CANNABIS USE, RESILIENCE AND MENTAL HEALTH IN ADOLESCENTS

By

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Abstract

Cannabis remains the most commonly used illicit substance during adolescence, yet little is understood about the influences on changes in use patterns. Additionally, there has been more focus on risk as compared to resilience in assessments of cannabis and psychopathology. Therefore this thesis aimed to assess self-reported factors influencing changes in patterns of cannabis use in adolescents, and to integrate resilience processes in the assessment of cannabis use, alcohol use, and psychopathology.

A 6-month prospective design involving a sample of 288 adolescents recruited from schools and from Child and Adolescent Mental Health Services was utilised. Participants completed the Cannabis and Young People Questionnaire, Resilience Scale for Adolescents, Community Assessment of Psychic Experiences, and Depression Anxiety Stress Scales.

A range of factors influenced changes in patterns of cannabis use, with an overarching influence of peers. Cannabis use was not related to psychopathology, nor did it moderate the relationship between psychopathology and resilience. However personal competence emerged as a significant negative predictor of depression, anxiety and stress. Level of social resources was the strongest negative predictor of alcohol use, and alcohol users had higher levels of depression. Therefore, there may be potential for utility of resilience factors, notably personal competence, and social resources in prevention and early intervention for mental health in adolescents.

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Dedication

I would like to dedicate this to my Mum, whose never ending prayers have seen me through, and to my Dad, whose face lights up with both bemusement and pride at the thought of me being an academic!

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Thesis Overview

The main aim of the thesis is to provide an assessment of cannabis use and associated mental health outcomes in adolescents. The thesis also seeks to integrate resilience processes in the assessment of cannabis use and mental health. This is because adolescence has been identified as a time of great developmental vulnerability, which, according to the resilience theories is a prime time for resilience processes to be at work. The following is an outline of the chapters in this thesis, providing an overview of the organization of the thesis.

Chapter 1.

This is a review of the literature identifying the factors that influence changes in patterns of cannabis use in adolescents. The chapter begins by outlining the factors that influence the initiation of cannabis use in adolescents. This is followed by an assessment of factors influencing progression to regular cannabis use, then a discussion of factors influencing the progression to problematic cannabis use. Finally, an assessment of factors influencing abstinence from cannabis by non-cannabis users is presented. Chapter 1 also serves as the introduction to study 1.

Chapter 2

This chapter is a literature review assessing the relationship between cannabis use and psychotic, mood and anxiety outcomes. Initially, there is a brief review of the literature identifying an association between cannabis use and psychosis, followed by an assessment of the mechanisms behind this association. This includes a neurotoxic model, psychosis proneness-persistence model, and synergism with other environmental risk factors. The

second section looks at the relationship between cannabis and mood and anxiety outcomes. This begins with a brief review of the relationship between cannabis and mood and anxiety disorders, followed by potential mechanisms behind the association. These include secondary psychopathological disorder models (i.e. neurotoxicity & psychosocial failure), and secondary substance use disorder models (i.e. self-medication, alleviation of dysphoria, & the regulation of cognitive states). Finally, the chapter introduces the concept of resilience in terms of an integration of the risk and resilience literature, introducing a model depicting the proposed transition from predisposition to psychopathological outcomes. This chapter serves as the introduction to study 2.

Chapter 3.

Chapter 3 is a conceptual review of resilience, assessing the developmental trajectories of resilience and substance use. This chapter thus begins by discussing the conceptual issues plaguing resilience research. Following on, developmental trajectories of resilience are outlined, and this involves an assessment of the change in resilience factors over time. An integration of resilience and substance use is then presented, assessing the effects of resilience on substance use utilizing the traditional risk and protective factor approach. Moreover, the chapter presents the developmental trajectories of substance use, and then identifies a gap in the literature in terms of the concurrent assessment of developmental trajectories of resilience and substance use. This chapter serves as the introduction to study 3.

Chapter 4.

This is the methodological chapter, outlining the full details of the study. Studies 1, 2 & 3 are all based on data collected as part of the same 6-month prospective study utilizing two samples. The main study sample was a sample of 261 young people recruited from schools in Birmingham. This formed the general adolescent sample, which was also the main study sample. A smaller clinical sample of 27 participants was recruited from Child and Adolescent Mental Health Services.

Chapter 5.

This chapter presents the rationale, aims and results for study 1. Study 1 was an assessment of the factors influencing change in patterns of cannabis use. More specifically, the study looked at self -reported factors influencing cannabis use in general, initiation, increases, decreases, voluntary abstinences and abstention in non-cannabis users. Frequency analysis was utilized for self-reported factors influencing cannabis use, initiation, increases, decreases, and abstention by non-cannabis users. Thematic analysis was utilized for participant responses regarding voluntary abstinences as reported by cannabis users.

Chapter 6

This chapter presents the rationale, aims and results for study 2, which was an assessment of the relationship between cannabis use and depression, anxiety, stress and sub-clinical psychosis. Cannabis users and non-users were compared on their levels of depression, anxiety, stress and sub-clinical psychosis. Moreover, the study also sought to assess whether cannabis use moderated the relationship between resilience and depression, anxiety, stress and sub-

clinical psychosis. Due to low levels of cannabis use in the sample, secondary analyses were also carried out for alcohol use. This is because both cannabis and alcohol are initiated during adolescence, they present with a similar risk etiology, and similar resilience factors have been identified for both cannabis and alcohol use in adolescence.

Chapter 7.

This chapter presents the rationale, aims and results for study 3. Study 3 aimed to assess the relationship between resilience and substance use, together with an analysis of whether and how resilience changes over time. Firstly, change over time of resilience factors is assessed. Secondly, analysis of whether resilience predicts cannabis use is carried out. Thirdly, there is also an assessment of the predictive utility of resilience for alcohol consumption.

Chapter 8

This is the discussion chapter for the three studies. In Study 1, a wide range of factors were identified as influencing change in cannabis use patterns, however, there appeared to be an overarching influence of peers in this study. Peers were found to influence cannabis patterns both directly and indirectly. Moreover, the factors influencing changes in cannabis use were generally comparable between the general and clinical adolescent samples.

Study 2 identified that neither cannabis nor alcohol use appeared to be related to psychotic, mood and anxiety symptoms in this study. Moreover, both cannabis and alcohol use did not moderate the relationship between resilience and these mental health outcomes. Moreover, cannabis use did not appear to worsen mental health for young people already accessing

mental health services. However, these findings may well be an artifact of the low levels of cannabis use in the study samples.

In study 3, there was no change over time identified for resilience factors, with findings comparable between the clinical sample from CAMHS, and the general adolescent sample from schools. Nevertheless, resilience was found to be lower for young people from CAMHS as compared to those from schools. Furthermore, resilience did not appear to be predictive of cannabis use, although two resilience factors were found to negatively predict the amount of alcohol consumed.

Chapter 9.

This is the general discussion, synthesizing findings across the three studies. Factors influencing cannabis use are framed within previously identified resilience frameworks. It is identified that the present research sample was influenced by both external and internal factors. The emergence of personal competence as a key resilience factor is also discussed. Furthermore, the overall strengths, limitations and implications of the present research are presented.

Chapter 1 Factors influencing change in patterns of cannabis use in adolescents

1.1 Introduction

Cannabis is the most widely used illicit drug and it comes third in popularity to alcohol and tobacco (EMCDDA, 2012). It has also been identified as one of the first illicit drugs to be used by young people, with onset of use beginning in early adolescence. Estimations of age of initiation vary from ages 11 to 13 years (Fuller, 2006; Perkonigg et al., 2008), with cannabis use disorders typically occurring between ages 15-25 years (Perkonigg et al., 2008). However, national data indicates a fall in adolescent cannabis use over the past few years, with past year cannabis use falling from 13.4% in 2001 to 7% in 2013 (Fuller & Hawkins, 2014). This trend is partially supported by European data, with a decline in use identified in adolescents in 2007, however, stabilizing by 2011 (Hibell et al., 2012).

In spite of the identified decrease in rates of use, cannabis still remains the most commonly used illicit drug by adolescents (Fuller & Hawkins, 2014; Hibell et al., 2012), It is thus imperative to fully understand the factors influencing its use in this population. The present review aims to assess the factors most commonly identified in the literature as influencing cannabis use and changes to cannabis use patterns in young people. This is achieved by presenting a discussion of factors influencing initiation, progression to regular use, progression to problematic use, decreases, and abstinence by non-cannabis users. The gaps in the literature are then identified, and this subsequently leads to the outlining of the rationale, aims and hypotheses for Study 1.

Search strategy

Reference databases (PsycInfo, Medline, Web of Science, and Embase) were utilised for gathering the literature. The search was conducted for peer-reviewed literature in English language, from the year 2000. The search terms used were:- Cannabis OR Marijuana AND Pattern OR Course OR Change OR Transition OR Initiat* OR Increase OR Decrease OR Regular OR Abuse* OR Dependen*. Papers were included if they utilized either adolescent samples only, or both adolescent and young adult samples. References were also followed up from other papers.

Adolescence has been universally described as the period between childhood and adulthood (e.g. Casey, Jones & Hare, 2008; Degner, 2006). However, identification of the specific timeframe within which adolescence falls appears to be problematic. This is because the timing of adolescence is determined by various factors including culture, time and individual differences (Degner, 2006). For example, Western definitions of the onset of adolescence pinpoint to the onset of puberty, which occurs at various ages (e.g. anywhere between ages 9-13 years) (Christie & Viner, 2005). Likewise, timing of the end of adolescence is not clearly defined. In an attempt to pinpoint the age at which adolescence ends, Roenneberg et al., (2004) assessed the circadian rhythms of 25,000 individuals recruited from Germany & Switzerland. They found an abrupt change around the age of 20 years, and this was taken as a marker for the end of adolescence (Roenneberg et al., 2004). However, this study did not take account of other physical, psychological, social and mental changes which also signify the end

of adolescence. Thus the term ‘adolescents’ can only be used loosely to refer to individuals transitioning from childhood to adulthood (Degner, 2006).

1.2 Initiation

Assessments of cannabis initiation indicate that there is a rapid increase in rates of initiation over the course of adolescence (e.g. Von Sydow et al., 2001). For example, in a sample followed up from the age of 11 years, 35% had initiated cannabis use by the age of 17 years (Bohnert, Anthony & Bresalau, 2012). However, it is important to note that cannabis initiation appears to be poorly defined in the literature, so much so that the majority of studies fail to explicitly assess the first experience of cannabis. A differentiation between initiation of experimental use and regular use is not always made. For example, Bohnert et al. (2012) measured cannabis initiation utilizing a yes/no answer to the question of whether participants in their study had used cannabis, even once. This question was pertaining to a 6-year period (between the ages of 11-17 years), thus the study failed to distinguish between factors influencing the actual onset of cannabis use (i.e. first experience with cannabis) from the factors influencing cannabis use in general. Nevertheless, various factors have been identified as influencing the initiation of cannabis use, and these will be discussed in turn.

1.2.1 Other substance use

It has been consistently identified that adolescents who use substances, in particular alcohol and tobacco, are more likely to initiate cannabis use (Von Sydow et al., 2002; Coffey et al., 2000; Bohnert et al., 2012; Agrawal et al., 2007; Ellickson et al., 2004; Perez et al., 2010; van den Bree et al., 2005; Guxens et al., 2011; Tucker et al., 2013). This appears to hold true for initiation of both experimental and regular cannabis use (van den Bree et al., 2005). Moreover,

it has been shown that comorbid alcohol and tobacco use appears to be a stronger predictor of cannabis initiation than either of these substances in isolation (van Leeuwen et l., 2011).

Three models have been put forward to explain why alcohol and tobacco appear to be precursors for cannabis. These are: - the route of administration, gateway, and common liability hypotheses. According to the route of administration model, it is the route in which substances are administered that predicts the use of other substances with a similar route of administration (Agrawal & Lynskey, 2009). Thus the use of an inhaled drug (e.g. tobacco) is more likely to result in the use of another inhaled drug (e.g. cannabis). Conversely, the gateway hypothesis posits that there are 'stages' in the use of illicit drugs whereby use of licit substances (e.g. alcohol), is followed by use of soft illicit drugs (e.g. cannabis), and ultimately use of hard illict drugs (Kandel, 2002; Kandel et al., 2006). On the other hand, the common liability model asserts that using drugs comes about as a result of a liability that is shared across substances (i.e. shared risk factors). Thus this model does not predict a specified sequence of drug use as postulated by the gateway hypothesis (van Leeuwen et al., 2011; Dagenhardt et al., 2010).

The evidence provided from studies directly assessing these three models in regards to cannabis initiation has been mixed. Some report finding support for the common liability model only (van Leeuwen et al., 2011), whilst others report support for both the route of administration and gateway hypotheses (Mayet et al., 2011). Additionally, it has been shown that the gateway effects previously identified may be partially explained by unmeasured common factors associated with the substances (Dagenhardt et al., 2010). Nevertheless, it

seems more likely that all three models are not necessarily mutually exclusive, with more recent evidence providing simultaneous support for all three (Mayet et al., 2014). This appears to be the most parsimonious explanation of the mixed support of the three models individually.

1.2.2 Peer substance use

Another consistently identified factor influencing cannabis initiation in adolescents is that of perceived peer alcohol, tobacco, and cannabis use (e.g. von Sydow et al., 2002; Coffey et al., 2002; D'Amico & McCarthy, 2006; Bohnert et al., 2012; Ellickson et al., 2004; Ragan & Beaver, 2010; Kosterman et al., 2000; Tucker et al., 2013). In some cases, it has been found that the effects of peers may be moderated by age and gender (Perez et al., 2010; Ellickson et al., 2004; Guxens et al., 2011). For example, peer influences have been identified for females and not for males (Perez et al., 2010). Moreover, it has also been identified that peer influence on cannabis initiation strengthens with age (Ellickson, et al., 2004). However, these gender and age differences are not always apparent (e.g. van den Bree et al., 2005).

The influence of peers on adolescent health behaviours has been previously explained by both selection and socialisation effects (Brechwald & Prinstein, 2011). Selection effects refer to an individual's inclination towards affiliation with like-minded individuals, whereas socialisation effects (e.g. social learning theory, Catalano et al., 1996) refer to the tendency of attitudes and behaviours of peers becoming increasingly similar over time (Brechwal & Prinstein, 2011). Even though both selection and socialisation effects have been identified as influencing adolescent health behaviours, there has been a tendency in the cannabis use literature to over-

state socialisation effects at the expense of selection effects. Therefore it has been suggested that selection effects may actually act as an unmeasured confound in cases where peer influence has been explained via socialisation effects, thus inflating the peer effects identified (Jaccard, Blanton & Dodge, 2005). However, Jaccard et al., (2005) studied sexual activity and binge drinking outcomes, although they assert their findings are applicable across different contexts, including cannabis use.

1.2.3 Antisocial behaviour and delinquency

Young people presenting with antisocial behaviour and its related behaviours (e.g. delinquency and conduct problems) have been identified as being at an increased risk of cannabis initiation (e.g. Coffey et al., 2000; Perez et al., 2010; Pedersen et al., 2001; Guxens et al., 2011; Shelton et al., 2007; van den Bree et al., 2005; Tucker et al., 2013). This effect appears to be stronger for males as compared to females (Guxens et al., 2011; Pedersen et al., 2011). This may be because it has been consistently identified that males are more likely to engage in antisocial behaviour than females (Moffit, Caspi, Rutter & Silva, 2001).

Antisocial behaviour has been linked to not having organised leisure time activities (Mahoney & Stattin, 2000). Findings from a large-scale prospective study of Spanish adolescents indicate that a lack of organised leisure time activities increased the risk for cannabis initiation (Perez et al., 2010). Interestingly, this effect was found only for males. Contrastingly, it has been found that the type of leisure activities themselves is not pertinent to cannabis initiation. Rather it is the person with whom leisure time is spent with that is predictive of initiation (Schaub et al., 2010). In this case, spending leisure time with friends, as opposed to family, partner or siblings, was predictive of cannabis initiation. Thus it can be postulated that the

identified effects of leisure time activities may be indicative of adolescents increasing the time they spend with peers as opposed to family.

1.2.4 Family factors

A wide range of factors relating to a young person's family has been identified as being influential in cannabis initiation. This has included, but is not limited to, parental marital status (Bohnert et al., 2012; Guxens et al., 2011; Tucker et al., 2013), maternal substance use (Bohnert et al., 2012); parent-child communication about drug use (Nonnemaker et al., 2012), parental employment status (Guxens et al., 2011), and low parental control (Tucker et al., 2013). However, it is important to note the decreasing influence of the family over an adolescent's substance use behaviour with a concurrent increase in peer influence (e.g. Ellickson et al., 2004). Indeed, spending leisure time with the family had no influence on cannabis initiation in the previously described study by Schaub et al., (2010). This decreasing family influence is discussed in the context of resilience trajectories in Chapter 3.

Cannabis initiation has been shown to be heritable (Agrawal & Lynskey, 2006). However, data from twin studies indicates that environmental factors are more influential in cannabis initiation as opposed to genetic factors. For example, Vink et al., (2010) assessed cannabis initiation in an adult Dutch twin sample. It was found that the variance in cannabis initiation was predominantly explained by environmental factors (both shared and unique) as opposed to genetic factors (Vink et al., 2010). Additionally, specific genetic mechanisms have been identified, and these have been shown to interact with family factors to influence cannabis use behaviour. For example, parental monitoring has been identified to interact with genetic

vulnerability for cannabis use (Otten et al., 2012). More specifically, it was identified that adolescent carriers of the DRD4 7-repeat allele had an exaggerated response to effects of parental monitoring than non-carriers. Thus they were more likely to use cannabis when levels of parental monitoring were low and vice versa (Otten et al., 2012). However, this study did not assess cannabis initiation specifically, rather use in general.

1.2.5 Gender

The literature identifies males as being more likely to be cannabis users than females (e.g. Chabrol et al., 2005; Hibell et al., 2012). However when initiation is specifically assessed in adolescence, males are no more likely to initiate than females (Bohnert et al., 2012; Perex et al., 2010; Schaub et al., 2012; Williams et al., 2007; D'Amico & McCarthy, 2006). At first glance, this appears paradoxical, but can be explained by the literature. For example, an assessment of European data indicates that when assessing lifetime prevalence, there appears to be a higher proportion of male cannabis users as compared to females (EMCDDA, 2005). There is also an increase in gender differences with age, thus there are comparable levels of use between males and females during adolescence, with males overtaking females by early adulthood (EMCDDA, 2005). This may be because males are at a higher risk of progressing to heavy persistent levels of use than females (e.g. Coffey et al., 2000, Chabrol et al., 2005, von Sydow et al., 2002). However, some studies do identify males as being more likely to initiate (e.g. von Sydow et al., 2002). Moreover, even when past year cannabis prevalence is assessed, males present with higher rates of use than females (Hibell et al., 2012).

1.2.6 Summary

A plethora of risk factors for cannabis initiation have been identified in the literature. An adolescent's use of other substances, in particular tobacco and alcohol, has been identified as influential. This relationship with other substance use can be explained via simultaneous influence of gateway effects, common liability and route of administration effects. Peer substance use also appears to influence initiation, and both peer selection and socialization effects explain the influence of peers. Antisocial behaviour, which has been previously linked to a lack of structured leisure activities, has also been found to influence cannabis initiation, especially in males. However, findings indicate that the type of leisure activity does not matter, rather the person with whom the activity is engaged in with. Multiple family factors also appear to influence initiation, with some of these factors interacting with genetic mechanisms. Even though males are more likely to be cannabis users than females, it remains unclear whether this is because they are at higher risk of initiation, or persistent use. However, because cannabis initiation is so poorly defined in the literature, it can be suggested that these identified factors may be in relation to cannabis use in general, rather than first experience with cannabis per se.

1.3 Progression to regular use

Assessments of cannabis use trajectories point to a number of young cannabis users who continue to use cannabis during adolescence (e.g. Swift et al., 2008; Juon et al., 2011). However, assessment of regular cannabis use cannot be easily carried out, as this is a poorly defined term. It is thus not clear from the literature what specific cannabis use frequency level

constitutes ‘regular’ use (e.g. daily versus weekly use). As a result, different types of progression of cannabis use, beyond the initial experimentation have been assessed. This includes continuity of use in general, increases in frequency/quantity, and daily cannabis use. This literature is presented below, with the term ‘regular use’ utilised loosely to combine these findings.

In a similar finding to the one previously cited for initiation, peer substance use has also been identified as a factor influencing the progression from initiation to regular cannabis use (e.g. Coffey et al., 2000; D’Amico & McCarthy, 2006; Gervilla, Cajal & Palmer, 2011). For example, Coffey et al., (2000) assessed the continuity of cannabis use from mid to late school, and the progression to daily use in a population based Australian adolescent sample. It was found that males reporting peer substance use were 6 times more likely to report daily cannabis use in late school. However, the effect of peer substance use on increasing frequency of use has also been found to be substance specific. For example, D’Amico and McCarthy (2008) identified that it was perceived peer alcohol and not cannabis use that was predictive of an increase in frequency of own cannabis use.

Peer substance use could have an effect on progression to regular use due to the peer selection and socialisation effects previously identified (Brechwald & Prinstein, 2011). Both these processes make intuitive sense. For example, it can be postulated that selection effects means a young person is surrounded by peers who subscribe to the same notions of cannabis use. A young person looking to experiment with cannabis may end up using on a regular basis if this is the behaviour of the peer group (socialisation effects). Indeed, social motives for cannabis

use in young people have been identified (e.g. Marsden & Strang, 2001; Lee, Neighbors & Woods, 2007; Patrick et al., 2011). Moreover, indirect support exists in the finding that spending leisure time with peers increases the likelihood of progressing to daily use (Schaub et al., 2010).

An adolescent's own alcohol and cigarette use have also been identified as conferring risk of progressing to regular cannabis use. In particular, those who report early use of alcohol have been identified as being at increased risk of progressing to daily cannabis use (Coffey et al., 2000). Moreover, it has been identified that increasing one's own cigarette and alcohol use is also predictive of a concurrent increase in the frequency of cannabis use (Schaub et al., 2010). However, it's not clear why this is the case, and which, if any of the previously identified models linking substance use and cannabis (i.e. self medication, route of administration or gateway models) may explain progression to regular use.

Leaving school early has been identified as a risk factor for progression to daily cannabis use (Legleye et al., 2011). It may be that leaving school early leads to a lack of structure with the adolescent engaging in cannabis use more regularly to fill the time. Leaving school may also be related to a delinquent profile (e.g. being excluded from school), and it has been identified that adolescents engaging in antisocial behaviour are at increased risk of regular cannabis use (Coffey et al., 2000; Gervilla et al., 2011). However, it may also be the case that it is regular cannabis use that increases the risk of leaving school early (Lynskey et al., 2003). Nevertheless, for those who do remain in school, the risk of progression is greater in instances

where cannabis is readily available at school (Coffey et al., 2000), and for those repeating a school year (Legleye et al., 2011).

1.3.1 Summary

There have been a number of different factors identified as conferring risk for progressing to regular cannabis use, these include peer substance use, which may be influential via the previously describes socialisation and selection effects. Alcohol and cigarette use have also been identified as conferring risk of progression to regular use, though it is not clear whether this is due to gateway, route of administration, or common liability effects. The school environment appears influential, both for those leaving early, and for those remaining in school. However, it does appear as though the factors increasing risk of progression to regular use are on the whole comparable to those identified for cannabis initiation. It is also important to note that these findings most likely relate to continuing cannabis use in general, rather than 'regular use' per se, due to the previously identified problems in defining regular cannabis use.

1.4 Progression to problematic use

The term 'problematic cannabis use' has been traditionally used to refer to cannabis abuse and/or dependence. When assessing cannabis use trajectories, it can be seen that abuse and dependence tend to occur predominantly during the period from late adolescence to early adulthood (von Sydow et al., 2001; Perkonigg et al., 2008; Swift et al., 2008). Moreover, it appears as though onset of problematic use wanes off during the latter stages of early to late adulthood (von Sydow et al., 2001). It is thus imperative to identify factors associated with

these clinical levels of use as they have been related to a wide range of negative outcomes (Armstrong & Costello, 2002) (see chapter 2 for review of effects on mental health).

1.4.1 Early age of cannabis onset

It has been identified that those initiating cannabis use early (i.e. before late adolescence) are more likely to progress to problematic use than those initiating later (e.g Von Sydow et al., 2002; Ellickson et al., 2004; Cheadle & Hartshorn, 2012; Chen et al., 2005; Swift et al., 2008). The effect of early initiation can be illustrated in a prospective study of North American indigenous adolescents followed up over a 5-year period. It was found that those initiating cannabis by the age of 12 years were 6.5 times more likely to experience cannabis abuse and dependence than those initiating later (Cheadle & Hartshorn, 2012). However, it is worth noting that this indigenous group has been shown to report generally higher rates of cannabis use as compared to other ethnic groups (Mitchelle & Plunkett, 2000), and may thus not be representative of a general adolescent population.

Despite early onset cannabis use being identified as a risk factor for developing cannabis abuse and dependence, this does not necessarily mean that the majority of adolescents initiating early will go on to develop abuse and dependence. Illustration of this can be seen in data collected as part of the Early Developmental Stages of Psychopathology Study (Witchen et al., 1998). Lifetime prevalence for cannabis abuse and cannabis dependence was 5.5% and 2.2% respectively (von Sydow et al., 2001). Therefore, there is only a minority who initiate early and continue into heavy problematic use patterns (Coffey et al., 2003; Swift et al., 2008). Furthermore, positive subjective responses to cannabis by those who initiate early are also

influential, as they have been found to show a dose-response association with cannabis abuse and dependence (Fergusson et al., 2003).

1.4.2 Gender

Males have been consistently identified as being at higher risk of developing cannabis abuse and dependence as compared to females (von Sydow et al., 2002; Cascone et al., 2011; Coffey et al., 2003; Swift et al., 2008). Furthermore, onset of cannabis abuse and dependence appears to continue over a more protracted period in males as compared to females. For example, onset of cannabis abuse and dependence was identified to occur from the age of 15 years to 22 years in females, but continued to occur until the age of 26 years in males (von Sydow et al., 2001). Moreover, recent data indicates that problematic cannabis use subsides much earlier in females than males, which may be why males present with higher lifetime prevalence (Farmer et al., 2015). This may be partially explained by brain imaging data, which shows that females mature faster than males (Lim, Han, Uhlhaas, & Kaiser, 2013). Thus it can be postulated that females may experience lifetime transitions (e.g. marriage) earlier than males, and such transitions have been linked to reductions in cannabis use (e.g. Terry, Wright & Cochrane, 2007).

1.4.3 Trauma/adversity

Cannabis abuse and dependence have been identified as being influenced by a young person's experience of adversity and/or trauma. Most consistently, it has been identified that those experiencing childhood maltreatment (either abuse or neglect), are at increased risk of

developing cannabis abuse and dependence (e.g. Rosch et al., 2010; Duncan et al., 2008; Oshri et al., 2011). Childhood sexual abuse has been identified as a stronger predictor of cannabis abuse/dependence as compared to childhood physical abuse (Duncan et al., 2008). This makes it important to distinguish between different types of abuse experienced as this has not always been done and may mask effects that are specific to a particular type of abuse (e.g. Rosch et al., 2010; Oshri et al., 2011). Other types of adversity conferring risk for cannabis abuse/dependence include parental death before the age of 15 (VonSydow et al., 2002) social and peer relationship problems (Cascone et al., 2011).

As a means of explaining how childhood maltreatment leads to the development of cannabis abuse and dependence, Oshri et al., (2011) employed a trajectory approach. They followed their sample of children from age 7 to 15 years. A developmental pathway was identified from childhood maltreatment (abuse or neglect), to personality functioning, then to externalizing behaviour and subsequently cannabis abuse/dependence. This indicates that childhood maltreatment acts as a predisposing factor, interacting with personality and behavioural factors and subsequently producing cannabis abuse/dependence (Oshri et al., 2011).

1.4.4 Mental Health.

Factors related to the mental health of an individual have also been identified as conferring risk for cannabis abuse and dependence. Such factors identified include both externalising problems (e.g. antisocial behaviour/conduct problems) (e.g. Rosch et al., 2010; Coffey et al., 2003), and internalising problems (i.e. depression and anxiety) (Swift et al., 2008; Gilder et al., 2012). The influence of mental health factors on cannabis abuse and dependence may point to either self-medication or common liability processes. Indirect support for the self-

medication view comes from an assessment of adolescent (aged 12-19years) cannabis dependence which identified having an 'avoidant coping style' as being a predictor of cannabis dependence (Cascone et al., 2011). This may indicate that those who utilise maladaptive coping methods are more likely to become dependent on cannabis as a means of coping.

1.4.5 Summary

Initiating cannabis early has been identified as a risk factor for developing problematic patterns of cannabis use. However, it is only a minority of early initiators that go on to develop problematic use, and it appears as if it is those with higher positive subjective responses to cannabis that are even more likely to develop abuse and dependence. Moreover, males appear to be at higher risk of developing cannabis abuse and dependence than females, and they also seem to experience a much more protracted period of initiating these problematic use patterns. This may be related to their delayed maturation, increasing the time it takes to experience lifetime transitions related to decreasing cannabis use. Furthermore, those who have experienced childhood trauma or adversity are at an increased risk of developing cannabis dependence and abuse, with effects appearing stronger for childhood sexual abuse as opposed to physical abuse. Both externalising and internalising problems also appear to increase risk for abuse and dependence, and this may be linked to both self-medication and common liability processes.

1.5 Decreases in cannabis use

When assessing trajectories of cannabis use in adolescence, it has been identified that only about 4% of those initiating early progress to increased levels of use (Coffey et al., 2000). This means that the majority of early initiators either maintain low levels of use or stop using altogether. Moreover, those who have already made the transition to heavy regular use could also reduce their levels of use. This means that it is important to assess the factors that are related to the decision to decrease cannabis use during adolescence, capturing both low level users and those previous heavy users experiencing a change in their cannabis use patterns. Such information has utility for informing early intervention efforts for those who already use cannabis.

A recent research focus on factors influencing decreases has emerged. This is illustrated by an assessment of data from the AddHealth study, which highlighted the importance of neighbourhood characteristics for influencing decreases in cannabis use (Pollard et al., 2014). Furthermore, a study of patients experiencing first episode psychosis indicated that a change in circumstances and the peer group influenced their decision to reduce cannabis use (Seddon, Copello & Birchwood, 2013). This finding of an influence of change in circumstances on decreases in cannabis use has also been previously identified in a non-clinical adult sample (Terry, Wright & Cochrane, 2007).

During adolescence, changes in circumstances may be related to the various transitions occurring during this period. It has previously been identified that adolescent transitions occur across three levels, that is, the individual, interpersonal and institutional levels (Goplerud,

1991). At the individual level, adolescents go though various biological, cognitive and psychosocial changes. For example, the onset of puberty is associated with various hormonal changes, which are related to adverse effects on emotional function, such as increased levels of depression (especially in females) reduced impulse control, and increased unpredictability (e.g. Ge, Conger & Elder, 2001; Buchanan, Eccles & Barker, 1992). Such factors have been identified as increasing risk of substance use in adolescence (see Chapter 3).

At the interpersonal level, adolescents experience changes in relationship dynamics, more notably, family and peer relationships. For example, it has been previously identified that over time, peers become more important to adolescents than the family, and thus may subsequently exert more influence (Furman & Burhmester, 1992). These changes in peer and family relationships are explored in more depth in Chapter 3. As peers have been identified as influential across various stages of cannabis use, it is likely that for the adolescent cannabis user, a change in peers may also translate into a change in cannabis use behavior, particularly if the new peer group does not approve of cannabis use.

At the institutional level, early adolescence is characterized by the transition into high school. This has been identified as a particularly stressful period; characterized by changes in peer networks, school environment and potential disruptions in support networks (Newman et al., 2007). It has been found that the transition into high school is related to an increase in substance use, particularly for adolescents with low levels of parental involvement (Gottfredson & Hussong, 2011). The influence of social support during this period has been shown for several outcomes. For example, it has been found to influence both academic and

psychological adjustment (Ruegger, Malecki & Demaray, 2010). Over the course of adolescence, it has been shown that perceived support from both teachers and classmates declines over time. This is associated with an increased risk of mental health difficulties (Wit, Karioja, Rye and Shain, 2011) and could also be asserted as contributory, at least partially, to the sharp increase in substance use observed with age during adolescence.

Another institutional level transition that some adolescence experience is that of entering the workforce, especially during late adolescence. This exposes the young person to a new set of peers and to new levels of responsibility. However, whether the outcomes of entering employment are positive or negative is not always clear-cut. Adolescent employment has been associated with various negative consequences such as dropping out of school (Warren & Lee, 2003), and increases in antisocial behavior (Apel et al., 2007). However, such negative outcomes appear to be largely influenced by factors such as the level of intensity of the work (Shoenhals, Tienda & Schneider, 1998) and socio-economic status (Leventhal & Graber, 2003). For example, Leventhal and Graber (2003) found that in a sample of low-income background African-Americans, young people who had been employed prior to the transition into adulthood were more likely to finish high school than those who were not employed. Overall, it seems likely that the experience and impact of various transitions during adolescence may be influenced by a number of different factors, such as the level of support and socio-economic factors.

1.6 Abstinence

Although cannabis use is common in adolescence, the majority never actually initiate cannabis. It is thus imperative to assess the factors that influence the decision not to use

cannabis in this group, as these will be informative for prevention efforts. Factors influencing abstinence from cannabis use have been identified as those that are protective against initiation. These factors are reviewed in chapter 3 and include academic achievement, personal competence, abstinent peers, and other parenting related factors (e.g. parental involvement in school). Nevertheless, the two most commonly identified factors cited as being protective against cannabis initiation are briefly outlined here.

Parental monitoring has emerged as one of the most commonly reported protective factors (Bohnert et al., 2012; Crano et al., 2008; Schinke et al., 2008; Farhat et al., 2011). This term refers to the parenting behaviours of supervision and keeping track of activities that the child is involved in (Statin & Kerr, 2000). To illustrate this point, Bohnert et al., (2012) followed up a large group of adolescents and measured parental monitoring at the age of 11 years, with an assessment of cannabis use at age 17 years. It was found that increased levels of parental monitoring were associated with reduced likelihood of cannabis initiation. As the authors pointed out, for each percentage increase on the parental monitoring scale employed in the study, the likelihood of cannabis initiation decreased by 6% (Bohnert et al., 2012). Likewise, doing activities with the family has also been identified as being protective against initiation (Juon et al., 2011), and could serve as an indirect method of monitoring.

Another factor identified as protective against cannabis initiation is that of religiosity. More specifically, it has been identified that adolescents presenting with high levels of religiosity are less likely to initiate cannabis use (e.g. Wallace et al., 2003; Wallace et al., 2007; Sinha et al., 2006; Mellor & Freeborn, 2011). The protective effects of religiosity on cannabis initiation

were shown in a sample of young adults drawn from the AddHealth study. It was found that a unit increase on the religiosity measure was associated with a concurrent 20% decrease in the risk of cannabis initiation.

Notwithstanding the evidence of a general protective effect of religiosity on cannabis initiation cited above, it does appear that religiosity differentially influences young people based on ethnic and other individual differences. For example, it has been identified that although Black adolescents report higher levels of religiosity than their White counterparts, the protective effect of religiosity appears to be stronger for White adolescents (Wallace et al., 2003). Moreover, recent data seems to indicate that it is the importance of religion to the individual that has the strongest influence on cannabis abstention, with private religiosity also being more influential than public religiosity (Fletcher et al., 2014; Salas-Wright et al., 2014). Effects of religiosity may be direct (e.g. cannabis use may be incongruent with one's beliefs thus using would create a state of cognitive dissonance) or indirect (e.g. taking part in religious activities may expose adolescents to pro-social peers, reducing likelihood of exposure to cannabis) (Marsigila, Kulis Nieri & Parsai, 2005; DeWall et al., 2014).

1.7 Overall Summary

A wide range of influential factors has been identified in the literature assessing the development of cannabis use from initiation to onset of problematic patterns of use. Factors influencing cannabis initiation during adolescence are varied. However, there appears to be a salient influence of peer substance use. This is not surprising as there is a previously identified shift from greater familial to peer influence during adolescence. An adolescent's own alcohol

and cigarette use also appear to be strong predictors of initiating cannabis use. On the whole, factors increasing risk of progression to regular use appear to be generally comparable to those influencing initiation. However, factors conferring risk for problematic cannabis use appear to have a distinct profile, which is at a more individual level. Indeed, it has been identified that progression to abuse and dependence is more strongly predicted by genetic as opposed to environmental factors (Verweji et al., 2010). There appears to be a paucity of research assessing factors influencing decreases in adolescent cannabis use. Moreover, the factors that influence periods of abstinences in adolescent cannabis users remain unidentified. For young people who abstain completely, there have been identified protective factors against cannabis initiation such as parental monitoring and religiosity. However, there is a need for information on self-reported factors linked to abstinence.

Chapter 2 Cannabis use and mental health: Assessing the transition to psychotic, mood and anxiety disorders.

2.1 Introduction

It has been shown that people who use cannabis are more likely to report experiencing psychopathological disorders, including psychotic, mood and anxiety disorders (Wittchen et al., 2007; Mc Gee et al., 2000; Armstrong & Costello, 2002). The degree of co-morbidity with other psychiatric disorders appears to increase together with increased severity of cannabis use (e.g. Armstrong & Costello, 2002). Such findings have led to the question of whether cannabis plays a role in the development of psychopathology.

In the past few years, an increase in the potency of cannabis products, particularly sinsemilla, has been identified (EMCDDA, 2004). Cannabis potency is determined by the level of delta-9- tetrahydrocannabinol (THC), which is the main psychoactive component of cannabis. European data indicates that from 1995 to 2002, the potency of sinsemilla doubled (from about 6% to 12%), although there was no change in potency observed for resin and herbal cannabis (EMCDDA, 2004). The concurrent increase in the availability of cannabis products produced from sinsemilla (EMCDDA, 2012) is a potential cause for concern, as more people may be exposed to the higher THC levels, which could increase the risk of developing psychopathology.

2.1.1 Aim

The present review aims to assess the relationship between cannabis and psychotic, mood and anxiety disorders, with a particular focus on the mechanisms behind the transition from cannabis use to psychopathological disorder. The review of the evidence is presented separately for psychotic, and for mood and anxiety outcomes. For each outcome, the literature assessing its relationship with cannabis and psychopathology is initially presented, with systematic review methods for gathering the literature employed. This forms a minor component of the review, as this literature has been previously reviewed on multiple occasions. Following on, a comprehensive narrative review exploring the possible mechanisms involved in the transition from cannabis use to psychopathological disorder is then presented. This forms the main part of the review, as there is a paucity of literature reviewing these mechanisms.

2.1.1.1 Search Strategy

Reference databases (PsycInfo, Medline, Web of Science, and Embase) were utilised for gathering the literature. The search terms used were:- Cannabis OR Marijuana AND Mental health, mental illness, psychopathology, psychopathological, mental disorder, psychiatric symptoms, depression, depressive, mood, anxiety, stress, psychosis, psychotic, suicide, suicidal. This yielded 1674 papers. The search was limited to peer reviewed literature in English language, from the year 2000, producing 554 papers. 231 relevant papers were identified based on the abstracts. For the initial systematic component, papers were included if they were prospective, and utilized large population based or clinical samples, and controlled for confounders. This yielded 50 papers, including those followed up from references.

The second part of the review assessing mechanisms behind the association was more inclusive, incorporating various methodologies including experimental, epidemiological and theoretical papers. The search period was increased to include papers from inception of the databases. This is due to the limited nature of both empirical data and reviews assessing mechanisms. 63 papers were selected for this part of the review, including those followed up from references of the previously selected papers for the first part of the review.

2.2 The association between cannabis and psychosis

This section focuses on the relationship between cannabis use and psychotic outcomes. The first part is a brief systematic review providing a description of the nature of the causal relationship between cannabis and psychosis. The second part aims to review the mechanisms behind the main effects identified in the relationship between cannabis and psychosis.

2.2.1 The nature of the relationship between cannabis and psychosis

Cannabis has been related to various psychotic outcomes, and these appear worsened for those who initiate use early (i.e. during adolescence). For example, those who initiate use by the age of 15 years experience more psychotic symptoms (Konings et al., 2008; Arsenault et al., 2002), and are twice as likely to develop a psychotic disorder (McGrath et al., 2010) as compared to those who initiate later. Similarly, cannabis also appears to reduce age of onset of psychotic symptoms in individuals at ultra-high-risk for psychosis (Dragt et al., 2012).

Other data from clinical samples seems to indicate that cannabis not only influences age of onset of psychotic disorder, but also age of onset of treatment for psychosis. It has been shown that patients with psychosis who use cannabis experience onset of psychotic disorder 2.7 years

earlier than those who do not use (Large et al., 2011). Additionally, Barrignon et al., (2010) found that patients with a history of cannabis use accessed treatment for psychosis approximately 10 years earlier than those without a cannabis use history. Heavy cannabis use before the age of 17 years further reduced the age at which treatment for psychosis began (Barrignon et al., 2010). Therefore cannabis appears to reduce the age of onset of psychotic disorder and treatment, with early onset of cannabis further reducing age of onset of treatment in clinical samples.

The finding that it is heavy cannabis use that further reduced the age of onset of psychotic treatment (Barrignon et al., 2010) may illustrate a dose-response effect. Indeed, it has been found that increasing the frequency of cannabis use also increases both the incidence of psychotic symptoms (Henquet et al., 2005; McGrath et al., 2007; Moore et al., 2007) and psychotic disorder (Zammit et al., 2002; Manrique-Garcia et al., 2012). Furthermore, psychotic symptoms appear to persist only with continued use of cannabis (Kuepper et al., 2011a; Wigman et al., 2011). However, studies showing dose-response effects have not always measured quantity of cannabis used, and as such these assertions are normally based only on frequency of cannabis use. It may be useful to also measure the quantity and type of cannabis used, as these could determine the level of exposure to THC.

Cannabis may synergistically combine with pre-existing 'psychosis liability' to trigger psychosis. This assertion stems from the finding that the effects of cannabis on psychosis appear to be stronger for those with a pre-existing psychosis liability defined as baseline expression of subclinical symptoms (Henquet et al., 2005). Sub-clinical symptoms have been

described as symptoms of psychosis that occur below the threshold level for a clinical diagnosis. This psychosis liability is thought to be genetically influenced as it has been found to be both familial and heritable (Kelleher & Cannon, 2010; Polanczyk et al., 2010). Recently, it has been identified that genetic liability for psychosis is expressed as differential sensitivity to the psychotomimetic effects of cannabis (GROUP researchers, 2011). Thus we would expect those with pre-existing psychosis liability to be at an increased risk of developing psychosis after cannabis exposure.

Specific genetic mechanisms thought to moderate sensitivity to the psychotomimetic effects of cannabis have been identified. For example, a functional polymorphism of the Catechol-O-Methyltransferase (COMT) gene, the COMT Val^{158} allele (Caspi et al., 2005; Henquet et al., 2006; Henquet et al., 2009). However, the literature identifying specific genetic mechanisms is still premature at best, and much more evidence is still required. For example, not all studies find support for the interaction between cannabis and the COMT Val^{158} allele (e.g. Zammit et, al, 2007), and other genes have also been implicated in moderating psychotomimetic effects of cannabis for example, ATK_1 (van Winkel & GROUP investigators, 2010) and BDNF Val66Met allele (Decoster et al., 2011).

