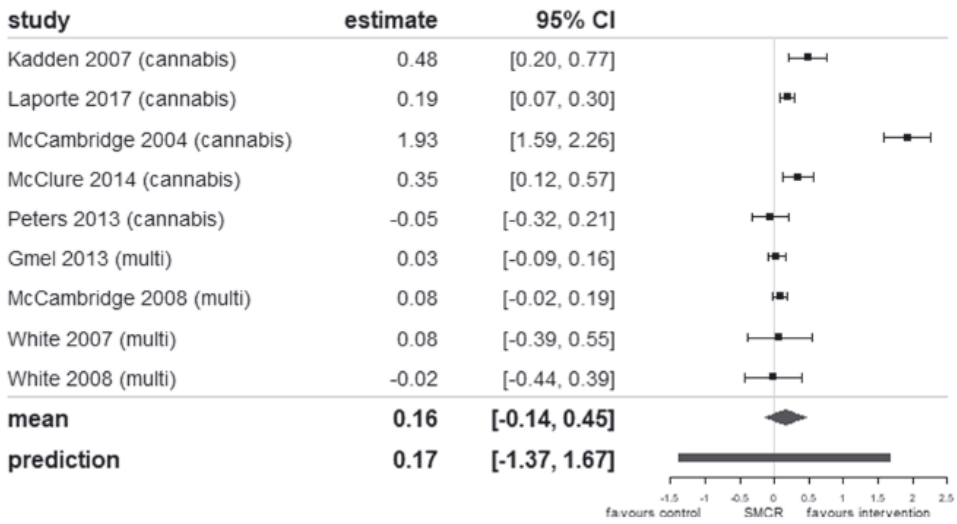

Figure 4 Tobacco reduction. Heterogeneity: $Q = 121.86$, $P = 0.9$, $I^2 = 0.98$, $n = 1068$

These corrections have been made in the on-line version.

Reference

1. Walsh H., McNeill A., Purssell E., Duaso M. A systematic review and Bayesian meta-analysis of interventions which target or assess co-use of tobacco and cannabis in single- or multi-substance interventions. *Addiction* 2020; **115**: 1800–14.

Cessation & reduction code:

```
canqrma<-escalc(ai=int_quit, n1i=n_int, ci=ctrl_quit, n2i=n_ctrl, measure="RR", data=canquitFINAL, atransf=exp, add=1/2, to="only0")
frogs<-bayesmeta(canqrma, labels=canqrma$author,
                 mu.prior.mean=1, mu.prior.sd=4, tau.prior=function(x){dhalfcauchy(x,scale=0.5)})
pppvalue(frogs, parameter = "mu", alternative = "greater", statistic = "q")
frogs$I2(tau=frogs$summary["median", "tau"])
fpfrogs<-forestplot.bayesmeta(frogs, expo=TRUE, zero=1, xlog=TRUE, shrink=FALSE, ci.vertices=TRUE)
frogscolumns<- cbind(fpfrogs$labeltext[,1],
                     c("intervention",
                       paste0(canquitFINAL[,"int_quit"],"/", canquitFINAL[,"n_int"]),
                       "",""),
                     c("control",
                       paste0(canquitFINAL[,"ctrl_quit"], "/", canquitFINAL[,"ctrl_notq"]),
                       "",""),
                     fpfrogs$labeltext[,2:3])
forestplot(frogs, labeltext = frogscolumns, expo=TRUE, xlog=TRUE, shrink=FALSE, zero=1,
           graphwidth=unit(8, "cm"), ci.vertices=TRUE, txt_gp = fpTxtGp(cex=.9),
           lineheight=unit(.8, "cm"), at=log(c(0.1, 0.5, 1, 2, 10)),
           xlab="favours control          Risk Ratio    favours intervention
           ")
```

```
tobred_int<-escalc(measure="SMCR", m1i=t_int_base_cpd, m2i=t_int_fu_cpd,
                   sd1i=t_int_base_cpd_sd, ri=variance, ni=n_int, data=tobredFINAL)
tobred_ctrl<-escalc(measure="SMCR", m1i=t_ctrl_base_cpd, m2i=t_ctrl_fu_cpd,
                    sd1i=t_ctrl_base_cpd_sd, ri=variance, ni=n_ctrl, data=tobredFINAL)
tobred<-data.frame(yi=tobred_int$yi-tobred_ctrl$yi, vi=tobred_int$vi+tobred_ctrl$vi)
prior<-median(tobred$yi)
priorsd<-median(sqrt(tobred$vi))
tobredbayes<-bayesmeta(y=tobred_int$yi, sigma=sqrt(tobred_int$vi), labels=tobred_int$author,
                       mu.prior.mean=prior, mu.prior.sd=priorsd, tau.prior="uniform")

tobredbayes$I2(tau=tobredbayes$summary["median","tau"])
pppvalue(tobredbayes, parameter = "mu", alternative = "greater", statistic = "q")

forestplot (tobredbayes, shrinkage = FALSE, expo=TRUE, digits = 1,
            graphwidth=unit(5, "cm"), ci.vertices=TRUE, txt_gp = fpTxtGp(cex=.9),
            lineheight=unit(.8, "cm"), lwd.zero=TRUE, zero=TRUE,
            xlab="favours control    Risk Ratio            favours intervention")
```