As well as being combined with genetic liability for psychosis, cannabis use may also combine with environmental factors in exerting its influence over development of psychosis. For example, it has been found that those living in an urban environment present with a significantly stronger association between cannabis use and psychosis, as compared to those living in a rural environment (Kuepper et al., 2011b). Kuepper et al. (2011b) also found that

psychotic symptoms could be attributed to synergistic effects of cannabis and an urban environment for between 51%-66% of people exposed to both variables. In other words, cannabis use combines with other environmental risk factors in an additive way, and this has been identified for other factors such as childhood trauma (Cougnard et al., 2007; Harley et al. 2009; Houston et al., 2008). The mechanism behind this synergism will be discussed in the next section.

In summary, the literature above shows that cannabis use is associated with psychotic outcomes, especially increased expression of psychotic symptoms. Initiating cannabis use in adolescence appears to be particularly problematic, as this leads to poorer outcomes (e.g. early onset psychosis). Psychotic outcomes also seem poorer for those who use cannabis more frequently. However, cannabis does not exert its influences on psychosis in isolation. Those with a pre-existing genetic vulnerability to developing psychosis are more likely to be affected. Additionally, cannabis also combines with other environmental risk factors when influencing psychotic outcomes.

2.2.2 Explaining the relationship between cannabis and psychosis

2.2.2.1 Age effects

The literature shows that the effects of cannabis on psychotic outcomes are stronger when cannabis is initiated at a young age, especially during adolescence (e.g. Arsenault et al., 2002; Konings et al., 2008; McGrath et al., 2010). Therefore, it is probable that cannabis may be interacting with specific neurodevelopmental processes occurring during adolescence (Trezza, Cuomo & Vanderschuren, 2008; Rubino, Zamberletti & Parolaro, 2012; Lubman, Cheetham

& Yücel, in press). This was suggested by Bossong et al. (2010) in their toxicology model of cannabis-induced schizophrenia. A toxicological approach posits that psychopathology occurs when the central nervous system is exposed to a toxic substance during a critical period in brain development (Bossong et al., 2010). In this case, cannabis is regarded as a toxic substance and adolescence as the critical period.

Cannabis is hypothesized to interfere with the changes occurring in brain neurotransmitter systems during adolescence (Lubman et al., in press). For example, it has been shown that dopamine neurotransmission in frontal cortical regions is naturally hyperactive during adolescence (Bossong et al., 2010). This produces refinement of dopamine innervations of the prefrontal pyramidal neurons (Bossong et al., 2010). It is possible that the hyperactivity of dopamine during adolescence may produce a vulnerability to the psychoactive effects of cannabis. This is because cannabis produces dopaminergic hyperactivity, particularly in mesolimbic regions (e.g. Wise, 2009; Kuepper et al., 2010), and this has been shown to produce positive symptoms of psychosis (Howes & Kapur, 2009).

As mesolimbic dopamine hyperactivity is triggered by cannabis and is also associated with positive psychotic symptoms, it could thus be the mechanism behind the psychosis inducing effects of cannabis. However, at present, there is not enough evidence to support this assertion. This is mainly because the majority of the evidence is based on animal paradigms, and thus the acute and long-term effects of cannabis exposure on dopaminergic transmission in humans are poorly understood (Kuepper et al., 2010).

There are various other changes in brain structure and chemistry that have been noted to occur in adolescence. For example, it has been identified that the pre-frontal cortex is still maturing, whereas the limbic system is fully matured and therefore behaviour tends to be more controlled by emotions (e.g. Casey et al., 2008; Bossong et al., 2010). Together with the findings of changes in dopamine neurotransmission highlighted above, it is clear that adolescence does represent a critical and potentially vulnerable period in brain development.

It has also been suggested that the poorer psychotic outcomes that are observed in those who initiate cannabis in adolescence may not necessarily reflect effects of cannabis on neurodevelopmental processes (Sundram, 2006). Rather, it may be that outcomes are due to a simple dose-response effect that results from cumulative exposure (Sundram, 2006). In other words, those who initiate cannabis early in adolescence may be exposed to more quantities of cannabis as they would have been ingesting cannabis over a longer period of time than late initiators. However, the evidence supports a neurodevelopmental effect, as early onset of use has been found to be associated with subclinical psychosis independent of lifetime frequency of cannabis use (Stefanis et al., 2004).

2.2.2.2 Dose-response effects

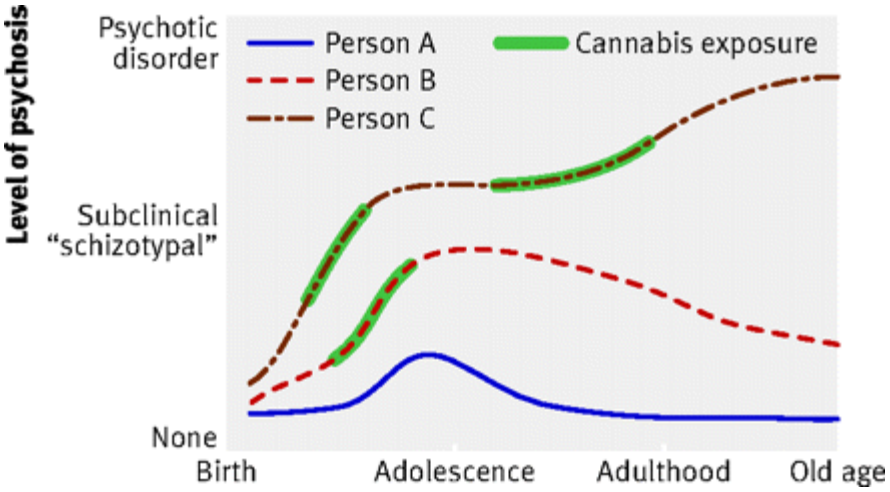
As previously noted, psychotic outcomes worsen with increased frequency and duration of cannabis use (Henquet et al., 2005; Zammit et al., 2002; Wigman et al., 2011; Kuepper et al., 2011a). This means that the more an individual is exposed to cannabis, then the higher the risk of developing psychosis. This effect may thus illustrate the process of sensitization. Sensitization has been previously described as "...the observation that individuals who are

exposed repeatedly to an environmental risk factor may develop progressively greater responses over time, finally resulting in a lasting change in response amplitude" (Collip et al., 2008, pp220-221). This means that an individual may experience onset and persistence of psychotic symptoms (and thus increased risk of developing a psychotic disorder), when they are repeatedly exposed to cannabis (and/or other environmental risk factors).

Psychosis proneness-persistence models offer an illustration of how sensitization to the effects of cannabis could lead to the development of a psychotic disorder (Cougnard et al., 2007; van Os et al., 2009; Kuepper et al., 2011a). According to such models, mild subclinical psychotic symptoms are naturally experienced mostly during childhood and adolescence, and these tend to wane during adulthood (Kelleher, 2012). This is regarded as normal developmental expression of these symptoms. However, when people are exposed to an environmental risk factor (e.g. cannabis), these subclinical symptoms tend to persist into adulthood. With repeated exposure to the risk factors, the symptoms persist for even longer and eventually develop into a clinically diagnosable psychotic disorder (see figure 1 for Kuepper et. al's, (2011) illustration of this model).

Psychosis proneness-persistence models assume that subclinical psychotic symptoms can be found in the general population. Subclinical symptoms are symptoms of psychosis that are not considered to be clinically relevant as they occur at sub-threshold levels for diagnosis of a psychotic disorder. Prevalence of subclinical psychotic symptoms in the general population is around 5% which is much higher than the prevalence rates for psychotic disorders (around 1%) (van Os et al., 2009; Hanssen et al., 2005; Cougnard et al. 2007). Such findings provide

evidence of the assertion that these symptoms are indeed found to occur naturally in the general population.



Person A presents with 'normal' developmental expression of subclinical psychosis, which peaks during adolescence, tapering off by adulthood. Person B is exposed to cannabis during adolescence, which prolongs the high expression of subclinical psychosis, with symptoms only tapering off during late adulthood. Person C is exposed to cannabis both during adolescence and adulthood. This causes them to experience persistently high expression of subclinical psychotic symptoms and the eventual transition to psychotic disorder. (Model copied from Kuepper R, Henquet C, van Os J, Lieb R, Wittchen H-U, Höfler M. 2011a. Continued cannabis use and incidence and persistence of psychotic symptoms: 10 year follow-up cohort study. *British Medical Journal*, 342:d738)

Figure 2.1 Cannabis-psychosis persistence model

The model also assumes that subclinical psychotic symptoms are normally transient, occurring as a developmental phenomenon mainly during adolescence. Indeed, most studies show that in most cases, these symptoms tend to discontinue (e.g. Hanseen et al., 2005; Mackie et al., 2011; Cougnard et al., 2007; Wigman et al., 2011; Lin et al., 2011). In order for the symptoms

to persist, then exposure to environmental risk factors such as cannabis is required. In other words, the pre-existing psychosis liability combines with environmental exposure. This has been identified in the literature, as cannabis use has been found to lead to persistence of sub-clinical psychotic symptoms (Mackie et al., 2011; Cougnard et al., 2007; Wigman et al., 2011).

The model also assumes that sub-clinical psychotic symptoms represent a liability for developing psychosis, and thus regard people presenting with these symptoms as being prone to psychosis. The finding that demographic factors that are usually related to psychotic disorder are also related to subclinical psychotic symptoms (e.g. young age, lower income, and male sex) (Van Os et al., 2009) provides indirect evidence for this assertion. Additionally, people experiencing sub-clinical psychotic symptoms do appear to have a higher risk of developing psychosis (Hanssen et al., 2005).

Conversely, a community based study of adolescents failed to find a link between hallucinations in adolescence and psychotic disorder during young adulthood (Dhossche, Ferdinand, Van Der Ende, Hofstra & Verhulst, 2002). However, recent evidence indicates that it is the co-occurrence of hallucinations and delusional ideation that leads to poor outcomes, rather than each of these symptoms occurring in isolation (Nuevo, Van Os, Arango, Chatterji, & Ayuso-Mateos, 2012). Nuevo et al. (2012) utilised population based data collected from 52 countries as part of the World Health Survey. It was found that co-occurring delusions and hallucinations were associated with poorer general health and functioning, greater severity of symptoms, and a higher probability of a lifetime diagnosis of psychotic

disorder, when compared to delusions and hallucinations occurring in isolation (Nuevo, et al., 2012). These findings are comparable to Hanssen et al. (2005) who found that odds of a clinical psychotic outcome were higher for those reporting multiple subclinical psychotic experiences, as compared to those reporting a single experience.

2.2.2.3 Synergism with other environmental factors

The finding of synergism between cannabis effects and other environmental exposures may point to a common mechanism by which these different factors exert their influence. Synergism may be a result of cross-sensitisation between cannabis and other environmental exposures (e.g. stress, urbanity, trauma). Cross-sensitisation occurs when pre-exposure to a stimulus increases the sensitivity of the response to a different stimulus. For example, past experiences of childhood trauma may increase an individual's sensitivity to the effects of cannabis. Thus we would expect poorer outcomes for those who experience both cannabis use and trauma, as compared to those who use cannabis in the absence of trauma, and this has been identified in the literature (Kuepper et al., 2011b; Cougnar et al., 2007; Harley et al., 2009; Houston et al., 2008).

Cross-sensitisation between drugs of abuse and environmental stressors has been demonstrated experimentally in animal studies. For example, Kikusui et al. (2005) used maternal separation in order to create psychosocial stress in their sample of rats. When the entire sample was injected with low doses of cocaine, it was found that the group that had experienced maternal separation showed a heightened locomotor response as compared to the group with no maternal separation. In this instance, experiencing maternal separation

increased the rats' sensitivity to the effects of cocaine (Kikusui et al., 2005). Similar results have been reported for other stimulant drugs (e.g. de Jong et al., 2005). However, there is a dearth of studies investigating THC cross sensitisation with stress, as the majority of available research has focused mainly on stimulant drugs (Kuepper et al., 2010).

Dopamine has been implicated in possibly playing a key role in the pathway linking environmental exposure and development of psychosis (Collip et al., 2008). Some studies have found that dopamine is released in response to stress in both humans and animals (Tidey et al., 1998; Wand et al., 2007; Pruessner et al., 2004). However, this is not always supported in the literature (e.g. Montgomery et al., 2006). Nevertheless, dopamine neurotransmission is also altered when sensitisation occurs (Collip et al., 2008). As dopamine has been previously linked to psychotic symptoms, it appears to be an attractive candidate for linking effects of different environmental exposures and subsequent development of psychosis. However, the precise mechanisms and pathways involved are still poorly understood (Collip et al., 2008).

2.3 The association between cannabis and mood and anxiety outcomes

2.3.1 Evidence that cannabis may lead to mood and anxiety disorders

Cannabis use has been previously identified as being associated with both depression and anxiety (Bovasso et al., 2001; Hytbaksh et al., 2007; Dagenhardt et al., 2013). For example, it has been identified that those presenting with a cannabis use disorder in adolescence are three times more likely to have a diagnosis of major depressive disorder in young adulthood (Marmostein & Iacono, 2011). Furthermore, adolescent cannabis use has also been associated with a significantly increased risk of experiencing anxiety states in young adulthood (Patton et

al., 2002). These associations between cannabis use and both depression and anxiety are in accordance with the identified comorbidity between depression and anxiety (Anderson & Hope, 2008).

Dose-response relationships have been identified between cannabis use and both depression and anxiety. For example, in a prospective study of young people followed up from the age of 17 years up to 24 years, it was found that adolescent cannabis use disorder, and not infrequent use, was linked to major depressive disorder in adulthood (Marmostein & Iacono, 2011). These findings are comparable to those from a 3 year follow-up study of an adult sample, which identified that those presenting with weekly or more cannabis use were at higher risk of presenting with any mood disorder than those using cannabis less frequently (van Laar et al., 2007). However, it should be noted that this effect was only identified for those presenting with any mood disorder in general, rather than specific disorders (e.g. dysthmia, major depression, bi-polar disorder etc.). In spite of this, dose-response effects appear to be robust, as has been identified in previously carried out systematic reviews for both depression (e.g. Dagenhardt et al., 2003) and anxiety (e.g. Crippa et al., 2009) outcomes.

In contrast to the literature for psychotic outcomes, early onset cannabis use does not appear to produce poorer outcomes in relation to depression as compared to late onset use. This was shown using data collected as part of the US National Survey on Drug Use and Health (Fairman & Anthony, 2012). A significant but modest association was identified between early onset cannabis use (before the age of 18 years) and depressive episodes during adulthood (Fairman & Anthony, 2012). It was also found that the odds of experiencing a

depressive episode in adulthood did not differ between early onset and late onset cannabis users (Fairman & Anthony, 2012). Thus, based on these findings, it would seem that early onset cannabis use does not appear to produce poorer outcomes. However, it may also be that these findings are confounded by the definition of early onset cannabis use (i.e. before the age of 18 years). The majority of studies identifying worse psychopathological outcomes for early onset cannabis use, in particular psychosis, have done so for cannabis use before the age of 16 years. Thus by widening this age range to the age of 18 years, effects attributable to the early-mid adolescent period of neurodevelopmental vulnerability may have been diluted. However, there are no real clear definitions of what constitutes 'early-onset' cannabis use.

The relationship between cannabis use and anxiety may be influenced by individual differences. One such factor identified is 'anxiety sensitivity'. This has been described as the fear of anxiety and anxiety-related situations (McNally, 2002). It is thought to be a trait that pre-disposes individuals to the development of anxiety and panic states (Zvolensky et al., 2006). It was previously found that cannabis use interacted with anxiety sensitivity in the prediction of anxiety symptoms (Zvolensky et al., 2006). Thus symptoms of anxiety may be more likely to occur in those presenting with high levels of anxiety sensitivity. It may be that cannabis use produces anxiety only in those pre-disposed to developing anxiety (via increased anxiety sensitivity). However, it is also plausible that it is increased anxiety sensitivity, and subsequent anxiety symptoms, that predispose an individual to cannabis use (Huiznick, 2013), as cannabis users frequently report relaxation motives for cannabis use (Hathaway, 2003). However, the sample utilized in Zvolensky et al. (2006) was exclusively composed of tobacco-smokers, which limits the generalizability of the findings.

The relationship between cannabis use and both depression and anxiety has not always been consistently identified in the literature (e.g. Arsenault et al., 2002). For example, a prospective study of a Norwegian sample failed to identify a link between early onset cannabis use (before the age of 16 years), depression and suicidal ideation. However, cannabis use at the age of 21 years was significantly associated with suicidal ideation and behaviour, both of which are related to depression. Paradoxically, no link was identified between cannabis use at the age of 21 years and later depression. The lack of an effect of early cannabis use on depression and suicidal behaviours may have been a result of the low levels of cannabis use identified in the younger age group in this sample. Nevertheless, the identified link between cannabis use and suicidal behaviours (i.e. ideation and attempts) has been identified elsewhere (Wilcox et al., 2004), though the link with completed suicides is less clear (e.g. Price et al., 2009).

Using adult data, it has been identified that several factors may confound the relationship between cannabis use and depression. Harder, Morral & Arkes (2006) assessed the relationship between cannabis use and depression, and also controlled for 55 co-variates. Before controlling for these factors, cannabis users presented with a higher risk of depression than non-cannabis users. However, the risk of depression became comparable between users and non-users after controlling for co-variates (Harder et al., 2006). Thus it would appear that cannabis use and depression may be related due to common risk factors. Some possible variables that may be influential in adolescence include low SES, childhood behavioural problems, and low parental attachment in childhood, as these have been identified as being related to both adolescent substance use and mental disorders (McGee et al., 2000).

The literature presented here appears to overly focus on the effects of adolescent cannabis use on adulthood depression and anxiety. There appears to be a paucity of research assessing both cannabis use and depression and anxiety outcomes during adolescence. This is important as adolescence is a period of neurodevelopmental vulnerability, and any causes of maladaptive mood and anxiety outcomes during this period need to be identified. Only a few studies have assessed both cannabis use and mood and anxiety outcomes during adolescence. For example, Repetto, Zimmerman & Caldwell (2008) assessed the joint developmental trajectories of cannabis use and depression during adolescence. It was found that a change in cannabis use did not predict change in depressive symptoms. Similarly, Griffith-Lendering et al. (2011) failed to find a relationship between cannabis use and internalising behaviour (including depression and anxiety) in their adolescent sample followed up over a 5-year period. However, the findings by Repetto et al. (2008) may have been confounded by systematic attrition, as participants who left study were more likely to have lower grade point average than those who completed all time points. Low academic achievement has been consistently related to cannabis use (e.g. Crano et al., 2008), thus they may have predominantly lost cannabis users. Additionally, the findings by Griffith-Lendering e al. (2011) may have been confounded by their broad definition of regular use, that is, using between 3-39 times within the past year. As has been previously identified, effects for both depression and anxiety are dependent on levels of use (e.g. Dagenhardt et al, 2003; Crippa et al., 2009).

In summary, the literature appears to show modest but significant associations between cannabis use and both depression and anxiety. Effects appear stronger for those who use

cannabis more frequently, though the relationship with early onset use is less clear. Individual difference factors, such as a anxiety sensitivity appear to also influence the relationship, however there also appears to be some common risk factors for cannabis use and both depression and anxiety. Overall, there has not been as much research carried out for depression and anxiety outcomes, as compared to psychotic outcomes. It has been previously suggested that this may be related to the higher clinical saliency of psychotic disorders, with cannabis users more likely to seek and receive attention for psychotic disorder as compared to anxiety disorders (Crippa et al., 2009). Moreover, there appears to be an over focus on the relationship between adolescent cannabis use and adulthood depression and anxiety, with not as much research focusing exclusively on the adolescent period.

2.3.1.1 Explaining the associations between cannabis use and mood and anxiety outcomes

2.3.1.1.1 Secondary psychopathological disorder models

According to such models, having a substance use disorder increases the risk of developing a psychopathological disorder. This means that cannabis use is expected to cause mood and anxiety disorders either directly or indirectly.

2.3.1.1.2 Neurotoxicity

A neurotoxic approach inherently implies that cannabis use leads to long lasting changes in neurotransmitter systems, which eventually lead to the development of a psychopathological disorder. This was suggested by Jans, Riedel, Markus and Blokland (2007) in their model of serotonergic vulnerability. They define serotonergic vulnerability as a state whereby the serotonin system becomes vulnerable (or sensitive) to alterations or dysregulations within the

system (Jans et al., 2007). This means that an individual presenting with serotonergic vulnerability is at increased risk of developing disorders that are related to functioning of the serotonin system.

Cannabis use may produce a state of serotonergic vulnerability by interfering with serotonergic transmission (Jans et al., 2007). For example, THC and other cannabinoid receptor agonists have been shown to inhibit serotonergic transmission in the hippocampus (Egashira et al., 2002; Hill et al., 2006). Such effects of THC on serotonergic systems in the hippoocampus are similar to those identified in depressed patients (Lopez- Figueroa et al., 2004; Parsey et al., 2006). As such, it is probable that the serotonergic vulnerability produced by cannabis exposure may interact with pre-existing serotonergic vulnerability in order to produce depression and other serotonin related disorders.

The concept of serotonergic vulnerability may explain why some individuals develop depression as a result of the same environmental exposures (e.g. stress) and others do not. Those with a pre-existing serotonergic vulnerability are expected to be at increased risk of developing depression (and other serotonin related disorders such as anxiety) (Jans et al., 2007). Depression and other mood and anxiety disorders are more likely to develop via an interaction of different environmental and biological factors that produce serotonergic vulnerability, rather than as a result of one factor alone. For example, the short allele of the 5-HTTLPR transporter gene has been found to moderate the influence of stress on the development of depression (Caspi et al., 2003; Hariri & Holmes, 2006). These results indicate an interaction between genetic and environmental factors.

However, serotonergic vulnerability represents only one route by which depression may develop as a result of cannabis and other drug use. There are other neurotransmitters involved in the etiology and prognosis of depression. Indeed, Jans et al. (2007) concede that serotonergic vulnerability may not be necessary in the etiology of depression. Moreover, a recent meta-analysis of the evidence failed to identify significant effects of 5-HTTLPR genotypes on depression neither independently nor via interaction with stressful life events (Risch et al., 2009).

2.3.1.1.3 Psychosocial failure

The psychosocial failure model postulates that cannabis use leads to later depression indirectly via its psychosocial effects. The model assumes that the psychosocial effects of cannabis form cascades of risk factors that eventually lead to depression (Degenhardt & Hall, 2003; Marmostein & Iacono, 2011; Fairman & Anthony, 2012). The psychosocial effects of cannabis consistently identified in the literature include educational failure, unemployment, other drug use, and crime (Crano et al., 2008, Fergusson et al., 2002; Compton et al., 2011; Mac Leod et al., 2004; McGee et al., 2000; Hall et al., 2009). This model may account for why cannabis use only presents with a modest increase in depression, as not all cannabis users will experience psychosocial problems.

An assessment of data from the American Psychiatric Institute for Research and Education's Practice Research Network Study of Psychiatric Patients and Treatment (SPPT) revealed that patients with cannabis use disorders were more likely to present with psychosocial problems than those without cannabis use disorders (Compton et al., 2011). For example, they were 3

times more likely to have educational and housing problems, and approximately 4 times more likely to have legal problems. However, as these findings are based on a help-seeking sample, it is possible that they may overestimate the prevalence of psychosocial problems in cannabis users.

Nevertheless, more direct evidence of the psychosocial failure model comes from a study by Marmostein and Iacono (2011). They utilised epidemiological data collected as part of the Minnesota Twin Family Study. It was found that the relationship between cannabis use disorders in adolescence and onset of major depression in young adulthood was partially mediated by psychosocial failure. However, as psychosocial failure only partially mediated the relationship, this indicates that there may be other mechanisms involved in the causal relationship between cannabis and depression. Conversely, the partial mediation could have occurred because only educational failure, unemployment and crime were measured as indices of psychosocial failure. Other unmeasured psychosocial effects of cannabis (e.g. family problems) could also lead to depression.

2.3.1.2 Secondary substance use disorder models

Secondary substance use disorder models assert that substance use and use disorders occur as a result of a primary mental disorder. Evidence for this assertion has been identified in the literature, whereby depression and anxiety have been shown to occur prior to initiation of cannabis (e.g. Feingold et al., 2015; Repetto et al., 2008; Griffith-Lendering et al., 2011; Hooshmand et al., 2012). Indirect evidence also comes from studies where the effects of cannabis on depression and anxiety outcomes are diminished after pre-existing

symptomatology is controlled for (e.g. Harder et al., 2006). Examples of specific secondary substance use disorder models include self-medication, alleviation of dysphoria, regulation of cognitive states. These are briefly presented in turn below.

According to the self-medication model, people select specific substances for their psychopharmacologic effects on specific symptoms of dysphoria (Khantzian, 1997). This would mean that people experiencing depression and anxiety would use cannabis in order to regulate their symptoms. However, this does not appear likely due to the effects of cannabis. Acute effects of cannabis have been found to include dysphoria, anxiety, paranoia, and panic (among others) (Hall, 1994). It would thus appear unlikely that users experiencing depression and anxiety would choose cannabis for these effects.

The alleviation of dysphoria hypothesis is more general than the self medication model. The model is based on the premise that people experiencing severe mental illness are more likely to experience feelings of dysphoria (Mueser et al., 1998). This predisposes them to using substances. As such, these people are expected to use substances for the same reasons as other people without mental illnesses (e.g. to have fun and get high), and this has been identified for cannabis use in psychosis (Dekker et al., 2009; Hames et al., 2012). However, this hypothesis seems to apply only to people experiencing severe mental illnesses, and it is unclear whether similar levels of dysphoria would be experienced during the prodromal phase of a mental disorder.

The regulation of cognitive states hypothesis asserts that people use substances in order to regulate uncomfortable cognitive states such as thoughts, feelings, perceptions, sensations, and memories (Toneatto, 1995). These cognitive states are perceived as harmful, threatening and undesirable, and thus substances are used to modify them. This model is quite comparable to the alleviation of dysphoria hypothesis, with the only difference being the focus on cognitive states rather than emotions.

2.3.1.2.1 Discussion

The literature on cannabis use and depression and anxiety disorders has not always differentiated between these models. For example, Buckner et al. (2011) experimentally demonstrated that people with social anxiety disorder crave for cannabis only during a social anxiety task. Cravings were not found either in anticipation of, or immediately after the task (Buckner et al., 2011). These findings could be taken as evidence of a self-medication effect. However, it could also be plausible that the participants craved for cannabis during the task in order to alleviate or regulate emotional discomfort, thoughts feelings and/or perceptions experienced during the task (assertion by both the alleviation of dysphoria and regulation of cognitive states models). Conversely, the authors also suggest a self-handicapping hypothesis whereby cannabis use is taken so that other people will attribute the participants' behaviour to the cannabis, and not to their lack of ability in regards to social skills.

The relationship between cannabis, mood and anxiety disorders may be bi-directional, with each producing vulnerability for the occurrence for the other (Muesser et al., 1998). For example, using cannabis may produce depression-related symptoms in an individual with an

existing predisposition for developing depression (e.g. serotonergic vulnerability; Jans et al., 2007), with continued use of cannabis being maintained by dysfunctional beliefs and expectancies about the effects of cannabis on the depression symptoms (Graham, 1998; Muesser et al., 1998; Expectancy theory, Goldman, 1987a).

It is also plausible that cannabis and depression co-occur due to shared underlying risk factors, and not necessarily because one causes the other. Such factors identified in the literature include socio-economic status, other substance use, childhood psychopathology, family factors (e.g. parental divorce, parental support etc...), age, gender, marital status, education, household income, stressful life events, psychiatric disorders, low self-control etc. (Harder et al., 2006; Harder et al., 2008; Fergusson et al., 2002; Pedersen, 2008; Bovasso, 2001; Otten et al., 2010). Indirect evidence of this assertion comes from findings of diminished associations between cannabis use and depression after controlling for covariates (e.g. Harder et al., 2006).

2.4 Resilience to the psychopathological effects of cannabis

The literature reviewed in this chapter has indicated that cannabis use may trigger or worsen psychotic and depression outcomes. However, the majority of people who use cannabis will not necessarily experience these psychopathological effects of cannabis. It is thus important to identify not only the factors that increase the risk of developing psychosis and depression after cannabis use, but also the factors that are protective and thus produce/enable resilience to the psychopathological effects of cannabis.

The resilience literature has previously identified the factors that are protective against initiation of cannabis use (see Chapter 3). It has also been shown that resilience factors have a negative relationship with symptoms of various mental disorders. For example, in studies of adolescents, resilience factors were able to predict occurrence of depression, anxiety, stress, and obsessive-compulsive symptoms (Hjemdal et al., 2007; Hjemdal et al., 2011; von Soest et al., 2010; Moljord et al., 2014). In these studies, the resilience factors measured were personal competence, social competence, structured style, family cohesion, and social resources. However, some researchers advocate the use of trait approaches to measure resilience (e.g. Prince-Embury, 2006). In spite of this, it has been argued that such trait based approaches offer no utility in the way of intervention, as traits are stable and not amenable to change (e.g. Masten, 2001; Luther et al., 2000; Meschke & Patterson, 2003).

There is currently a dearth of information on the factors that are responsible for producing resilience to the psychopathology inducing effects of cannabis. Thus it is not known what factors are responsible for protecting a cannabis user from developing psychosis and depression/anxiety as a result of their cannabis use. There is some evidence that resilience factors may moderate the effects of environmental exposure on psychopathological outcomes. For example, Dishion and Connell (2006) found that low levels of self-regulation made the adolescents in their sample more vulnerable to the effects of stressful life experiences on depressed mood. In this case, self-regulation thus moderated the effects of stress exposure on adolescents' depressed mood. There is thus a need to identify the specific resilience factors involved for cannabis users. Identification of these will enable them to be targeted for interventions.

2.4.1 Intergration of the risk and resilience literature

The proposed model illustrated in figure 2 attempts to simplistically integrate the literature on the factors involved in the transition from predisposition to the development of psychopathology via exposure to cannabis and other environmental risk factors. Cannabis is treated as one of multiple environmental risk factors that moderate the relationship between predisposing factors and psychopathological outcomes. Resilience factors are also incorporated in order to illustrate how resilient outcomes may be achieved in spite of exposure to multiple risk factors such as cannabis. The model will be described below using examples of some of these factors.

Predisposing factors include genetic and childhood environmental risk factors (e.g. pre-natal & birth complications). Genetic factors and childhood environmental risk factors have both been found to synergise with cannabis use and increase the risk of developing psychopathology (GROUP researchers, 2011; Caspi et al., 2003; Hariri & Holmes, 2006; Cougnard et al., 2007; Harley et al., 2007; Houston et al., 2008). Genes have also been identified as being influential in brain neurodevelopment processes, which are said to be, "*…genetically determined, epigenetically directed and environmentally influenced"* (Tau & Peterson, 2010, page 148). Some resilience factors may also be influenced by genetics (e.g. personality traits) (Sen et al., 2004) and by experience of various childhood environmental risk factors, such as trauma.

As well as being moderators of the relationship between predisposing factors and psychopathological outcomes, adolescent environmental risk factors and brain neurodevelopment processes may mutually influence each other. For example, the increase in adolescent risk taking behaviour, such as cannabis use has been attributed to a fully matured limbic system and an underdeveloped pre-frontal system, typical of brain development in adolescence (e.g. Casey et al., 2008). Such findings indicate how brain neurodevelopment may influence exposure to environmental risk factors, in this case cannabis use in adolescence. Conversely, cannabis use may also interfere with brain neurodevelopment processes such as changes in dopamine transmission (Bossong, 2010). Thus the 'moderators' in the model interact with each other.

Another example of moderators interacting with each other involves brain neurodevelopment and resilience factors. In spite of going through the same period of limbic controlled behaviour, which produces increases in risk taking, not all adolescents use cannabis (or other substances). It has been found that resilience factors are protective against substance use (e.g. von Soest et al., 2010) (See Chapter 3 for review of resilience and substance use).

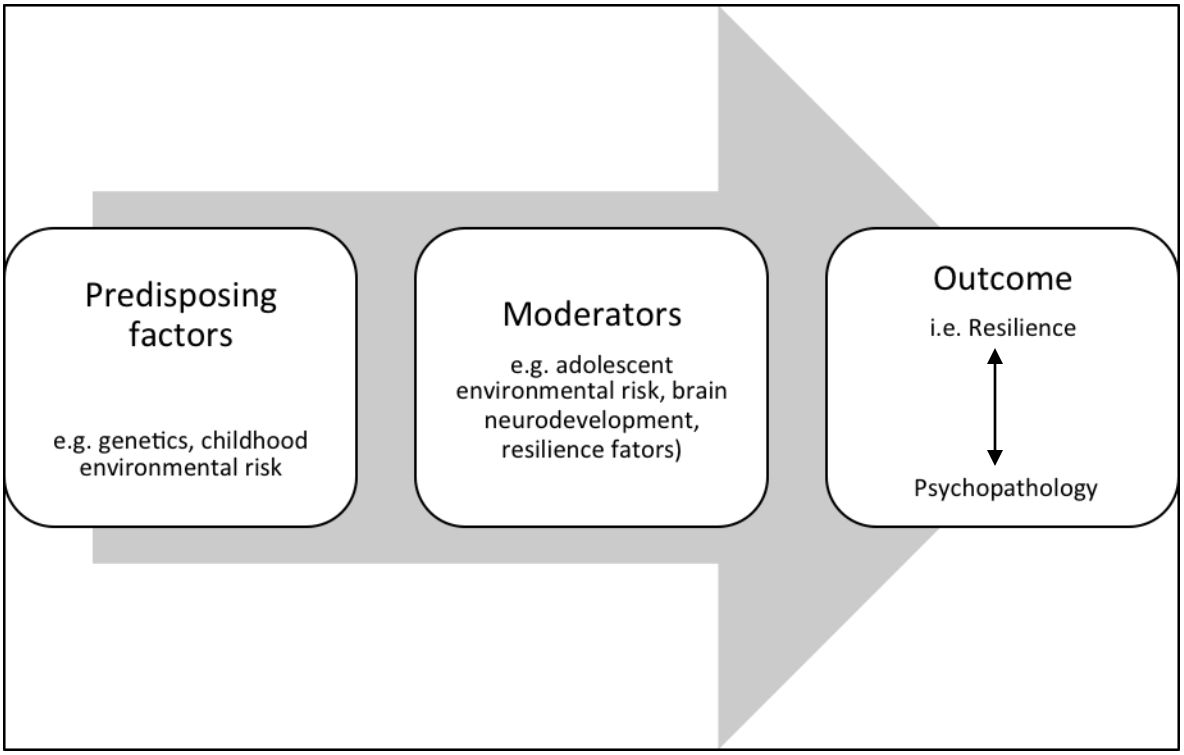


Figure 2.2 Proposed model for the transition from predisposition to psychopathology. The influence of predisposing factors on the psychopathological outcome is moderated by a number of factors, including resilience factors.

Resilience factors are included as a moderator. This is to account for those exposed to the various pre-disposing factors and moderators (risk factors) who do not necessarily develop psychopathology. Thus resilience factors are proposed to buffer against the adverse effects of these factors. This assertion is supported by the previously identified study, which shows that self regulation was able to moderate the effects of stress-exposure on depression outcomes (Dishion & Connell, 2006). This buffering of risk may thus reduce the likelihood of developing psychopathology.

Cannabis use may also interact with resilience factors. This assertion is based on a study by Griffin, Scheier and Botvin (2009) assessing the relationship between self management skills and substance use over time during adolescence. Although self management skills generally

showed little change over time, early substance use was associated with a decrease in these skills (Girffin et al., 2009). Thus using substances may interfere with the development of resilience factors, which would in turn impact on psychopathological outcomes. The result would be an increased risk of such outcomes, as there will be reduced levels of protection.

As previously outlined in this chapter, cannabis use may increase risk of developing psychopathology in one of two ways ; (a) indirectly via its psychosocial effects as has been identified for cannabis and depression (Degenhardt & Hall, 2003; Marmostein & Iacono, 2011; Fairman & Anthony, 2012), and (b) directly via its neurotoxic effects (Bossong et al., 2010; Jans et al., 2007).

When assessing outcomes, it is important to note that a bi-directional link between resilience and psychopathology is proposed (as illustrated in Figure 2.2). This is because neither resilience nor psychopathology is treated as a static outcome. For example, it is possible for an individual who develops psychopathology to subsequently produce resilient outcomes, such as reduced levels of morbidity, or even recovery from the disorder. As Rutter (2006) puts it across, "resilience may sometimes reflect later recovery, rather than an initial failure to succumb." It is also possible for an initially resilient individual to eventually develop a psychopathological disorder, perhaps in response to the eroding of resilience factors (see Chapter 3 for discussion of developmental trajectories of resilience).

2.5 Summary

The relationship between cannabis use and psychosis has been extensively studied in the literature. Neurodevelopmental approaches provide an explanation of the poorer outcomes

associated with early cannabis initiation (e.g.Bossong et al., 2010). The literature presented also indicates the relevance of bio-psychosocial approaches, as environmental exposures have been found to interact with pre-existing psychosis liability in producing psychotic outcomes after exposure to cannabis (GROUP researchers, 2011; Henquet et al., 2005). Sensitisation processes offer a mechanism via which cannabis use may lead to the transition to psychotic disorder.

For mood and anxiety outcomes, the findings presented in this chapter do not appear consistent, and this has been identified in previous reviews (e.g. Degenhardt et al, 2003). It appears as though cannabis produces a modest increase in the risk of developing a mood disorder. Neurotoxicological models provide a direct pathway via which cannabis may cause mood disorders via its influence on brain neurotransmitter systems (e.g. serotonin, Jans et al., 2007). Conversely, psychosocial models provide an indirect path from cannabis use to mood disorders. In this instance, the psychosocial effects of using cannabis are responsible for triggering the disorder. It also appears plausible that in some cases, cannabis users may present with comorbidity with mood and anxiety disorders due to a secondary substance use disorder. In this case, self-regulatory models such as the self-medication model, offer explanations of the reasons for using cannabis in response to psychopathology. More research with a focus on mood and anxiety outcomes is required in order to resolve these apparent inconsistencies in findings (Rubino et al., 2012).

It is still not clear whether age effects of cannabis use on psychopathology are due to neurodevelopmental effects or are just a result of cumulative exposure (i.e. dose-response

effects). Thorough analysis of type, frequency and quantity of cannabis use and effects on psychopathology are required. Previous research has not always thoroughly measured these patterns of use, and for those who have measured frequency of use, quantity and type of cannabis used have not been taken into account. This is important as level exposure to THC may determine the occurrence of psychopathology (Degenhardt & Hall, 2009).

Moreover, the current data available is composed of studies that have measured cannabis use over different periods of time. Even within some individual prospective studies, periods of cannabis exposure differ within the sample (e.g. NEMESIS study- exposure anywhere between the 1950's when the older sample would have been adolescents, to 1999, Hanseen et al., 2005). This might mean a confounding of the differential effects of different strains of cannabis, as THC content in some cannabis products appears to be increasing (EMCDDA, 2004). This might provide an explanation of some weak effects and inconsistencies reported in the literature. Thus current research on potential psychopathological effects of cannabis is thus needed, as this will identify the impact of the more potent cannabis varieties currently available.

The studies reviewed also appear to be mainly focused on the factors and mechanisms that confer risk of the development of psychopathology in cannabis users. However, there also needs to be a focus on the mechanisms behind resilience to psychopathology-inducing effects of cannabis. This is of particular importance, as quite a large number of people are exposed to cannabis, but only a small minority develops psychopathological outcomes as a result. A thorough account of the specific resilience factors responsible for protecting against specific

symptoms is thus needed. Identification of such factors will be paramount to the development of interventions, as these can then be targeted for improving psychopathological outcomes.

Chapter 3 Developmental Trajectories of Resilience and Substance Use

The central idea behind resilience involves a shift in focus from risk of illness towards protection from illness. This type of thinking is a product of the "Positive Psychology" movement, which emphasized a shift in focus from maladjustment or psychopathology to positive adjustment (Seligman & Csikzentmihalyi, 2000). It has been defined in the literature as the process by which adaptive outcomes are achieved despite exposure to high-risk environments or stressful circumstances (Masten & Patterson, 2003; Luthar, Ciccheti & Becker, 2000; Zolkoski & Bullock, 2012). This definition paints a picture of resilience as a dynamic process, as opposed to a static trait (Rutter, 2006; Fergus & Zimmerman, 2005).

The resilience literature has mainly focused on multiple developmental outcomes of individuals brought up in high-risk environments. Substance use outcomes will be the focus of this chapter. It is hoped that a more dynamic way of thinking about the relationship between substance use and resilience will be introduced. More specifically, the idea that resilience goes further than influencing initiation of substance use will be explored. This will be achieved by assessing the developmental trajectories of resilience and how these may simultaneously influence one's substance use trajectories. To begin with, conceptual issues plaguing the resilience literature will be highlighted. Following on, developmental trajectories of resilience and substance use are discussed separately. This leads on to an evaluation of the literature on how resilience influences substance use outcomes. Finally, a more dynamic approach for

studying resilience and substance use is introduced together with suggestions for future directions.

3.1 Conceptual issues in resilience research

Since its inception, resilience research has been hindered by a number of conceptual issues, mostly relating to how the concept is to be defined. Consequently, three main schools of thought have emerged. The first argument asserts that resilience is a trait possessed by individuals (e.g. Jacelon, 1997; Connor & Davidson, 2003; Ong et al., 2006). According to this view, adversity does not need to occur in order for one 'to be' resilient, because possessing the resilience trait enables one to be resilient. However, the trait approach subverts the utility of interventions because traits are static and not amenable to change (Fergus & Zimmerman, 2005). Moreover, there is a danger of placing blame on individuals for not being able to achieve adaptive or desirable outcomes (Fergus & Zimmerman, 2005). Additionally, it has also been argued that resilience cannot be conceptualised as a trait, as it is not a single quality of an individual (e.g. Rutter, 2006).

The second argument links resilience to the concept of post-traumatic growth, with proponents suggesting that resilience may develop as a result of post-traumatic growth (Tedeshi 1999; Joseph and Linley 2006; Atkinson, Martin & Rankin, 2009). This has been defined as the experience of a positive psychological change following experience of trauma (Atkinson et al., 2009). This idea brings into focus the study of outcomes, and is in line with common definitions of resilience as the ability to achieve adaptive outcomes in spite of exposure to

adverse risk. This definition of resilience contains two implicit assumptions that need to be met in order for one to be said to be resilient. These will be discussed in turn.

The first implicit assumption of the definition of resilience incorporating posttraumatic growth is that there needs be exposure to adverse risk (Merschke & Patterson 2003; Masten & Obradovic, 2006). However, what constitutes 'significant risk' has been unclear in the literature (Luthar et al., 2000, Merschke & Patterson, 2003; Masten & Obradovic, 2006). This is of importance because if risk is not deemed significant then it can be argued that it is competence being studied rather than resilience (Mershcke, 2003). It has thus been suggested that risk is significant where there is persistent exposure to adverse conditions (high risk), exposure to a single traumatic event or both high risk conditions and single trauma occur (Merschke & Patterson, 2003).

The second implicit assumption is that successful adaptation should occur. However, there has also been argument over what constitutes successful adaptation. This is further compounded by the fact that individuals deemed to be resilient in one area of functioning are not necessarily resilient in all other areas (Aldwin & Sutton, 1998; Luthar et al., 2000). Developmental researchers have traditionally measured outcomes in different areas of functioning according to expected developmental trajectories, whereas other researchers, such as substance use researchers, have measured outcomes of one variable (Luthar et al., 2000). However, it has been argued that due to the dynamic nature of resilience, it is not expected to occur in all areas of functioning, thus there is a need to look at different outcomes (Luthar et al., 2000; Rutter, 2006).

Although resilience and post-traumatic growth may occur as a result of similar processes involving risk and protective factors (Aldwin & Sutton, 1998), post-traumatic growth need not occur in order for resilience to occur. This is because, by definition, resilience involves a return to baseline functioning after exposure to trauma or threat, whereas post-traumatic growth occurs when individuals are able to use the traumatic experience or threat to further individual development or growth (Tedeschi, Park & Calhoun, 1998; Linley & Joseph, 2005). Post-traumatic growth therefore goes beyond the return to baseline functioning, thus it is plausible to be resilient in the absence of post-traumatic growth. In line with this, resilience has been identified as a product of basic human adaptation systems, which everyone possesses (Masten, 2001: Lerner, 2006).

The third argument views resilience as a dynamic interactive process involving a number of factors working in concert to produce adaptive outcomes (e.g. Luthar & Cicchetti, 2000; Meschke & Patterson, 2003; Fergus & Zimmerman, 2005: Rutter, 2006). Rather than focus on outcomes, this idea of resilience emphasizes the importance of studying the processes responsible for producing the adaptive outcomes. These dynamic processes involve a set of interactive factors that operate at many different levels and across multiple domains. Different factors from the individual, family and community domains are thought to be involved. Merschke & Patterson (2003) point out the importance of interaction at all levels, for example, intelligence could act as a protective factor, only when there is a supportive adult or teacher in the child's life.

Interestingly, proponents of the resilience 'as a process' argument have even suggested that there should be a distinction made between 'resilience' and 'ego-resiliency' (Luthar & Cicchetti, 2000). According to this view, the 'resilience as a trait' approach may be in fact referring to 'ego-resiliency'. Ego-resiliency is a personal trait of an individual that has been defined as the ability to flexibly adapt impulse control relative to contextual demand (Weiland et.al, 2012). Ego-resiliency may actually act as a protective factor in the process of resilience (Luthar & Cicchetti, 2000; Weiland et.al, 2012) hence the two schools of thought may actually be referring to two separate but interrelated concepts.

A more recent definition of resilience has been suggested which addresses some of these issues. According to Hjemdal et al., (2006) resilience should be defined as, "...the protective factors, processes and mechanisms that contribute to a good outcome despite experiences with stressors shown to carry significant risk for developing psychopathology." (Hjemdal, Friborg, Stiles, Rosenvinge & Martinussen, 2006). This definition identifies resilience as a process, applies less stringent parameters for risk exposure, and offers a more inclusive view of outcomes (good outcomes as opposed to adaptive).

Resilience research has also been hindered by a lack of consensus in the terminology used. For example, the terms protective and promotive factors have been used by some interchangeably, whilst others argue that there is a difference in meaning between the two terms. It has been identified that the term 'protective' is indicative of a model of how promotive factors act to alter the path from risk to adversity (Fergus & Zimmerman, 2005).

These different resilience models will be presented later in this chapter. However, these distinctions have not always been made clear in the literature.

The different approaches to studying resilience have hindered progress of the resilience literature, and consensus will need to be reached in order to further our knowledge. For the purposes of clarity, this thesis adopts the 'resilience as an interactive process' view, as this has been widely adopted by the substance use literature. However, it is reasonable to assume that the three approaches to studying resilience are not necessarily mutually exclusive. It is more likely that resilience is a process, which draws upon an individual's multiple resources, including personal traits in order to produce adaptive outcomes. Additionally, the term 'protective factor' will be used to identify all factors that either directly produce positive outcomes or those that mitigate or eliminate the effects of risk factors.

3.2 Developmental trajectories of resilience

Adolescence is an important period for assessing the influence of various factors involved in the process of resilience. This is because risk and protective factors have been identified to be more influential during periods of developmental transition, for example, from childhood to adolescence (Scheier, Newcomb & Skager, 1994). Adolescence has also been identified as a critical part of development, as young people at this stage experience multiple changes occurring in all domains including social, physical and psychological. This makes adolescence a time of experiencing great challenges and opportunities (Peterson, Leffert, & Graham 1995). These changes produce instability, which intensifies the influence of any risk or protective factor (Merschke &Patterson, 2003).

Protective factors involved in the process of resilience are influenced by a number of developmental processes, which may impact on their change over time. On an individual level, there have been a number of protective factors that have been identified as key resilience factors. These include social competence, problem solving skills, critical consciousness, autonomy, sense of purpose, self-regulation, self-control, self-reinforcement, decision making (Benard, 1993; Zolkoski & Bullock, 2012). The majority of these factors relate to self-management and impulse control, which are behaviours controlled by the pre-frontal cortex.

During adolescence, the pre-frontal cortex is not yet fully developed (Casey et al., 2008; Bossong & Neisnick, 2010) and thus the related self-management skills are not yet matured. This protracted development of the pre-frontal cortex continues during adolescence, with full maturity achieved in adulthood. We would thus expect little change in these factors over adolescence and this has been found in the literature. For example Griffin et al. (2009) assessed self-management skills (decision making, problem solving, self-control and self-reinforcement) longitudinally from the age of 12 to 15 years. There was very little change identified in these factors over time, and a trend towards a decline in these factors was identified. However, others have found that behavioural control does increase over time during adolescence (e.g. Wong et al., 2006).

The process of resilience also involves family and peer factors, and these may also be influenced by adolescent development over time. From the family level, protective influences

have been found for quality of relationships within the family (e.g. parent-child attachment, Brook et al., 1999) and parenting processes (e.g. parental monitoring, parental knowledge, Farhart et al., 2011; Crano et al., 2008.) The influence of the family changes in tandem with developmental changes within the adolescent. It has been found that the importance of the family to the adolescent, especially parents, diminishes over time (Furman & Burhmester, 1992). Parenting processes such as parental knowledge of the adolescent's behaviour decline over time, together with family activities (Coley et al., 2008). The reduced time spent with the family also limits the family's influence over the adolescent's behaviour.

As the family loses its influence over behaviour, there is a concurrent increase in the importance and influence of peers over the adolescent's behaviour. Assessments of adolescent peer dynamics have found that the stability in adolescent friendships appears to increase with age (Poulin & Chan, 2010; Brange et al., 2007). This means that as adolescents develop, they keep more of their friends. It is reasonable to assume that this increased stability enables peers to exert more influence, as young people are exposed to the same peers over a longer period of time than during childhood. This is indirectly supported in studies identifying a stronger influence of peers over family factors for adolescent substance use outcomes (e.g. Cleveland, Fenberg, Bontempo & Greensberg, 2008; Parsai, Voisine, Kulis & Nieri, 2009).

However, adolescent friendships are not always stable. For example, it has been found that depressed mood may predict friendship instability in adolescents (Chan & Poulin, 2009). On the other hand, this effect was only found for best friendships from the same school, as secondary friendships and best friendships from other contexts remained stable. Moreover, it

has been found that females are more likely to switch friends as compared to males (Brange et al., 2007). This means that although there is a general pattern of increased stability in friendships over time, there are also some adolescents who experience instability in their friendships during the same time period.

3.3 Bringing together resilience and substance use

3.3.1 How does resilience affect substance use?

It has been asserted that in order to study resilience, there needs to be a thorough account of risk and protective factors (Rutter, 2006). Models of resilience offer an explanation of how protective factors act in order to produce resilient outcomes after one has been exposed to risk. The compensatory, protective and challenge models have been suggested in the resilience literature and will each be discussed in turn in relation to substance use. For the purposes of discussing models of resilience, protective factors will be referred to as 'promotive factors', as the term 'protective' implies a specific model of resilience.

According to the compensatory model, the promotive factor exerts its influence on outcomes independently from the risk factor (Fergus & Zimmerman, 2005; Zolkoski & Bullock, 2012). This means that the promotive factor affects outcome without changing the risk factor. For example, poverty may be a risk factor for substance use. Parental monitoring may act as a promotive factor by keeping the adolescent away from high substance use areas. Thus parental monitoring acts without altering the risk factor, as poverty will still be present.

The protective model asserts that the promotive factor acts as a moderator of the relationship between the risk factor and the negative outcome. The promotive factor may either neutralise (protective-stabilizing model) or diminish (protective- reactive model) the effects of the risk factors (Fergus & Zimmerman, 2005).

The challenge model postulates that there is a curvilinear relationship between risk factors and outcome. This model highlights the importance of level of exposure to risk factors. Both high and low levels of risk are predicted to produce negative outcomes. However, moderate exposure to a risk factor may actually offer an adolescent a chance to employ coping strategies in order to deal with the risk. Thus the same factor may either be a risk or a promotive factor, depending on level of exposure (Fergus & Zimmerman, 2005).

3.3.1.1 Risk and protective factors for adolescent substance use

Recently, resilience research within the substance use literature has begun to focus on the processes involved in resilience, which adopts the second approach to resilience previously described. This has included a thorough examination of risk and protective factors that are seen as key to the process of resilience. These risk and protective factors have been studied within multiple domains, using theoretically driven models. Such models take account of the fact that resilience operates not only within an individual, but also involves the person's environment. For example, Rew and Honer's (2003) youth resilience framework looks at risk and protection within individual, peer, family and community domains. This is synonymous with the social-ecological framework adopted by Ostaszewski and Zimmerman (2006). The

following is a brief review of some of the risk and protection processes within the four main domains; individual, peer, family and community identified in the substance use literature.

3.3.1.1.1 Individual

Academic achievement has been identified as a protective factor against substance use in adolescents. This has been found for alcohol, tobacco and marijuana use (e.g. Farhart et al., 2011; Thai et al., 2010; Bryant et al., 2003). It is thus tempting to view poor academic performance as a risk factor for substance use. Indeed, it has been found that adolescents who drink alcohol, smoke cigarettes, and/or use marijuana present with poorer academic performance when compared to their counterparts who do not use substances (e.g. Diego, Field & Sanders, 2003; Corona et al., 2009; Rew & Honer, 2003). However, it has been shown that poor academic performance is more likely a consequence of rather than a prerequisite to substance use (Crano, Siegel, Alvaro & Hemovich, 2008).

Personal competence is a factor that has been identified as being protective and involved in producing resilience to multiple maladaptive outcomes. It has been described as a set of cognitive and behavioural self-management skills (Griffin et.al, 2001) that include self-control, self-regulation, self-reinforcement, and problem solving skills. These skills are thought to help an individual to confront and actively manage and solve challenges in life. (Griffin et al., 2001). Previous findings indicate that personal competence exerts its protective effect against substance use via an increase in psychological wellbeing (Griffin et al., 2001, Griffin et al., 2002).

For adolescent substance use, specific personal competence skills found to be protective include behavioural and emotional self-control (Wong et al., 2006; Wills et.al, 2006; Botvin et.al, 1998; Griffin et al., 2001; Griffin et.al, 2002); self-reinforcement skills (Botvin et al., 1998), decision making skills (Botvin et al., 1998; Griffin et al., 2001; Griffin et.al, 2002) and self-regulation skills (Griffin et al., 2001; Griffin et.al, 2002). These skills have been found to improve over the course of adolescence, and risk of substance uses tends to increase for those with a lower rate of improvement (e.g. Wong et.al, 2006).

The literature indicates that resilience is associated with mental health of individuals. For example, it has been found that both single and cumulated resilience factors are able to negatively predict the occurrence of common mental disorders such as depression and anxiety (Dishion & Connell, 2006; Prince Embury, 2006; Hjemdal et al., 2007; Hjemdal et al., 2010). It has also been identified that recovery from mental health problems involves resilience factors such as hope and optimism (Atkinson, 2009). Mental health problems have been consistently related to substance use in the literature. For example, it has been found that up to 60% of adolescent substance users also present with psychiatric comorbidity. Specific at risk mental states for substance use have been identified and these include conduct disorder, and antisocial personality disorder, which have both been identified as increasing risk of early initiation and subsequent substance use problems (Kessler et al., 1996; Pedersen, Mastekaasa & Wichstrom, 2001; Mueser et al., 2006; Elkins, McGue & Iacono, 2007).

It is reasonable to suggest that resilience may mediate the relationship between mental health and substance use. It is possible that mental health problems increase the risk of using

substances for those who are low on resilience factors. Those with higher levels of resilience may utilise more adaptive methods of coping with their symptoms. Individuals with lower levels of resilience may also possess a limited repertoire of coping skills which may increase risk of using substances in response to negative affect. This self-medication perspective is reviewed in chapter 2. Moreover, in line with a 'resilience as a complex process of interactions' view, it is also probable that substance use may moderate the relationship identified between resilience and mental health outcomes. Such a view posits that substance use may interfere with the protective influence of resilience factors. For example, its been identified that early substance use is associated with a decrease in self-management skills over time, from early to mid adolescence (Griffin et al., 2009). In this case substance use may thus interfere with the development of resilience factors. This view is empirically tested in Study 2 of this thesis.

However, in inferring risk of substance use from mental disorders, caution needs to be exercised. It is difficult to deduce unequivocal causality in the relationship between mental disorder and substance use. This is because it has been found that some substances increase risk of mental disorder. For example, cannabis use has been identified as a risk factor for psychosis (Arsenault et al., 2002; Kuepper et al., 2011), and for depression and anxiety (Patton et al., 2002). More thorough examination of the relationship between cannabis and mental disorders is made in chapter 2.

3.3.1.1.2 Peer

Having friends who use substances has been consistently documented as a risk factor for adolescents' own substance use, as documented in Chapter 1. Furthermore, peers who do not use substances have been found to be a protective factor against substance use in adolescence. Syvertsen et al., (2010) assessed lifetime and regular use of alcohol and cigarettes and found that low friends' alcohol and other drug use was protective against adolescents' alcohol use. However, this factor was not protective over cigarette use. The authors assert that this may be indicative of the more instantaneous physically addictive nature of cigarettes which become less of a social activity in comparison to alcohol use (Syvertsen et al., 2010). Protective influences have also been identified for other substances. For example, White et al., (2006) found that having fewer friends who use marijuana was protective against increases in marijuana use.

3.3.1.1.3 Family

Social learning and modelling processes can also be identified within the family. Both parental substance use and sibling substance use have been identified as risk factors for adolescent substance use (Brook et al., 1999; Fleming, Hyoshin, Harachi & Catalano, 2002; Brook et al., 2006). However, the co-occurrence of risk factors may make unclear which processes underlie risk. For example, maternal substance use normally co-occurs with depression and/or stressful life events. It has been found that what confers the risk in substance using mothers may be the depression rather than the substance use per se (Luthar & Sexton, 2007). However, Luthar and Sexton's (2007) study assessed childhood outcomes of internalising and disruptive disorders, and not substance use. Thus these results would need to be replicated for substance use outcomes.

The quality of relationships within the family also confers risk and/or protection from substance use. Protective factors that have been identified include family cohesion (Veselska et al., 2009), parental warmth (Crano, et al., 2008), maternal affection (Brook et al., 1999), parental identification (Brook et al., 2006), and parent-child attachment (Brook et al., 1999; Flemming et al., 2002; Hemphill et al., 2011). Some of these factors have been found to be bi-polar in nature, that is, absence or low levels of the factor have been found to confer risk. For example, Brook et al., (1999) found that low paternal and low maternal identification were risk factors for marijuana use in adolescents.

Parenting related factors such as parental involvement in school (Flemming et al., 2002; Bryant et al., 2003), opportunities and rewards for prosocial involvement (Hemphill et al., 2011), and parental monitoring (Farhart et al., 2011; Crano et al., 2008; Schinke et al., 2008; Bohnert, Anthony & Breslau, 2012) have also been found to be protective against tobacco, alcohol, marijuana, and other drug use. However, there is a potential danger here of blaming parents for adolescent substance use, for example, in cases were parental monitoring is deemed low. Conversely, Brook et al., (1999) found that resistance to maternal and paternal control acted as risk factors for marijuana use, thus it is not merely the absence of these protective factors that would cause risk, there appears to be an influence of the adolescent's response.

3.3.1.1.4 Environment

There are different environment related factors that can serve as either risk or protective factors. It is widely recognised that children brought up in deprived socio-economic

environments are at increased risk of substance use, among other forms of maladjustment. However, although low socio-economic status is a risk factor for substance use, high socio-economic status has also been identified as such, and even more so than low socio-economic status (Luthar et al., 2006). Additionally, it is likely that effects of low socio-economic status may not be direct as there are many problems associated with the status. For example, it has been found that an increase in household income is related to an increase in number of family activities, which have been found to be protective against substance use (Coley et al., 2008). Thus it is likely that socio-economic status attracts a cascade of other risk factors that create a vicious cycle of risk leading up to maladaptive behaviours such as substance use.

Other environment related factors which increase risk of substance use in young people include experience of discrimination and violence (Brook et al., 2006) and acculturation (Thai et al., 2010). Moreover, the school environment is also influential in substance use behaviour. Protection from substance use has been found through possibilities to participate in school (Eschman et al., 2010), taking part in after school activities (Schinke et al., 2008), and rewards for pro-social behaviour in the school setting (Corona et al., 2008). Bryant et al., (2003) also identify other protective school related factors such as school bonding, school interest and school effort.

3.3.2 Substance use trajectories: how does substance use change over time?

There are two main approaches that have been employed in identifying trajectories of substance use over time. The first approach is the normative trajectory approach. This involves identifying the most commonly followed trajectory within a population (Maggs &

Schulenberg, 2004; Tucker et al., 2005). Normative trajectory approaches are useful for identifying the expected developmental patterns of substance use (Maggs & Schulenberg, 2004). However, even normative developmental expression of substance use behaviour may lead to negative outcomes (Chassin et al., 2002). For example, short-term effects of alcohol intoxication include an increase in risky sexual behaviour (e.g. Cooper, 2002). Moreover, long term effects have been identified (e.g. increased risk of psychosis following adolescent onset cannabis use (Arsenault et al., 2002) (see chapter 2 for full review of mental health outcomes of adolescent cannabis use).

The majority of research studying substance use trajectories from adolescence to adulthood has mainly focused on cigarettes, alcohol, and cannabis use. These substances appear to show a general increase in use over time (Coley et al., 2008, Bryant et al., 2003; Kandel & Logan, 1984). More specifically, it has been found that the normative trajectory for alcohol, cigarettes and cannabis involves initiation during adolescence (around age 13 years), peak by early adulthood (early to mid-20s), and a decline thereafter (Kandel & Logan, 1984; Duncan et al., 1997; Coley et al., 2008; Bryant et al., 2003; Chen & Jacobson, 2012). The increase in initiation observed during adolescence may be related to brain development and other factors such as peer influence (Crano et al., 2008; Bossong & Neisnick, 2010).

Another high risk period of substance use occurs during the transition from late adolescence to emerging adulthood (Needham, 2007; Chen & Jacobson, 2012; Kandel & Logan, 1984; Tucker et al., 2005). This increased risk is thought to occur possibly as a result of the amount of changes an individual goes through during this period (e.g. living independently for the first

time, Schulenberg & Maggs, 2002). At the other end of the normative trajectory of substance use is the decline, which has been identified during adulthood (around the age of 23 years, Kandel & Logan, 1984). This has been termed a maturing out process, and is related to transitions into adult roles (e.g. marriage, employment, and starting a family) (O'Malley, 2004; Dawson et al., 2006) and possibly personality change (Littlefield et al., 2009).

Although normative trajectories are useful for identifying developmental trends, not everyone will follow the expected substance use trajectory. To account for this, a second approach to studying trajectories has been utilised, and this has been termed a taxonomy approach. (Maggs & Schulenberg, 2004). This involves the identification of distinct subgroups of people who follow similar discrete trajectories. A taxonomy approach thus enables the identification of distinct antecedents and consequences for the different trajectories followed, focusing intervention and prevention to suit the different subgroups of people.

Three broad types of trajectories have been identified for alcohol, cannabis and cigarettes. These are 'early onset', 'late onset' and 'experimenters'. Within these broad categories, there are also trajectory sub-types which define different substance use behaviour within each trajectory type. In the 'early onset' trajectory group, some young people appear to show a pattern of heavy use during early adolescence, which declines into middle to late adolescence (Marti et al., 2010; Maggs et al., 2004; Tucker et al., 2005; Chassin et al., 2002; Guo et al., 2002). Others maintain consistently high levels of use (Tucker et al., 2005), or consistently moderate levels of use (Tucker et al., 2005; Guo et al., 2002). Other young people appear to follow a trajectory similar to the normative trajectory, which involves a gradual increase in

substance use which peaks during early adulthood and declines after (Tucker et al., 2005; Marti et al., 2010).

'Late onset' substance users present with a sharp increase in use from late adolescence to early adulthood (Guo et al., 2002; Chassin et al., 2002; Flory et al., 2004). These young people are indicative of the second high risk period for substance use which has previously been identified as the transition from adolescence to adulthood. On the other hand, there are some young people who will consistently maintain very low levels of substance use, and these have been identified as 'experimenters' (Guo et al., 2002; Tucker et al., 2005). These studies identifying discrete substance use trajectories have also found an interrelationship between different substance trajectories. This means, for example, that early onset alcohol users are also likely to be early onset cannabis users (Flory et al., 2004; Duncan et al., 1997).

3.3.3 How would a change over time in resilience factors affect SU trajectory?

Much of the literature on substance use and resilience that has been presented in this chapter has assessed the static influence of protective factors on substance use outcomes. Protective factors are thus mainly treated as 'stage-setters', which, when measured at baseline, will have an impact on subsequent substance use behaviour. While this is an important aspect of protective factors, this focus on their static influence has been at the expense of a more dynamic view of protection.

The literature presented in this chapter on resilience trajectories indicates that resilience factors may change over time. It is thus important to identify and assess the changing and

continued influence of these factors over substance use trajectories. Such an approach is in harmony with the view of resilience as a dynamic process. Moreover, it is more informative for intervention efforts to unravel the changing nature of influence of factors that are involved in the process of resilience.

Some research has begun to look at the influence of resilience factors on substance use trajectories. However, most of these studies assess the resilience factors at baseline only, and then track their influence on substance use trajectories (e.g. Bryant et al., 2003; Flory et al., 2004). For example, in a sample of adolescents followed up from age 11 to 21 years, Flory et al. (2004) found that protective factors (e.g. self esteem, peer pressure resistance, and low sensation seeking) measured at baseline were able to predict substance use trajectories for alcohol and cannabis use (early onset, late onset and non users).

However, only studies that have tracked both substance use and protective factors over time are able to inform us of the nature of this dynamic relationship. The only study to address this was by Griffin et al. (2009). They assessed the developmental trajectories of self-management skills together with substance use in a sample of adolescents followed up from age 12 years to age 15 years. They found that high levels of self management skills at baseline were protective against substance initiation. It was also found that substance use influenced self-management skills. An increase in substance use over time was associated with a decrease in self-management skills, indicating a reciprocal relationship. However, self management skills did not improve but appeared to decrease over time. This could have been due to the whole assessment period of the study falling within adolescence, a time where the prefrontal cortex

is still maturing. As such very little change would have been expected in self management skills.

There remain gaps in our knowledge about how change in protective factors impact on one's substance use trajectory. This needs to be assessed over a long period, which covers adolescence and the transition into adulthood. This is because it has already been identified that the risk and protective factors involved in the process of resilience are more influential during this developmental period. Moreover, this will enable us to assess the impact of change in protective factors (such as self management skills) that do not fully develop until early adulthood.

Summary

Three main schools of thought have emerged when it comes to the conceptualization of resilience. The most commonly adopted within the substance use literature is the view of resilience as a process involving complex interactions between risk and protective factors. Although there are still conceptual issues to iron out, it has been shown that opposing views of resilience may not necessarily be mutually exclusive. A more unified theory of resilience that takes account of traits, processes and outcomes is needed.

Evidence for developmental trajectories of resilience has been inconsistent, with some identifying that resilience factors may change over time during adolescence, whilst others identify little to no change in these factors. It may be postulated that those factors related to the protracted development of the prefrontal cortex may be less likely to change.

Contrastingly, resilience factors stemming from the peer and family domains may change in conjunction with the previously identified increasing influence of peers over family during adolescence.

Studies of risk and protective factors for various substance use outcomes indicate that there is influence of factors across the individual, peer, family, and environment domains. Two main approaches to studying substance use trajectories have been employed; normative and taxonomy approaches. Although normative approaches have utility for identification of developmental trends in substance use, taxonomy approaches are useful for identifying distinct sub-groups of people following the same trajectory. A dynamic approach to studying resilience and substance use would involve concurrent assessment of substance use and resilience trajectories. This incorporates a more dynamic view of resilience.

Chapter 4 Methodology

This thesis reports on 3 studies whose data were collected as part of one bigger study. The methodology was thus the same across the three studies, and will be described below.

4.1 Design

The study carried out was a 6-month prospective study utilizing self-report questionnaires completed at 2 time points; baseline and follow-up at 6 months. This follow-up period has been previously successfully applied to studies assessing changes over time for various substances and mental health outcomes in adolescents (e.g. Green et al., 2004; D'Amico & McCarthy, 2006). The main sample for the study was a general adolescent sample recruited from schools. For practicality reasons, a small sample size was of 240 was decided upon based on research studies assessing cannabis use and mental health in young people (e.g. Chabrol et al., 2005; Buckner et al., 2007; Durdle et al., 2008). These studies successfully report utilizing sample sizes ranging from 212 to 265 participants. A sensitivity power analysis was conducted in order to determine the effect size that could be obtained with a sample of 240. This was calculated using GPower3 software. The results showed that a regression analysis with 11 predictors (resilience & mental health subscales, cannabis use), power of 0.8, and an alpha level of 0.01 would produce a medium effect size of 0.10.

A smaller clinical sample was recruited from the NHS Child and Adolescent Mental Health Services (CAMHS). The eligibility criteria for the study required participants to be aged between 11-18 years, and be able to read and write in English.

4.2 Recruitment and Sampling

A convenience sampling method was utilized for all study participants. This was due to the efficiency and feasibility of convenience sampling.

Schools

Schools within the [redacted] were approached via letters, e-mails and telephone inviting them to take part in the research. Three schools consented to take part, stating the number of classes of students they could make available for the research. For the fourth school, participants had been invited to the University of Birmingham for a research experience day, where they attended the university for a day, for the purposes of taking part in research within the School of Psychology. Three of the secondary schools were all comprehensive schools catering for pupils from year 7 (age 11 years) to year 13 (age 18 years). One of the schools was a specialist sixth form college, catering for post 16 years education (age 16-18 years).

Figure 4.1 illustrates that 261 participants across the four schools completed the study measures at baseline. However, at follow-up, three schools withdrew from the study. The reasons for withdrawing given by the schools were related to insufficient time to allocate for the study due to exam and other commitments (e.g. work experience for year 10s). This meant that overall, the retention rate for the school sample was only 18.39%. However, because only one school took part in the follow-up study, they effectively formed a sub-sample of the entire school sample. Henceforth these will be referred to as the 'School sub-sample', and as figure 4.1 illustrates, 93.31% of that sample were retained for the follow-up assessment.

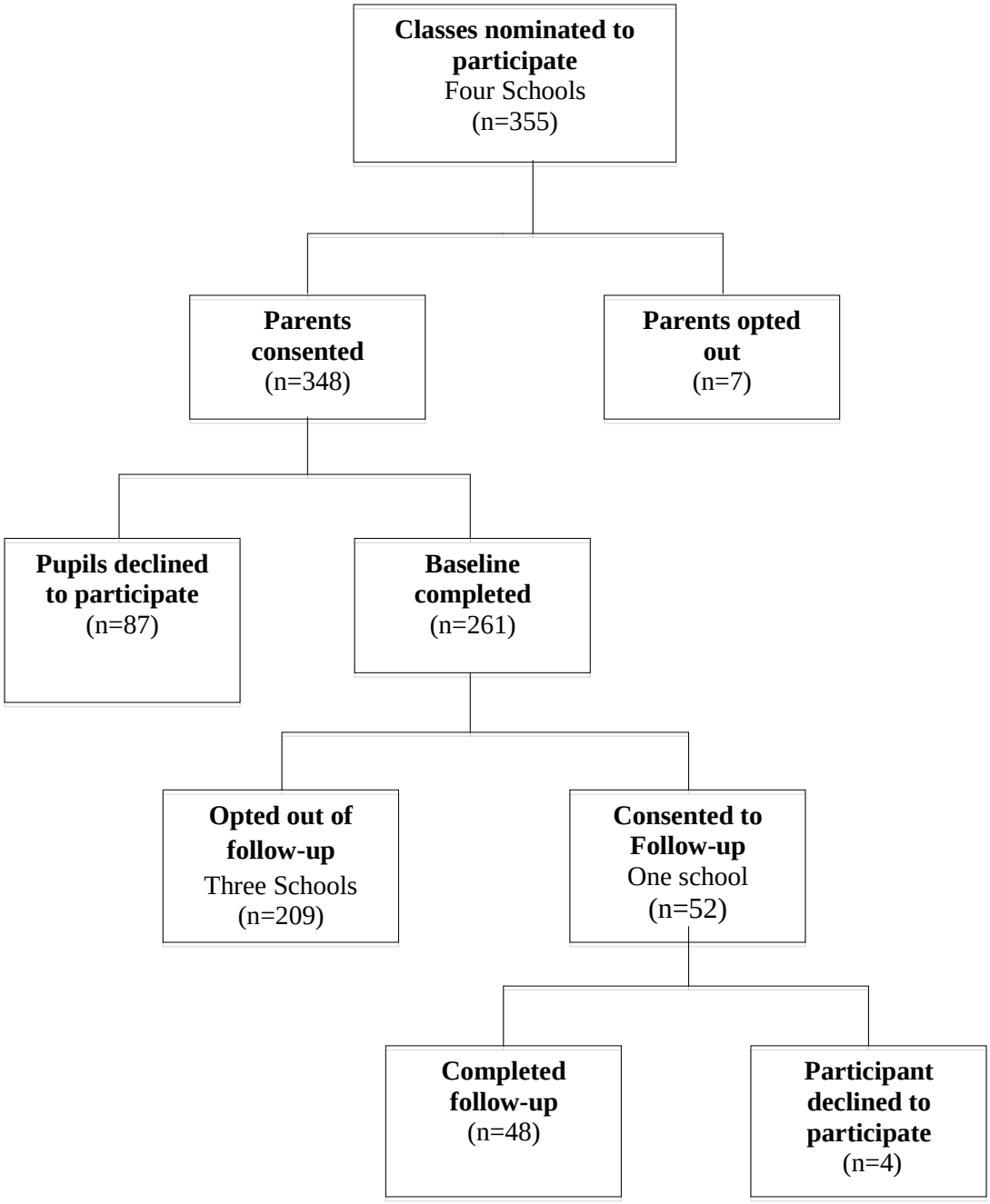


Figure 4.1 Schools recruitment flowchart

CAMHS

The CAMHS service is a community-based service, which operates across three sites. The service accepts referrals from primary care professionals, education professionals, health visitors and from adult mental health services. Referrals are accepted on condition that the individuals are aged from 0-17 years. Additionally, they must also be experiencing severe and enduring mental health difficulties, e.g. eating disorders, psychosis, severe depressive disorder, severe phobic and anxiety states, attention deficit hyperactive disorder with co-morbidity, and autism spectrum disorder with co-morbidity. CAMHS provides assessment and treatment utilizing various psychological therapies, e.g. CBT, Family Therapy, Psychotherapy, etc. Where appropriate, they also provide referrals to other specialist services. Service users are discharged when treatment objectives are met, when they relocate to another area, when needs should be met in other services, or when the service user turns 17, upon which they may be transferred to adult mental health services. Figure 4.2 illustrates the recruitment process for the CAMHS service. It can be seen that 27 participants completed the baseline assessment, and the retention rate at follow-up was 62.96%.

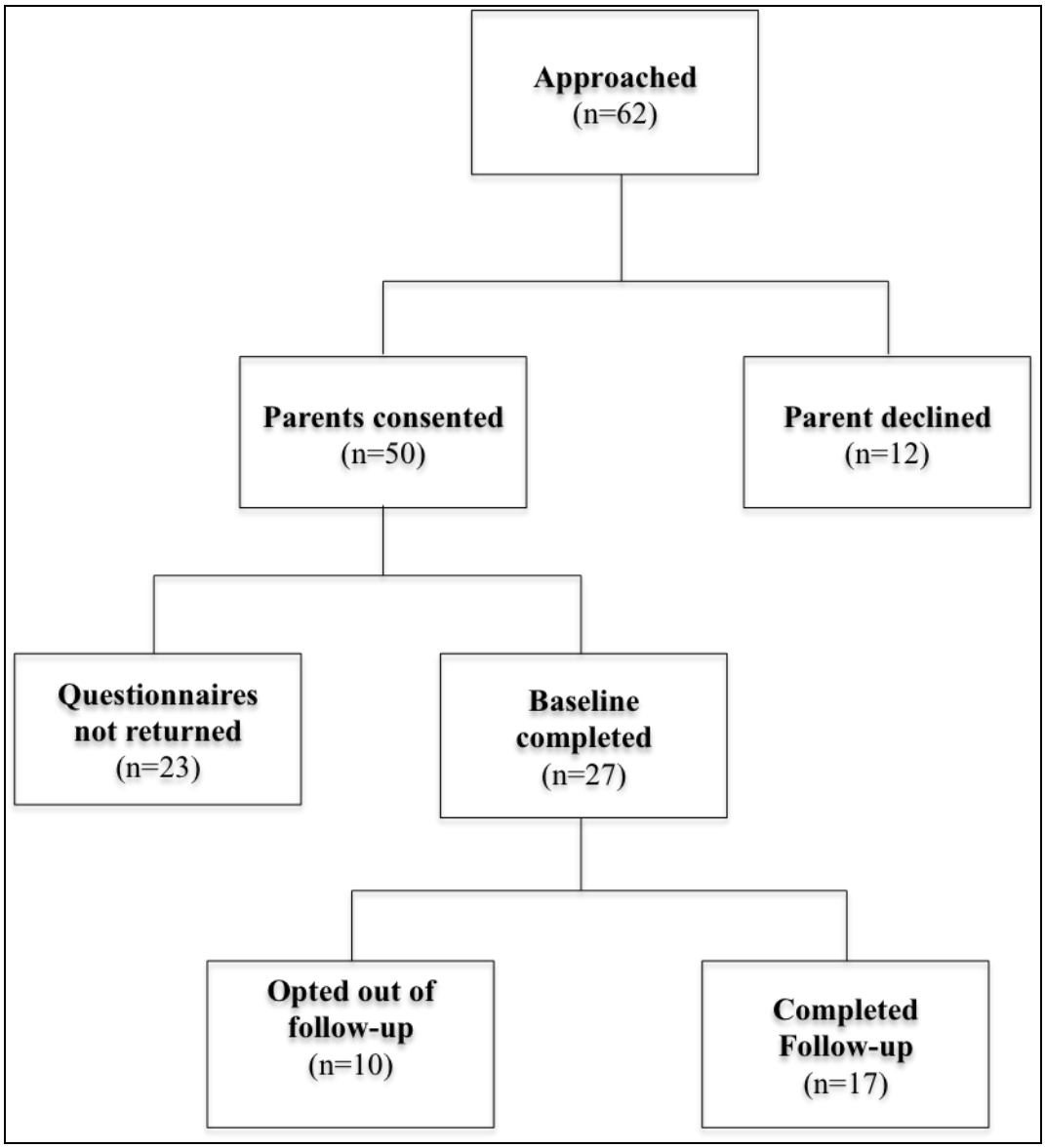


Figure 4.2 CAMHS recruitment flowchart

Recruitment issues

Several issues were encountered during the study, which subsequently led to the high rates of attrition in the school sample, and low participant numbers in the CAMHS sample. At the outset, there were several delays within the ethical approval application process. Initially, ethical approval for the school sample was sought in April 2011 from the University of Birmingham Research Ethics Committee. However, this application was not processed, as

they indicated the need to gain ethical approval for both the school and CAMHS samples from one committee, i.e. the NHS Research ethics committee (NRES). The process for gaining NRES ethical approval was lengthy, due to various other procedures involved (e.g. occupational health clearance etc.). However, the main delay was due to the requirement of a named research site collaborator as part of the NRES application. Several clinicians within CAMHS were approached, and there was a general reluctance to get involved with the project. Most commonly cited reasons for refusal included time constraints, and pressure due to the re-organisation of the service. The process of identifying a research site collaborator was lengthy, involving visits to various CAMHS clinics, and began in February 2011, with a collaborator ultimately identified in May 2011. Subsequently, the NRES application was submitted in June 2011, and ethical approval was finally granted in October 2011. A school to take part in the project was also identified in June 2011. The school utilised random allocation to one of 5 colleges upon enrolment (every n^{th} name). As such, one college would have provided the required sample size of participants across the school years. However, after ethical approval was gained, this school unexpectedly dropped out of the study in November 2011, before data was collected. They indicated concerns over a drug related incident and the desire to avoid highlighting any further drug use within the school, in spite of assurances of anonymity. It proved quite difficult to get other schools on board, with the subsequent identification of a college visiting the university for a research experience day (July 2012). An amendment to the ethical approval was sought and gained in April 2012, to increase the age range of participants to 18 years, in order to accommodate the ages of the college students. It wasn't until September 2012, that a second school had been recruited; however they restricted participation to their 6^{th} form students, composed of a small intake of 40 students. In

December 2012, two further schools were recruited via the School of Psychology Secondary Schools Research Group. The first follow-ups were due in January 2013 for the sixth form college, however the college arranged these around the students' study leave days, and the students did not attend. The college was unwilling to organise any further days for the follow-ups to be conducted, as they stated it was unlikely the students would be interested. Only one school completed the follow-up study. The remaining two schools withdrew from the study, citing various availability issues (e.g. work experience, exam preparation etc).

For the CAMHS sample, recruitment could not begin prior to R&D approval, which was gained in December, 2011. This did not occur until a few months post-ethical approval due to delays of documentation from the research collaborator. The research collaborator needed to gain approval from their line manager. After this, the study's research collaborator arranged for my attendance at the team meeting composed of clinicians from 3 CAMHS clinics, in order to introduce the study. However, this did not take place until April 2012. After the meeting the clinicians agreed to take part, and recruitment for the study began. The last set of baseline participants were recruited in March 2013; with follow-ups in August 2013 as there were time constraints limiting the project (minimum 3 year registration period for PhD was ending in September 2013). Recruitment of participants from CAMHS was itself hampered by a few factors. Clinicians restricted access to some patients. In particular, those whom they felt were too unwell to take part, and new referrals. As stipulated by the ethics committee, clinicians were to make the first approach to participants, but in some instances they indicated that they forgot to do so during the patients' routine appointments. Another barrier to recruitment was from parents/caregivers, who commonly indicated reservations about the

study introducing ideas of drug use to their children. The return rate of the questionnaires by the participants was low; 46% of those who had consented did not return the completed questionnaires.

4.3 Participants

Schools

At baseline, the school sample was aged between 11-18 years ($\bar{x}$ =16.21 years, SD= 1.45), and 59.8% were female. The participants predominantly identified themselves as UK White (82.4%). The school sub-sample was aged between 14-15 years at baseline ($\bar{x}$ =14.79 years, SD= .29). At follow-up, they had a mean age of 15.31 years(SD =.29). Of these 64.6% were female, and the majority were UK White (91.7%).

CAMHS

At baseline, the clinical sample from CAMHS was aged between 13-16 years ($\bar{x}$ =14.95, SD= 1.12). 55.6% of the sample was female, and they predominantly identified themselves as UK White (77.8%). The 17 participants who took part in the follow-up had a mean age of 15.63 years (SD= 1.03), with 58.8% being female. 82.4% identified themselves as UK White.

4.4 Measures

4.4.1 Cannabis and Young People Questionnaire

The Cannabis and Young People Questionnaire (CYPQ) is a measure that assesses patterns of cannabis use and factors that influence use. It was constructed based on qualitative data from an interview study of cannabis users by Terry et al., (2007). The scale has 46 items and it contains different sections for those who have never used cannabis, previous users and current users. It assesses current and previous cannabis use patterns, reasons for abstention and for changing use patterns (increases, decreases, abstinences). The questionnaire also collects demographic data and data on cigarette, alcohol and other illicit substance use. The CYPQ utilizes both closed and open-ended questions. Piloting of the questionnaire for ease of completion and face validity was carried out with 126 school children aged 14-18years. Face validity was also assessed for this study using a small opportunity sample of 5 girls aged 11. The wording was subsequently made age-appropriate.

4.4.2 Community Assessment of Psychic Experiences (CAPE, Stefanis et al., 2002)

The CAPE is a well used and validated 42- item scale that measures presence of sub-clinical expressions of psychotic like experiences (PLEs). The CAPE questions are based on a 4 point likert scale, with responses ranging from 'never' to 'nearly always'. It assesses presence of Positive, Negative and Depressive symptoms, together with an associated distress score for each symptom. Only the Positive scale was utilized for the present study. A three-factor structure has previously been identified for the CAPE Positive scale. More specifically, the CAPE positive symptom scale measures psychotic symptoms of 'Magical Thinking',

'Persecutory Ideation', and 'Bizarre Experiences' (Yung et al., 2006, Hides et al., 2009, Yung et al., 2007). Magical thinking relates to the attribution of causal relationships that cannot be justified by reason. Persecutory ideation is a measure of paranoia, and bizarre experiences is measure unusual phenomena such as perceptual abnormalities. The CAPE has been quite widely utilized for adolescent samples (Yung et al., 2007, Konings et al., 2008, Hides et al., 2009, Lin et al., 2011), and has been shown to have good reliability and validity (Brenner et al., 2007).

4.4.3 Resilience Scale for Adolescents (READ, Hjemdal & Friborg, 2006)

The READ is a validated 28-item measure of resilience factors that have previously been identified in the literature as fostering various adaptive outcomes. It utilizes a 5-point likert scale, and was constructed based on the Resilience Scale for adults (Friborg et al., 2003). All questions are worded positively; with responses on the scale ranging from totally agree to totally disagree. These responses are scored from 1 (totally disagree) to 5 (totally agree), thus the higher the score then the higher the level of resilience. The READ has a five-factor structure, which assesses levels of 'Personal Competence', 'Social Competence', 'Structured Style', 'Social Resources', and 'Family Cohesion'. Personal competence is a measure of various cognitive and behavioural self management skills (e.g. problem solving, self-reinforcement etc.) thought to help an individual to confront and actively manage and solve challenges in life. Social competence relates to the ability to effectively interact with peers. Structured style relates to the propensity for self-organization. Social resources are a measure of the availability of external sources of support. Family cohesion is a measure of the emotional bond within the family. The READ has been shown to have good internal

consistency (α=0.94, Hjemdal et al., 2007) and has been previously utilized in adolescent samples (von Soest et al., 2010, Hjemdal et al., 2006b, Hjemdal et al., 2007). In previous longitudinal studies it has proven successful in predicting various psychopathological outcomes (Hjemdal et al., 2006).