8.6 Appendix 6 Data analysis plan (published at www. osf.io)

Title

Tobacco and cannabis co-use: a questionnaire survey of further education students aged 16-30

Authors

Hannah Walsh, Maria Duaso, Ann McNeill

Description

Background and rationale for study:

Tobacco and cannabis are two of the most commonly used psychoactive substances worldwide, and both are associated with multiple adverse health effects. Co-use of tobacco and cannabis presents a unique challenge when addressing harmful and dependent use of each substance. Despite being commonly co-used, they are usually treated separately in clinical interventions, and co-use is rarely addressed.

Use of tobacco and cannabis in the UK is highest amongst young adults, hence this group presents an important opportunity to intervene in the development of tobacco and/or cannabis use disorders. Research describing prevalence of use of both substances amongst UK young adults exists; but little is known about how this same population may have, or have attempted to, quit or reduced their use of either, and about their potential motivation to do so. Evidence describing intention to quit, interest in and knowledge of various support options is required in order to develop the evidence base for a potential intervention to address tobacco and cannabis use amongst this population, as well as evidence of socio-demographic factors which may influence the patterns of tobacco and cannabis use and quitting.

A recent review evaluated predictors of tobacco quit attempts and success. There is good evidence that intention to quit as well as previous successful attempt predicts future quit attempts, and some evidence that expectations of quitting improving health and confidence in quitting predict quit attempts. There is good evidence that higher dependence negatively predicted quit success, though mixed evidence only of desire to quit and confidence in predicting quit success. Overall the review concludes that motivation is more important for intention to quit, and level of dependence for success (Vangeli, Stapleton et al. 2011).

Socio-economic factors relating to smoking have also been reviewed, and multiple relevant factors listed (Hiscock, Bauld et al. 2011). Those most salient to the current study include uptake of smoking being higher amongst low SES and quit attempts less successful. People with lower SES may report higher nicotine dependence, reduced social support during quit attempts and lower self-efficacy.

Literature on predictors of cannabis quit attempts and success is much less established. There are two studies which closely mirror this current study, and which are used to inform which analyses are warranted in addition to those describe above.

Masters found participants reported the following were higher for tobacco than cannabis: importance of quitting, readiness to quit and recent quit attempts. However, confidence in ability to quit tobacco was lower than for cannabis. They also found a positive association between cannabis quit attempts and depressive symptoms.

McClure found that previous quit attempts were much higher for tobacco than cannabis, and that during a tobacco quit attempt around half? ½ said their cannabis use increased; during a cannabis quit attempt, over half said their tobacco use increased. “Interest” in quitting tobacco was higher than cannabis; a preference for quitting tobacco before cannabis was observed, and the majority expressed a preference to quit either substances without treatment. The sole predictor of quit attempts for cannabis was a BME background, no tobacco-related characteristics were predictive. Similarly, no cannabis use characteristics predicted tobacco quit attempts (McClure et al., 2018).

The findings from these two studies, in addition to predictors of tobacco quit attempts and success, were used to inform the research question for the current study carried out in further education colleges in South East England.

Research questions

1. What is the most frequent type of cannabis used, consumption method and patterns of co-use amongst a sample of young adults who report co-use
2. For both tobacco and cannabis, what are the most frequent reasons for use, reasons to quit and reasons for relapse, methods used to quit and likelihood of substitution of one for the other during quit attempts
3. Which individual factors predict frequency of use and dependency on tobacco and cannabis, motivation to quit and previous quit attempts or success for tobacco and/or cannabis

Hypotheses

No hypotheses made as study not powered to test any

Design Plan

Study type

Observational study

Blinding

None

Is there any additional blinding in this study?