4.4.4 Depression Anxiety Stress Scales (DASS 21, Lovibond, 1995)

The DASS is a well-established measure that assesses Depression, Anxiety and Stress symptoms. It is composed of statements that participants have to indicate how often they applied to them. Responses are based on a 5-point Likert scale ranging from 'did not apply to me at all', to 'applied to me very much or most of the time'. Although the original measure consists of 42 items, the shortened 21- item version was utilized in the present study for ease of use.

The sub-scales of the DASS 21 have been found to have acceptable internal consistency when tested on an adolescent sample (Cronbach's alpha; 0.82- Depression, 0.67- Anxiety, 0.88- Stress, Hjemdal et al., 2010). More recently, the tripartite model of negative emotionality presented by the DASS 21 was confirmed in a large community sample of adolescents (Willemsen et al., 2011), thereby confirming the validity of the DASS in measuring symptoms of depression, anxiety and stress in adolescents. The measure also allows use of arbitrary cut-off scores in order to assess the severity of depression, anxiety, and stress symptoms. These are presented in Table 4.1.

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Table 4.1 DASS cut-off scores for symptom severity

		DASS sub-scales		
		Depression	Anxiety	Stress
Symptom Severity	Normal	0-9	0-7	0-14
	Mild	10-13	8-9	15-18
	Moderate	14-20	10-14	19-25
	Severe	21-27	15-19	26-33
	Extremely Severe	28+	20+	34+

4.5 Procedure

Schools

Passive consent was sought from parents by sending them information sheets together with opt out reply slips. Those students who were opted out by their parents were excluded from the study. Participants were given an information sheet and also signed a consent form if they agreed to take part. The questionnaires were administered in groups under exam style conditions in order to ensure confidentiality. The researcher and a teacher were always present. Questionnaires were handed out to the participants in envelopes and upon completion, were handed back to the researcher in the envelope. The order of testing for the groups was dependent on the school timetable and was agreed by the Head Teachers. After questionnaires were returned to the researcher, the participants were handed a debriefing sheet which sign posted participants to the relevant agencies that they could speak to in regards to substance use problems. The same procedures were utilized for the follow-up. The information, consent and debrief forms are presented in Appendix B.1.

CAMHS

Parents or guardians together with the patient were informed about the study and were then presented with an information sheet. If the parent consented, and the young person was willing to take part, they were asked to bring the signed consent form on their next visit to the clinic. Participants were given the questionnaires to take home with them in a stamped envelope addressed to the researcher. They completed these at home and posted them to the researcher. In the event that questionnaires where not returned, participants received up to 3 telephone calls as reminders. After this those who still did not return the questionnaires were regarded as decliners. For the follow-up study, the researcher contacted the participants via telephone and those consenting to take part were sent the questionnaires via post. Again up to 3-reminder telephone calls were made to the participants to compete the questionnaires. Those who still did not return their questionnaires after this were regarded as declining to take part. The information, consent and debrief forms are presented in Appendix B.2

4.6 Ethics

Ethical approval for the study (for both the school and CAMHS samples) was obtained from the NRES South Birmingham Research Ethics Committee (Ref 11/WM/ 0284). Additionally, R & D approval for the CAMHS sample was obtained from the Research and Development office for the Heart of England NHS Foundation Trust (see Appendix A for documentation).

In order to ensure confidentiality, participants generated a unique identification code for their questionnaires by answering a series of questions. This code was also used to match up baseline and follow-up responses. The use of subject generated identification codes has

previously been successfully utilized in prospective studies and the questions used for the presented study were adapted from Yurek et al., (2008). These are shown in Table 4.2 below.

Table 4.2 The question set for participant ID code generation

Subject Generated Identification Code (SGIC) and Question Set	
What is the...	**e.g.**
First letter of mother's first name	M
Number of older brothers (living and deceased)	01
Number representing the month you were born	05
First letter of middle name (if none, use X)	A
Example ID	**M0105A**

4.7 Data analysis strategy

All statistical analyses were conducted using IBM SPSS Statistics (version 20) software. Due to the multiple comparisons carried on the data, a more conservative alpha level of .01 was used in order to control for the family wise error rate. Both qualitative and quantitative data analysis procedures were employed in the thesis. As the specific strategy employed differed for each study, these are outlined separately below.

4.7.1 Study 1

Frequency analysis was used to identify the most commonly selected factors cited as influencing cannabis use, initiation, increases, decreases, and abstention. Because participants could select multiple factors, this resulted in various combinations of these factors. Goodness

of fit chi-square was used to assess whether some combinations were more commonly selected than others. Thematic analysis was utilized to analyse participants' responses to the free response question on what had influenced voluntary abstinences. The themes identified where then used to construct a thematic network.

4.7.2 Study 2

Mann Whitney tests were utilized to compare cannabis users and non-users on their reported levels of depression, anxiety, stress and subclinical psychosis. This was due to the non-normal distributions of these mental health factors. In order to assess whether cannabis users and non-users differed on their change in mental health factors over time, Mann Whitney tests were used to compare cannabis users and non-users identified at baseline on their follow-up levels of depression, anxiety, stress and subclinical psychosis. This was only carried out for the CAMHS sample, as there was very little cannabis use identified in the School sub-sample. The same analytical procedures were also carried out for comparisons between alcohol users and non-users.

Spearman's correlations were carried out first in order to establish the relationship between resilience and the mental health factors (depression, anxiety, stress and sub-clinical psychosis). In order to assess the moderation effect of cannabis, hierarchical multiple regression models were run, as there is no non-parametric alternative to regression. These were run separately for each mental health factor as the criterion variable (but only those factors with a significant relationship with resilience). The criterion variables were all log transformed using natural logs (log n) in order to control for their skewed distributions. In step

1 of the regression, cannabis use (user/non-user dichotomy), and the resilience factors of personal competence, social competence, structured style, social resources and family cohesion were entered as predictors. Predictors were centered in order to control for multicollinearity when the interaction terms were entered. These analyses were carried out for the school sample only, as the sample from CAMHS was of insufficient size for this analysis. The same analyses were run for assessing the moderating effects of alcohol use.

4.7.3 Study 3

Wilcoxon signed rank tests were utilized for comparing baseline and follow-up resilience factors. These analyses were carried out for the School sub-sample and the CAMHS sample. In order to assess whether resilience predicts cannabis use, logistic regression analysis was performed with cannabis use (user-non user dichotomy) as a criterion variable, and personal competence, social competence, structured style, social resources, and family cohesion as predictors for the School sample. This analysis could not be carried out in the CAMHS and school sub-samples due to insufficient sample sizes.

In order to assess whether resilience predicts alcohol use, multiple regression analysis was run with amount of alcohol units consumed per sitting as the criterion variable. The resilience factors of personal competence, social competence, structured style, social resources and family cohesion were entered as predictors. In order to assess whether resilience at baseline predicted amount of alcohol units consumed at follow-up, multiple regression analysis was

carried out on data from the school sub-sample. Resilience factors at baseline were entered as predictors, and alcohol units consumed per sitting at follow-up as the criterion variable.

Chapter 5 Study 1

5.1 Rationale & Hypotheses

The literature presented in Chapter 1 points to a number of factors associated with different stages of cannabis use utilising multivariate approaches. A thorough account of factors influencing changes in patterns of cannabis use is needed in adolescent cannabis users, utilising a person centred approach whereby factors are assessed from the perspective of the individual. It has been previously suggested that this kind of assessment may help to delineate issues of causality, which are lacking in current multivariate approaches (Terry et al., 2007). An assessment of self-reported factors would thus be useful for augmenting the current literature based on multivariate approaches.

Such an approach has been previously utilised in a qualitative study by Terry et al., 2007, which, to the present study author's knowledge, is the only study to fully take into account these factors in a non-clinical sample. Initiation of cannabis use appeared to be predominantly influenced by curiosity about the effects of cannabis. However, peers were not a commonly cited reason for initiation. Increases in cannabis use were identified as being most commonly influenced by others' increased use (e.g. peers), more opportunities to use cannabis brought about by a change in circumstances, and perceived beneficial effects of cannabis (Terry et al., 2007). Decreases in cannabis use were commonly reported as resulting from changed circumstances (e.g. new relationship with non-cannabis user, new job, moving house). Additionally, 31% of the respondents pointed to the negative effects of cannabis. However, reasons for decreases were generally more diverse than those cited for increases. Periods of

abstinences reported by cannabis users were identified as resulting from a short-term change in circumstances (e.g. visiting parents, or going on holiday). Moreover, participants also reported abstaining due to concerns over mental and physical health (Terry et al., 2007).

Notwithstanding the informative nature of this study, it is important to note that it was carried out using an adult sample, reporting using cannabis over a protracted period of time (average of 14 years). This necessitates an analysis of adolescent data, as the influences on cannabis use in adolescence are likely to differ from those of adulthood. With the current state of the literature in mind, the aim of the present study was thus to provide a thorough assessment of self reported factors influencing changes to cannabis use patterns in both a general and clinical sample of adolescents. This information was gathered utilising a measure constructed based on Terry et al.,'s (2007) findings cited above. To avoid confusion, henceforth the term 'abstention' will be utilised for non-cannabis users, and the term 'abstinence' will be used to refer to cannabis users reporting brief periods of not using cannabis. With this and previously reviewed literature in mind, the study hypotheses were as follows:-

1. Among the factors influencing cannabis use, peers will be the most influential factor.
2. Peers will be the most influential factor for cannabis initiation.
3. Use by other people will be the most commonly cited factor for increases in cannabis use.
4. Reasons relating to life transitions will be the most commonly selected for decreases in cannabis use.
5. Religion will be the most commonly cited reason for abstention from cannabis by non-cannabis users.

5.2 Results

5.2.1 Rates of cannabis use

As can be seen in Table 5.1, baseline current cannabis use was low, with only 5 and 6 participants reporting this in the School and CAMHS samples respectively. Moreover, Table 5.1 illustrates that rates of cannabis use were quite low for the school sub- sample both at baseline and at follow-up. Due to these low levels of use across the samples, both current and previous users will henceforth be collectively referred to as 'cannabis users'.

Comparisons of proportions of cannabis users indicates that participants from CAMHS were more likely to be cannabis users than participants from schools (p=.006, Fisher's exact test, two tailed). No age differences were identified between cannabis users ($\overline{x}$ = 16.72, SD= 1.12) and non-cannabis users ($\overline{x}$ = 16.12, SD= .91) from the School sample (*t* (256)= -2.39, p=.02).

4 participants did not report their age. Similarly, no differences in age were identified between cannabis users ($\overline{x}$ = 15.48, SD= .91) and non-cannabis users ($\overline{x}$ = 14.64, SD= 1.14) from the CAMHS sample (t (25)= -1.97, p= .06). 1 participant did not report their age. Overall, in the school sample, cannabis users were more likely to be male than non-users (X^2 (df=1) =12.08, p = .001). In the CAMHS sample, there were no differences in gender distribution between cannabis users and non-users both at baseline (X^2 (df=1) =.20, p = .71) and at follow-up (X^2 (df=1) =.08, p = .58).

Table 5.1 Number of participants in each cannabis use group across the school and CAMHS samples at baseline and follow-up.

		Baseline			Follow-up	
		School (n=261)	**School Sub-sample (n=52)**	**CAMHS (n=27)**	**School Sub-sample (n=48)**	**CAMHS (n=17)**
Cannabis Use Group	**Never Used**	223 (85.4%)	48 (92.3%)	17 (63%)	38 (79.2%)	8 (47.1%)
	Previous User	33 (12.6%)	3 (5.8%)	4 (14.8%)	8 (16.7%)	3 (17.6%)
	Current User	5 (1.9%)	1 (1.9%)	6 (22.2%)	2 (4.2%)	6 (35.3%)

In the School sample, only 26.32% (n=10) of the cannabis users provided data of their previous and current cannabis use frequency. Of these, two reported daily use, three once a week, two once a fortnight, and three once a month. Two of them were current cannabis users, thus provided information on quantity of cannabis used as well. One reported smoking one joint per week, and the other reported smoking 2 joints per month.

In the CAMHS sample, 80% (n=8) of the cannabis users reported frequency of use. Two reported daily use, one reported using once a week, two reported using once a fortnight and three reported using once a month. Of these, three were current cannabis users, thus also provided information on quantities used. One reported smoking one joint per day and the other two reported smoking one joint every month.

Age of Initiation of Cannabis Use

Cannabis users from the School sample reported initiating cannabis between the ages of 13-17 years (median= 15.17, mode= 14) (n=35) at baseline. 3 cannabis users from schools did not provide their age of cannabis initiation. For the cannabis users from the CAMHS sample, age of initiation was reported between 12 and 16 years (median=13.38, mode=13.00) (n=10). Cannabis users from the School sample reported a significantly higher age of initiation than those from the CAMHS sample (U =83, p= .01).

5.2.2 Hypothesis 1. Among the factors influencing cannabis use, peers will be the most influential factor.

Cannabis users responded to a multiple response question of what had influenced their use of cannabis. Frequency analysis indicates that the most common factor was 'peers', with 45.9% and 70% of cannabis users selecting it in the School and CAMHS samples respectively (see Figure 5.3). The combination of factors that were selected by participants were assessed in order to identify the most common factor groupings. A goodness of fit $\chi 2$ indicated that participants in the School sample showed a preference of some factor combinations over others (χ 2 (13, N= 37) = 39.05, p<.001). A look at the observed frequencies indicates that most participants chose 'peers' only, as opposed to the other factors and their combinations (see Table 5.2). 1 cannabis user was excluded from this analysis due to missing data. However, in the CAMHS sample all factor combinations had equal probability of being selected (χ^2 (3, n=10) = 2, *p*= .720).

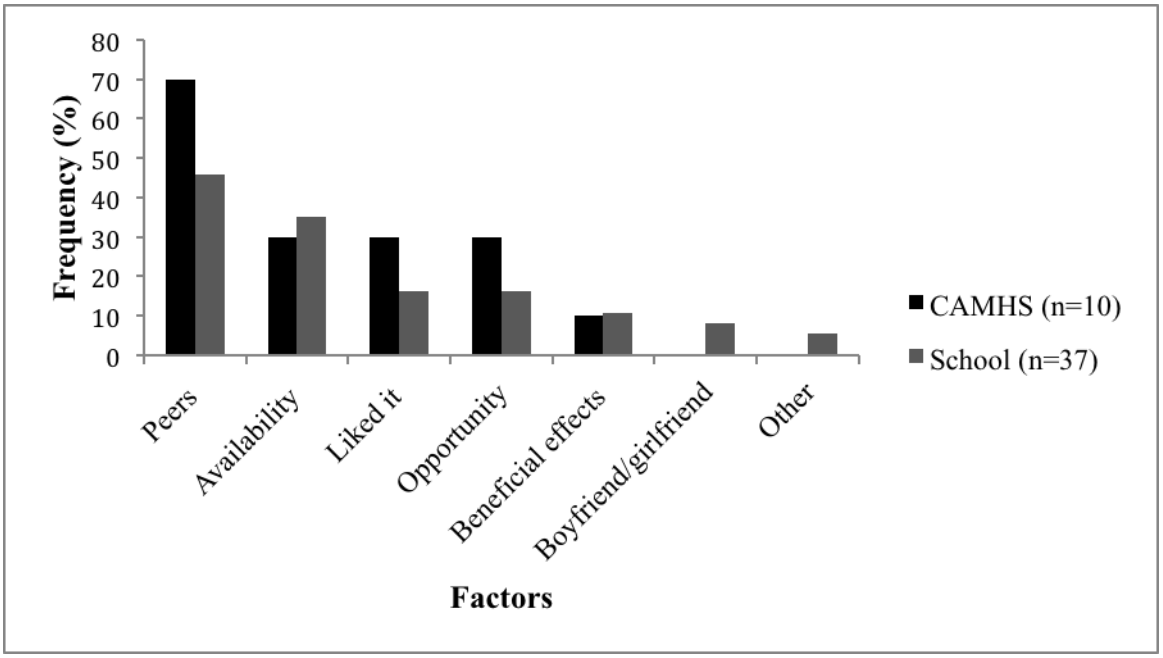

Figure 5.1 Proportion of cannabis users from the School and CAMHS samples selecting each factor in response to the question of what had influenced their cannabis use. 1 cannabis user from the School sample did not provide data.

Table 5.2 Number of cannabis users from the School sample (n=37) selecting each combination of factors in response to the question of what had influenced their cannabis use in general. 1 cannabis user had missing data.

Responses	Observed N
Peers	11
Opportunity	6
Liked it	4
Beneficial	3
Other	2
Peers + opportunity	2
Peers + availability + opportunity	2
Availability	1
Availability + liked it	1
Boyfriend/girlfriend	1
Boyfriend/girlfriend + availability + opportunity	1
Beneficial + liked it + opportunity	1
Peers + availability	1
Peers + boyfriend/girlfriend + opportunity	1

5.2.3 Hypothesis 2. Peers will be the most influential factor for cannabis initiation.

In response to the question on what had led them to try cannabis, the frequency analysis indicates that 'curiosity' was the most commonly selected response, with 55.9% and 90% of the cannabis users from the School and CAMHS samples selecting this response respectively (see Figure 5.5). However, 3 cannabis users from schools and 1 from CAMHS did not provide data. When assessing the combination of responses selected by participants, the goodness of fit χ^2 indicated that participants from the School sample showed a preference of some factors over other (χ^2 (7, N=34) =35.18, p<.001). A look at the observed frequencies indicates that 'curiosity' remained the most frequently selected factor (see Table 5.3). Contrastingly, all factor combinations had equal probabilities of being selected in the CAMHS sample (χ^2 (4, n=9) = 1.556, *p*= .942).

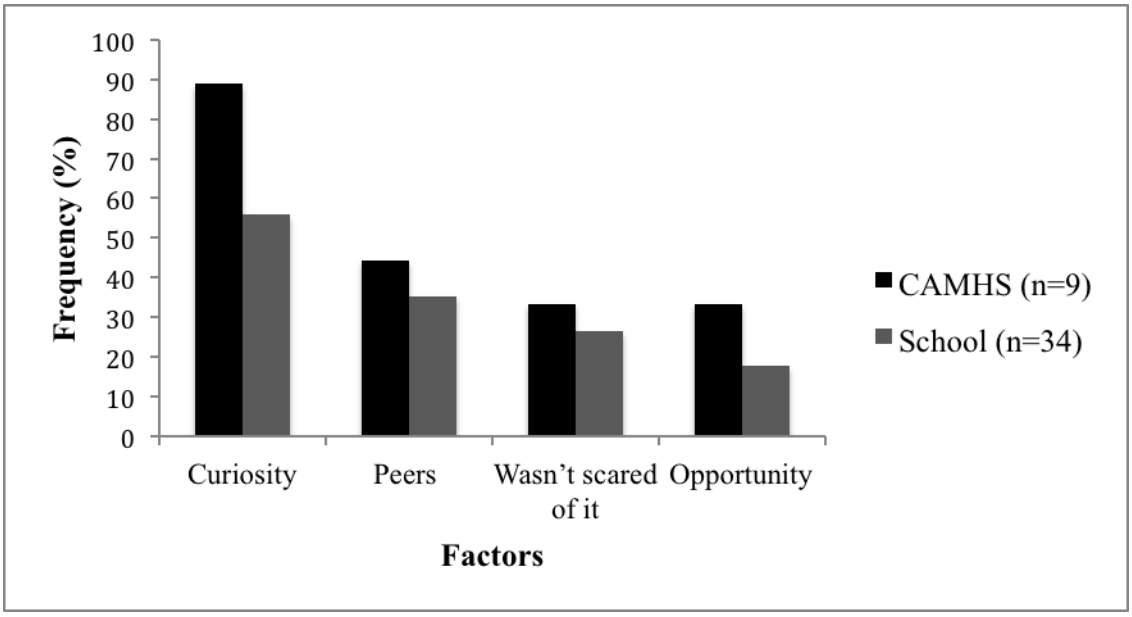

Figure 5.2 Proportion of cannabis users from the School and CAMHS samples selecting each factor in response to the question of what had led them to try cannabis use. 3 cannabis users from the School sample and 1 from the CAMHS sample did not provide data.

Table 5.3 Number of cannabis users from the School sample (n=34) selecting each combination of factors in response to the question of what had influenced their cannabis initiation. 4 cannabis users had missing data.

Responses	Observed N
Curiosity	14
Peers	7
Opportunity	6
Curiosity + opportunity + peers+ wasn't afraid of it	3
Peers + wasn't afraid of it	1
Wasn't afraid of it	1
Curiosity + wasn't afraid of it	1
Curiosity + peers	1

5.2.4 Hypothesis 3. Use by other people will be the most commonly cited factor for increases in cannabis use

Of the cannabis users in the School sample, 55.3% (n=21) reported having periods where their cannabis use either increased or decreased. Frequency analysis indicates that the most commonly selected reason for increased cannabis use was 'increased use by others', with 60% of this sample selecting this response (see Figure 5.6). 1 cannabis user did not report reasons for increased use. None of the response combinations were any more likely than the others to be selected by the participants (χ 2 (9, n=20) = 9, p=.485).

Of the cannabis users in the CAMHS sample, 50% (n=5) reported having periods where their cannabis use either increased or decreased. When asked about reasons for their increased use,

participants were equally likely to cite 'others increased use', 'more opportunities to use', 'positive effects', and 'more money'. These responses were selected by 4 out of 5 of the cannabis users. The remaining cannabis user cited religious reasons. Additionally, combinations of these responses were equally likely to be selected (χ^2 (2, n = 5) = 1.6, p=.63).

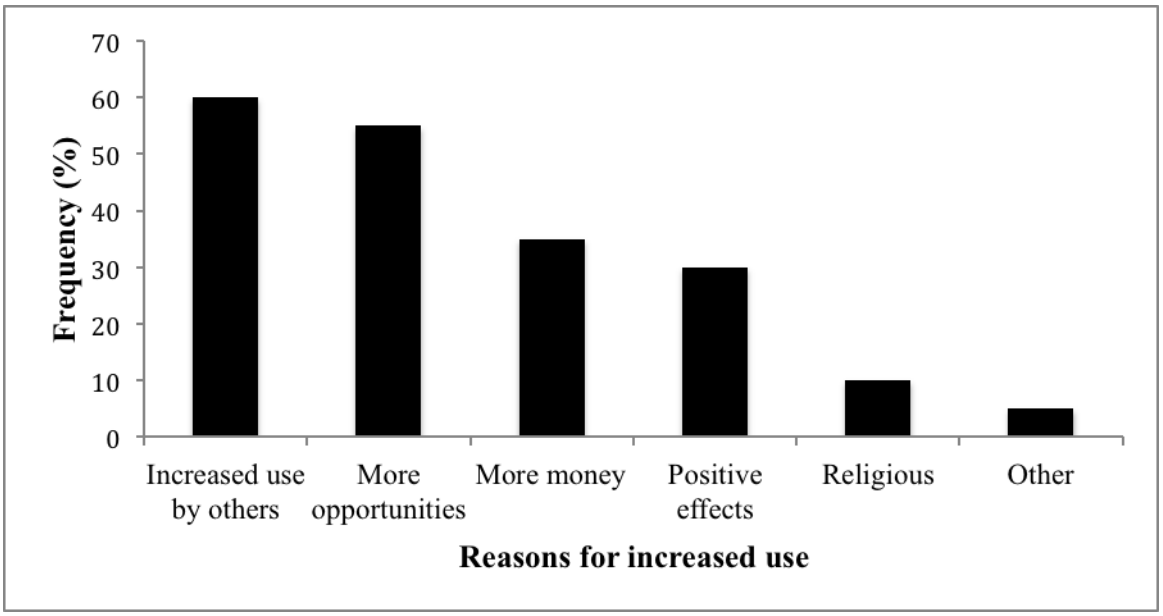

Figure 5.3 Proportion of cannabis users from the School sample (n=20) selecting each reason for increasing their cannabis use. 1 cannabis user did not provide data.

5.2.5 Hypothesis 4. Reasons relating to life transitions will be the most commonly selected for decreases in cannabis use.

When asked about reasons for decreasing their cannabis use, cannabis users from Schools most commonly indicated that they 'grew out of it' (see Figure 5.7). An assessment of the response combinations indicates that they all had equal probability of being selected (χ^2 (14, n=21) =11.143, p= .743).

In the CAMHS sample, only 2 cannabis users indicated reasons for decreased use. One participant selected 'financial concerns', whilst the other selected ' legal concerns'. The remaining cannabis users did not indicate any reasons for decreased use.

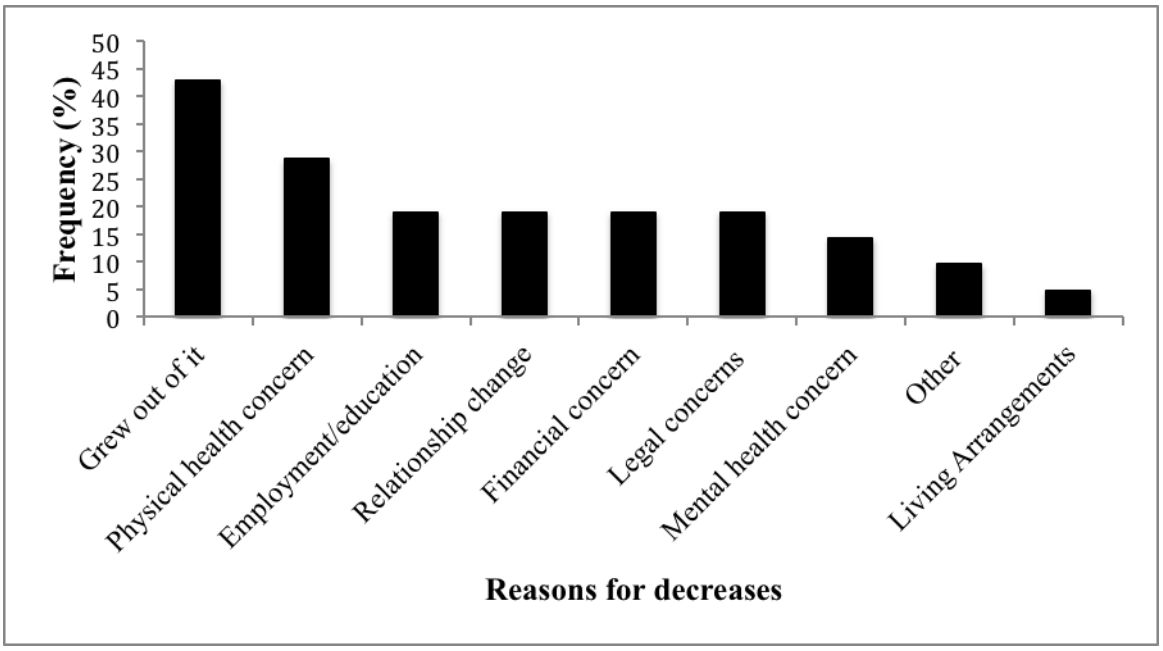

Figure 5.4 Proportion of cannabis users from the School sample (n=21) selecting each reason for decreasing their cannabis use.

5.2.6 Hypothesis 5. Religion will be the most commonly cited factor for abstention by non-cannabis users.

Non-cannabis users responded to the multiple response question of what factors had influenced them not using cannabis. In the School sample, 'concerns about physical health' was the most commonly selected factor (n=145, 72.5%) (see Figure 5.8). This was closely followed by 'concerns about mental health' (n=140, 70%), and effects of cannabis (n=133, 66.5%). 23 non-cannabis users did not provide reasons for not using cannabis. There were 93 different combinations of factors selected by the participants. Some factor combinations were

more likely to be selected over others (χ^2 (92, n=200) = 278.02, p<.001). The two most commonly selected response combinations were 'legal' + 'physical health concerns' + 'mental health concerns' + 'effects' (n=15), and 'peers' + 'legal concerns' + 'physical health concerns'+ 'mental health concerns' + 'effects' (n=15).

Non-cannabis users from the CAMHS sample were most likely to cite 'physical health concerns' as a factor that had influenced their abstention from cannabis (see Figure 5.8). Figure 7 also illustrates that 'mental health concerns' was the second most commonly selected response, and 'legal' and 'financial' were the third most commonly selected responses. The diffferences in frequencies between these factors were small (n=1). The factor combinations also had equal probabilities of being selected by the participants (χ^2 (7, n=13) = 3.615, p= .904). 4 participants did not indicate reasons for not using cannabis.

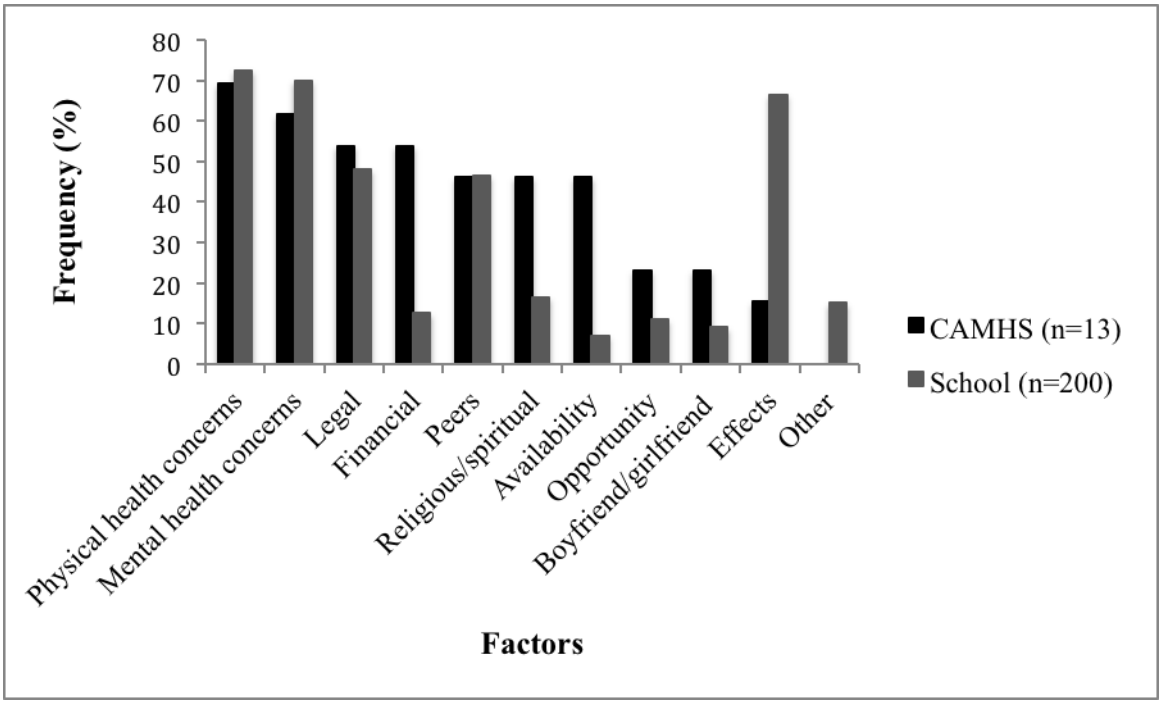

Figure 5.5 Proportion of cannabis users from the School and CAMHS samples selecting each factor in response to the question of what had influenced them to not use cannabis use. 23 cannabis users from the School sample and 4 from the CAMHS sample did not provide data.

5.2.7 Qualitative analysis: Factors influencing voluntary abstinences in cannabis users.

In an attempt to understand the reasons for voluntary abstinences from cannabis use by cannabis users, an exploratory analysis was carried out. Participants responded to two open-ended questions that were related to periods when they had abstained from cannabis. The first question required participants to provide details of a time when they had chosen not to use cannabis. The second question required participants to state what their reasons for this choice were. Thematic analysis was selected as the most appropriate method for analysing this qualitative data. This is because by definition, it seeks to identify, analyse and report patterns

within data (Braun & Clarke, 2006). This allows the identification of the most salient influences from the descriptions provided by the participants. An inductive approach to the analysis was utilised so that there were no pre-existing notions or theories to guide in identification of themes. As a result, the themes identified were data driven. This approach was deemed suitable as there is a lack of pre-existing data on the influences of abstinences for young cannabis users, thus the theoretically flexible nature of thematic analysis allows for unresticted interpretation of the data. Additionally, the approach to thematic analysis was both semantic and realist. This means that it was reflective of the explicit content of the data and reported an assumed reality evident in the data, respectively (Braun & Clarke, 2006). These approaches allowed for the best possible utilisation of the small data set, avoiding over-analysis of the data. Stages of thematic analysis were followed as has been previously outlined (Braun & Clarke, 2006; Attride-Stirling, 2001) and these are described below.

The first stage of the analysis involved familiariasation with the data by reading and re-reading the participant responses. In the second stage, codes were generated from the participant responses. The responses were then classified according to these codes, and each response could be classified under multiple codes. The third stage involved generating themes from the identified codes. In order to achieve this, responses corresponding to each code were re-read, and the codes were collapsed into themes. For the purposes of producing an inclusive dataset, all themes generated were included in the final list regardless of the number of responses falling into each theme. In the fourth stage of the analysis, the themes were reviewed, named and defined. This involved re-reading the participant responses in order to ensure that the themes were representative of the data. Some themes were collapsed into one,

if they were conceptually similar, whilst others were seperated. As part of producing the final analysis, a thematic network was constructed duing the final stage. The previously identified themes were utilised as basic themes. The basic themes were then collapsed into organising themes.

5.2.7.1 Cannabis users from the School sample

Out of all the cannabis users in the school sample, 89.47% (n=34) reported having had experienced voluntary abstinences from cannabis. However, only 64.71% (n=22) of these partcipants responded to the questions asking them to provide details of and reasons for these abstinences. Overall, the majority of responses refered to specific incidents of abstaining (54.55%, n= 12), whereas only 27.27% (n=6) refered to abstaining over longer periods. It was not clear in 18.18% (n=4) of responses whether participants were referring to incidents or periods of abstinences. The themes identified related to both external and internal influences on the decision to abstain. These were, 'peers', 'before important events', 'prior to family interactions', 'state of mind', 'negative effects', and 'attempt to quit'. These will be discussed in turn.

Peers

In 50% of the responses (n=11), participants indicated that decisions to abstain from cannabis had occurred in situations involving their peers. This involved either being offered by their peers, or simply being in an environment where cannabis was being smoked by peers. Examples of such responses are given below.

T0104P: My friends were smoking a spliff, they offered me some and I decided.

S0207F: Asked to go at a friend's where they would have been smoking it, didn't go.

The first response cited above indicates that some decisions to abstain from cannabis were spontaneous, and were not necessarily a pre-planned response. The second response indicates that strategies to abstain from cannabis sometimes involve a reassessment of peer interactions. In this case the participant reported that they had actively avoided being in an environment where they knew their peers would be smoking cannabis. 27.2% of responses (n=3) in the 'peers' theme indicated being at a party when they had abstained from cannabis. On the other had, 72.73% (n=8) reported being with peers (either at home or undisclosed location) when they made the decision to abstain. This shows that participants were able to refrain from using cannabis despite being in situations where their peers were smoking it.

Prior to important events

Analyses of the responses also revealed that cannabis users reported abstaining from cannabis prior to important events. 18.18% responses (n=4) indicated abstinence prior to an important event, although the specific events reported varied. One respondent indicated abstaining 'before exams', another 'before important rugby matches'. Another respondent indicated that they abstained 'before a drug test' , while the other only stated that they abstained 'before important events'.

P0012S: I was given a date for a drug test, I did not smoke for a month before and did not start again for a month after…to see the effect it had on me.

The response quoted above indicates that in this case the cannabis user initially intended to give the impression of abstinence without actually intending to quit permanently. However, the decision to continue abstinence after the drug test was made in order to assess the effects

of cannabis. Citing important events as reasons for abstaining also shows that participants had an awareness of the effects of cannabis on their performance. This suggests that for some cannabis users, they continue to use cannabis in spite of these negative effects.

Prior to family interactions

Participants also revealed that they had abstained prior to family interactions. 22.72% (n=5) of all responses mentioned either family in general or parents. Of these respondents, one stated that they abstained 'before seeing family', while another stated that they abstained 'if they were seeing their parents a short time afterwards'.

N0304N: *... Also didn't want to be caught high by family.*

This reponse indicates an issue of worry over intoxication being dicsovered by the cannabis user's family, and this was stated by other cannabis users as well. This indicates that young cannabis users are aware of their families' disapproval of their cannabis use, and will abstain as needed to avoid being caught. These absitnences are likely to be short-lived as they tend to occur in situations where the cannabis user is faced with the possibility of family encounters.

State of Mind

45.45% (n=10) of responses indicated the cannabis user's general state of mind as being related to their abstinences. Four respondents indicated that they 'didn't feel like it' and one indicated that they 'couldn't be bothered'. Two respondents indicated that they 'did not want to'. The remaining responses are given below:-

T0104P: *Didn't fancy any on that day.*

T0104J: *Just got bored of it.*

NoID: *Mind-set, but now I want to be more open to new things*

The first response quoted above indicates a temporary incident of abstaining. In this case the cannabis user is influenced by their mood state on that particular day, and this shows that abstinance from cannabis is also influenced by transient factors. The second response may indicate that continuation of use is contingent on the effects of cannabis. In this case the cannabis user reports 'getting bored' of it, which might indicate either not getting the desired effects or a desire to experience a different type of 'high'. In the third response, there is a shift in the mind-set of the cannabis user. The participant is expressing a desire to try out new experiences, and cannabis may be seen as getting in the way of that.

Negative effects of cannabis

Negative effects of cannabis were included in 31.81% (n=7) of the responses. Some examples of these responses are given below:

L0008R: *...plus had a bad feeling one time and it put me off it.*

N0304N: *Didn't want to become paraletic (?), vomiting (mixing substances)…*

P0012S: *...did not want to upset my parents or detriment my opprotunities later in life.*

In the first response, the cannabis user is vague in regards to the specific nature of the negative effects experienced as a result of smoking cannabis. The so called 'bad feeling' could be either physical or psychological in nature. The second response indicates a desire to avoid a perceived physical effect of cannabis, especially when mixed with other substances that the cannabis user was also ingesting at the time (alcohol). In the third response, the cannabis user is referring to psychosocial effects of using cannabis, both short term (i.e. upsetting parents)

and long term (i.e. future opportunities). Together, these responses indicate that young cannabis users have an awareness of the different types of negative effects that smoking cannabis produces. This awareness is based both on prior experienced effects of cannabis, and perceived impact of cannabis in future.

Attempt to quit cannabis

The final theme emerging from the responses was an 'attempt to quit' cannabis, with 18.18% of the responses (n=4) containing some reference to it. Two participants indicated that they 'didn't need to (smoke cannabis) anymore'. The other two responses are given below.

S0001J: Being with someone who smoked regularly encouraged me to also smoke but there was a time I decided I didn't want to.

T0104J: When I say I'm going to stop

In the first respone quoted above, the cannabis user had been influenced to use cananbis by their partner. Their period of abstinence was influenced by their decision to stop using cannabis. In the second instance, an unsuccessful attempt to quit is clearly indicated by the cannabis user's response. This cannabis user expresses a resolution to quit using cannabis, but having periods of abstinence indicates that its not always easy to permanently stop despite the cannabis user resolving to do this.

In constructing the thematic network (Figure 5.11), the aforementioned themes were utilised as basic themes. They were then collapsed into two organising themes. These were, 'internal influences', and 'external influences', with each containing 3 basic themes. Thus the thematic network illustrates that abstinences were influenced by both internal and external factors.

5.2.7.2 Cannabis users from CAMHS

Out of the 10 cannabis users in the CAMHS sample, 6 reported having times when they chose not to smoke cannabis. 2 of these cannabis users referred to specific incidents when they had chosen to abstain, whilst 3 referred to periods of abstinence. It was not clear for the remaining cannabis user whether they were referring to either incidents or periods of abstinence. Thematic analysis of the responses provided by this group of cannabis users revealed three main themes. These were ‘attempt to quit’, ‘family ’ and ‘mood state’. These will be discussed in turn.

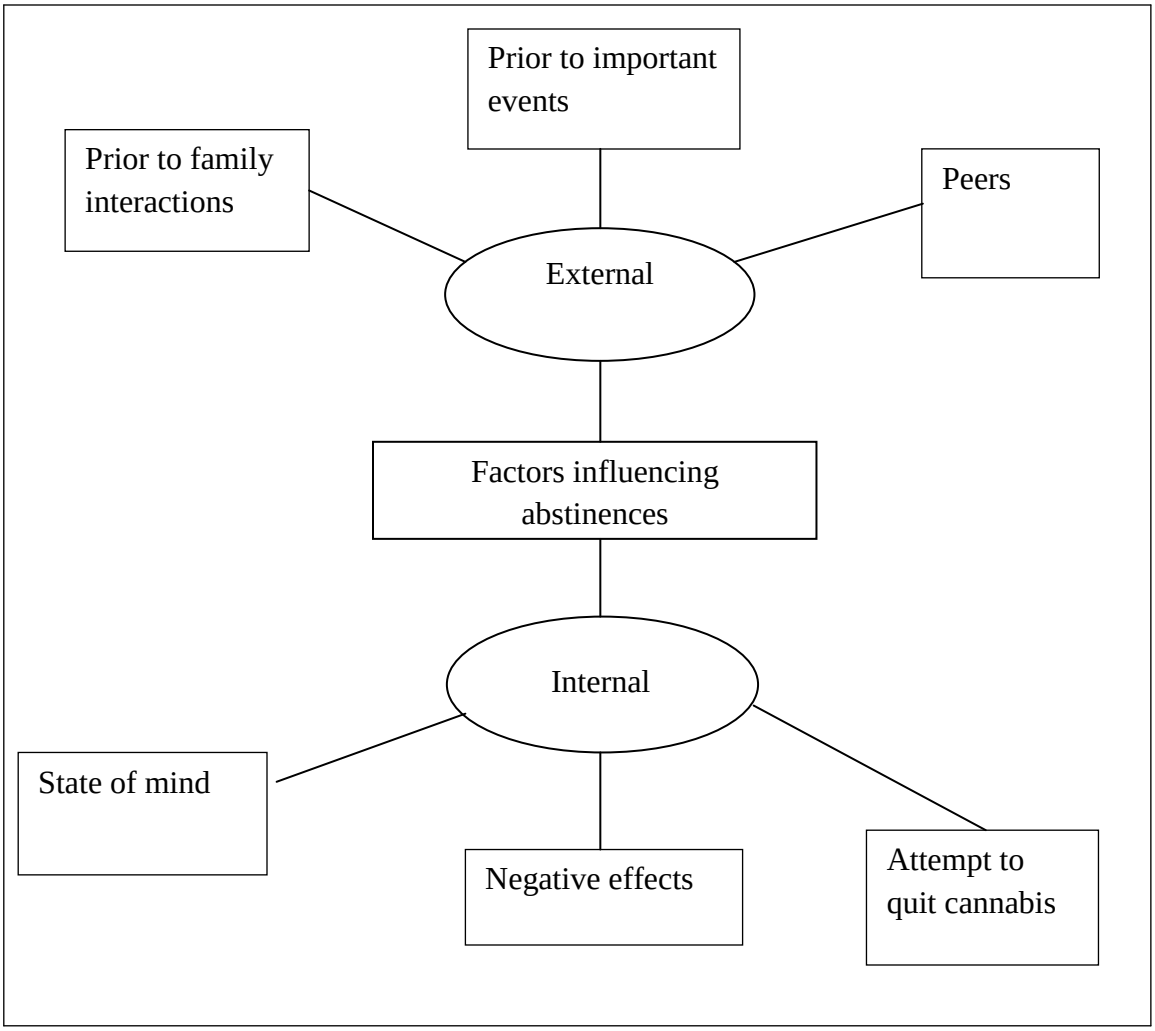

Figure 5.6. Thematic network for factors influencing voluntary abstinences in cannabis users from schools (n=22). Of the 34 cannabis users indicating that they had experienced periods and incidents of voluntary abstention, 12 did not provide any further details.

Attempt to quit

2 respondents indicated that they had chosen to abstain from using cannabis during attempts to quit using cannabis. Their responses are given below.

D0103E: I didn't want to do it anymore so I stopped for a bit.

J0008A: I decided to stop.

These two responses illustrate that the cannabis users had made a conscious decision to stop using cannabis. It can also be inferred that quitting cannabis is not always a linear decision, and that users who make the decision to stop using may start again in spite of this resolution to quit.

Family

3 of the responses indicate that the cannabis users' decision to abstain had been influenced by their family, either directly or indirectly. These responses are given below.

> *C0202X: My mum had found out and it upset her so I stopped to not upset her anymore.*
>
> *D0202L: I was seeing my family soon after, I didn't want them to see me high.*
>
> *D0103E: My brother got messed up on it and I didn't want that to happen to me.*

In the first response, the cannabis user was directly influenced by the effect it had on their mother. In this case they made a conscious decision to stop for a while in order to avoid this consequence of using cannabis. The other two responses are more preventative in nature. One of these users reports not using to possibly avoid repercussions from family, with whom they were interacting with at that time. The other user indicates being indirectly influenced by the effects cannabis had on their brother. The awareness of the negative effects of cannabis thus influenced their decision to abstain at that time. However, it is interesting to note that these abstinences were temporary; meaning that awareness of the negative effects of cannabis may not be enough to produce a permanent change in cannabis use.

Mood state

The final theme emerging from the data was 'mood state'. 2 respondents indicated being influenced by their mood at the time when they chose to abstain.

H0004L: Couldn't be bothered to do it.

G0105X: I didn't feel like it.

These two responses indicate that young cannabis users are may be influenced to abstain by their current mood. In this case these young people indicate that the desire to smoke cannabis is not always present, and they are able to refrain from using when they simply do not feel like it.

As there were only 3 themes identified, a thematic network was not constructed for this data.

5.2.8 Summary of findings

Figure 5.12 is an illustrative summary of the findings presented in this chapter. The most commonly cited factors for initiation, increases, decreases and abstinences are shown in the form of a cannabis use trajectory. This illustrates the dynamic nature of cannabis use patterns, as it shows an example of how cannabis use may change over time. It can be seen that peers appear to be influential at the majority of stages of use, namely initiation, increases and abstinences. Together with the previously reported finding by the present study that peers were cited as influential for adolescents' own cannabis use in general, these findings thus point to an overarching influence of peers on cannabis use.

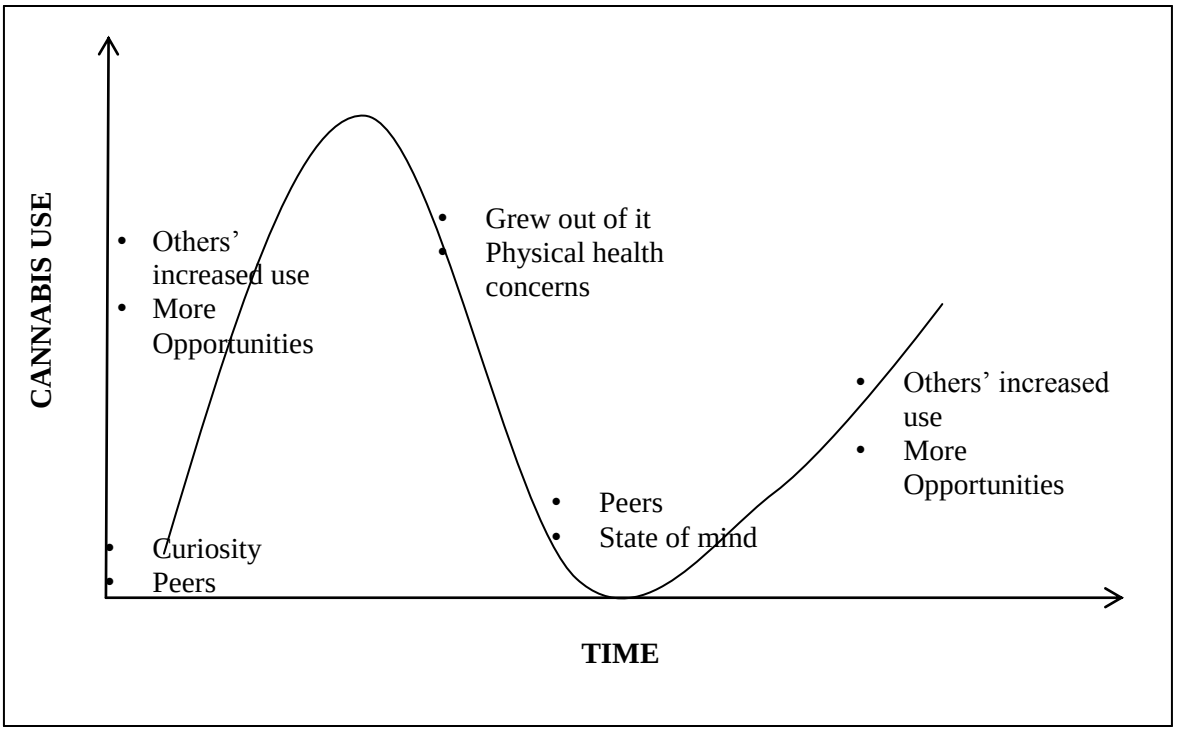

Figure 5.7 Reasons influencing changing patterns of cannabis use superimposed on an example cannabis use trajectory

Chapter 6 Study 2

6.1 Rationale and hypotheses

The evidence presented in chapter 2 indicates that the literature linking cannabis use and psychotic outcomes has generally been more consistent than that assessing mood and anxiety outcomes. This is illustrated by a recent review of the various psychosocial and health consequences of cannabis, acknowledging psychotic but not mood and anxiety outcomes (Hall, 2015). Thus the nature of the relationship between cannabis and mood and anxiety outcomes still remains unclear. Therefore there remains a need to further explore this relationship.

Upon closer inspection, it is clear that the cannabis use literature assessing both psychotic outcomes, and mood and anxiety outcomes has overly focused on risk at the expense of resilience processes. A resilience centred approach focuses on the factors and processes involved in achieving adaptive/positive outcomes (see Chapter 3 for a conceptual discussion of resilience). Part of this approach involves a thorough account of risk and protective factors for various outcomes (Rutter, 2006). However, beyond the regular protective factors identified in the literature, there has also been a highlighting of 'resilience factors'. These are key or global protective factors that have been identified as playing a role in protecting against a wide range of maladaptive outcomes (Aldwin & Sutton, 1998; Masten, 2001).

Resilience factors have been shown to be negatively related to various mental health outcomes including depression, anxiety and stress (e.g. Moljord et al., 2014; Hjemdal et al.,

2011). However, it is not clear what the relationship is between these factors and subclinical psychosis, as this has yet to be assessed. Furthermore, it was previously identified that over time, cannabis use in adolescents was associated with a decrease in self-management skills (a resilience factor) (Griffin et al., 2009). Thus it may be postulated that using cannabis may interfere with the protective mechanisms of resilience factors for mental health outcomes. This may be a mechanism by which cannabis use in adolescence produces the previously identified maladaptive mental health outcomes (i.e. psychotic, mood and anxiety outcomes). However this has not been previously assessed in the literature.

In response to these gaps in the literature, Study 2 thus aims to integrate resilience in the assessment of cannabis use and mental health outcomes. Specifically, to assess whether psychosis is related to resilience factors, and whether cannabis interferes with the protective effects of resilience factors against depression, anxiety, stress and subclinical psychosis. Moreover, before this analysis is carried out, the relationship between cannabis use and mental health will be established. Specifically, cannabis users and non-users will be compared on their reported levels of depression, anxiety, stress, and subclinical psychosis.

Furthermore, although the primary focus for the study is cannabis use, secondary analyses based on alcohol use will also be conducted. This is because young people who use cannabis are also more likely to be alcohol users (e.g. Buckner, Ecker & Cohen, 2010; Griffith-Lendering et al., 2011; Price et al., 2009). Both substances are initiated in adolescence and present with a similar etiological risk profile (e.g. Newcomb, Maddahian & Bentler, 1986; Lynskey, Fergusson & Horwood, 1998). Moreover, alcohol use has been previously identified

as being linked to depression (e.g. Boden & Fergusson, 2011; Fergusson, Boden & Horwood, 2009; Ranney et al., 2013), anxiety (Kaplow, Curran, Angold & Costello, 2001; McKenzie, Jorm, Olsoon & Patton, 2011; Low et al., 2008), stress (Rutledge & Sher, 2001) and subclinical psychosis (Mackie, Costellos-Ryan & Conrod, 2011; Dagenhardt & Hall, 2001; Johns et al., 2004). These analyses will thus establish whether effects are substance specific, or whether it is adolescent substance use in general that interferes with resilience processes against mental health outcomes. The resilience literature for cannabis and alcohol use is concurrently discussed in Chapter 3.

With these aims and findings of previous literature in mind, the hypotheses for Study 3 were as follows:-

1. Cannabis users will present with higher levels of depression, anxiety, stress and subclinical psychosis than non-cannabis users.
2. Current alcohol users will present with higher levels of depression, anxiety, stress and sub-clinical psychosis than non-users.
3. Cannabis use will moderate the relationship between resilience and depression, anxiety, stress and subclinical psychosis.
4. Alcohol use will moderate the relationship between resilience and depression, anxiety, stress and subclinical psychosis.

6.2 Results

6.2.1 Comparisons between baseline and follow-up MH measures.

Reported levels of mental health were compared at baseline and follow-up in order to assess change over time of these factors. This was carried out for the school sub-sample and the CAMHS sample independently. In the school sub-sample, Wilcoxon signed ranks tests indicated that there were no differences between baseline and follow-up DASS-21 measures of depression (*Z*= -.124, *p* =.901), anxiety (*Z*= -.891, *p*= .373), stress (*Z*= -.138, *p*=.890) and negative emotionality (*Z*=1.107, *p*=.915). Moreover, no differences were identified in baseline and follow-up CAPE measures of bizarre experiences (Z=-.184, *p*=.854), magical thinking (Z=-.125, p=.901), persecutory ideation (Z=-.961, p=.336), and subclinical psychosis (Z=-.655, p=.512) (see Table 6.1 for means and medians).

Similarly, in the CAMHS sample, there were no differences between baseline and follow-up DASS-21 measures of depression (Z= -.73, p=.46), anxiety (Z-1.04, p=.30), negative emotionality (Z= -1.99, p= .05), and CAPE measures of bizarre experiences (Z=-.361, p=.718), persecutory ideation (Z= -2.43, p=.02), and subclinical psychosis (Z= -.93, p=.35). However reported levels of magical thinking (Z= -2.49, p= .01) and stress (Z=-2.812, p=.005) were higher at follow-up as compared to at baseline. These differences are illustrated in Table 6.1.

Table 6.1 Mental health factor means (SD) and medians (range) at baseline and follow-up across all samples

		Baseline				Follow-up		
Measure		***School (n=251)***	***School Sub-sample (n=51)***	***CAMHS (n=27)***	***p***	***School sub-sample (n=46)***	***CAMHS (n=17)***	***p***
CAPE	Bizarre Experiences	10.49 (3.65)	10.82 (5.00)	14.44 (6.03)	.008*	9.74 (3.34)	14.82 (6.82)	.002*
		9 (11)	9 (10)	13 (15)		8 (5)	12 (17)	
	Persecutory Ideation	9.80 (2.69)	9.82(2.96)	9.93 (3.29)	.577	9.54 (2.76)	10.24 (3.67)	.324
		9 (10)	9 (13)	10 (10)		9 (10)	10 (14)	
	Magical Thinking	8.86 (2.72)	8.49 (2.53)	8.56 (3.17)	.695	7.96 (2.11)	9.24 (3.54)	.230
		8 (9)	8 (6)	10 (11)		8 (8)	10 (12)	
	Subclinical psychosis	31.46 (8.35)	31.63 (10.10)	35.63 (12.10)	.112	29.65 (7.57)	36.59 (12.62)	.045
		29 (27)	28 (22)	32 (33)		27 (25)	33 (30)	
DASS-21	Depression	6.62 (8.33)	5.39 (8.24)	14.63 (11.79)	<.001**	4.19 (7.40)	19.24 (12.26)	<.001**
		4 (38)	2 (16)	12 (38)		0 (14)	17 (38)	
	Anxiety	5.58 (6.37)	4.46 (5.70)	11.37 (8.40)	.002*	4.67 (4.99)	14.71 (7.27)	<.001**
		4 (24)	2 (12)	14 (23)		3 (14)	17 (24)	
	Stress	7.67 (7.8)	6.12 (7.46)	14.52 (12.19)	.001*	5.58 (6.13)	18.12 (12.03)	<.001**
		4 (26)	4 (20)	8 (34)		4 (16)	19 (35)	
	Negative emotionality	19.40(20.01)	15.70 (19.72)	40.37 (29.46)	<.001**	14.00 (16.46)	52.29 (28.16)	<.001**
		12 (60)	8 (46)	48 (90)		8 (36)	61 (91)	

Note. Means and SD presented first, medians and range in second row. Mann Whitney *U* tests, **p<.01, **p<.001,* Comparisons made between school sub-sample and CAMHS at baseline and follow-up. Due to missing data, Ns range from 236-251 for the School sample, and 48-51 for the School Sub-sample at baseline. At follow-up, Ns range from 42-46 in the School Sub-sample.

6.2.2 Hypothesis 1. Cannabis users will present with higher levels of depression, anxiety, stress and subclinical psychosis than non-cannabis users.

Table 6.2 illustrates that there were no differences in reported levels of depression, anxiety, stress, and subclinical psychosis between cannabis users and non-cannabis users from schools and CAMHS at baseline. This suggests that cannabis may not be associated with mood, anxiety and psychotic problems in young people. Moreover, it does not appear to worsen mental health for young people with pre-existing mental health problems. Follow-up comparisons could not be carried out for the school sub-sample due to low numbers of cannabis users both at baseline (n=4) and follow-up (n=10).

In the CAMHS sample, change over time of mental health factors was assessed by comparing cannabis users and non-users identified at baseline on mental health factors reported at follow-up. It was found that baseline cannabis users did not differ with non users on DASS-21 measures of depression (U= 20.0, p=.191), anxiety (U=21.0, p=.256), stress (U=26, p=.53), and negative emotionality (U=24.0, p= .40), and CAPE measures of bizarre experiences (U=26.5, p=.53), magical thinking (U=27.5, p=.59) and subclinical psychosis (U=14.5, p=.06) at follow-up. However there was a trend toward significance for persecutory ideation (U=11, p=.03).

Table 6.2 Baseline comparisons of mental health between cannabis users and non-users from the School and CAMHS samples

Measure		School			CAMHS		
		Cannabis users (n=34)	**Non-cannabis users (n=217)**	***p* (sig)**	**Cannabis users (n=10)**	**Non-cannabis users (n=17)**	***p* (sig)**
CAPE	Bizarre Experiences (SD) 9 (5)	9.94 (2.96) 9 (11)	10.58 (3.75) 9 (11)	*ns*	15.1 (6.38) 16 (15)	14.06 (5.97) 13 (15)	*ns*
	Persecutory Ideation (SD) 9 (9)	10.12 (2.30) 9 (10)	9.75 (2.74) 9 (10)	*ns*	11.1(4.41) 12 (10)	9.24 (2.31) 10 (7)	*ns*
	Magical Thinking (SD) 8.5 (9)	9.38 (3.26) 8 (9)	8.78 (2.63) 8 (9)	*ns*	8.2 (3.79) 6 (11)	8.76 (2.84) 10 (7)	*ns*
	Subclinical psychosis (SD) 29.5 (18)	31.26 (7.33) 29 (27)	31.49 (8.51) 29 (27)	*ns*	37.1 (13.54) 37 (33)	34.76 (11.51) 31 (33)	*ns*
DASS-21	Depression (SD) 4 (20)	6.57 (7.83) 4 (38)	6.62 (8.43) 4 (38)	*ns*	20.40 (14.84) 24 (34)	11.24 (8.31) 12 (24)	*ns*
	Anxiety (SD) 4 (12)	6.23 (6.54) 4 (24)	5.47 (6.36) 4 (24)	*ns*	12.20 (6.36) 16 (14)	10.88 (9.56) 14 (23)	*ns*
	Stress (SD) 8 (16)	7.39 (7.04) 4 (26)	7.72 (7.92) 4 (26)	*ns*	16.00 (12.75) 8 (28)	13.65 (12.15) 18 (34)	*ns*
	Negative emotionality (SD) 14 (38)	19.88 (17.76) 12 (60)	19.33 (20.38) 12 (60)	*ns*	48.60 (31.76) 48 (76)	35.53 (27.85) 49 (69)	*ns*

Note. Means and SD presented first, medians and range in second row. Mann Whitney *U* tests. 4 cannabis users and 6 non-cannabis users in the School sample had missing data for all the mental health variables. Overall, the Ns for each MH variable ranged from 236-251 for the school sample due to missing data.

6.2.3 Hypothesis 2. Current alcohol users will present with higher levels of depression, anxiety, stress and subclinical psychosis.

Table 6.3 illustrates the proportion of alcohol users and non-users across the three samples. It was found that in the school sample there were comparable proportions of alcohol users and non-users (X^2 (1, n=257)= 1.41, p=.24). 4 participants did not provide data on alcohol use status. A chi-square test of independence indicated a significant relationship between sample type (school sub-sample versus CAMHS) and alcohol use status (user versus non-user) at baseline (χ^2 (1, N=77) = 8.3, *p*=004). Expected frequencies indicate that the CAMHS sample reported higher than expected alcohol use as compared to the school sub-sample. However, at follow-up, there was no relationship identified between sample type and alcohol use status (χ^2 (1, n=63)= 3.55, *p*= .06). This indicates that there was a higher proportion of alcohol users in the CAMHS sample as compared to the school sub-sample, but only at baseline. Alcohol use data was not provided by 2 participants from the school sub-sample both at baseline and follow-up.

In the school sub-sample, comparisons between baseline and follow-up alcohol user/non-user proportions indicate that there was a significant relationship between baseline and follow-up reported alcohol use (χ^2 (1, n=44) =11.78, *p*=.001). 4 participants did not provide data on alcohol use (2 at baseline and 2 at follow-up). Expected frequencies indicate a higher than expected frequency of alcohol non-users at baseline remaining non-users at follow-up. Additionally, there was also a higher than expected frequency of baseline alcohol users remaining alcohol users at follow-up. This indicates that participants in the school sub-sample were unlikely to change their alcohol use status over the follow-up period.

Table 6.3 Alcohol use status and levels of alcohol use at baseline and follow-up for the School and CAMHS samples.

		Baseline			Follow-up	
		School (n=257)	School sub-sample (n=50)	CAMHS (n=27)	School sub-sample (n=46)	CAMHS (n=17)
Alcohol Use Status	Current User	138 (52.9%)	18 (34.6%)	19 (70.4%)	23 (47.92%)	13 (76.47%)
	Non user	119 (45.6%)	32(61.5%)	8 (29.6%)	23 (47.92%)	4 (23.53%)
Levels of alcohol use	Mean units per sitting (SD)	9.64(7.12)	5.66 (4.99)	2.54 (1.70)	6.35 (4.62)	2.98 (1.84)
	≤4 units per sitting	26(18.84%)	8 (44.4%)	15 (78.94%)	8 (34.78%)	10 (76.92%)
	>4 units per sitting	85(61.59%)	7 (38.89%)	3 (15.79%)	14(60.87%)	3 (23.08%)

Note. Data on alcohol use was not provided by 4 participants from the School sample and 2 from the School sub-sample at baseline. 2 participants from the School-subsample did not provide data at follow-up.

In the CAMHS sample, comparisons between baseline and follow-up alcohol user/non-user proportions indicate that there was a significant relationship between baseline and follow-up reported alcohol use (χ^2 (1, n=17) =9.59, p=.002). Expected frequencies indicate a higher than

Table 6.4 Mental health factor means (SD) and medians (range) for current alcohol users and non-users from Schools.

Measures		Baseline School Sample (n=261)		Baseline School sub-sample (n=52)		Follow-up School sub-sample (n=48)	
		Current User (n=138)	Non-User (n=119)	Current User (n=18)	Non-User (n=32)	Current User (n=23)	Non User (n=23)
CAPE	Bizarre Experiences	9.79(2.11) 9 (11)	9.75(2.04) 9 (8)	8.92 (1.51) 8 (5)	9.3(2.0) 9(10)	9.27(1.53) 8(4)	8.84(1.59) 8(5)
	Persecutory Ideation	9.84(2.31) 9.5 (10)	9.13(2.16) 9 (9)	11.47 (3.47) 11 (12)	9(2.30) 8.5 (9)	9.57(1.91) 10(6)	9.10(2.39) 9(10)
	Magical Thinking	8.75(2.30) 8 (9)	8.46(2.24) 8 (9)	8.07 (1.73) 8 (6)	7.66(1.26) 7 (6)	7.6(1.40) 7(5)	8.14(2.33) 8(8)
	Subclinical Psychosis	30.73(5.89) 29 (27)	29.8(6.05) 29 (27)	31 (6.95) 29 (21)	28.5(4.98) 28(21)	29.33(4.97) 28(18)	28.15(5.46) 27(25)
DASS-21	Depression	6.35(6.64)	4.46(5.74)	5.47 (6.21)	3.16(4.25)	3.73(5.28)	2.32(4.50)
		4(38)	2 (22)	4 (16)	2(16)	2(14)	.0(14)
	Anxiety	4.15(4.43)	4.35(4.54)	4.93 (4.40)	2.48(2.5)	4(3.30)	3.42(3.20)
		4 (24)	3 (22)	4 (12)	2(10)	4 (10)	2(8)
	Stress	7.81(6.61)	6.0(6.4)	5.43 (5.57)	4.39(5.23)	6.5(4.37)	2.58(2.39)
		6(24)	4 (26)	4 (18)	2(20)	6(16)	2(6)
	Negative emotionality	17.74(14.22)	14.4(14.02)	14.71(14.24)	9.87(10.37)	14.27(9.56)	8.62(9.05)
		14 (60)	10 (60)	14 (44)	7(46)	10(28)	6(36)

Note- means and SD presented first, medians and range in the second row. Alcohol use data missing from 4 participants from Schools and 2 from the sub-sample at baseline and follow-up.

expected frequency of alcohol non-users at baseline remaining non-users at follow-up. Additionally, there was also a higher than expected frequency of baseline alcohol users remaining alcohol users at follow-up. These findings indicate that participants from CAMHS were unlikely to change their alcohol use status over the follow up period.

A Wilcoxon signed rank test indicates that alcohol users reported consuming significantly more units per sitting at follow-up as compared to at baseline in the school sub-sample (Z= -4.35, p<.001). The mean alcohol units consumed per sitting did not differ between baseline and follow-up in the CAMHS sample (Z=-1.0, p=.32) (Wilcoxon signed ranks test). These findings indicate that participants in the school sub-sample increased their alcohol consumption over the follow-up period, whereas those from CAMHS did not change their alcohol consumption over time.

Mann Whitney U tests were conducted in order to compare current alcohol users and non-users on their reported levels of depression, anxiety, stress and subclinical psychosis. It was found that in the school sample, current alcohol users reported significantly higher levels of the DASS-21 measure of depression than non-alcohol users at baseline (*U*= 5472, p= .006) (see table 6.3 for medians). Interestingly, there was a trend towards significance for the CAPE measure of persecutory ideation (*U*= 5365.5, p=.019), and the DASS-21 measure of stress (*U*= 5739.5, p=.017). However, there were no differences found in reported levels of the CAPE measures of bizarre experiences (*U*=6424, p=.80), and magical thinking (*U*= 6673, p=.302), and the DASS-21 measures of anxiety (*U*=6016, p=.715) and negative emotionality (*U*=5279, p=.045). These findings suggest that young alcohol users are more likely to report higher

levels of depression than non-alcohol users. Alcohol use in young people does not appear to be related to any other mood or psychotic symptoms.

In the school sub-sample at baseline, there were no differences found between current alcohol users and non users in reported DASS-21 measures of depression (U= 190, p= .29), anxiety (U=151.5, p= .09), stress (U= 190.5, p= .51), and negative emotionality (U= 176.5, p= .40), and CAPE measures of bizarre experiences (U= 154.5, p= .45), magical thinking (U= 170, p=.37), and subclinical psychosis (U= 160, p=.35). However, there was a trend towards significance for persecutory ideation (U= 147.5, p= .02). Moreover, baseline current alcohol users and non users did not differ on follow-up DASS-21 measures of depression (U= 168.5, p=.71), anxiety (U= 111.5, p= .12), stress (U= 145.5, p=.39), and negative emotionality (U= 152.5, p= .43), and CAPE measures of bizarre experiences (U= 198.5, p=.87), persecutory ideation (U= 178, p=.37), magical thinking (U= 157.5, p=.08), and subclinical psychosis (U= 187, p=.51). Which suggests that in this younger general adolescent sample, alcohol did not appear to influence psychotic, mood and anxiety symptoms over time.

Similarly, in the CAMHS sample at baseline, there were no differences found between current alcohol users and non-users on reported DASS-21 measures of depression (U=49.5, p= .16), anxiety (U= 63.5, p= .52), stress (U=69, p=.74), and negative emotionality (U=75, p=.98), and CAPE measures of bizarre experiences (U=71, p=.82), persecutory ideation (U=58.5, p=.36), magical thinking (U=76, p=1.0), and subclinical psychosis (U=75.5, p=.98). Moreover, baseline current alcohol users and non users did not differ on follow-up DASS-21 measures of

anxiety (U= 26.0, p=.53), stress (U= 25.5, p=.46), and negative emotionality (U=19, p= .18), and CAPE measures of bizarre experiences (U=30, p=.81), persecutory ideation (U= 16.5, p=.10), magical thinking (U= 23, p=.35) and subclinical psychosis (U=21.0, p=.26). However, there was a trend towards significance for depression (U=9.0, p =.02). Which suggests that alcohol does not appear to worsen mental health in young people with pre-existing mental health problems.

Overall, depression appears to be the only mental health factor that differentiated between alcohol users and non-users, though not in all the samples. Although not significantly related to alcohol use, persecutory ideation emerged as a potential factor that differentiates alcohol users and non-users as there was a trend identified in both the school and CAMHS samples.

6.2.4 Hypothesis 3. Cannabis use will moderate the relationship between resilience and depression, anxiety, stress, and sub-clinical psychosis.

Due to small sample sizes, this analysis was only carried out for the school sample. Correlations were carried out in order to establish the relationship between resilience and the mental health factors (depression, anxiety, stress and subclinical psychosis). Table 6.5 indicates that all the CAPE measures of subclinical psychosis, bizarre experiences, persecutory ideation, and magical thinking did not appear to be correlated to any of the READ resilience factors, apart from magical thinking and its significant positive correlation to social competence. Thus subclinical psychosis was not related to resilience. The DASS-21 measures of depression, anxiety, stress and negative emotionality appeared to be significantly negatively correlated with the majority of the resilience factors (see Table 6.5). This means that the higher the levels of resilience, then the lower the levels of depression, anxiety, stress and

negative emotionality. Interestingly, the DASS-21 measures of depression, anxiety, stress and negative emotionality appeared to be significantly positively correlated with the majority of the CAPE measures of subclinical psychosis, persecutory ideation, magical thinking, and bizarre experiences. This means that the higher the levels of depression, anxiety, stress and negative emotionality, then the higher the levels of subclinical psychosis.

In order to assess the moderator effect of cannabis use, hierarchical multiple regression models were run using the enter method. In step 1 cannabis use, personal competence, social competence, structured style, social resources and family cohesion were entered as predictors. In step two, the interaction terms for each resilience variable and cannabis use were entered. Predictors were centered in order to control for multicollinearity when the interaction terms were entered. If cannabis acts a moderator of the relationship between resilience and mental health, the interaction terms (for cannabis and the resilience factors) are expected to be significant predictors in the models. These were run separately for depression, anxiety, stress, and negative emotionality as criterion variables. The CAPE measures of sub-clinical psychosis, bizarre experiences, persecutory ideation and magical thinking were not included in the analysis as there were virtually no significant correlations with the READ resilience factors. The criterion variables were all log transformed using natural logs (log n) in order to control for their skewed distributions.

Table 6.5 Spearman's correlation coefficients for relationship between resilience and mental health factors for the School Sample.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Resilience	-													
2. Personal Competence	.833**	-												
3. Social Competence	.706**	.566**	-											
4. Structured Style	.620**	.516**	.307**	-										
5. Social Resources	.792**	.534**	.512**	.341**	-									
6. Family Cohesion	.787**	.512**	.451**	.346**	.655**	-								
7.Subclinical Psychosis	-.009	-.108	.077	-.053	.035	.031	-							
8. Bizarre Experiences	.033	-.073	.135	-.034	.096	.057	.766**	-						
9.Persecutory Ideation	-.138	-.164	-.143	-.137	-.093	-.002	.781**	.444**	-					
10. Magical Thinking	.139	-.002	.175*	.073	.152	.128	.765**	.501**	.392**	-				
11.Depression	-.437**	-.466**	-.299**	-.292**	-.183**	-.295**	.288**	.279**	.352**	.155	-			
12. Anxiety	-.201*	-.226*	-.179*	-.134	-.103	-.084	.313**	.288**	.377**	.151	.488**	-		
13. Stress	-.250**	-.364**	-.198**	-.134	-.136**	-.142	.386**	.314**	.382**	.297**	.652**	.533**	-	
14. Negative Emotionality	-.325**	-.414**	-.255**	-.214*	-.121	-.168	.386**	.355**	.433**	.234**	.839**	.745**	.890**	-

Note. *p<.01, **p<.001. Ns range from 199-252 due to missing data.

For the depression outcome, the step 1 model was significant (F (6, 208)= 12.51, p<.001), and accounted for 24.4% of the variance in depression scores (ΔR^2=.27, *F Change*= 12.51*)*. Table 6.6 shows that only personal competence was a significant negative predictor of depression. When the interaction terms were entered to the model at step 2, the model remained significant (F (11, 203), = 6.75, p< .001) (ΔR^2=.003, *F Change*= .15*)*. Personal competence remained as the only significant predictor of depression (Table 6.6). These findings indicate that none of the interaction terms were significant suggesting that cannabis use did not moderate the relationship between these resilience factors and depression (as illustrated in Table 6.6). Due to missing data, the N's in this analysis ranged from 215-261.

For the anxiety outcome, the step 1 model was not significant (F (6, 196) = 2.88, p= .01) (ΔR^2=.08, *F Change*= 2.88*)*. When the interaction terms were entered to the model at step 2, the model was also not significant (F (11, 191) = 1.89, p= .04). None of the interaction terms were significant, indicating no moderation effects. This suggests that cannabis use did not moderate the relationship between resilience factors and anxiety. Due to missing data, the N's in this analysis ranged from 203-261.

For the stress outcome, the step 1 model was significant (F (6, 211) =5.86, p<.001) and accounted for 11.9% of the variance in stress scores (ΔR^2=.14, *F Change*= 5.86*)*. Table 6.6 shows that personal competence was the only significant predictor for stress. When the interaction terms were entered to the model at step 2, the model remained significant (F (11, 206) = 3.55, p<.001) (ΔR^2=.02, *F Change*= .81*)*.

Table 6.6 Standardised beta coefficients for predictors from the hierarchical regressions assessing moderating effects of cannabis on the relationship between mental health and resilience. Three separate regressions were carried out for depression, anxiety, stress and negative emotionality outcomes.

		Outcomes			
	Predictors	**Depression**	**Anxiety**	**Stress**	**Negative Emotionality**
Step 1	Cannabis	.095	.101	.071	.160
	Personal competence	-.460**	-.267*	-.418**	-.453**
	Social competence	-.064	-.077	-.046	-.090
	Structured Style	-.064	-.007	-.054	-.012
	Social resources	.180	.039	.050	.120
	Family cohesion	-.123	.044	.036	.035
Step 2	Cannabis	.086	-.060	.059	.134
	Personal competence	-.448**	-.282	-.383**	-.443**
	Social competence	-.085	-.108	-.091	-.128
	Structured style	-.063	.040	.055	-.008
	Social resources	.180	.079	.061	.134
	Family cohesion	-.133	-.004	-.016	.003
	[a]Can*PersComp	-.028	.037	-.067	-.019
	Can*SocComp	.069	.105	.129	.125
	Can*StrucStyle	-.004	-.116	.014	-.046
	Can*SocRes	-.002	-.076	-.019	-.026
	Can*FamCoh	.004	-.048	.075	-.026

*Note. *p<.01, **p<.001,* [a]Can*PersComp= Cannabis X Personal Competence etc. Due to missing data Ns ranged from 215-261, 203-261, 218-261 & 206-261 for the Depression, Anxiety, Stress and Negative Emotionality outcomes respectively.

Again, only personal competence was a significant negative predictor. This suggests that high levels of personal competence were predictive of low levels of depression. None of the interaction terms were significant indicating that cannabis did not moderate the relationship between resilience factors and stress. Due to missing data, the N's in this analysis ranged from 218-261.

For the negative emotionality outcome, the step 1 model was significant (F (6, 199) = 8.46, p<.001) and accounted for 17.9% of the variance in negative emotionality scores (ΔR^2=.20, *F Change*= 8.46*)*. As illustrated in Table 6.6, personal competence was the only significant negative predictor of negative emotionality scores, indicating that high levels of personal competence were predictive of low levels of negative emotionality. When the interaction terms were entered to the model in step 2, the model remained significant (F (11, 194), = 4.80, p<.001). (ΔR^2=.01, *F Change*= .53*)*. However, none of the interaction terms were significant predictors, which suggests that cannabis was not a moderator of the relationship between resilience factors and negative emotionality. Due to missing data, the N's in this analysis ranged from 206-261.

6.2.5 Hypothesis 4. Alcohol use will moderate the relationship between resilience and depression, anxiety, stress, and psychotic-like experiences.

In order to assess the moderator effect of alcohol use, hierarchical multiple regression models were run using the enter method. In step 1 alcohol units consumed per sitting, personal competence, social competence, structured style, social resources and family cohesion were entered as predictors. In step two; the interaction terms for each resilience variable and alcohol

units consumed per sitting use were entered. Predictors were centered in order to control for multicollinearity when the interaction terms were entered. Models were run separately for depression, anxiety, stress, and negative emotionality as criterion variables. Sub-clinical psychosis was not included in the analysis as there were virtually no significant correlations with resilience (apart from magical thinking). The criterion variables were all log transformed using natural logs (log n) in order to control for their skewed distributions.

For the depression outcome, the step 1 model was significant (F (6,187)= 11.59, p<.001), and accounted for 24.8% of the variance in depression scores (ΔR^2=.27, *F Change*= 11.59*)*. Table 6.7 shows that only personal competence was a significant negative predictor of depression. When the interaction terms were entered to the model at step 2, the model remained significant (F (11, 182), = 6.55, p<.001) (ΔR^2=.01, *F Change*= .63*)*. However, none of the interaction terms were significant suggesting that alcohol units consumed per sitting did not moderate the relationship between these resilience factors and depression (as illustrated in Table 6.7). Personal competence was a negative predictor of depression indicating that high levels of personal competence predicted lower levels of depression. Due to missing data, the N's in the analysis ranged from 194-249.

For the anxiety outcome, the step 1 model was not significant (F (6, 176) = 2.25, p= .04) (ΔR^2=.07, *F Change=2.25)*. When the interaction terms were entered to the model at step 2, the model was also not significant (F (11, 171) = 1.39, p= .04) (ΔR^2=.01, *F Change*= .40*)*. None of the interaction terms were significant, indicating no moderation effects. This suggests that alcohol units per sitting did not moderate the relationship between resilience factors and depression. Due to missing data, the N's for the analysis ranged from 183-256.

Table 6.7 Standardised beta coefficients for predictors from the hierarchical regressions assessing moderating effects of alcohol on the relationship between mental health and resilience. Three separate regressions were carried out for depression, anxiety, stress and negative emotionality outcomes.

		Outcomes			
	Predictors	**Depression**	**Anxiety**	**Stress**	**Negative Emotionality**
Step 1	Alcohol units	.125	.007	.096	.079
	Personal competence	-.464**	-.250	-.421**	-.438**
	Social competence	-.072	-.069	-.052	-.085
	Structured Style	-.042	-.015	-.071	-.008
	Social resources	.183	.029	.053	.111
	Family cohesion	-.129	.042	.032	.031
Step 2	Alcohol units	.159	-.015	.097	.080
	Personal competence	-.490*	-.217	-.440**	-.450**
	Social competence	-.064	-.084	-.046	-.087
	Structured style	-.041	.019	.081	-.005
	Social resources	.187	.020	.059	.114
	Family cohesion	-.120	.044	.031	.039
	[a]Alc*PersComp	-.075	.078	-.108	-.052
	Alc*SocComp	-.044	-.098	.163	.045
	Alc*StrucStyle	.131	-.072	.112	.081
	Alc*SocRes	-.051	.018	-.072	-.100
	Alc*FamCoh	-.034	.078	.124	.135

*Note. *p<.01, **p<.001,* [a]Alc*PersComp= Alcohol X Personal Competence etc. Due to missing data Ns ranged from 194-249, 183-256, 196-256 & 186-256 for the Depression, Anxiety, Stress and Negative Emotionality outcomes respectively.

For the stress outcome, the step 1 model was significant (F (6,189) =5.41, p< .001) and accounted for 11.9% of the variance in stress scores (ΔR^2=.15, *F Change*= 5.41*)*. Table 6.7 shows that personal competence was the only significant negative predictor for stress. When the interaction terms were entered to the model at step 2, the model remained significant (F (11, 184) = 3.77, p<.001) (ΔR^2=.04, *F Change=1.68).* Again, only personal competence was a significant negative predictor. This suggests that high levels of personal competence were predictive of low levels of depression. None of the interaction terms were significant indicating that alcohol units consumed per sitting did not moderate the relationship between resilience factors and stress. Due to missing data, the N's for the analysis ranged from 196-256.

For the negative emotionality outcome, the step 1 model was significant (F (6, 179) = 6.74, p<.001) and accounted for 15.7% of the variance in negative emotionality scores (ΔR^2=.18, *F Change*= 6.74*)*. As can be seen in Table 6.7, personal competence was the only significant negative predictor of negative emotionality scores, indicating that high levels of personal competence were predictive of low levels of negative emotionality. When the interaction terms were entered to the model in step 2, the model remained significant (F (11, 174), = 3.89, p<.001) (ΔR^2=.01, *F Change*= .56*)*. However, none of the interaction terms were significant predictors, which suggests that alcohol units consumed per sitting did not moderate the relationship between resilience factors and negative emotionality. Due to missing data, the N's for the analysis ranged from 186-256.

Chapter 7 Study 3

7.1 Rationale and hypotheses

The literature reviewed in chapter 3 indicates some gaps in current knowledge of substance use and resilience, some of which will be addressed in Study 3. Firstly, as the literature review indicates, the data on change over time of individual level resilience factors is conflicting. These are the self-management type factors that have been said to be under the control of the pre-frontal cortex, which shows protracted development over the adolescent period. On one hand, some report an increase in some of these factors over time during adolescence (e.g. Wong et al., 2006). On the other had, others identify very little or no change in these factors over adolescence (e.g. Griffin et al., 2009). It may be that change over time is dependent on the actual factor being measured, and thus it is imperative to assess whether and which individual level factors change over time.

Secondly, the influences of family and peers have been shown to change over time during adolescence, with an increase identified in peer influence (e.g. Cleveland et al., 2008). However, it is not clear how these changes impact on resilience factors stemming from the peer and family domains (e.g. social competence & family cohesion). Thus a direct assessment of change over time in peer and family related factors is needed. This is because if these factors are to be targeted for intervention, then a thorough assessment of their plasticity is needed.

Thirdly, there has been an abundance of factors identified as being protective in the assessment of substance use outcomes. Whilst this is useful for understanding positive outcomes in substance use, application of these factors in clinical practice is hindered by pragmatic reasons. That is, there are too many factors to successfully measure in healthcare settings. Thus a more condensed approach is required in order to bridge the gap between research and practice. This has been attempted in some research utilizing cumulated indices of resilience (e.g. Cleveland et al., 2008; Ostaszweski & Zimmerman, 2006). However, in order to create the index, multiple protective factors still need to be identified and measured first, thus subverting the potential time-saving

Fourthly, a more practical approach would involve the utilization/measurement of a few key factors that have been identified as fostering positive outcomes. This has been made possible by the creation of resilience scales, these measure key resilience factors that have been identified as influential in producing a wide variety of positive outcomes. However, there is a paucity of application of these measures in the adolescent substance use literature. Thus there needs to be an assessment of whether these key resilience factors are related to adolescent substance use.

Fifthly, in keeping with a view of resilience as a dynamic process, if change in these resilience factors is identified, then there is a need to concurrently assess the change in substance use and resilience, in order to further understanding of the dynamic nature of the relationship between substance use and resilience.

Thus Study 3 aims to fill these gaps in the literature by utilizing a validated self-report measure of resilience (Resilience Scale for Adolescents) (Hjemdal & Friborg, 2006). Change over time in resilience factors will be assessed as part of a six-month prospective study. Moreover, the relationship between resilience and substance use will be assessed. Based on the literature reviewed in chapter 3, the hypotheses for Study 3 are:-

1. There will be a difference between baseline and follow-up measures of resilience.
2. Resilience will be predictive of cannabis use.
3. Resilience will be predictive of alcohol use.

7.2 Results

7.2.1 Descriptives: Resilience comparisons between the School sub-sample and CAMHS sample

At baseline, participants from the school sub-sample reported higher levels of personal competence, structured style, social resources, and total resilience, as compared to participants from CAMHS (see Table 7.1). Table 7.1 also indicates that there were no differences in reported levels of social competence and family cohesion between the school sub-sample and CAMHS samples at baseline.

At follow-up, participants in the school sub-sample still reported higher levels of personal competence, structured style and total resilience than participants from CAMHS. However, there was no longer a difference in reported levels of social resources between these two samples. Table 7.1 also shows that social competence and family cohesion remained comparable between the school sub-sample and CAMHS sample at follow-up. Overall, these

results indicate that the school sub-sample predominantly reported higher levels of resilience than the CAMHS sample.

7.2.2 Hypothesis 1. There will be a difference between baseline and follow-up measures of resilience

Reported levels of resilience were compared at baseline and follow-up in order to assess change over time of these factors. This was carried out for the school sub-sample and CAMHS sample separately. Wilcoxon signed ranks tests indicated that in the school sub-sample, there were no differences between baseline and follow-up resilience measures of personal competence (Z= -1.06, p= .29), social competence (Z= -1.21, p= .23), structured style (Z= -1.32, p= .19), social resources (Z= -1.61, p= .11), family cohesion (Z= -1.56, p= .12), and total resilience (Z= -.43, p = .67).