NA

Randomisation

None

Sampling Plan

Existing data

New data were collected for this study

Data collection procedures

Study data collection

A questionnaire was developed which investigated in detail tobacco and cannabis use, and motivation and experiences of quitting one or both substances. The survey was distributed via email to all students (or in one case to all students aged 16-30) of three further education (FE) colleges,

two in London and one in the home counties. All FE students were invited to undertake screening for the survey, and all those between the ages of 16-30 who reported current or past 6 month use of tobacco and cannabis were invited to complete the full survey. Participants who indicated in the screening section that they did not use either were excluded from the full survey.

Sample size

384

Sample size rationale

A sample of 384 participants would provide a 95% confidence level and 0.5 margin of error. However, it wasn't possible to estimate how many students at each college would be eligible to participate (i.e. recent co-use of tobacco and cannabis and aged 16-30) hence it wasn't possible to estimate a response rate.

Variables

Manipulated variables

None

Measured variables

Personal characteristics:

Age, gender, level of study, ethnicity, sexuality, disability, experience of a mental health problem, postcode sector (used to calculate Index of Multiple Deprivation), subjective social status, achievement at college

Tobacco use characteristics:

Frequency of use, Cigarette Dependence Scale: short version (CDS-5), previous quit attempts, previous quit success, Motivation To Stop Smoking (MTSS), knowledge of someone else who has quit smoking, methods used to quit, reasons for relapse to tobacco use, duration of quit attempt, confidence in future quit attempt, potential future methods for tobacco quit attempts, substitution with cannabis during quit attempt

Cannabis use characteristics:

Frequency of cannabis use, Cannabis Abuse Screening Tool (CAST), type of cannabis used, type of co-use practised, consumption methods used, substitution during quit attempt with tobacco, how often shared with others/consumed alone, proportion of tobacco in joint, reasons for smoking cannabis, Motivation To Stop Cannabis (MTSS adapted for cannabis use), knowledge of someone else who has quit cannabis, methods used to quit, reasons for relapse to cannabis use, duration of quit attempt, confidence in future quit attempt, potential future methods for cannabis quit attempt

Indices

The tool 'GeoConvert', provided by the UK Data Service, census support, allows the user to input a postcode sector, which gives the LSOA (Lower Layer Super Output Area), i.e. the location to the nearest ~650 households. The Index of Multiple Deprivation for each individual participant can then be calculated based on an average all of the postcodes within this LSOA.

Analysis plan

Statistical models

Regression analysis will be used to examine any association between factors predicting quit attempts and success, and motivation to quit one or both substances. The type of regression will depend on normality tests, and on type of data.

Inference criteria

A p-value threshold of <0.05 will be used to identify statistically significant results.

Data exclusion

Responses will be excluded if they appear to be repeat responses from same participant. In situations where more than one answer is given to the question, then the most conservative will be selected.

Missing data

Incomplete or missing data will be excluded from the analysis.

Exploratory analysis

None

References

Vangeli, Eleni, et al. "Predictors of attempts to stop smoking and their success in adult general population samples: a systematic review." *Addiction* 106.12 (2011): 2110-2121.

Hiscock, Rosemary, et al. "Socioeconomic status and smoking: a review." *Annals of the New York Academy of Sciences* 1248.1 (2012): 107-123.

8.7 Appendix 7 Interview schedule

- What's your first name?
- Have you participated in a research interview before?
- Some of the things I ask might seem very obvious, but I want to know about what you think, and about your understanding, so I will ask you to explain things in your words
- Expect interview to last around 30-40 minutes; ensure in private uninterrupted space; not recording now but will record
- I will need to send the voucher somewhere, please can you give me address – kept only for purposes of voucher.
- Would you like me to send you a summary of the findings? If so, will keep address for this purpose only.
- Key pieces of information from study information sheet: (READ THIS THROUGH)
- Do you have any questions?

RECORDING NOW……

Demographic question

How old are you? Gender?

How would you describe your ethnicity?

What are you currently studying?

Preliminary questions:

Q1 Please tell me a bit about your tobacco and cannabis use:

a) When did you start using each?
b) How often do you use each? When did you last use?
c) How do you use them? Do you use tobacco in joints?
d) Would you describe yourself a 'smoker'? If not, why not?

Exploring physical and psychological capability in relation to smoking and cessation

Q2

a) How easy or difficult it would be to stop tobacco? Or cannabis?
b) How would you consider your ability to stop smoking tobacco and/or cannabis?
c) How capable are you of stopping smoking tobacco and/or cannabis? Could you rate your capability out of ten?

Q3

a) What would you do to help you stop tobacco and/or cannabis?
b) what methods would increase your chances of stopping?
c) what support is available?
d) any specific difficulties you anticipate?
e) any strategies you could use?