Similarly, in the CAMHS sample, there were no differences between baseline and follow-up resilience measures of personal competence (Z= -.17, p= .24), social competence (Z= -2.24, p= .03), structured style (Z= -1.47, p= .14), social resources (Z= -.47, p= .64), family cohesion (Z= -1.65, p= .10) and total resilience (Z= -.34, p= *.73).* These results indicate that resilience factors did not appear to change over time across the samples.

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Table 7.1 Resilience factor means (SD) and medians (range) at baseline and follow-up across the School and CAMHS samples

	Baseline				**Follow-up**		
Resilience Subscales	***School (n=256)***	***School Sub-sample (n=52)***	***CAMHS (n=27)***	***p***	***School sub-sample (n=46)***	***CAMHS (n=17)***	***p***
Personal Competence	29.12 (4.52)	30.21 (3.97)	23.78 (7.92)	<.001**	28.85 (6.41)	22.82 (6.39)	.001*
	30 (24)	31 (19)	22 (26)		28 (32)	21 (21)	
Social Competence	19.15 (2.91)	18.94 (2.51)	15.07 (6.60)	.036	17.78 (4.77)	15.29 (6.01)	.104
	19 (14)	19 (10)	18 (18)		19 (20)	17 (16)	
Structured Style	13.95 (2.57)	14.09 (2.43)	12.55 (3.07)	.006*	14.71 (2.94)	11.19 (2.29)	<.001**
	14 (13)	14 (11)	12 (12)		15 (11)	11 (8)	
Social Resources	21.41 (2.57)	21.00 (2.69)	18.70 (3.44)	.003*	19.43 (5.06)	19.00 (3.69)	.342
	22 (10)	22 (12)	19 (11)		22 (20)	20 (11)	
Family Cohesion	23.40 (3.93)	22.94 (3.26)	21.19 (6.93)	.374	24.15 (4.19)	20.00 (7.69)	.091
	24 (19)	23 (14)	22 (19)		25 (17)	18 (22)	
Resilience Total	106.08 (13.69)	106.8 (11.27)	91.56 (24.29)	.001*	104.69 (20.93)	87.06 (19.98)	.006*
	107 (77)	107 (43)	91 (78)		108 (78)	86 (61)	

Note. Comparisons made between the School sub-sample and CAMHS sample at baseline and follow-up. Mann Whitney U Test, *p<.01, **p<.001. N's range from 226-256 for the School sample due to missing data. N's also range from 45-52 at baseline, and 40-46 at follow-up for the School Sub-sample. For the CAMHS sample, N's range from 22-27 at baseline, and 16-17 at follow-up.

7.2.3 Hypothesis 2. Resilience will be predictive of cannabis use

In order to assess whether resilience predicts cannabis use, logistic regression analysis was performed with cannabis use (user-non user dichotomy) as an outcome variable, and personal competence, social competence, structured style, social resources, and family cohesion as predictors for the School sample. A test of the full model with all five predictors against a constant-only model was not significant (x^2 (5, N=212) = 9.52, p=.09), indicating that the predictors as a set were not able to reliably distinguish between cannabis users and non-cannabis users. Table 7.2 indicates that none of the resilience factors were able to predict cannabis use status. Thus resilience did not appear to be able to predict cannabis use status in the school sample. 49 cases were excluded from this analysis due to missing data, as logistic regression employs a listwise deletion procedure by default in SPSS. Thus only cases with complete sets of data (for both cannabis use and the resilience factors) were included. This analysis could not be carried out in the CAMHS and school sub-samples due to insufficient sample sizes.

Table 7.2 Regression coefficients from the logistic regression assessing whether resilience factors are able to predict cannabis use status (user/ non-user groups) in the School sample (n=212).

Predictors	β	*Wald*	*p*
Personal competence	.16	4.31	.04
Social competence	.10	1.03	.31
Structured style	-.15	2.76	.10
Social resources	-.16	1.71	.19
Family cohesion	-.05	.43	.51

Note. *Due to listwise deletion procedure, 49 cases with missing data were excluded from the analysis.*

7.2.4 Hypothesis 3. Resilience will be predictive of alcohol use.

In the school sample, multiple regression analysis was conducted in order to determine whether the resilience factors predicted amount of alcohol consumed per sitting for participants reporting current alcohol use. Though 138 participants identified themselves as current alcohol users, 102 provided data on the amount of alcohol consumed per sitting. Thus these 102 participants were included in the present analysis. The resilience factors of personal competence, social competence, structured style, social resources and family cohesion were entered as predictors, and alcohol units consumed per sitting as the criterion variable. The overall model was significant, predicting 15.4% of the variance in alcohol units per sitting (F (5, 96)= 4.68, p= .001). When all the other predictors were controlled for, structured style (β =-.31, t (96)= -2.93, p= .004) and social resources (β= -.43, t (96) =-3.28, p= .001) were the only significant predictors of alcohol units consumed per sitting. Social competence (β= .20, t (96) =1.73, p= .09), personal competence (β= .26, t (96) = 2.02, p= .05) and family cohesion (β= .24, t (96) = 1.97, p= .05) were not significant predictors.

In order to assess whether resilience at baseline predicted amount of alcohol units consumed at follow-up, multiple regression analysis was carried out on data from the school sub-sample. Resilience factors at baseline were entered as predictors, and alcohol units consumed per sitting at follow-up as the criterion variable. It was found that baseline resilience factors were not predictive of alcohol units consumed at follow-up (F (5,33) =1.75, p = .15). This analysis could not be carried out in the CAMHS sample due to insufficient sample size.

Overall, these results indicate that the resilience factors of structured style and social resources emerged as negative predictors of alcohol units consumed per sitting. This means high levels of structured style and social resources, predicted a low amount of alcohol units consumed per sitting. However, it appears as though resilience factors at baseline did not predict amount of alcohol units consumed per sitting at follow-up.

Chapter 8 Discussion

8.1 Study 1

Taking all the findings of this study into account, there appeared to be some variation in relation to support for the study's hypotheses. Some hypotheses were supported, others only partially, and one was not supported. Support for the first hypothesis was found. When asked to respond to what had influenced their cannabis use in general, the most commonly reported singular response was 'peers' for both the cannabis users from schools and those recruited from CAMHS. This seemed to hold even when compared to the combinations of responses as selected by the participants, but only for users from schools. This was an expected result, as peer substance use has been identified to influence cannabis use at various stages of use, that is, from initiation (e.g. D'Amico & McCarthy, 2006; Bohnert et al., 2012; Ellickson et al., 2004) to progression to regular use (Gervilla et al., 2011; Coffey et al., 2000; D'Amico & McCarthy, 2006). Moreover, it appears as though when a cannabis user changes their peer group, presumably to non-cannabis using peers, their own cannabis use decreases (Seddon et al., 2013). Thus peers appear to exert a great influence on a cannabis user's behavior.

This overarching influence of peers can be explained by theories of adolescence citing increasing independence and the search for an identity, which causes detachment from familial influence and on to greater peer influence (Furman & Buhrmester, 1992). Peers exert their influence via the previously identified selection and socialization effects (Brechwald & Prinstein, 2011). Thus by choosing a group of peers with similar interests (selection), or by

experiencing behavior change through processes of social influence (socialization), the young person's behavior mirrors that of their peers.

However, when assessing reasons for cannabis initiation in the present study, 'peers' was not the most commonly selected factor by cannabis users from schools and from CAMHS. This could be construed as a contradiction of previous findings identifying peer substance use as one of the most influential factors of an adolescent's own cannabis initiation (e.g. von Sydow et al., 2002; Coffey et al., 2002; Bohnert et al., 2012). However, these findings were not strictly contradicted, as 'peers' emerged as the second most commonly cited reason for cannabis initiation. This indicates that peers were still quite commonly influential for initiation.

The finding that 'curiosity' was the most commonly cited reason for initiating cannabis is supported by previous literature based on adult data (Terry et al., 2007; Seddon et al., 2013). This finding implies that from the perspective of the adolescent cannabis users, internal motivations are the strongest influence on the decision to try cannabis. However, Seddon et al., (2013) identified that curiosity about cannabis appeared to be driven by peer influence (e.g. users had been exposed to their peers smoking cannabis, and were thus curious about what it was like). This indicates that peers may still be influencing the decision to try cannabis, albeit indirectly. It could be that those who continue to use cannabis are those whose experience of cannabis is positive. Indeed it has been identified that the more positive subjective reactions a cannabis user has when they initiate cannabis early, then the more likely they are to develop problematic patterns of use (Fergusson et al., 2003).

By specifically assessing factors that led participants to try cannabis for the first time, the present study attempted to address the problems in the previous literature surrounding the definition and assessment of cannabis initiation. Thus from the cannabis user's perspective, the present study was able to assess the factors influencing the first experience of cannabis. This is in contrast with previous research that is confounded by the lack of specificity in assessing the actual first experience of cannabis use (e.g. Bohnert et al., 2012).

Only partial support was found for the third hypothesis. This is because 'increased use by others' was the most commonly cited reason for increased use by cannabis users only from the school sample. Although not explicitly identified, the 'others' that this response is referring to could potentially include peers, that is, those with whom cannabis is normally consumed. This assertion is echoed in the adult data which showed that the 'others' that influenced increases included peers, partners and family members (Terry et al., 2007). Additionally, as previously stated, the present study sample reported that peers had influenced their cannabis use in general, which is also comparable with other adolescent data showing peers as one of the main influences of progression in cannabis use (e.g. Gervilla et al., 2011; Coffey et al., 2000).

Interestingly, the 'positive effects' of cannabis was one of the least likely responses to be chosen for reasons for increasing cannabis use. This was unexpected, as the idea that one is more inclined to increase cannabis if their experience of cannabis use is positive not only makes intuitive sense, but has also been identified for influencing progression to problematic use (Fergusson et al., 2003). However, it could be that peer influence is enough to increase one's non-problematic levels of cannabis use, as cannabis may be consumed as a means of

social interaction. The subjective effects of cannabis may become more influential as one progresses to developing cannabis abuse and dependence. Indeed, Seddon et al., (2003) identified that social reasons were cited for continuation of cannabis use.

The picture was slightly more complex for cannabis users from CAMHS. The reasons given for increases in cannabis use were more varied as the following factors were equally selected:- 'others increased use', 'more opportunities to use', 'positive effects', and 'more money'. It thus seems that for young people experiencing mental health problems, there are multiple influences on their decision to increase cannabis use. Additionally, the reasons cited here are comparable to those given by adult cannabis users (Terry et al., 2007). However, increases in cannabis use were predominantly attributed to external influences (Terry et al., 2007), whereas the present findings point to both internal and external influences.

The fourth hypothesis was also only partially supported. Though cannabis users from schools indicated that they had decreased cannabis because they 'grew out of it', the other factors relating to life transitions were cited as reasons for decreasing cannabis use by a small minority of cannabis users. Furthermore, the only 2 respondents from CAMHS cited legal and financial concerns as the reason for decreasing cannabis. It is possible that the life transition factors listed within the CYPQ may not be relatable to an adolescent sample as they were derived from adult data by Terry et al. (2007). These included relationship changes, changes in living arrangements and changes in employment/education. However, when assessing the merits of each factor, it becomes clear that they may well be equally applicable to the adolescent sample utilized in the present study. Firstly, adolescent peer and romantic

relationships do commonly change, although they may become more stable over time (Branje et al., 2007; Collins & Larson, 2004). Secondly, during early adolescence, the transition into high school would constitute a change in education, and would subsequently impact on peer groups (Poulin & Chan, 2010). Thirdly, moving home is a relatively common occurrence, which may also subsequently impact on peer groups and educational settings (i.e. new school). Therefore it is reasonable to contend that the transitions assessed within the CYPQ are not necessarily detached from those occurring during adolescence. However, it is possible that the impact of such 'life transitions' are moderated and mediated by protective factors such as family support.

Previous research indicates that decreases in cannabis use were most commonly attributed to a change in circumstances (e.g. new job) (Terry et al., 2007). Such changes in circumstances are related to life transitions, which are part of a maturing out process (e.g gaining employment). Thus the current study's finding that cannabis users felt they had 'grown out of it' indirectly points to this process. However, normative trajectories indicate that this normally occurs during early adulthood (e.g. O'Malley, 2004; Dawson et al., 2006). In spite of this, it may be postulated that it is still possible for some adolescents to experience the effects of 'maturing out', albeit at a different time period, in a different context. For example, the 'maturing out' process has been related to a change in personality (Littlefield et al., 2009) and consequently developing new interests, which could very well occur early, and cause the young person to decrease their cannabis use. Furthermore, although normative trajectories are useful for identifying general patterns of behavior, not everyone will follow these pre-defined

trajectories (Maggs & Schulenberg, 2004) (see Chapter 3 for discussion of trajectory approaches).

A factor that was potentially overlooked in the identification of reasons for decreases is that of peer influence. This is because it has been previously identified as influencing decreases in cannabis use (Seddon et al., 2013). The present study did not allow for the identification of this reason, as it was not incorporated within the Cannabis and Young People Questionnaire (CYPQ). However, peer influence was not cited as a reason for cannabis decreases in the study on which the measure was based (Terry et al., 2007). This could be because the sample of cannabis users was older in the Terry et al. (2007) study (mean age of 30.9 years) as compared to Seddon et al. (2013) sample (mean age of 25 years), thus would experience less peer influence. In as much as peer influence increases with age during adolescence, it decreases with age during adulthood (Furman & Buhrmester, 1992). Therefore the present study may have benefited from incorporating this factor due to the adolescent sample utilized.

There was no support identified for the fifth hypothesis. Religious and spiritual reasons were not the most commonly identified reasons for abstention by non-cannabis users from schools and from CAMHS. Instead, concerns about physical health, mental health and effects of cannabis emerged as the most commonly cited abstention reasons by non-cannabis users from schools. Those from CAMHS cited mental health concerns, legal and financial reasons. These findings thus indicate that young people possess an awareness of the potential health consequences of cannabis. This finding is also comparable to data from the Monitoring the Future Survey, where a strong negative relationship was identified between the levels of the

perceived risks of cannabis and the levels of use at the group level (Johnstone, O'Malley, Bachman & Schulenberg, 2012). This was interpreted as showing that the more a young person views cannabis as risky, then the less likely they are to use (Johstone et al., 2012).

In contradiction to the hypothesis, religiosity was not the most commonly cited reason for abstention. This also appears to contrast the literature identifying that those high in religiosity appear less likely to initiate cannabis (e.g. Mellor & Freeborn, 2011; Sinha et al., 2006). However, it is also reasonable not to expect a collective influence of religion. The present study sample predominantly identified as White British, and religion has been found to be influenced by ethnicity. For example, Black as compared to White adolescents have been found to be more involved with religion (e.g. Jang & Johnson, 2010), and collectively report religion to be of more importance to them (e.g. Watt & Rogers, 2007). The influence of religion on adolescent substance use also appears to be influenced by ethnicity. It has been suggested that white adolescents rather than Black adolescents are more likely to be influenced by religion at an individual rather than group level (Wallace et al., 2003). This means that religion is only protective against substance use only for those who view religion as personally important to themselves (Fletcher et al., 2014; Salas-Wright et al., 2014). As such, only a minority would be influenced by religion, which was found in the present study. However, it should be noted that the literature making comparisons of the effect of religiosity between Black and White adolescents is predominantly based on American samples. Such findings are thus likely to be heavily influenced by social and cultural differences. For example, the central role of Christianity in African-American communities is well established (Jang & Johnson, 2010). This can be tentatively contrasted with UK National Census data

showing that Christianity is the largest UK religion, with over 90% of UK Christians identifying as White British (Office of National Statistics, 2011). Thus the picture may differ for UK data due to cultural and ethnic differences.

Interestingly, a reasonably large proportion of adolescents from CAMHS identified religious/spiritual reasons for abstention at baseline (46.15%). However, this drastically declined at follow-up to only 9.7%. This is could be an indicator of systematic attrition, with more religious participants less likely to complete the follow-up study. Capturing data on religious/spiritual beliefs would have enabled the identification of reasons for this large difference.

The thematic analysis identified that voluntary abstinences in cannabis users from schools were influenced by factors that were both internal and external to the cannabis users. Internal influences reported included the cannabis user's state of mind, an attempt to quit cannabis, and experience of negative effects of cannabis. External influences cited for periods of abstinences included peers, family interactions, and prior to important events

The reasons given by cannabis users for abstinences were generally comparable between the cannabis users from schools and those from CAMHS. However only three themes were identified from the CAMHS cannabis user responses, as compared to the six identified from the cannabis users from schools. Nevertheless, the three identified themes (an attempt to quit, family, and mood state), directly mapped onto the themes identified from reasons cited by the cannabis users from schools.

An attempt to quit cannabis emerged as a reason that was given by cannabis users for abstinences. It is probable that this attempt to quit cannabis was related to the negative effects of cannabis, which also emerged as a reason cited for voluntary abstinences. This is because a relationship between the negative effects of cannabis and cessation has been previously identified (Terry-McElrath et al., 2008; Ellingstad et al., 2006). Moreover, as cannabis users were responding to a question on voluntary abstinences, this implies an identification of failed cessation attempts. In order to achieve sustained cessation, other cannabis users have indicated that they engage in new or former activities not related to cannabis use, avoid cannabis use triggers, and they make changes to their lifestyle (e.g. exercise) (Ellingstad et al., 2006).

Previously, cannabis users have cited short-term changes in circumstances as a reason for voluntary abstinences (Terry et al., 2007). This is comparable to the present findings, notably in relation to the 'external influences' theme (i.e. family interactions, prior to important events). Taken together, these findings point to adaptability to changing situations and circumstances by cannabis users. That is, they are able to briefly abstain from cannabis use when the situation warrants that change, before returning to their usual levels of use. This differentiates them from those presenting with a substance use disorder, who by definition, continue to use in spite of consequences drug use (Diagnostic and Statistical Manual of Mental Disorders- 5th Edition, American Psychiatric Association, 2013).

Interestingly, it emerged that abstinences from cannabis occurred in situations involving peers. This peer effect was characterized by either resisting peer pressure to use, or avoiding

situations where peers would be using cannabis. This indicates that although there are some adolescents who feel confident enough to resist peer influence, others are not as confident and thus employ an avoidance strategy in order to remain abstinent. The avoidance of cannabis use triggers and the resultant change in peer groups have both been identified as influential in maintaining change in former cannabis users (Ellingstad, Sobell, Eickelberry & Golden, 2006). However, this is based on an assessment of cessation of cannabis use and not brief abstinences. Nevertheless, it remains an informative finding in light of the lack of research on reasons for brief voluntary abstinences in adolescent cannabis users.

Study strengths and limitations

The present study provides a thorough account of factors influencing change in cannabis use in both a clinical and general adolescent sample. To the best of the study author's knowledge, this is the first study to employ a self-report approach to assess these factors in an adolescent sample. Moreover, factors influencing voluntary abstinences in adolescent cannabis users have previously been unidentified, and this is the first study to assess said factors. However, the retrospective manner in which this data was collected may have confounded the results, due to the fallibility of memory.

Notwithstanding this criticism, the self-report approach employed in the present study allowed for the identification of factors that would normally be missed out by multivariate approaches. In this case, we were able to determine the factors that were salient from the perspective of the cannabis user themselves. This kind of information is useful for prevention and early

intervention, as these are the factors that are more proximal from the point of view of the adolescent, and thus may be more directly influential.

However, the factors identified in the study may have been constrained to those contained within the CYPQ. This measure was constructed based on adult data and may leave out factors salient to adolescent samples. However, the majority of the findings of the study on which the CYPQ was based were supported, indicating utility of the measure. Furthermore, it incorporates qualitative elements (i.e. use of the 'other' option with space for free response) in order to capture any unlisted factors. This option was rarely utilised by the current study sample, further providing support of the measure's ability to capture the most salient factors. Nevertheless, more research is needed in order to confirm this.

Implications

The present study findings have implications for current research practices in the study of cannabis use patterns in adolescents. There is a need to incorporate more self report approaches in order to add to the existing large body of literature based on multivariate approaches. This will help to further understand the processes behind changing patterns of cannabis use, but also help in elucidating causal mechanisms (Terry et al., 2007). There is also a need for more qualitative analysis of the reasons for changing consumption patterns in adolescence in order to inform self-report measures, so as to capture and utilize a more complete range of factors influencing cannabis users in general.

Conclusion

The present study was based on, and built upon the work of Terry et al., (2007) on identification of the factors influencing changes in cannabis use. As expected, the present study's findings largely corroborated those identified by Terry et al., (2007). Although a wide range of factors were identified as influencing change in cannabis use patterns, there appeared to be an overarching influence of peers in the current study. Peers were found to influence cannabis patterns both directly and indirectly. Moreover, the factors influencing changes in cannabis use were generally comparable between the general and clinical adolescent samples.

8.2 Study 2

Overall, there was no support found for the majority of Study 2's hypotheses. In contrast with the first hypothesis cannabis users and non-users did not differ in their levels of depression, anxiety, stress and subclinical psychosis. This was found for both the general adolescent sample recruited from schools, and the clinical sample recruited from CAMHS. Moreover, mental health remained comparable between cannabis users and non-users over time in the clinical sample, as no differences were identified at follow-up.

The present study's failure to find any effects of cannabis use on depression, anxiety and stress provides support for research identifying no association between cannabis use, depression and anxiety (e.g. van Laar et al., 2007; Harder et al., 2006; Arsenault et al, 2002). However, the study also contradicts findings of an association (Fairman & Anthony, 2012; Hayatbakhsh et al., 2007; Patton et al., 2002). Previous studies indicate that the associations between cannabis use, depression and anxiety appear to be strengthened by high frequency of

cannabis use (Fairman & Anthony, 2012; Hayatbakhsh et al., 2007; Patton et al., 2002). For example, Patton et al., (2002) found that daily cannabis users were more likely to report depression and anxiety symptoms than weekly users. In the present study, only 26.32% of cannabis users from schools reported their use frequency, with only a couple of users reporting daily use, and the rest indicating weekly use or less. The lack of an effect of cannabis use on depression and anxiety identified in the present study, together with the previous findings of stronger effects for high frequency cannabis use, appear to show that the majority of cannabis users in the present study may have been low level users. Thus effects may have been identified had there been a higher frequency of cannabis use in the sample. However, this assertion is speculative at best, and no firm conclusions may be inferred without the frequency data of the majority of cannabis users.

The absence of an effect of cannabis use on depression, anxiety and stress could also be due to the assessment of cannabis use in general, and not distinguishing it from problematic use. This is because it has recently been found that the association of early cannabis use with depression is explained by the subsequent onset of cannabis dependence (Henchoz et al., 2014). Hence it may have been more useful to utilize a measure of cannabis dependence. However, cannabis dependence was assessed with the Severity of Dependence Scale (Gossop et al., 1995), which was incorporated within the Cannabis and Young People Questionnaire. Because this could only be assessed for current cannabis users, and there was only a small minority (n=5 in the school sample, n=6 in the CAMHS sample) identifying as current users, the data could thus not be utilized due to insufficient sample size to carry out the analysis.

It is also probable that cannabis may not universally affect depression and anxiety across users, thus we would not expect to find a general difference in these mental health factors between users and non-users. It may be that those who develop depression and anxiety after exposure to cannabis present with a pre-existing vulnerability to developing depression and anxiety. A case in point is the previously identified concept of serotonergic vulnerability (Jans et al., 2007) as THC has been found to interfere with serotonergic transmission (Egashira et al., 2002; Hill et al., 2006). Also, effects may be gender specific, although the findings on this appear contradictory (e.g. Repetto et al., 2008; Wilcox et al., 2004; Patton et al., 2002).

The present study further brings into question secondary substance use disorder models, which postulate that depression, anxiety and stress would occur prior to cannabis initiation (e.g. Repetto et al., 2008; Griffith-Lenderinget al., 2011; Hooshmand et al., 2012). As such, it would be expected for cannabis users to present with higher levels of depression, anxiety and stress as compared to non-users. However, it may be that it is problematic levels of use that are preceded by depression, anxiety and stress as opposed to general levels of use (e.g. Swift et al., 2008; Gilder et al., 2012) (see Chapter 1 for a review of factors associated with onset of problematic cannabis use). Therefore, effects may have been masked by not differentiating between cannabis users and problematic users.

However, secondary substance use disorder models are not necessarily limited to depression, anxiety and stress. Other mental health problems would also be expected to influence cannabis use. In support of this assertion, it was found that there was generally a higher proportion of cannabis users in the clinical sample recruited from CAMHS as opposed to the general

adolescent sample recruited from schools (see chapter 5). This provides indirect support of secondary substance use disorder models, as causality cannot be established in this case.

The present study finding of no difference in levels of reported subclinical psychosis between cannabis users and non users is in direct contradiction of the literature reporting a link between cannabis use and psychotic symptoms (e.g. Arsenault et al., 2002; Henquet et al., 2005; Dragt et al., 2012). The present study assessed both cannabis use and sub-clinical psychosis during adolescence. However, in the majority of previous studies, cannabis use is predominantly measured during adolescence, with psychotic outcomes measured in adulthood (e.g. Arsenault et al., 2002). This could indicate that the effects of cannabis use on psychosis, if any, are delayed, with adolescent cannabis use only producing symptoms of psychosis over a protracted period of time.

Indeed, the literature does identify persistent cannabis users as being at a higher risk for psychosis as compared to incident and other low level users (e.g. Kuepper et al., 2011a; Wigman et al., 2011). Thus a delay in onset of psychosis may be indicative of a cumulative exposure effect as a result of persistent heavy cannabis use. This assertion is also supported by the previously identified dose-response effect, with increased frequency of cannabis use simultaneously producing an increase in expression of both psychotic symptoms (e.g. McGrath et al., 2007; Moore et al., 2007) and psychotic disorder (Manrique-Garcia et al., 2012; Zammit et al., 2002).

Interestingly, a trend towards significance for persecutory ideation was identified for cannabis users from CAMHS when followed up over time. This trend pointed to a potential for reported levels of persecutory ideation being higher for cannabis users as compared to non-users. This is in line with the finding of an association between cannabis use and paranoia previously identified in the literature (Freeman et al., 2011). This also supports a recent shift in focus on paranoia, as opposed to psychosis in general, with more recent evidence indicating a causal link between THC and paranoia (Freeman et al., 2014). As the effect of cannabis use on persecutory ideation was not significant in the current study, this may have been affected by low power due to the small sample size from CAMHS. Nevertheless this is an informative finding that warrants further exploration in the future.

Even though the present study takes a snapshot view of the effects of cannabis use on psychosis during adolescence, the findings do not appear to provide support for a neurotoxic model (Bossong et al., 2010) identifying adolescence as a particularly vulnerable period. Nevertheless, adolescence still appears to pose a neurodevelopmental risk period, as effects of cannabis use on psychosis have been identified irrespective of lifetime frequency of use (Stefanis et al., 2004). Moreover, a neurotoxic model, by definition, does not necessarily limit outcomes to adolescence.

In line with the second hypothesis, it was found that alcohol users in the general adolescent sample reported higher levels of depression than non-alcohol users. This finding is in support of the well-established relationship between alcohol and depression (e.g. McKenzie et al., 2011; McFarlane et al., 2013; Poulin, Hand, Boudreau & Santor, 2005). Although the present

study cannot establish a causal relationship between alcohol use and depression, this has been previously identified (e.g. Fergusson, Borden & Horwood, 2009) with some even suggesting a primary route from alcohol use to depression (Borden & Fergusson, 2011).

In addition to the causal link identified from alcohol use to depression, the inverse also appears to hold true (Borden & Fergusson, 2011; Sihvola et al., 2008; Paljärvi et al., 2009). This is indicative of a self-medication/ secondary substance use disorder effect. As such, this could also be a valid explanation of the present study findings. However, recent data indicates that the path from depressive symptoms to alcohol use was not significant in an adolescent sample (Hooshmand, Willoughby & Good, 2012). It is postulated that alcohol is usually consumed in social contexts during adolescence, which enhances the young person's social networks, making it less likely that they would need to use alcohol for self-medication (Hooshmand et al., 2012).

However, alcohol use did not appear to worsen mental health for current alcohol users accessing the CAMHS service. This may be because they were much younger than the sample recruited from schools, and so they may not have used alcohol long enough to produce effects on their mental health. Information regarding age of initiation of alcohol use would have been useful for assessing whether this was the case; however this data was not collected for alcohol users. Nevertheless, analysis of change in alcohol consumption indicates that the participants from the school sub-sample increased their levels of use over time. This increase was not identified in the CAMHS sample, thus drinking levels may not have been sufficient enough to impact on pre-existing mental health problems. These findings are also comparable with those

highlighted above indicating that adolescent alcohol users are unlikely to use alcohol for self-medication reasons (Hooshmand et al., 2012).

When assessing anxiety in the current study, no differences were identified between current alcohol users and non-users. This is in direct contradiction with the literature identifying a link between alcohol use and reported levels of anxiety (e.g. Kaplow, Curran, Angold & Costello, 2001; Lewis, Johnson, Williams & Harris, 2008; Cheung et al., 2010; Rutledge & Sher, 2001). This could be indicative of insufficient levels of alcohol use for producing effects, as heavy and problematic use have been identified as being associated with anxiety (e.g. Zimmerman et al., 2003; Lewis et al., 2008, Cheung et al., 2010). However, the majority of alcohol users (just over 61%) reported using above the maximum recommended daily alcohol units per sitting, indicating high levels of use in this sample of adolescents. Thus it would be reasonable to expect associations with reported levels of anxiety and stress in this sample.

Interestingly, a trend for stress was identified, with this being potentially higher for alcohol users as compared to non-users. This finding links in with the literature identifying the increased incidence of alcohol use in adolescents after exposure to stressful life events. For example, data from a German birth cohort indicated that heavy adolescent drinking was predicted by a combination of negative life events and possessing the C allele of rs1876831 (CRHR1 gene) (Blomeyer et al., 2008). Data from the same cohort also showed that the same genes predicted earlier age of onset of alcohol use for those exposed to negative life events (Schmid et al., 2010). Thus stress appears to interact with genetic factors in influencing alcohol use behaviour. However, the study sample was predominantly a high risk sample,

experiencing either obstetric complications and/or high rates of psychosocial problems within the family, thus findings may not be generalisable.

Nevertheless, alcohol users themselves report tension-reduction/coping motives for alcohol use (e.g. Rutledge et al., 2001; Kuntsche et al., 2005), though this does not appear to be the main motive for adolescent alcohol use (Rutledge et al., 2001). Further support for tension-reduction effects of alcohol are provided by studies showing that in some cases, alcohol may produce dampening of the body's stress-response (Galavas & Weinberg, 2006; Croissant et al., 2008). However, these are more likely to be temporary effects, as levels of stress are still higher among alcohol users, and would be expected to be lower if alcohol use was an effective coping strategy. The relationship between alcohol and stress appears to be quite complex, with alcohol's effects on stress being subject to various influences, for example genetic factors as previously mentioned (Blomeyer et al., 2008; Schmid et al., 2010), family history of alcoholism (Croissant et al., 2006), and gender (Croissant et al., 2011), to name a few. In addition, it should be noted that only a trend and not a significant effect was identified in the present study. This may be due to the DASS measure of stress utilized in the present study, assessing only past month levels of arousal, at the exclusion of earlier experiences of stress. This is because early life stressors have been found to influence drinking behavior in adolescents (e.g. Enoch, 2011), thus measurement of these may have strengthened the effect.

Akin to the findings for cannabis use, the present study did not find a link between alcohol and subclinical psychosis, as current alcohol users and non-users did not differ on their levels of reported subclinical psychosis. Support for this finding exists in other studies assessing

adolescent alcohol use and psychotic symptoms (e.g. Macke et al., 2011). However, this does not appear to be the case for adolescents experiencing a first episode of psychosis, as cannabis and alcohol appear to be the most commonly reported combination of substance use in this population (Baeza et al., 2009).

Nevertheless, it is interesting to note the trend towards significance identified in the present study for persecutory ideation, with alcohol users potentially presenting with higher levels than non-alcohol users. Tentative support for this comes from studies identifying a link between problematic alcohol use and paranoid ideation/thoughts (Geisner, Larimer & Neighbors, 2004; Johns et al., 2004). However, paranoid ideation need not involve persecutory ideation as well, thus the link between these findings may be diminished. Regardless of this, other studies appear to support the association between alcohol use/disorders and psychosis (e.g. Dagenhardt & Hall, 2001; van Mastrigt, Addington & Addington, 2004). Furthermore, alcohol use has also been implicated in the onset of psychotic disorder. Recent evidence points to an indirect effect of alcohol use, which was found to weaken the relationship between cannabis use and the conversion from clinical-high risk status to onset of psychotic disorder (Auther et al., 2015). However, it has been previously noted that on the whole, evidence of a causal relationship between alcohol and psychosis appears to be quite weak, due to alcohol use being commonly linked with use of other substances (like cannabis) that are associated with psychosis (Barkus & Murray, 2010). This dismissal of the effects of alcohol may thus hinder research, in particular assessing the relationship between specific types of psychotic symptoms and alcohol use, as there have only been a handful of studies addressing this.

In support of the existing literature utilizing the same measure of resilience, a negative relationship was identified between the majority of resilience factors and reported levels of depression, anxiety, stress and negative emotionality in the general adolescent sample (Hjemdal et al., 2007; Hjemdal et al., 2011). This means that the higher the reported levels of resilience then the lower the reported levels of depression, anxiety and stress.

Personal competence emerged as the only significant negative predictor of depression, stress and negative emotionality. This may be because only weak relationships were identified between the remaining resilience factors and depression, stress and negative emotionality. Nevertheless, these weak associations are comparable to those identified previously in the literature (Hjemdal et al., 2011). Moreover, in partial support of the present study findings, personal competence has previously been identified as the strongest predictor of depression, anxiety and stress (Hjemdal et al., 2011).

The present study also found that social competence was not a significant predictor of depression, anxiety and stress. In a previous study, it was identified that social competence was not predictive of depression (Hjemdal et al., 2011). It can be argued that the effect of social competence is likely to be mediated by having a supportive social network. This is because it may be more beneficial to interact with people who provide emotional support, rather than being socially competent within a non-supportive network. In support of this assertion, positive social networks have been incorporated into substance misuse interventions (e.g. Social Behaviour and Network Therapy) (Copello et al., 2002; Copello et al., 2006).

Thus we would expect social resources to be negatively related to depression as has been previously identified (Moljord et al., 2014; Hjemdal et al., 2007; Hjemdal et al., 2011). However, this was not the case in the present study.

None of the resilience factors predicted levels of anxiety reported by the general adolescent sample recruited from schools. This finding is partially supported by previous research identifying that family cohesion and structured style were not predictive of social anxiety (Hjemdal et al., 2007). However, the rest of the resilience factors were predictive of social anxiety, which contradicts the present findings. Thus it would appear that anxiety is not related to resilience factors in this case.

Furthermore, the present study indicated that subclinical psychosis was not related to resilience. This may be because expression of psychosis at sub-clinical levels has been identified in the general population, with increased expression of such symptoms identified in adolescence as normal transient developmental phenomenon (Mackie et al., 2012; Kuepper et al., 2011a; Kelleher, 2012). Thus it may be that resilience would not influence this outcome in adolescence, as by definition it would not be a maladaptive outcome. As such, it is reasonable to assume that resilience may become influential for psychotic symptoms over and above the 'normal' levels of expression. However, such an assertion is speculative at best and further research is required in order to ascertain the nature of this relationship further.

Both cannabis and alcohol use did not moderate the relationship between resilience and the mental health measures of depression, anxiety, stress and negative emotionality. This means

that in this case, using either cannabis or alcohol did not appear to deter the protective effects of the resilience factors (more specifically, personal competence). It could be that for cannabis use, the effects are masked by the singular grouping of previous and current users, as moderation may kick in only for heavy or persistent users as opposed to lower level users. However, the same assertion cannot be made for alcohol use, owing to the high levels of use reported by the present study sample. Further research is thus needed to clarify this assertion, as the potential moderating effects of cannabis and alcohol use have not been previously assessed.

Strengths and limitations

It is possible that the present study may have lacked the sensitivity to detect effects. This is because the cannabis user category consisted of both previous and current users, thus including both low level incident users with persistent users. Such an approach would potentially dilute any effects pertaining specifically to persistent users as identified in the literature. However, this approach was unavoidable due to low levels of cannabis use in the study samples. Moreover, this approach has been previously successfully applied in the literature assessing cannabis use in adolescents (e.g. Perez et al., 2010).

However, the rates of cannabis use identified in the present study are lower than was expected based on previous findings of approximately a third of adolescents reporting cannabis use (e.g. Perkonigg et al., 2008; Swift et al; 2008). This may limit the generalizability of the findings. However, there appears to be a trend towards decreasing rates of cannabis use in adolescents.

This is illustrated by adolescent data from the annual Smoking Drinking and Drug Use Among Young People in England, with the most recent report highlighting a fall in rates of reported past year cannabis use (from 13.4% in 2001 to 7% in 2013) (Fuller & Hawkins, 2014). Thus the present study may simply be illustrative of this reduction in cannabis use among adolescents.

To the best of the study author's knowledge, this is the first study to assess the association between self reported resilience and subclinical psychosis in adolescents. This is also the first study to assess the moderating effects of cannabis and alcohol use on the relationship between resilience and mental health. Nevertheless, interpretation of these findings should be made with the previously identified caveats in mind.

Study implications

This study seems to indicate potential effects of cannabis on specific symptoms of psychosis. More attention needs to be given to identifying the specific psychotic symptoms that are related to cannabis use. This effort has recently begun in the literature, and could potentially help alleviate some of the inconsistencies in the literature. It could also be helpful for further elucidation of the mechanisms responsible for the causal link between cannabis and psychosis.

As there were no effects identified for depression and anxiety in differentiating between cannabis users and non-users, it highlights the need to identify the individual factors that confer risk of developing mood and anxiety outcomes following exposure to cannabis. Such factors are only beginning to be understood and studied, although research is still limited.

Personal competence emerged as the only resilience factor to predict levels of depression, anxiety and stress. This predictive utility could be applied to research involving an assessment of depression, stress and anxiety symptoms in adolescents. Moreover, as personal competence is a resilience factor that is amenable to change, it shows potential for utility in prevention and early intervention efforts targeted at adolescents. Such resilience based efforts targeting adolescents in secondary schools are currently underway (Dray et al, 2014), and may benefit from a focus on improving personal competence in adolescents

Conclusion

Overall, it appears as though in this sample, cannabis use was not related to psychotic, mood and anxiety symptoms, nor did it appear to worsen mental health for young people already accessing mental health services.

8.3 Study 3

In general, the majority of the present study hypotheses were not supported, with partial support found only for one hypothesis. The first hypothesis was not supported, as baseline and follow-up levels of resilience were comparable across the study samples. With regard to self-management type resilience factors (i.e. personal competence & structured style), the present study's findings are comparable to what has been previously identified in adolescent samples. For example, Griffin et al. (2009) found that self-management skills showed very little change over time, with a trend towards decline. However, it may be that it is the age at which these factors are assessed that determines whether changes are detected or not. Griffin et al. (2009) assessed change from early to middle adolescence. Likewise, in the present study, change over

time was assessed in the school sub-sample and CAMHS samples, which were both composed of participants in the early-middle adolescence phase. As previous research suggests protracted development of the pre-frontal cortex, which is largely responsible for self-management type skills (Casey et al., 2008; Bossong & Neisnick, 2010), changes may not occur until the later phases of adolescence. Had it not been for attrition, these differences may have been assessed for the participants from the school sample in the late phase of adolescence.

Drawing upon the notion that peer influence increases over time, peer related resilience factors might reasonably be expected to increase over time as well (social resources & social competence). However this was not the case in the present study, which appears contradictory. It is possible that changes in peer related factors might occur at an individual rather than group level. This is because it has been identified that some discrete circumstances may affect the stability of peer networks (e.g. depressed mood) (Chan & Poulin, 2009). Regardless of the influence of these discrete factors, group changes in peer networks have been identified, in accordance with expected developmental trajectories (e.g. Poulin et al., 2011). Thus it would be reasonable to expect changes in the present study.

By the same token, a decrease in reported levels of family cohesion was expected but not supported by the present study's findings. This is because the importance of the family to the adolescent diminishes over time (Furman & Burhmester, 1992) and parenting processes such as parental knowledge of the adolescent's behaviour decline over time, together with family activities (Coley et al., 2008). As previously noted in regards to changes in self management

factors, it seems likely that this would have been influenced by the age of the sample. Changes in the early-middle adolescence phase may not be substantial enough to detect, and may become more apparent over the later phase of adolescence. Thus changes may have been detected for the older adolescent sample.

It may be postulated that the assessment of change over time of resilience factors overall may have been hindered by the follow-up interval of six months being insufficient to detect changes. Some of the research on changes in resilience related concepts such as behavioral control and self-management skills has been conducted utilizing yearly intervals (e.g. Wong et al., 2006; Griffin et al., 2009) with mixed results. On the same token, others assessing peer networks have identified changes using shorter follow-up intervals (monthly or bi-monthly) over time periods comparable to the present study (5 or 8 months) (e.g. Chan & Poulin, 2008; Poulin et al., 2011). Thus it is reasonable to expect change in these factors over the 6-month follow-up interval utilized in the present study. However, these comparisons are only based on research relating to similar concepts. The lack of direct research assessing the change in the presently measured resilience factors over time in adolescence hinders the ability to determine a suitable follow-up interval. Perhaps replicating this research over a longer follow-up period may help to clarify this matter.

The second hypothesis was also not supported, as resilience was not predictive of cannabis use status. This finding is in contradiction to the literature identifying comparable resilience factors as protective against substance use (e.g. Griffin et al., 2001; Griffin et al., 2002; Wong et al., 2006). Thus if resilience factors were protective against substance use, it would be

expected that they would be negative predictors of cannabis use. However, it could be that the measure of cannabis use was not sensitive enough in that it included those low level experimental users as well as more regular and persistent users. This is illustrated by an assessment of self-management skills during adolescence, which showed that early expression of these skills (during early adolescence) was protective against increases in substance use (cannabis and alcohol) over time (Griffin et al., 2009). Therefore it can be postulated that the protective influences of resilience factors may be more likely utilized when use goes beyond normative developmental experimentation with cannabis. This assertion is also indirectly supported by the assessment of whether resilience predicted amount of alcohol consumed discussed below. Thus a more sensitive analysis would have included levels of cannabis use (i.e. frequency and/or quantitiy).

In support of the third hypothesis, resilience appeared to be predictive of alcohol use, with 'structured style' and 'social resources' emerging as the only significant predictors. These were both negative predictors, indicating that high levels of these factors were predictive of lower amount of alcohol consumed per sitting. However, the resilience factors of personal competence, social competence and family cohesion were not significant predictors, which contradicts the previous literature (e.g. vonSoest et al., 2010).

Social resources were identified as the stronger of the two predictors of alcohol consumption at each sitting by current alcohol users. This indicates that having a supportive social network appears to be especially protective of alcohol consumption, a finding that is supported in the literature (e.g. Whitney, 2010; Hunter-Reel, McCrady, Hildebrandt & Epstein, 2010).

Moreover, the importance of a supportive social network has also been highlighted by its integration into alcohol and other substance misuse interventions (e.g. Social Network Behavior Therapy) (Copello et al., 2002; 2006), and in particular by its integration into the quality standards for substance use interventions for young people by the National Institute for Health and Care Excellence (NICE, UK, 2011). This indicates that a supportive social network is an important factor for fostering positive outcomes both for amount of alcohol consumed, and during treatment for alcohol misuse. Nevertheless, this relationship between alcohol use and social resources has not always been identified in adolescent samples (vonSoest et al., 2010).

The identification of structured style as a negative predictor of amount of alcohol use in the present study is comparable to what has been identified for both alcohol and other substance use in adolescents (vonSoest et al., 2010; Veselska et al., 2009). Having a structured style means having the propensity for self-organization. Therefore it may be postulated that these adolescents with a structured style may be more likely to take part in organized activities, and this may thus mitigate substance use behaviour. This is because a lack of organized activities in adolescents has been identified as a risk factor for substance use (e.g. Perez et al., 2010; Coffey et al., 2000).

Nevertheless, in spite of the predictive utility identified for structured style, it was found that personal competence, another self-management type resilience factor, was not predictive of alcohol use. This finding contradicts what has been previously identified (e.g. von Soest et al., 2010) especially as personal competence has been targeted for substance use prevention and

early intervention programs aimed at adolescents (e.g. Life Skills Training) (Botvin & Griffin, 2002). However, resilience factors are not necessarily universally protective against substance use, and some may even confer risk. For example, Veselska et al., (2009) identified protective effects of structured style and family cohesion for tobacco and cannabis use but social competence was a risk factor. This may be because high levels of social competence may expose an adolescent to situations were peers are engaging in substance use and other risky behaviour, increasing the risk for their own substance use through social learning processes such as modeling (Veselska et al., 2009).

However, it was also found in the present study that, baseline levels of resilience were not predictive of follow-up levels of amount of alcohol units consumed per sitting. This appears contradictory to the finding of a significant effect using baseline data. This may be because the follow-up analysis was carried out in the sub-sample from schools, which may not have been representative of the main school sample. For example, it was found that this sample was much younger in age than the main school sample. Thus this finding may have been an artifact of the differences between the samples.

Strengths and Limitations

The present study adds to the emerging literature assessing the utility of self-report measures of resilience for assessing substance use outcomes in adolescents. However, the analysis of change over time in resilience factors was assessed using the sub-sample from schools, which may not be representative of the main sample. Especially important is the age difference between the samples, as young people from the sub-sample were younger. A more robust

approach would have utilized follow-up data from the entire sample. However this was not possible for pragmatic reasons in this case.

Moreover, the lack of change identified in resilience factors may have been due to an insufficient follow-up period. It may well be that although some resilience factors may not change much due to protracted brain development; those that do change may do so over a protracted period of time. Thus a longer follow-up period would have allowed for full tracking of these factors.

Furthermore, interpretations of the finding of predictive utility of social resources and structured style for alcohol consumption should be made with the caveat of a relatively small effect size in mind. This is because these factors were only able to account for 15.4% of the variance in the amount of alcohol consumed at each sitting. It is likely that other unmeasured factors would have also predicted the amount of alcohol consumed. Nevertheless this is still an informative finding identifying specific resilience factors that show predictive utility for alcohol consumption.

Conclusion

Overall, there was no change over time identified for resilience factors, with findings comparable between the clinical sample from CAMHS, and the general adolescent sample from schools. Nevertheless, resilience was found to be lower for young people from CAMHS as compared to those from schools. Furthermore, resilience did not appear to be predictive of

cannabis use, although two resilience factors were found to negatively predict the amount of alcohol consumed.

Chapter 9 General Discussion

9.1 Aims of thesis

This thesis had two key aims. Firstly, it aimed to provide an assessment of the factors that influence changes in patterns of cannabis use as reported by the adolescent cannabis users themselves. Secondly, the thesis aimed to integrate resilience processes in the assessment of cannabis use and mental health.

9.2 Summary of results

This thesis presented three novel findings. Firstly, it identified reasons for voluntary abstinences by cannabis users, which have not been previously identified for adolescent samples. These involved both external and internal influences, most commonly peers and the adolescent's state of mind. Secondly, it was shown that adolescents report decreasing their cannabis use due to concerns about their physical health, and feeling they have outgrown cannabis. These reasons for decreases have not been previously identified in adolescent samples. Thirdly, it is the first research to show that substance use (i.e. cannabis and alcohol), does not moderate the relationship between resilience and mental health.

Personal competence emerged as a key predictor of mental health. However, cannabis use did not appear to be related to either mental health or resilience. Conversely, alcohol users had higher levels of depression than non-users, with alcohol use being negatively predicted by resilience. The key findings from the three studies presented in this thesis will now be discussed in relation to the two key aims of the thesis stated above.

9.2.1 Factors influencing changes in cannabis use patterns

The factors influencing changes in cannabis use patterns were assessed in Study 1. Peers, and curiosity were the most commonly reported reasons for initiation. For increases, others' increased use and more opportunities to use cannabis were commonly cited. Decreases were influenced by physical health concerns and the feeling that they had outgrown cannabis use. Voluntary abstinences by cannabis users were influenced by both internal and external factors, most commonly the user's state of mind at the time, and peers. Non cannabis users reported abstaining from cannabis due to concerns about the effects of cannabis on physical and mental health. Overall, these findings indicate a mixture of both internal and external influences on cannabis use. Moreover, there was an overarching influence of peers, as they were cited as influential for initiation, increases, and voluntary abstinences. This was an expected developmentally appropriate finding in that the importance of peers increases during adolescence, thus their influence would also be expected to increase (Furman & Burhmester, 1992).

These findings fit well with resilience frameworks such as social ecological theory (Brofenbenner, 1986), and the youth resilience framework (Rew & Horner, 2003). Social ecological theory (Brofenbrenner, 1986) looks at adolescent development as a function of interactions between factors at the individual, proximal environment (i.e. family & peers) and distal environmental (i.e. community) levels. Likewise, Rew and Horner's (2003) youth resilience framework identifies sources of risk and protection for adolescent substance use across the individual, family and community domains. However, these frameworks are quite broad, and do not identify the main domains of influence for different substance use

behaviors. The findings of Study 1 partially address this shortcoming. An assessment of the main factors reported as influential reveals that initiation and increases were mostly attributed to external influences (i.e. peers, more opportunities to use, others' increased use). Conversely, decreases and voluntary abstinences were most commonly attributed to internal influences (i.e. grew out of it, physical health concerns, state of mind). Although not directly assessed, this finding may be tapping into the adolescent users' locus of control. This is because it has been identified that substance abuse outcomes may be better for those with an internal locus of control in relation to their substance use. For example, those with a more internal locus of control are more likely to report voluntary abstinences (Sedava, 1986), and have higher personal motivation for treatment (Murphy & Bentall, 1992). However interesting these findings may be, they are based on adults with substance abuse disorders, thus may not be comparable to the present sample of adolescent cannabis users. The literature on locus of control and substance use/abuse appears to be very limited, thus it would be beneficial for future research to directly assess how locus of control may influence changes in substance use patterns.

Study 1's account of self reported factors influencing the process of change in cannabis use patterns is essential as it may help delineate issues of causality in the factors identified using multivariate approaches (Terry et al., 2007). Moreover, this information has utility for informing early intervention programs aimed at adolescent cannabis users. For example, the findings of Study 1 show that adolescents have a great amount of insight into the influences on their cannabis use behavior. One of the main goals of Cognitive Behavioural Therapy for substance misuse is to help the client to become cognizant of what influences their substance

use behavior, and to provide alternatives for these influences (McHugh, Hearon, & Otto, 2010). Thus it may be postulated that those experiencing problematic cannabis use patterns may be those who lack insight into their cannabis use behavior, and are therefore more likely to struggle to avoid cannabis cues in order to change their patterns of use.

Overall, the factors reported as influencing changes in cannabis use patterns were largely comparable between the clinical and general adolescent samples in the present study. This may be because when motives for cannabis use have been assessed, people with mental health problems report using cannabis for the same reasons as those without (e.g. for social enhancement) (e.g. Dekker, Linszen & de Haan, 2009; Lee, Neighbors, & Woods, 2007). Thus it follows that reasons influencing changes in these use patterns will be comparable. Nevertheless, it would be expected that reasons for changes, especially decreases and abstinences, might differ if cannabis use interferes with mental wellbeing. However, Study 2 showed that cannabis use did not appear to worsen mental health for the clinical adolescent sample from CAMHS, which has been previously identified for psychosis outcomes (e.g. Cantwell et al., 2003).

It should be noted, that the small size of the sample of cannabis users may hinder the generalisability of the findings from Study 1. More specifically, the factors identified as influential for cannabis use changes are based on a small sample of only 38 cannabis users from schools, and only 10 from the clinical sample, whose views may thus not be representative of adolescents in general. However, some of the data appears to map on to what has been previously identified. For example factors reported as influential for initiation and

increases are generally comparable with those that have been identified previously (e.g. vonSydow et al., 20002; Brechwald & Pristein, 2011). Nevertheless, the findings in relation to decreases and voluntary abstinences will require replication, due to the paucity of information surrounding these changes in adolescent cannabis use patterns.

The present study is limited by the lack of reliable data on the levels of cannabis used in the sample, due to the low numbers of cannabis users providing this information. This limits the interpretation of the findings, as clear statements in regards to the type of cannabis user these findings relate to cannot be made. More specifically, it is likely that factors that influence different changes in cannabis use are likely to differ between low level sporadic users and 'regular'/heavy users. This is because each change in cannabis use is likely to be qualitatively different (e.g. in meaning, and impact) for each type of user. For example, voluntary abstinences may be more effortful and consequential for dependent cannabis users due to experiencing a withdrawal syndrome (Budney & Hughes, 2006). This is illustrated in a study of cannabis dependent individuals attempting to abstain from cannabis. It was found that the higher the level of dependence then the greater the levels of functional impairment following an abstinence attempt (Allsop et al., 2012). Thus different changes in patterns of cannabis use, in this case abstinence, may, in real terms, mean different things to different types of cannabis user. Hence more information on the levels and frequency of cannabis use may have been beneficial in the present study.

9.2.2 The relationship between cannabis use, resilience and mental health

Following on from identification of reasons for patterns of cannabis use, the relationships between cannabis use, mental health and resilience were assessed. These analyses were based on a more contemporary view of resilience, thus looking at resilience as a process, and utilizing a self-report measure of key resilience factors.

Personal competence emerged as a key negative predictor of mental health (i.e. depression, stress and negative emotionality) as identified in Study 2. However, this influence did not extend to cannabis use, as study 3 illustrated that personal competence did not predict cannabis use. It is thought that personal competence skills help an individual to confront and actively manage and solve challenges in life, resulting in an increase in psychological wellbeing (Griffin et al., 2001, Griffin et al., 2002). However, it is also this increase in wellbeing that is thought to produce a reduction in substance use, whereas in this case, personal competence did not predict substance use, which is in contradiction with the literature (Griffin et al., 2002; Wong et al., 2006; Wills et al., 2006).

Cannabis use did not appear to be related to either mental health or resilience in the present studies. More specifically, cannabis users and non-users presented with comparable levels of depression, anxiety, stress and sub-clinical psychosis as identified in Study 2. Furthermore, cannabis did not appear to moderate the relationship between resilience and mental health (Study 2), and resilience did not appear to predict cannabis use (Study 3). However, levels of cannabis use were quite low across the study samples, with fewer than expected participants identifying as cannabis users. Though it may be asserted that this would impact on the power

of the analyses, this did not appear to be the case for the assessment of the moderating effects of cannabis, as the regression was able to detect medium effect sizes in the prediction of mental health variables (i.e. depression, stress, and negative emotionality). On the other hand, comparisons of mental health between cannabis users and non-users may have been affected, as small samples diminish the power of non-parametric tests. This may mean that some small effects may have been missed. However, this was unavoidable, due to the non-normal distribution of the data.

The clinical sample from CAMHS presented with generally lower resilience levels than the general adolescent sample from schools. This is in support of the literature identifying that resilience is able to distinguish between clinical and general population samples (Friborg et al., 2003), and is able to negatively predict mental health (e.g. Hjemdal et al., 2006). The present findings for the clinical and general adolescent samples were comparable in terms of the lack of difference identified in mental health between cannabis users and non-cannabis users. However, the rest of the analyses were not carried out for the clinical sample due to insufficient sample size, hindering the comparisons between the two samples.

9.2.3 The relationship between alcohol use, resilience and mental health

Though resilience predicted amount of alcohol consumed, (Study 3), and alcohol users presented with higher levels of depression than non-alcohol users, alcohol did not moderate the relationship between resilience and mental health. The predictive utility of resilience for alcohol use was expected given the findings in the adolescent substance use literature for various resilience factors (e.g Botvin et al., 1998; Wong et al., 2006). Moreover, the link

between alcohol use and depression was not surprising, given the established nature of this relationship identified in the literature (e.g. Fergusson, Boden & Horwood, 2009; Ranney et al., 2013; Sihvola et al., 2008). For example, a meta-analysis identified a causal linkage between alcohol use disorders and major depressive disorder, with alcohol use disorders primarily causing major depression (Boden & Fergusson, 2011).

The findings presented in this thesis suggest that the disruption of the protective influences of resilience factors may not be the mechanism via which alcohol use produces adverse mental health outcomes such as depression. This finding may lend itself to alternative explanations of the identified link between alcohol and depression, both in the present study and in prior research (e.g. Boden & Fergusson, 2011). However, a secondary substance use disorder model whereby depression leads to alcohol use and misuse seems unlikely. This is because alcohol use has been identified as predominantly a social activity during adolescence (Hooshmand et al., 2012), and adolescents experiencing depression are more likely to be socially excluded (Cheadle & Goosby, 2012). It thus stands to reason that this may limit their exposure to social situations involving alcohol consumption (e.g. parties). However, this assertion can be considered problematic because of the inherent assumption that young people with depression do not drink alone. Additionally, the study by Cheadle and Goosby (2012) also identified that the shared experience of depression is also a basis for the formation of new friendships, thus these young people may still be drinking socially, albeit in smaller social groups.

It may also be proposed that it is risky and problematic levels of alcohol use (e.g. binge drinking, dependence etc.) that disrupt resilience processes, and the present study may have benefited from identifying these patterns of use. However, the majority of alcohol users in the present study reported high levels of use per sitting which were above the recommended daily units. The relationship between alcohol use and depression has been assessed in the adolescent literature utilizing various measures of alcohol use including past month/year alcohol use frequency (e.g. Flemming et al., 2008; Marmostein et al., 2009), number of intoxication episodes (e.g. Strandheim et al., 2009), average weekly intake (Paljarvi et al., 2009), number of alcohol related problems (Crum et al., 2008) and so forth. However, some of the commonly adopted terms such as binge drinking, are not always well defined. For example there are differences in the number of drinks used to define a binge in the literature (e.g. 4 versus 5 drinks) (Hill et al., 2000; Viner & Taylor, 2007). Additionally, the term 'binge drinking' has been criticized for failing to take account of some other factors that influence the effects of alcohol such as weight, food consumption, rate of drinking and so forth. The present study attempted to subvert these difficulties by utilizing standard units of alcohol per sitting, which can readily be replicated.

9.3 Overall Strengths

By assessing factors influencing changes in cannabis use patterns, this thesis extends the literature; which has previously assessed this only in general and clinical adult samples (Terry et al., 2007; Seddon et al., 2013). This gap in the literature was addressed utilizing both a general and clinical adolescent sample, which allowed for comparisons to be made in terms of whether they are influenced by the same factors.

Moreover, by adopting a contemporary approach to studying resilience processes in substance use, the present research adds to this relatively new wave of research adopting non-trait based self-report measures of resilience. This is imperative for bridging the gap between research and clinical application, as the resilience factors are easily measured and are amenable to change, thus can be targeted for intervention.

The current programme of research also adds to the pre-existing literature by incorporating a previously understudied and generally difficult to access sample of young people from CAMHS. This service deals with the full spectrum of childhood and adolescent mental health problems, rendering it ideal as a generalized clinical adolescent sample. However, the specific mental health problems experienced by the research participants were not assessed, and thus the variation in mental disorders in the study sample could not be identified.

9.4 Limitations

Interpretations of the findings presented within this thesis need to be made with the research limitations in mind. The unexpectedly low levels of cannabis use across the study samples may have limited the ability of some of the analysis to detect effects attributable to cannabis use. A larger sample size would have enabled the capture of more cannabis users. Although comparable sample sizes have been previously successfully utilized, these samples were predominantly composed of young people in the late adolescent and early adulthood stages (e.g. Chabrol et al., 2005). Thus the high rates of cannabis identified within these previous studies would not be comparable to the present study sample. However, it could also be that this low level of cannabis use is an indirect indication of the identified decline in cannabis use

by adolescents (Fuller & Hawkins, 2014). Thus only tentative conclusions can be drawn from these analyses due to this shortcoming.

Furthermore, the CAMHS sample was smaller than planned (initial target n= 35), which inhibited the analyses that could be run using the data. This resulted in some planned analyses not being carried out, and thus limited the findings in relation to this sample. However, this could not be avoided due to pragmatic issues with recruitment. Nevertheless findings are still informative, albeit exploratory, as this is a previously understudied sample.

The follow-up duration period of 6 months may have been insufficient for detecting changes in resilience, if any and substance use over time. As substance use was found to increase over time, a longer follow-up period would have enabled the concurrent assessment of substance use and resilience trajectories. Additionally, follow-up analyses in the main study sample from schools were hindered by attrition.

The wide age range of participants may have confounded the findings presented in this thesis, in particular those from the School sample (age 11-18 years). This is because this sample encompasses young people across different stages of adolescence, namely early (age 11-13 years), middle (age 14-16 years), and late adolescence (age 17-19 years) (Clark-Lempers, Lempers & Ho, 1991). These developmentally distinct stages have been previously identified to differ in various ways in the literature. For example, initiation of substance use increases with age across adolescence, with a peak age of initiation reached around middle-late

adolescence (e.g. Von Sydow et al., 2001). This is also apparent in the present study, as data from the School sample indicates a peak age of cannabis initiation at the age of 16 years.

Furthermore, other differences have been identified across the different stages of adolescence such as the quality of relationships between the adolescent and significant others (e.g. increased importance of peers with age & decreased importance of parental relationships) (Furman & Burhmeister, 1992; Clark-Lempers et al., 1991). At the individual level, it has been identified that an individual's identity may show progression from early to late adolescence (Meeus, Van De Schoot, Keijsers, Schwartz & Brange, 2010). Additionally, the majority of the literature has utilized narrower age ranges, more often looking at middle-late adolescence, thus the present study findings may not be comparable to the general literature (e.g. Von Sydow et al., 2001; Coffey et al., 2000; Repetto et al., 2008).

However, in spite of the differences identified across the course of adolescence, it is suggested that utilization of a wide age range in the present study, as in some other studies, enables the identification of phenomena occurring outside the expected normative developmental trajectories (i.e. due to individual differences). For example, in the previously cited study by Meeus et al. (1991), 63% of the sample did not make the identified transition in their identity development. Although not common practice, a similar approach to age ranges has been previously successfully utilized in the literature assessing cannabis use, mental health and resilience across adolescence (e.g. Chabrol et al., 2005; Thai et al., 2010).

9.5 Research Implications

The findings carry some implications for future research strategies. Firstly, there needs to be a long-term prospective assessment of cannabis use trajectories incorporating an assessment of reasons for changes in cannabis use at each stage of the trajectory (both self-report and multivariate approaches). Moreover, resilience factors will need to be incorporated in order to assess whether they are predictive of a) trajectory followed, b) factors influencing each stage (e.g. could it be that adolescents low in personal competence are more susceptible to peer influence for increasing cannabis use). This approach will enable more accurate capture of this information, and may go some way towards delineating issues of causality. Moreover, such information would be useful for informing prevention and early intervention strategies aimed at adolescents.

Secondly, based on the low levels of cannabis use identified in this study, together with the general decline identified in previous research in adolescents (Fuller & Hawkins, 2014), future studies assessing cannabis use in this population will require the utilization of large sample sizes. Although labour intensive, such an approach will enable the capture of significant numbers of cannabis users, and thus facilitate analyses based on cannabis users. Such an approach will guarantee sufficient power to detect effects. However, there also needs to be a research effort aimed at identifying the reasons for this decline in use, which will be useful for informing programs aimed at encouraging further decreases in adolescent cannabis use.

9.6 Clinical Implications

The emergence of personal competence as a key resilience factor for various mental health outcomes in this sample further substantiates the need to target these skills for prevention and early intervention efforts aimed at improving mental health in adolescents. Furthermore, peer influence was pervasive in influencing changes in patterns of cannabis use in the present research. This points to the need to incorporate skills for resisting peer influence in prevention and early intervention efforts for cannabis use in adolescents.

Conclusion

Though both external and internal influences were identified as affecting changes in cannabis use patterns, there was an overarching influence of peers identified. Moreover, personal competence emerged as a key resilience factor for predicting mental health in the present sample of adolescents. However, cannabis use did not appear to moderate the relationship between resilience and mental health. Low levels of cannabis use identified in this study may have consequently masked any effects. Thus future research will require large sample samples with follow up spanning the adolescent period. This will enable researchers to fully map out cannabis use trajectories, and associated self reported factors influencing change at each stage of the trajectory including resilience factors and mental health outcomes.

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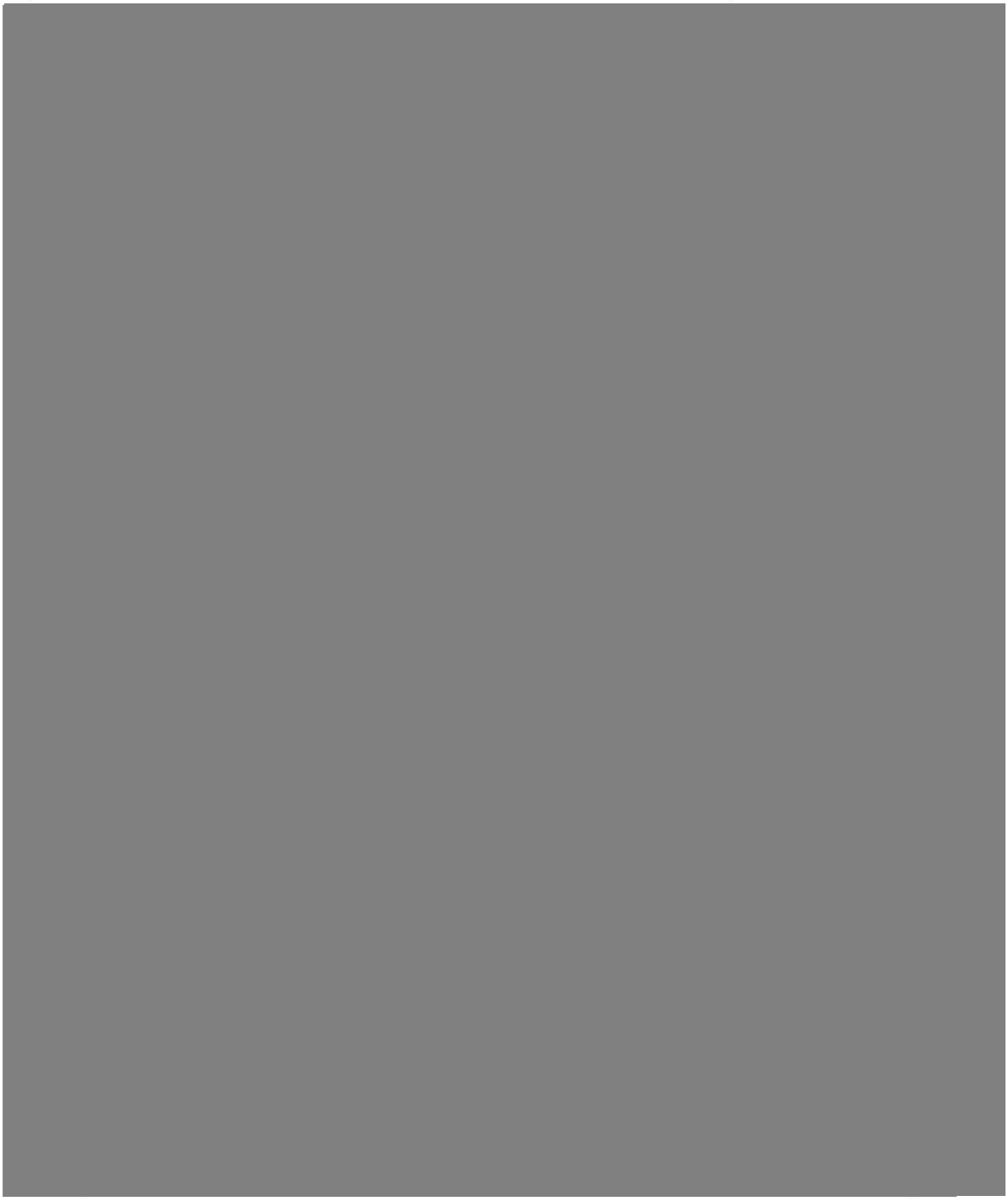
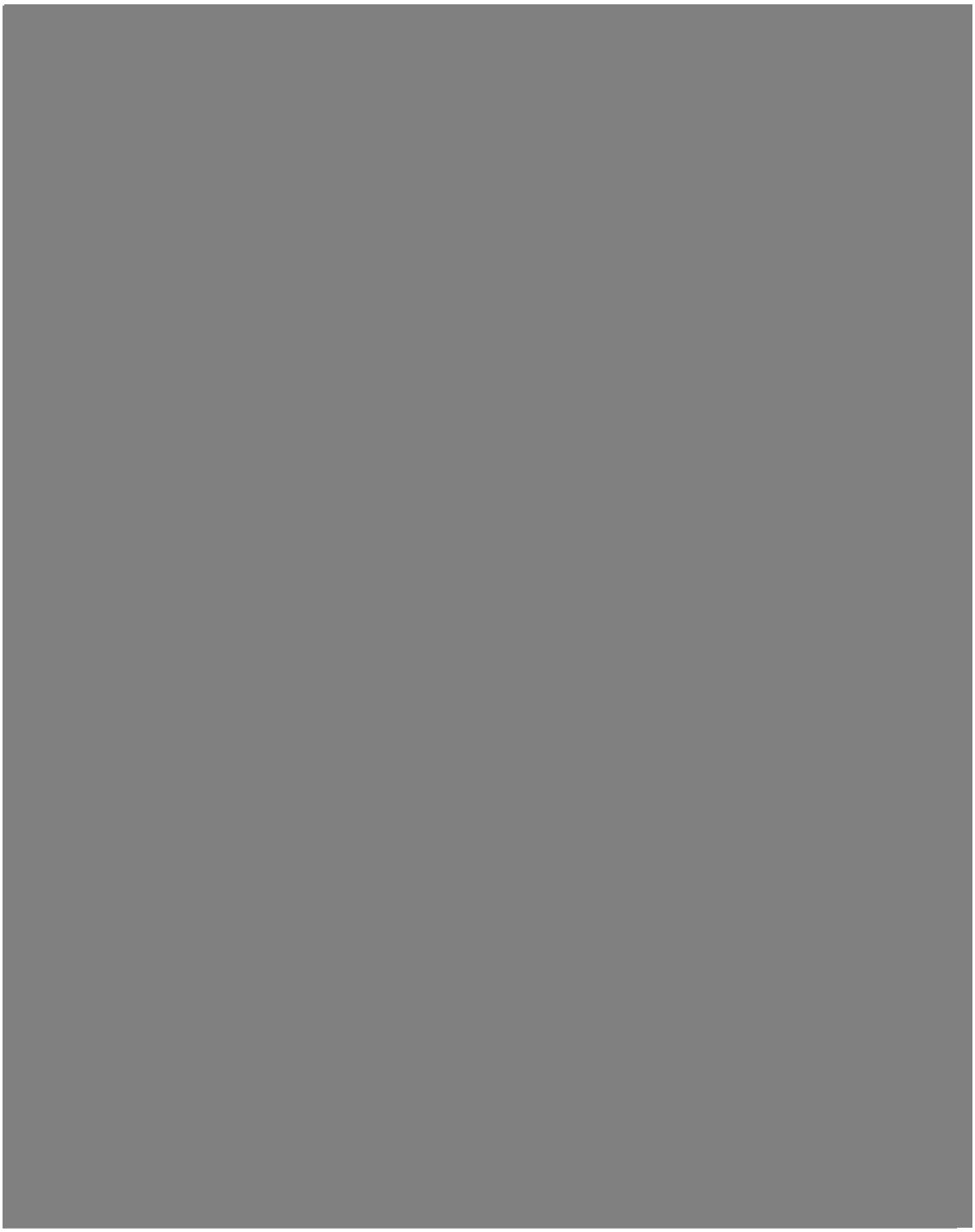
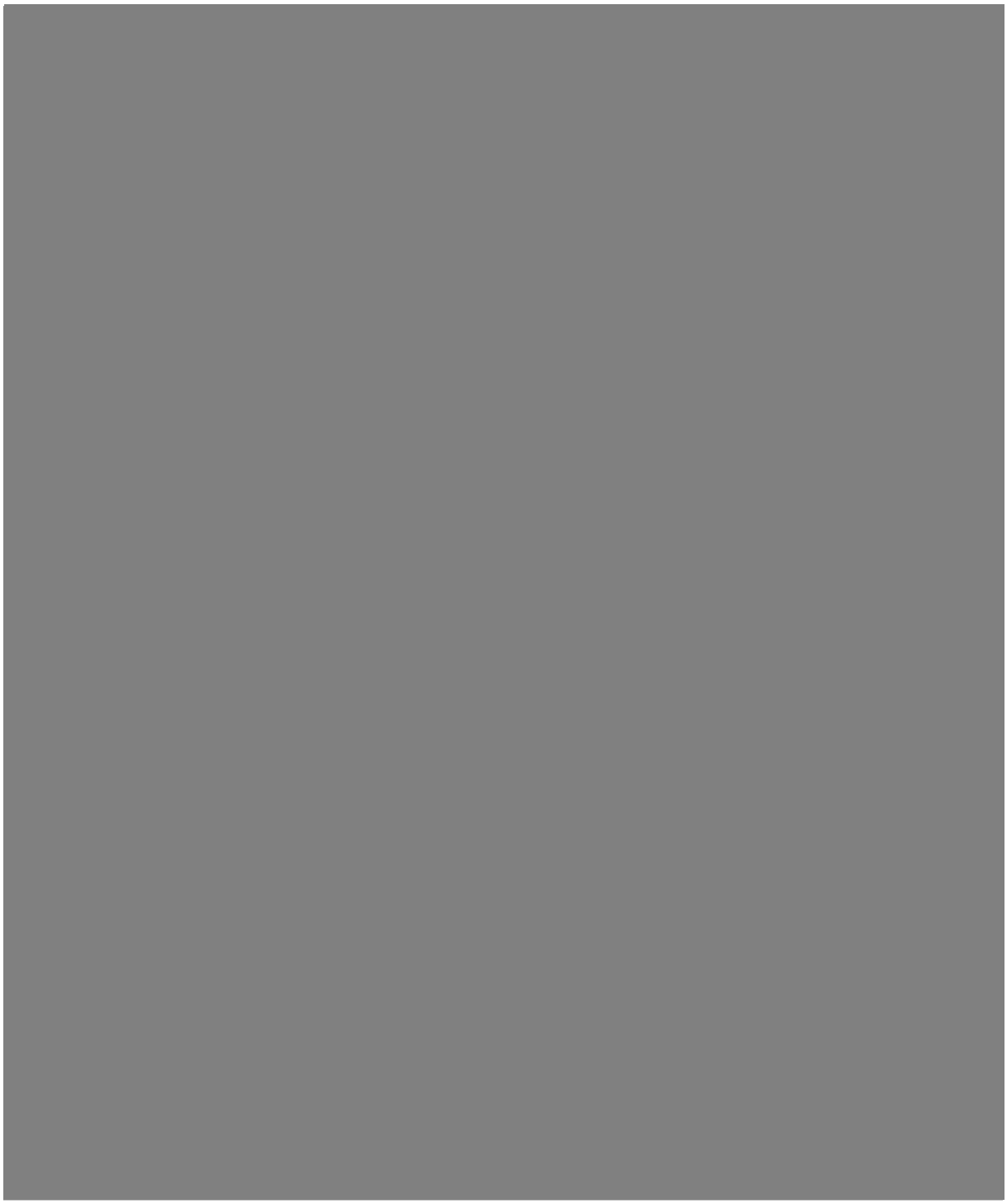
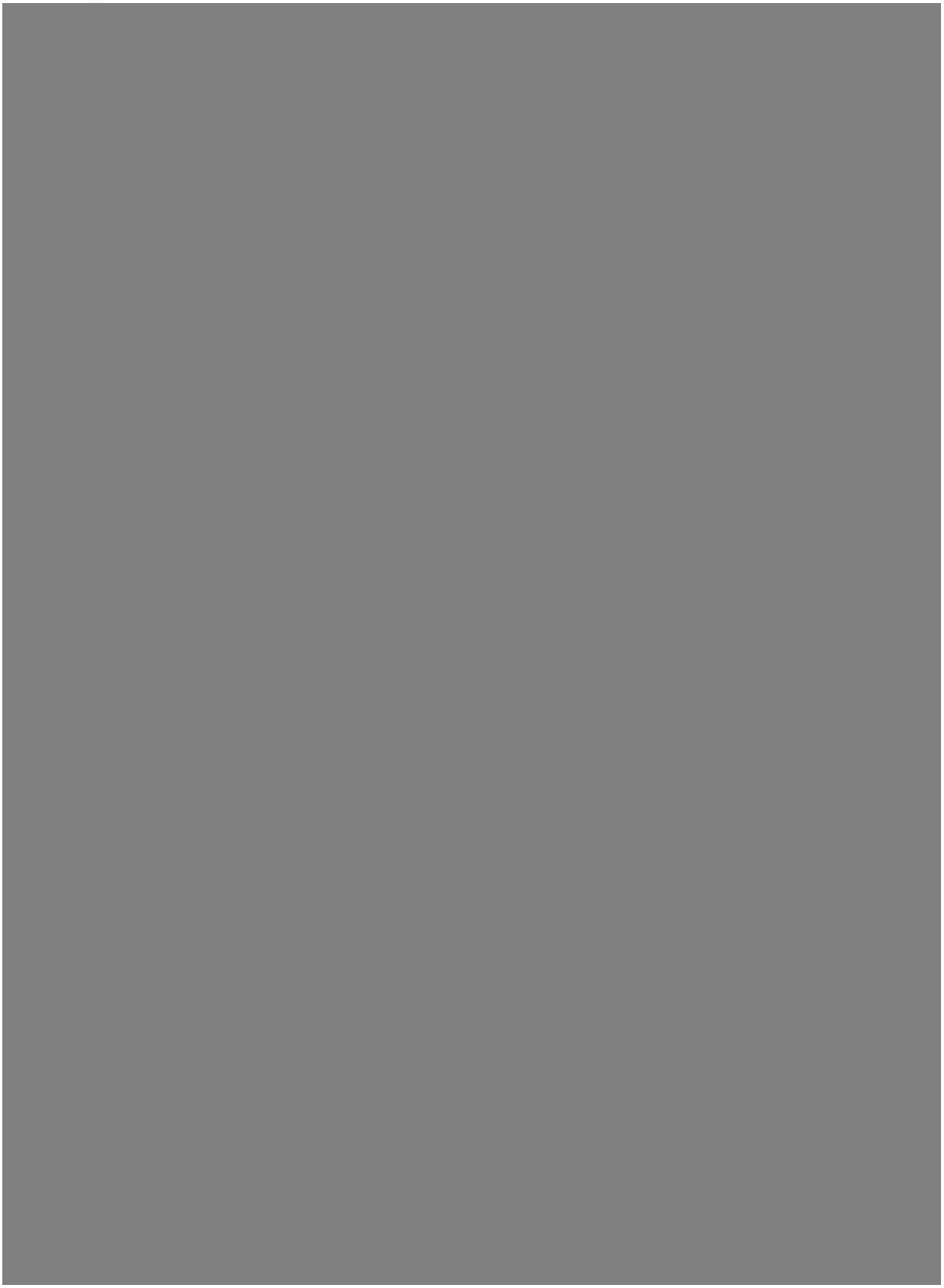
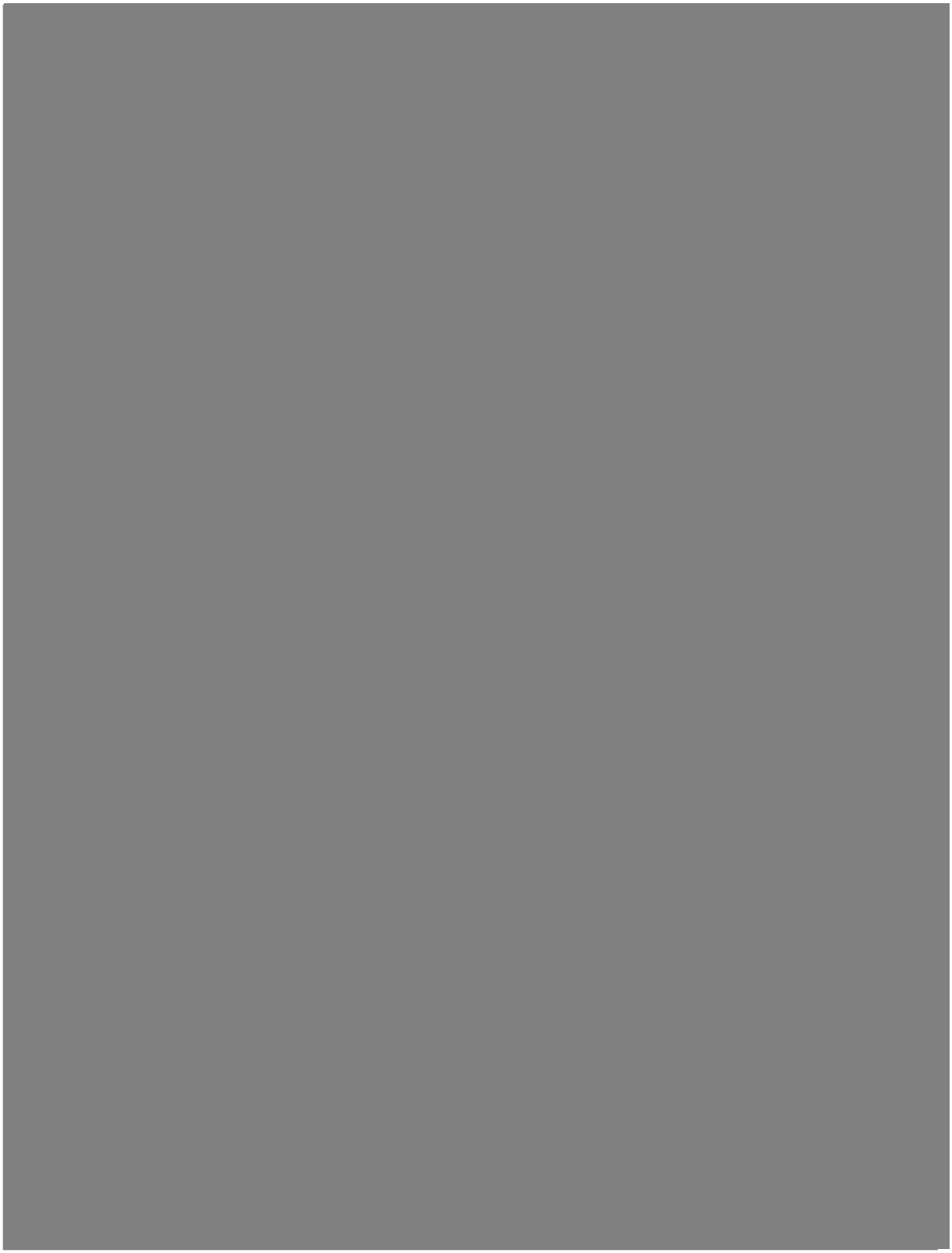
Appendix A. Ethical Approval