Exploring environmental and social opportunities in relation to smoking cessation/cannabis cessation

Q4

a) What are the things around you that you that would help/hinder quitting tobacco and/or cannabis?
b) What change would have to happen in your situation to make that easier?
c) How do you think people around you would/could help/hinder quitting/reducing?
d) How does your home/college/social context influence, help or hinder you?

Q5

a) Who else around you smokes tobacco and/or cannabis?
b) Who do you know who has quit?

Q6

a) What would be an idea way of supporting smoking cessation or cannabis cessation/reduction for you? What format?
b) What support is currently available to you?

Exploring automatic and reflective motivation in relation to smoking tobacco and cannabis and quitting/reducing

Q7

a) What does tobacco (then cannabis) do for you? What does it mean for you?
b) What could/would/does/did motivate you to quit/reduce each?

Q8

a) How would friends/family react if you quit?
b) How do you feel about the fact that you smoke tobacco/cannabis?
c) How would you expect to feel if you quit? What difference would it make to your life?

Other (if not already discussed)

What sort of impact do you think smoking cigarettes/cannabis has on your health? Physical and mental?

Does it make a difference where you are? i.e. if you're not allowed to smoke in college, or on the grounds, does that mean you smoke less?

Anything else

Is there anything you'd like to add? Anything you think is important that we haven't talked about?

Do you have any questions?

8.8 Appendix 8 Examples of qualitative analysis

8.8.1 Initial thematic framework (stage 3; identifying a framework)

Thematic framework v5

1. Experiences of use
    a. First initiation
        i. Age
        ii. Experience of first use
    b. Context of use
        i. Peers influence
        ii. Family influence
        iii. Friendship groups
            1. Non-using friends
            2. Friends who also use
        iv. Availability
    c. Addiction
        i. To cannabis
        ii. To tobacco
            1. In context of cannabis use
    d. Reasons for use
        i. Multiple reasons
        ii. To escape
        iii. Stress reliever
        iv. Sleep aid
    e. Amount/potency
        i. Uncertainty re amount used
        ii. Intoxication affects measure of amount used
        iii. Variation in amount used
        iv. Inflation of potency estimate/OR/potency estimation
        v. Compares amount with peers
    f. Frequency of use
        i. Daily use
        ii. Pattern of use
    g. Identity as a cannabis user
2. Consequences of use
    a. Mental health impact
        i. Positive effect on MH
        ii. Use as coping mechanism
        iii. Negative impact on MH
        iv. psychosis
    b. Reflective thinking as a result of use
        i. ‘deep’ thinking
        ii. ‘overthinking’
    c. Harms, risks of c use
        i. Tolerance
        ii. THC/CBD ratio
        iii. Short-term risks
    d. Harms of tobacco use

        i. Tobacco = cancer
    e. Creates distance, 'bubble' effect
    f. Effect on mood
    g. Physical impact of use
    h. Pleasure in doing other activities
    i. Social contact effects
        i. Sexual effects
3. Choices around use (context of use?)
    a. Influence of cost on consumption
        i. Joints are cheapest ROA
    b. Influence of cost on ROA
    c. ROA
        i. Effect of intoxication by ROA
        ii. ROA link to higher risks
        iii. Modifications of intended ROA
        iv. Use of blunts
        v. Peers provide broader range of ROA
        vi. Multiple ROA
    d. Type of cannabis purchased/used
        i. Dealer provision of types
        ii. Flavours – lemon, sweets
        iii. Homegrown cannabis, weed vs skunk
        iv. Quality, assessment of quality
        v. Special occasion
        vi. Selective with products
    e. Control over use
        i. Wages used mostly on cannabis
        ii. If there, will use
        iii. Making allowances/adaptations in life to accommodate use
        iv. What does overuse look like
    f. Information sought re impact/harms etc
        i. Availability/absence of knowledge
    g. Personal perspective on knowledge
        i. Knowledge/understanding of potency/risk through witnessing others
        ii. Who also knows about their cannabis use
    h. Uses experiences of peers to determine strength/impact/risk
4. Views of use
    a. Identity as a cannabis user
    b. Identity as a tobacco user
    c. Incongruence of 'non-smoker' who uses
    d. Rejection of smoker identity
    e. Thoughts about being a user
    f. Views of cigarettes
        i. 'disgusting'
5. Co-use
    a. Experience of co-use
        i. Taste/smell of tobacco
        ii. Reasons for tobacco in joint

            1. Tobacco aids burning
        iii. Availability of joints, of tobacco
    b. Relative harm of tobacco vs cannabis
    c. Incongruence of ‘non-smoker’ who uses tobacco
    d. Craving for tobacco vs for cannabis
    e. Co-administration as default
6. Experiences of abstinence/reduction
    a. Episodes of abstinence
        i. Reasons for abstinence
            1. External influences
    b. Motivation for abstinence
        i. Fitness
        ii. College attendance poor
        iii. Experience of abstinence
        iv. Reasons to return to use
        v. Withdrawal ‘symptoms’
    c. Future expectations of abstinence
        i. Parenthood
        ii. Withdrawal expectations
        iii. Idea of life without cannabis
7. Quit methods, process
    a. Availability of services
    b. Anticipated process of quitting
    c. Sources of support
    d. Simultaneous cessation
    e. Confidence in own ability
        i. Action required to maintain abstinence

8.8.2 Example of framework matrix in Excel (stage 4; charting)

	1 : 1_Ivan_	2 : 10_Owen	3 : 11_Danielle	4 : 12_Lewis	5 : 13_Efua	6 : 14_Miriam
A : 6. Experiences of abstinence and or reduction						
B : episodes of abstinence	when you quit, can you remember what was the longest period of time you went without smoking cigarettes?	Even now it's always like, I would like to go back. It would be nice to have one joint and that would be it, but I didn't find it difficult.	I tried it when I was 11 and continued until now. I stopped when I was pregnant. Oh god, for the first three months I was			
C : episodes of T abstinence	like the tar from cannabis, like obviously it's not good to have tar in your lungs, but, if I'm taking a break, like as both a tolerance		There was so much information given to me, and in my head, my heart was saying, "Yes, you really do need to stop, it can really	I smoke cigarettes as well, and that's something that I do want to quit, but it's not something that I want to quit right now. It's just one of	I don't really feel like I need it, but it would be nice to have it with me, especially when I'm in another country.	I stopped smoking for two months. It was July 2017, because that's around the time when my member of family passed away. I don't
D : reason for abstinence						
: use of alcohol in C abstinen						
uture expectations of abstine	Errh, very difficult Very difficult. Can you say a bit about what would be really difficult? Like, I'd just be craving a				I think it would be difficult because since I use it when I'm with friends, it would be harder to say no to that, but I think I have to just cut down	

8.8.3 Example of condensed summary (stage 4; charting)

(condensed from matrix in Nvivo then condensed again from excel spreadsheet)

AD: Shift to regular Tobacco use

As a result of smoking Tobacco in a joint – enjoyed the head rush so sought it out – then started cigarettes alone

Moved from stolen cigs from mother, friend's mother into buying their own, or being bought by mother as a means of reducing harm from purchasing on the street

AE: Smoking cannabis alone

Smoking with others often a preference, because more fun, a sociable thing to do, but also because it prevents you from going into your own head too much, and from experiencing negative thoughts, even suicide. Some smoke alone only if there's no one to smoke with, and some don't like smoking other people's skunk especially, as you don't know what's in it

AF: Societal influence

(Grime) artists singing about it – even if negative content – makes teenagers more aware of it, and this helps it become popular, and tempts people to try it, 'it's easy to sing about drugs'.

AG: Ubiquity of cannabis use

'mainstream'

AH: Upbringing

Having a 'rough' upbringing brings people into contact with cannabis at an earlier age, related to poorer mental health

AI: Work

Work provided money, which for some meant more use, and a culture developed of using cannabis after work. Also similar influence for tobacco – smoking together in the van between jobs.

One told by supervisor that tobacco use would either start, or increase, and conclusion is therefore no point in trying to stop because the context is going to be pro-smoking.

For others, it provided increased responsibility, and a meaningful job gave them less free time, but didn't want to use cannabis to relax as much, as had a different focus now. They saw increased use as a factor reducing someone's options for later in life. For work with less meaning (eg temporary factory etc) then it provided respite from the boredom, or physical strain, and there was a culture of using cannabis together, and it provided a stress release. Also, as a means of relaxing after work it was more important when the work was more boring. When work became more important then the risks of using cannabis were outweighed.

AJ: first initiation + AM: Experience of first cannabis use

Access via older students who went to college, with older family (therefore endorsed) use coincided with other cultures, eg skating, rock; available via friends, found some in their home (mother's)

First use both unremarkable and very intense; highly socially construed (ie needed to not cough etc) but also for some very negative, strong smell, disliked taste, had no impact so didn't know what for, over time became more familiar and more common

8.8.4 Example of mind map (stage 5; mapping)