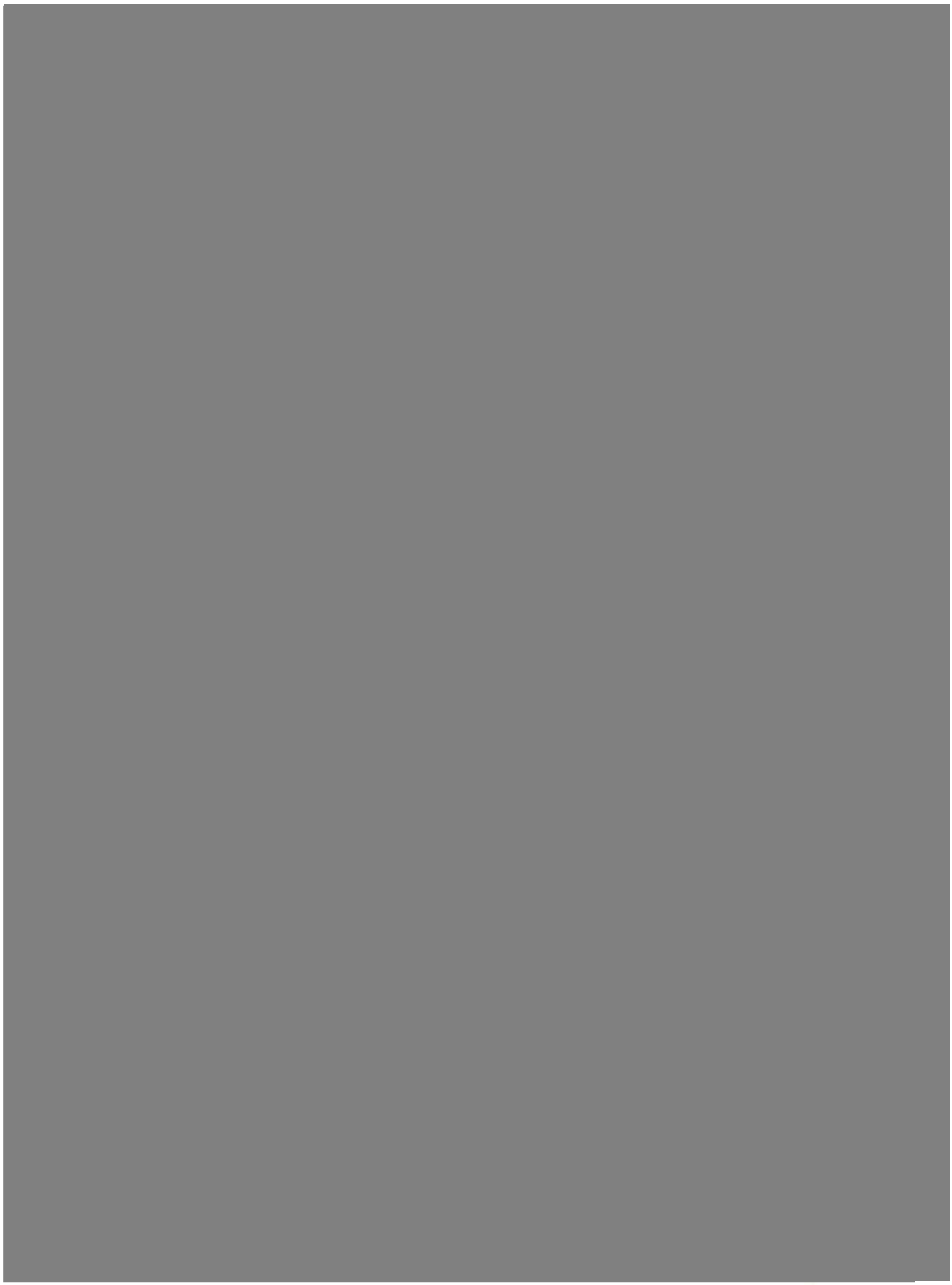


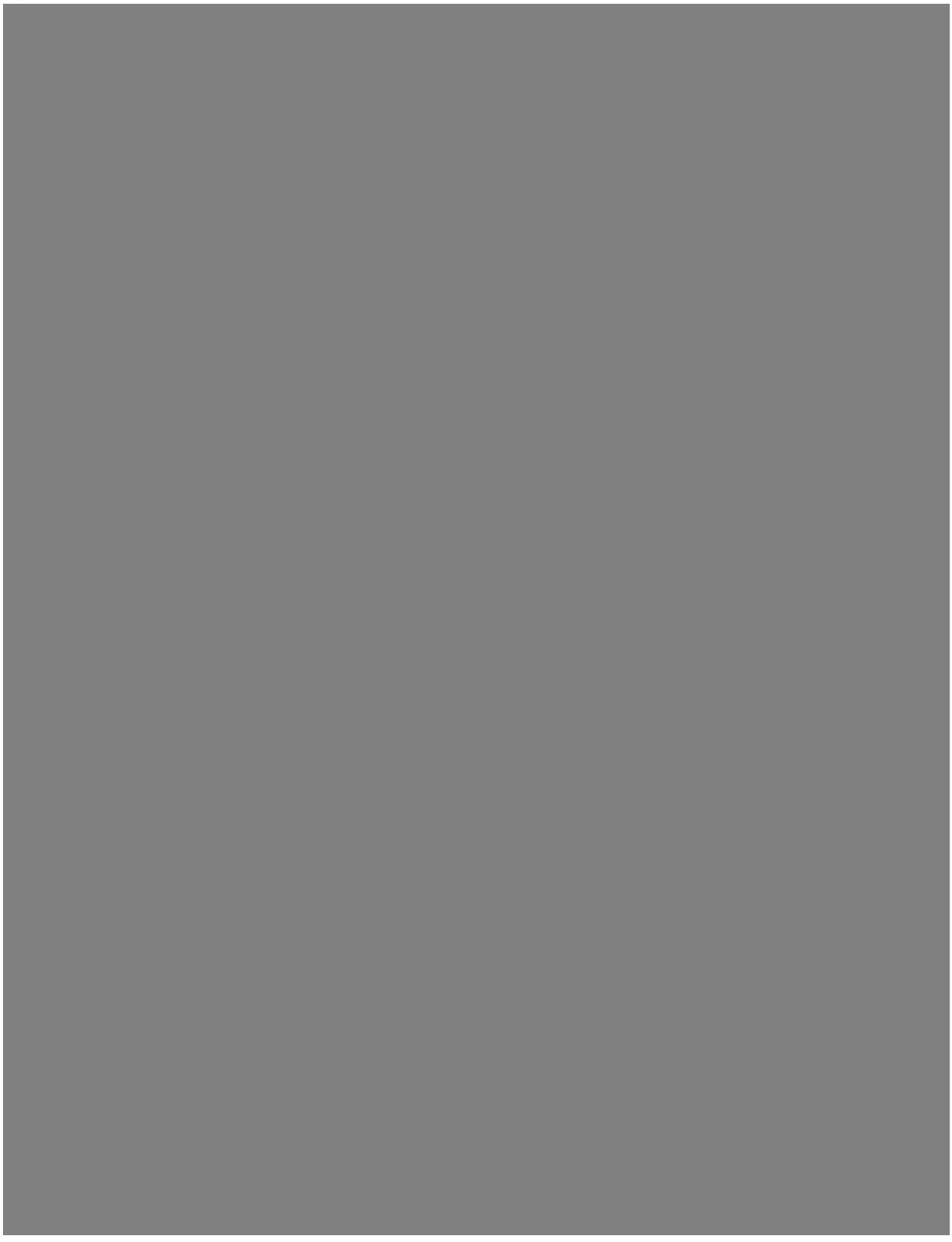


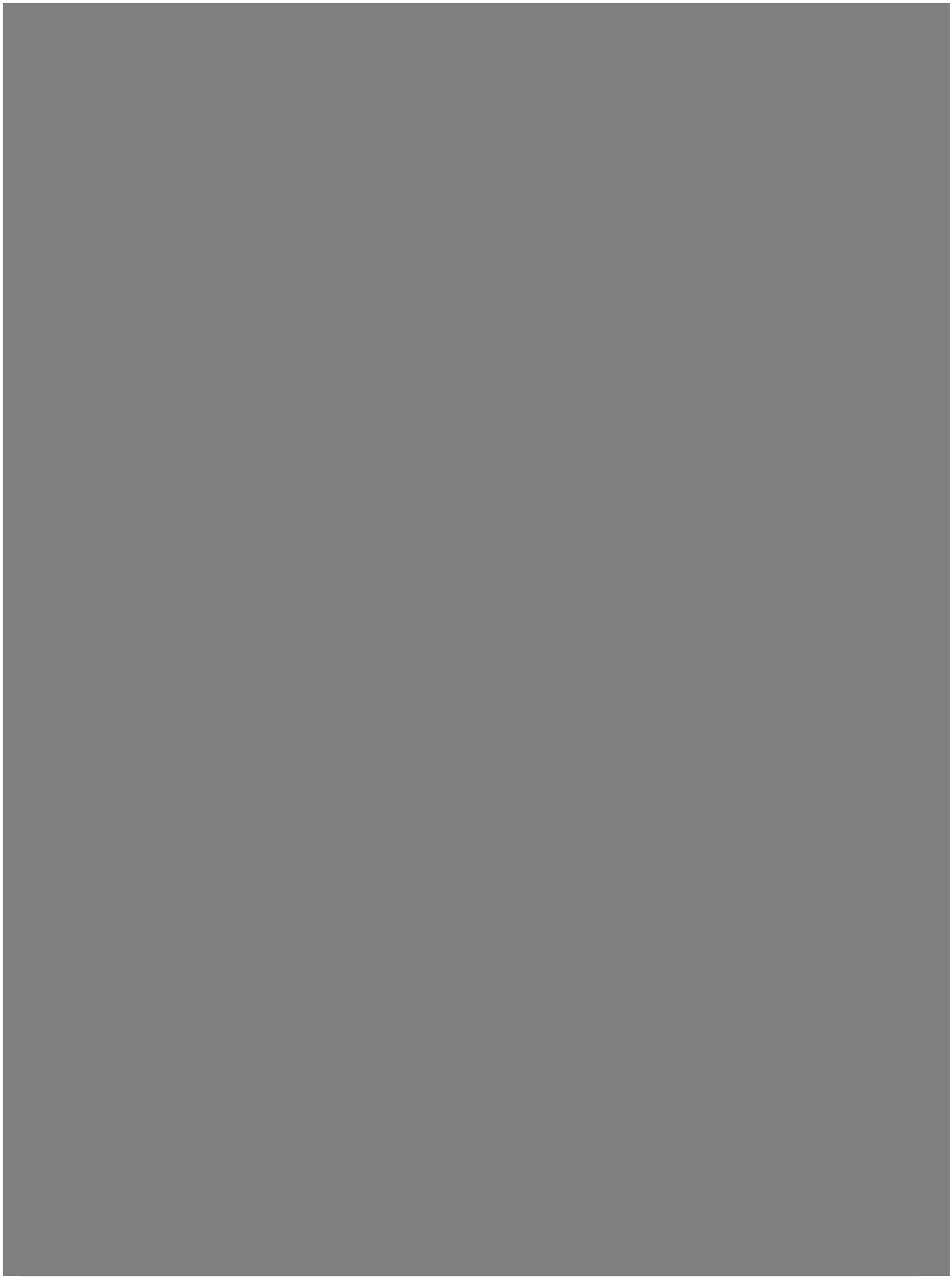


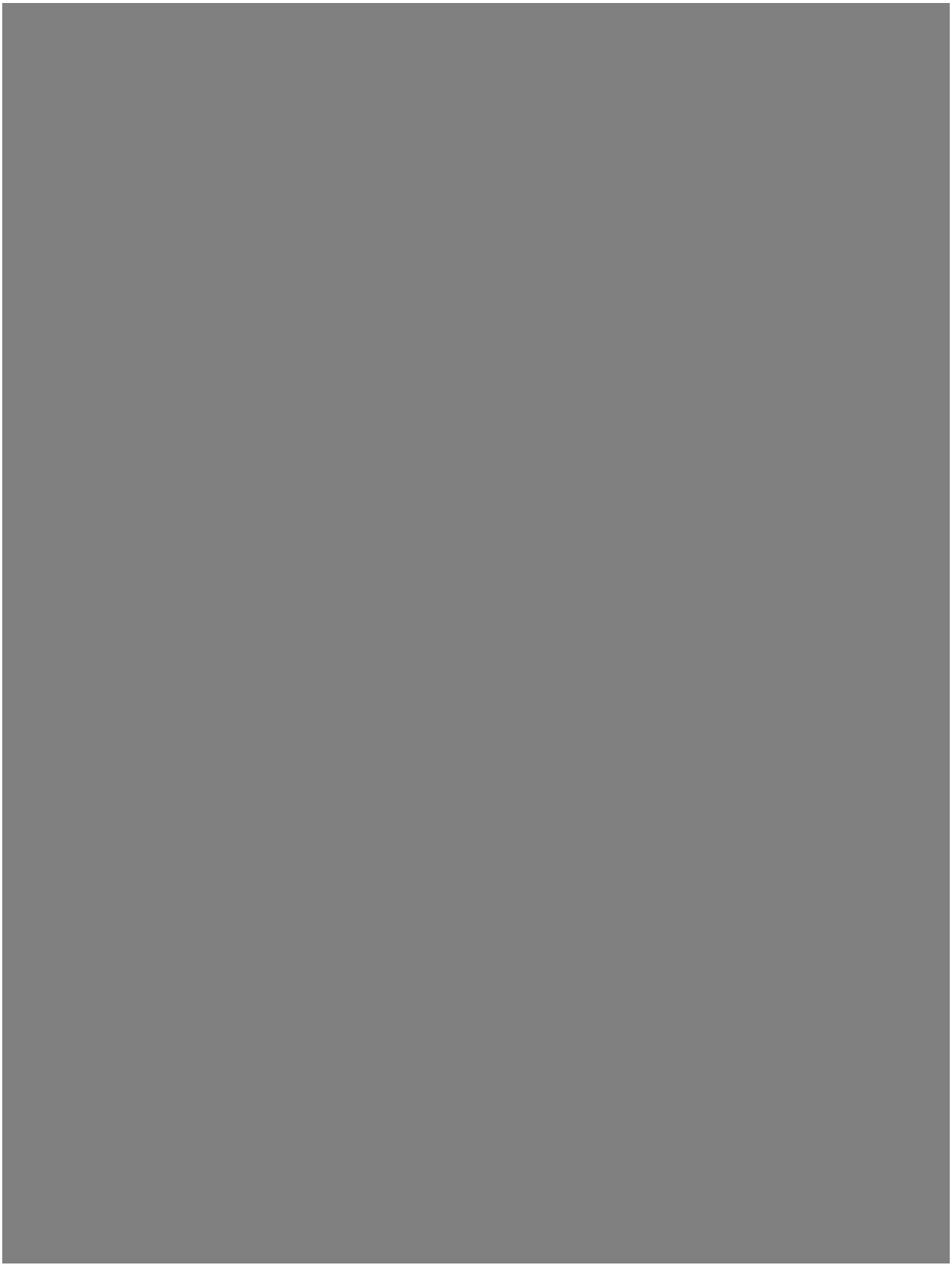


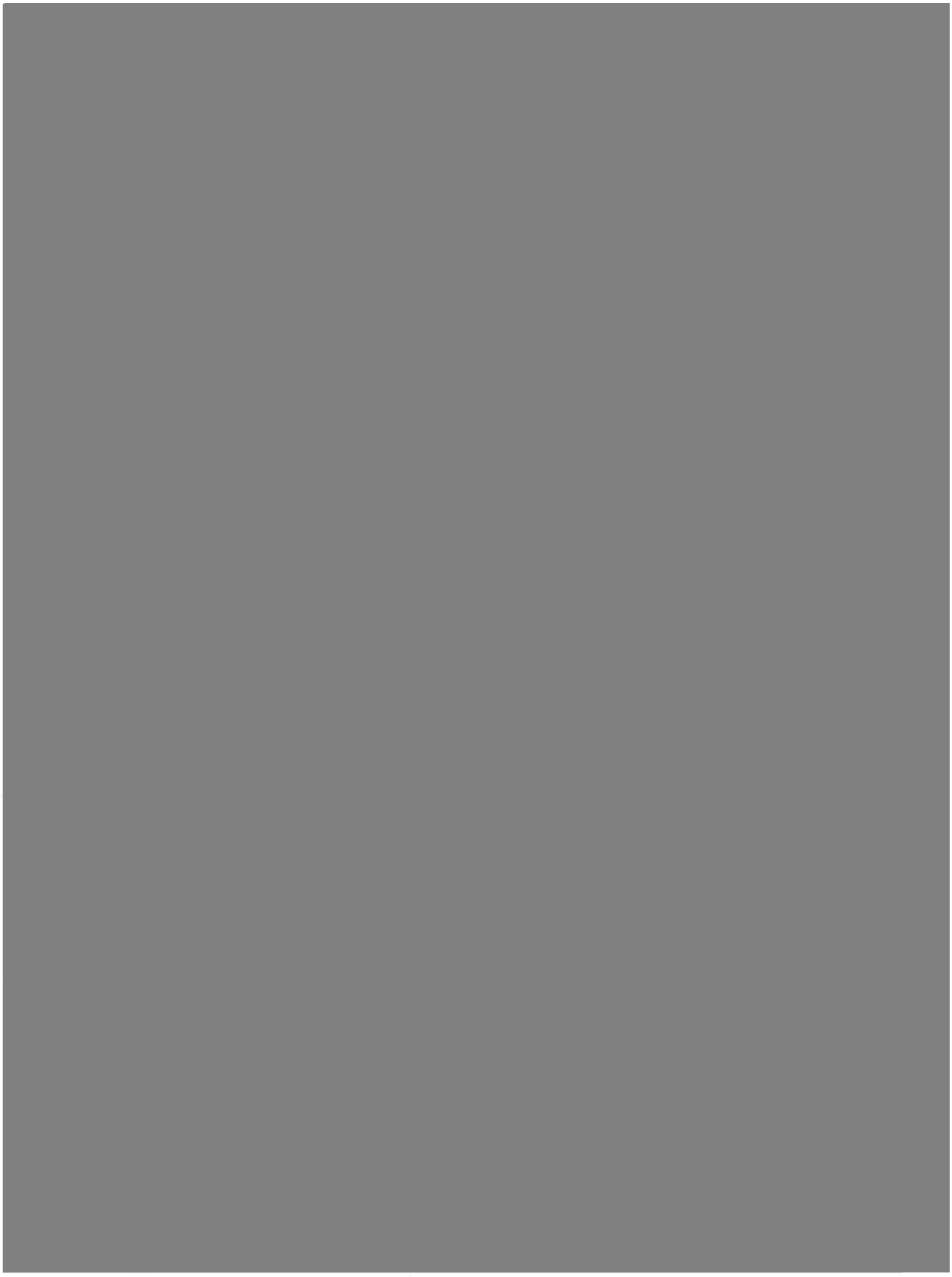












Appendix B Information and Consent Forms

B.1 School Sample

UNIVERSITY OF BIRMINGHAM

School of Psychology
University of Birmingham
Edgbaston
B15 2TT

27 June 2012

Dear Sir/ Madam

RE: Perception of substance use survey

My name is Blessing Marandure and I am a doctoral researcher under the supervision of Dr Hermine Graham at the University of Birmingham. I have been given permission by [redacted] to carry out a research study in the school. I would like to invite your son/daughter to take part in this research study. This study has received ethical approval from the NHS National Research Ethics Service.

Before you decide whether or not they should take part, you need to understand why the research is being done and what it would involve for your son/daughter. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask the researcher if there is anything that is not clear or if you would like more information.

What is the purpose of the study?
The study aims to understand attitudes to cannabis use among young people. It also looks at why non-users choose not to use cannabis and how use may change over time for those who use. The study will also look at how mental well-being influences these choices.

Who can take part?
People invited into this study can be male or female and they do not need to be cannabis users. They must be aged between 11-18 years. A total of 270 young people are being invited to take part.

Is taking part mandatory?
Participation in this research is voluntary, and your son/daughter does not have to take part if you do not wish them to (or if they do not wish to). All the information relating to the study will be explained to your son/daughter prior to taking part. They will also be free to withdraw from the study at any time without having to give a reason.

What will taking part involve?
Should you agree to let your son/daughter take part, they will be provided with a pack containing 4 questionnaires they need to complete. This will consist of: *The Cannabis and Young People Questionnaire*, *Resilience Scale for Adolescents*, *Community Assessment of Psychic Experiences*, and *Depression Anxiety Stress Scales.* It is anticipated that it will take no longer than 30- 35 minutes for your child to complete the questionnaires. Your son/daughter will be asked to complete the same questionnaires in a follow-up study 6 months from initial participation.

Confidentiality: What will happen to the results of the research study?

UNIVERSITY OF BIRMINGHAM

All the data collected will be kept anonymised and confidential, and will not be accessible to anyone else apart from the researcher. This information will not be passed on to parents or anyone else involved in your son or daughter's care. Participant identities will not be revealed in any of the publication of the results, and it will not be possible to identify individuals as no identifiable personal information will be recorded on the questionnaires.

Are there any risks involved in taking part?
As the questionnaires ask information on drug use and mental wellbeing, some young people may become worried about their answers to the questions. In order to minimise this risk, your son/daughter will be fully informed of their right to withdraw from the study at any point. They will not have to answer any questions that they do not wish to. Your son/daughter will also be made aware that all information collected will be treated as confidential and will not be passed on to anyone else. They will also be given the contact details of the relevant agencies where they can talk to someone about the issues explored in the study. The study supervisor, Dr Hermine Graham, is a qualified Clinical Psychologist and will provide advice where required.

So what's the point?
Information collected will improve the current knowledge base surrounding cannabis use, as not much research has been carried out in this age group. It may also be useful for informing preventative strategies aimed at this age group.

If you agree for your son/daughter to take part, you do not need to respond and they will be included in the study. However, if you <u>do not wish</u> for your son/daughter to take part, please let us know by filling out the reply slip below and returning it in the stamped self-addressed envelope provided.

Kind Regards

Blessing Marandure (Doctoral Researcher)
School of Psychology,
University of Birmingham
Edgbaston
B15 2TT
Email [redacted]

I_____ **<u>do not wish</u>** for my son/daughter_____

in form _____to take part in the research entitled:- **Perception of substance use survey**, being undertaken by Blessing Marandure under the supervision of Dr Hermine Graham.

Signed_____

Date_____

Version 4 25/03/12

UNIVERSITY OF BIRMINGHAM

Participant Information Sheet
Perception of substance use survey

We are asking you if you would join in a research project to find out about what young people think about using cannabis. Before you decide if you want to join in, it's important to understand why the research is being done and what it will mean for you. So please consider this information carefully. Talk to your family, friends, or tutor if you want to.

What is the study about?
We want to find out what young people think about using cannabis.

Why have I been invited to take part?
The study is for young people aged 11 to 18, and a total of 270 young people will be invited to take part.

Do I have to take part?
No. It is up to you. We will ask for your consent and then ask if you would sign a form. We will give you a copy of this information sheet and your signed form to keep. You are free to stop taking part at any time during the research without giving a reason.

What will I be asked to do?
You will be asked to fill out some questionnaires and this should take you about 30-45 minutes. After 6 months, you will be contacted again and asked to fill out the same questionnaires.

What are the risks?
There is little risk involved in taking part. However, some people may get worried about the information they give in the questionnaires. If you do, there will be contact details of different helplines you could get in touch with, and these will be given to you at the end. You do not have to answer any questions that you do not wish to answer.

What if I do not wish to continue at any stage?
You are free to stop taking part in the study at any time. Let the researcher know if you no longer wish to take part. You can refuse to answer any question, and may refuse to do anything requested of you.

What are the benefits?
The study will help our understanding of what young people think about cannabis use. However, there will be no direct benefits to you for taking part.

What happens to the information?
All information is completely confidential. Each questionnaire will be given a code and will not include your name or any information that could identify you. Your teachers, parents or friends **will not** be able to see any of the answers that you give. It will not be possible to identify you in any reports that will be written about the study.

Who has reviewed the study?
Before any research goes ahead, it has to be checked by a Research Ethics Committee. They make sure that the research is fair. This project was checked by the NHS Research Ethics Committee.

What else can I expect from the researcher?
You are free to ask any questions about the study. You may also ask for a copy of the results.

Thank you for reading this information sheet. If you would like any more information, you may contact the researcher (details below).

Blessing Marandure (Doctoral researcher)
School of Psychology
University of Birmingham
Edgbaston
Birmingham
B15 2TT
Email: [redacted]

UNIVERSITY OF BIRMINGHAM

CONSENT FORM for secondary school students
Study title: Perception of substance use survey
Researcher: Blessing Marandure

Please initial box

1. I confirm that I have read and understood the information about the above study that has been provided, and have had enough time to consider and ask questions about the study. I am satisfied by the answers given to my questions. ☐

2. I understand that I am taking part as a volunteer and that I am free to stop the study at any time without having to give a reason. ☐

3. I understand that data collected during the study may be looked at by individuals from regulatory authorities or from the NHS trust where it is relevant to my taking part in this research. I give my permission for these individuals to have access to my data. ☐

4. I agree to being contacted after 6 months to take part in the follow-up study. ☐

5. I agree to take part in the above study ☐

Name	Date	Signature
Researcher's Name	Date	Signature

Version 3 25/03/2012

UNIVERSITY OF BIRMINGHAM

Debriefing information

Thank you for taking part in the study. If any of the questions in the questionnaires worried you, or if you feel you need to talk to someone about cannabis use or mental well-being, please feel free to contact any of the following agencies who will be able to advise you:-

Youth to Youth helpline- 020 8896 3675 www.youth2youth.co.uk
Mind- 0845 766 0163 www.mind.org.uk
Talk to Frank- 0800 77 66 00 www.talktofrank.com
DrugsLine- 0808 1 606 606 www.drugsline.org

If you need any further help or advice, you may contact the researcher on the email address below.

Thank you

Blessing Banga

[redacted]

Version 1

UNIVERSITY OF BIRMINGHAM

Participant Information Sheet
Perception of substance use survey

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You will be asked to fill out some questionnaires and this should take you about 30-45 minutes. After 6 months, you will be contacted again and asked to fill out the same questionnaires.

What are the risks?
There is little risk involved in taking part. However, some people may get worried about the information they give in the questionnaires. If you do, there will be contact details of different helplines you could get in touch with, and these will be given to you at the end. You do not have to answer any questions that you do not wish to answer.

What if I do not wish to continue at any stage?
You are free to stop taking part in the study at any time. Let the researcher know if you no longer wish to take part. You can refuse to answer any question, and may refuse to do anything requested of you.

What are the benefits?
The study will help our understanding of what young people think about cannabis use. However, there will be no direct benefits to you for taking part.

What happens to the information?
All information is completely confidential. Each questionnaire will be given a code and will not include your name or any information that could identify you. Your teachers, parents or friends **will not** be able to see any of the answers that you give. It will not be possible to identify you in any reports that will be written about the study.

Who has reviewed the study?
Before any research goes ahead, it has to be checked by a Research Ethics Committee. They make sure that the research is fair. This project was checked by the NHS Research Ethics Committee.

What else can I expect from the researcher?
You are free to ask any questions about the study. You may also ask for a copy of the results.

Thank you for reading this information sheet. If you would like any more information, you may contact the researcher (details below).

Blessing Marandure (Doctoral researcher)
School of Psychology
University of Birmingham
Edgbaston
Birmingham
B15 2TT
Email:

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Parent Information Sheet

Research on cannabis use in adolescents.

We would like to invite your son/daughter to take part in a research study. Before you decide whether or not they should take part, you need to understand why the research is being done and what it would involve for your son/daughter. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask the researcher if there is anything that is not clear or if you would like more information.

What is the purpose of the study?
The study aims to understand attitudes to cannabis use among young people. It also looks at why non-users choose not to use cannabis and how use may change over time for those who use. The study will also look at how mental well-being influences these choices.

Who can take part?
People invited into this study can be male or female and they do not need to be cannabis users. They must be aged between 11-16 years. A total of 270 young people are being invited to take part, and some of them will be from a local secondary school.

Is taking part mandatory?
Participation in this research is voluntary, and your son/daughter does not have to take part if you do not wish them to (or if they do not wish to). All the information relating to the study will be explained to your son/daughter prior to taking part. They will also be free to withdraw from the study at any time without having to give a reason.

What will taking part involve?
Should you agree to let your son/daughter take part, they will be provided with a pack containing 4 questionnaires they need to complete. This will consist of: *The Cannabis and Young People Questionnaire*, *Resilience Scale for Adolescents*, *Community Assessment of Psychic Experiences*, and *Depression Anxiety Stress Scales.* It is anticipated that it will take no longer than 30- 45 minutes for your child to complete the questionnaires. Your son/daughter will be asked to complete the same questionnaires in a follow-up study 6 months from initial participation.

Confidentiality: What will happen to the results of the research study?
All the data collected will be kept anonymised and confidential, and will not be accessible to anyone else apart from the researcher. This information will not be passed on to parents or anyone else involved in your son or daughter's care. Participant identities will not be revealed in any of the publication of the results, and it will not be possible to identify individuals as no identifiable personal information will be recorded on the questionnaires.

Are there any risks involved in taking part?
As the questionnaires ask information on drug use and mental wellbeing, some young people may become worried about their answers to the questions. In order to minimise this risk, your son/daughter will be fully informed of their right to withdraw from the study at any point. They will not have to answer any questions that they do not wish to. Your son/daughter will also be made aware that all information collected will be

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treated as confidential and will not be passed on to anyone else. They will also be given the contact details of the relevant agencies where they can talk to someone about the issues explored in the study. The study supervisor, Dr Hermine Graham, is a qualified Clinical Psychologist and will provide advice where required.

So what's the point?
Information collected will improve the current knowledge base surrounding cannabis use, as not much research has been carried out in this age group. It may also be useful for informing preventative strategies aimed at this age group.

If you are happy for your son/daughter to take part, please let us know by filling out the consent form and returning it on your next appointment. When you return the consent form, your son/daughter will be given the questionnaires to fill in.

Kind Regards

Blessing Banga (Doctoral Researcher)
School of Psychology,
University of Birmingham
Edgbaston
B15 2TT
Email:

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CONSENT FORM for parents for CAMHS sample
Study title: Factors Influencing Cannabis Use in Young Adolescents
Researcher: Blessing Banga

Please initial box

1. I confirm that I have read and understood the information sheet dated 3/10/11 (version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my son/daughter's participation is voluntary and that they are free to withdraw at any time without giving any reason, without their medical care or legal rights being affected. ☐
3. I understand that data collected during the study may be looked at by individuals from regulatory authorities or from the NHS trust where it is relevant to my son/daughter taking part in this research. I give my permission for these individuals to have access to my son/daughter's data. ☐
4. I agree to being contacted after 6 months for my son/daughter to take part in the follow-up study. ☐
5. I agree to my son/daughter taking part in the above study. ☐

_____	_____	_____
Name	Date	Signature
_____	_____	_____
Researcher's Name	Date	Signature

Version 2 3/10/2011

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Debriefing information

Thank you for taking part in the study. If any of the questions in the questionnaires worried you, or if you feel you need to talk to someone about cannabis use or mental well-being, please feel free to contact any of the following agencies who will be able to advise you:-

Youth to Youth helpline- 020 8896 3675 www.youth2youth.co.uk
Mind- 0845 766 0163 www.mind.org.uk
Talk to Frank- 0800 77 66 00 www.talktofrank.com
DrugsLine- 0808 1 606 606 www.drugsline.org

If you need any further help or advice, you may contact the researcher on the email address below.

Thank you

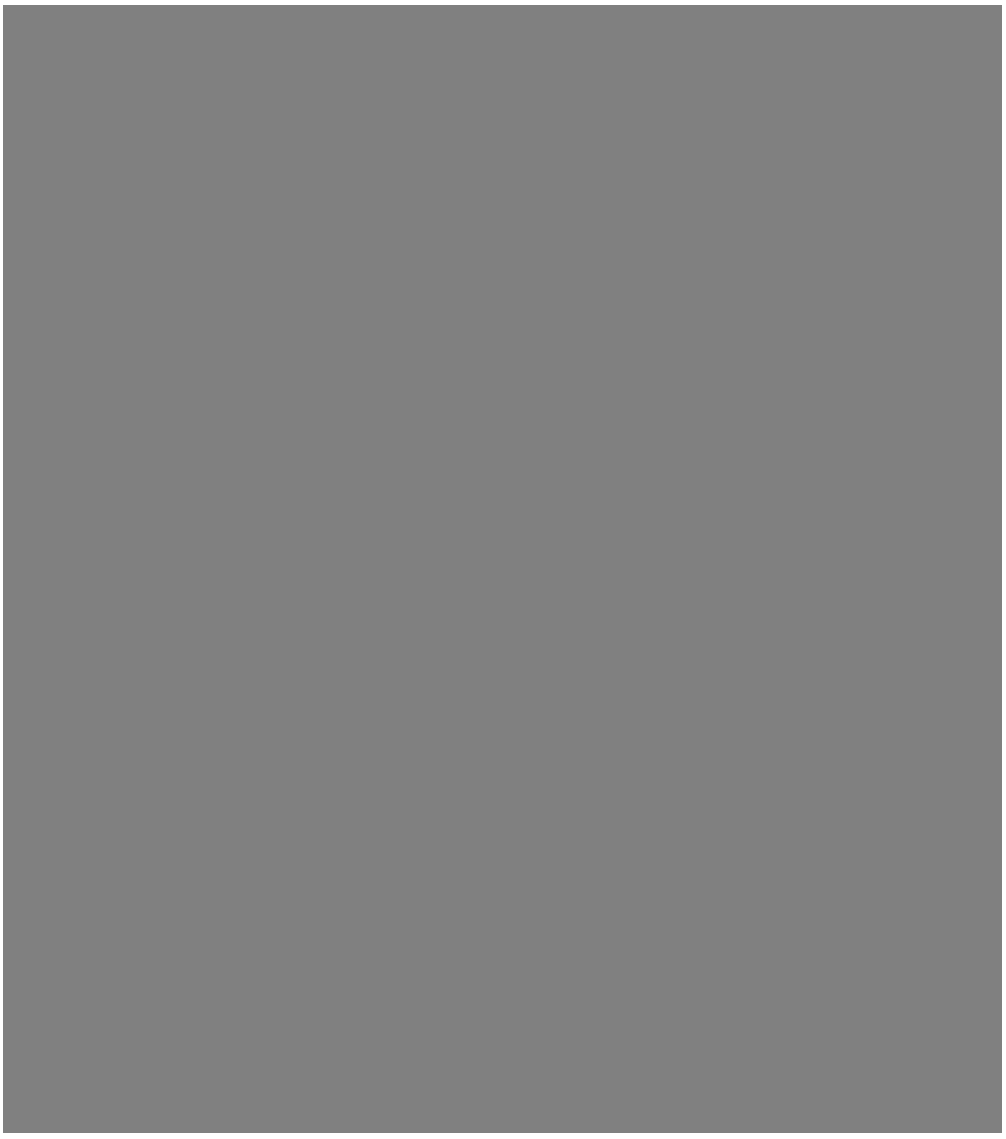
Blessing Banga

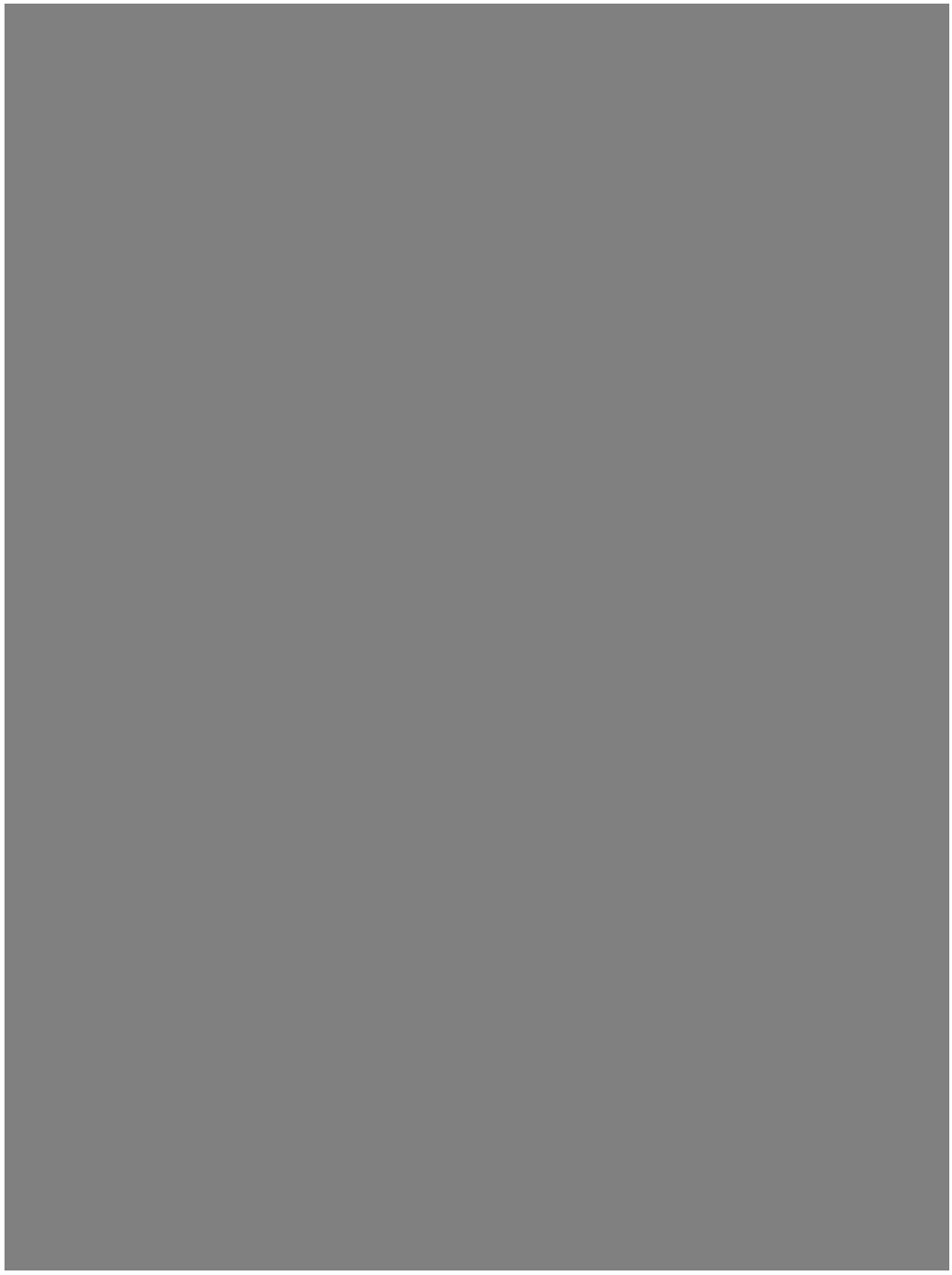
[redacted]

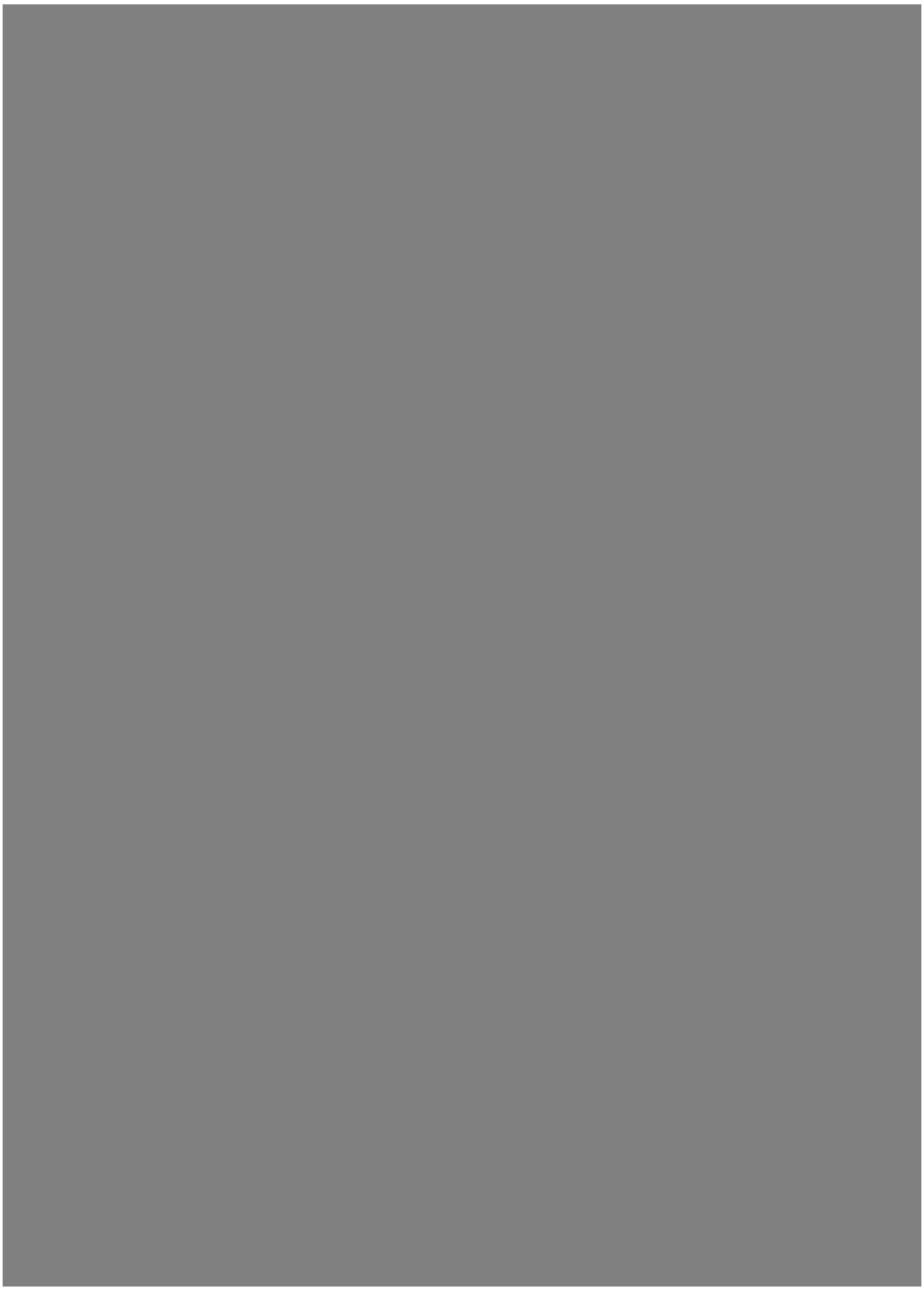
Appendix C Measures

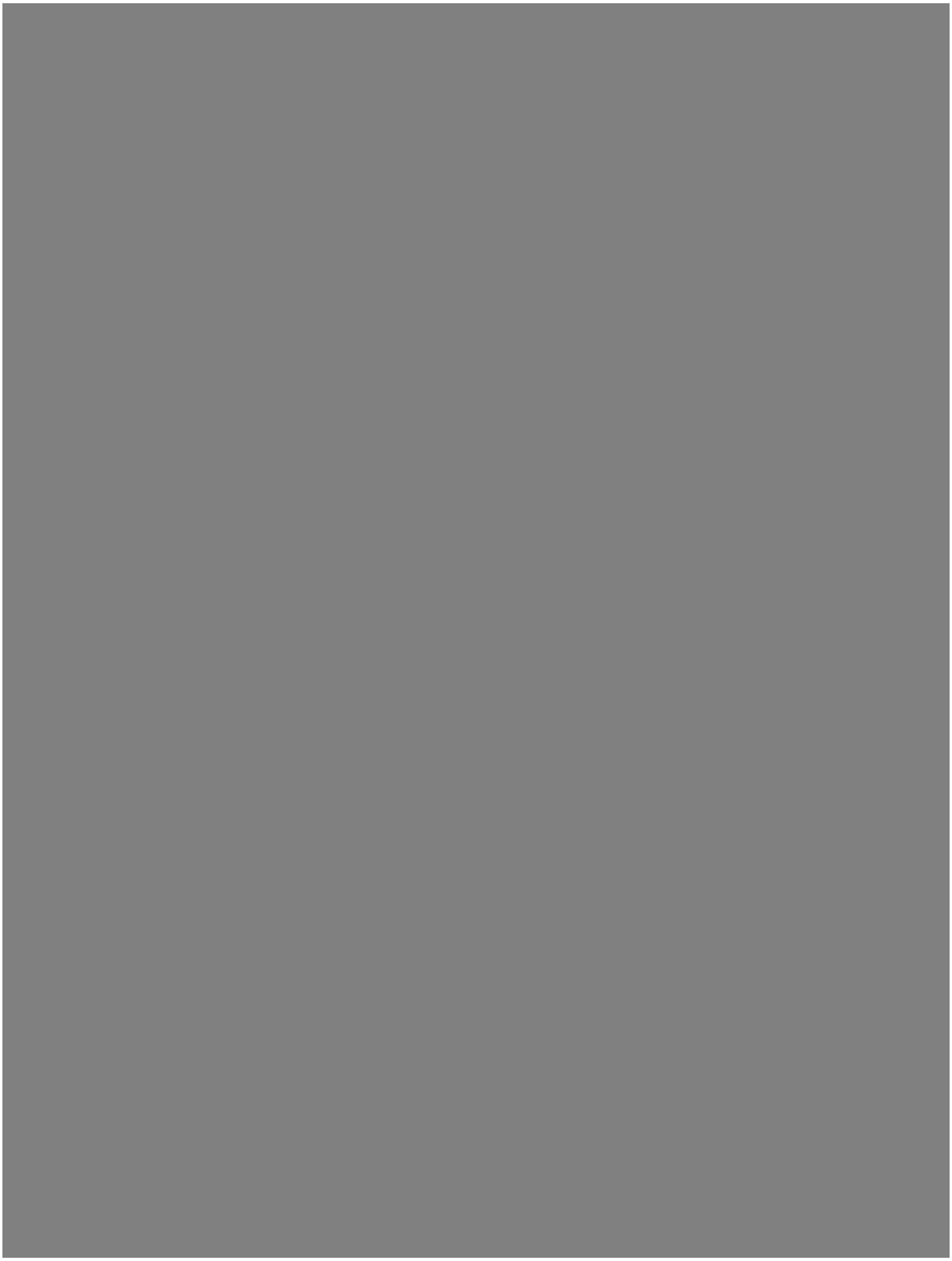
C1

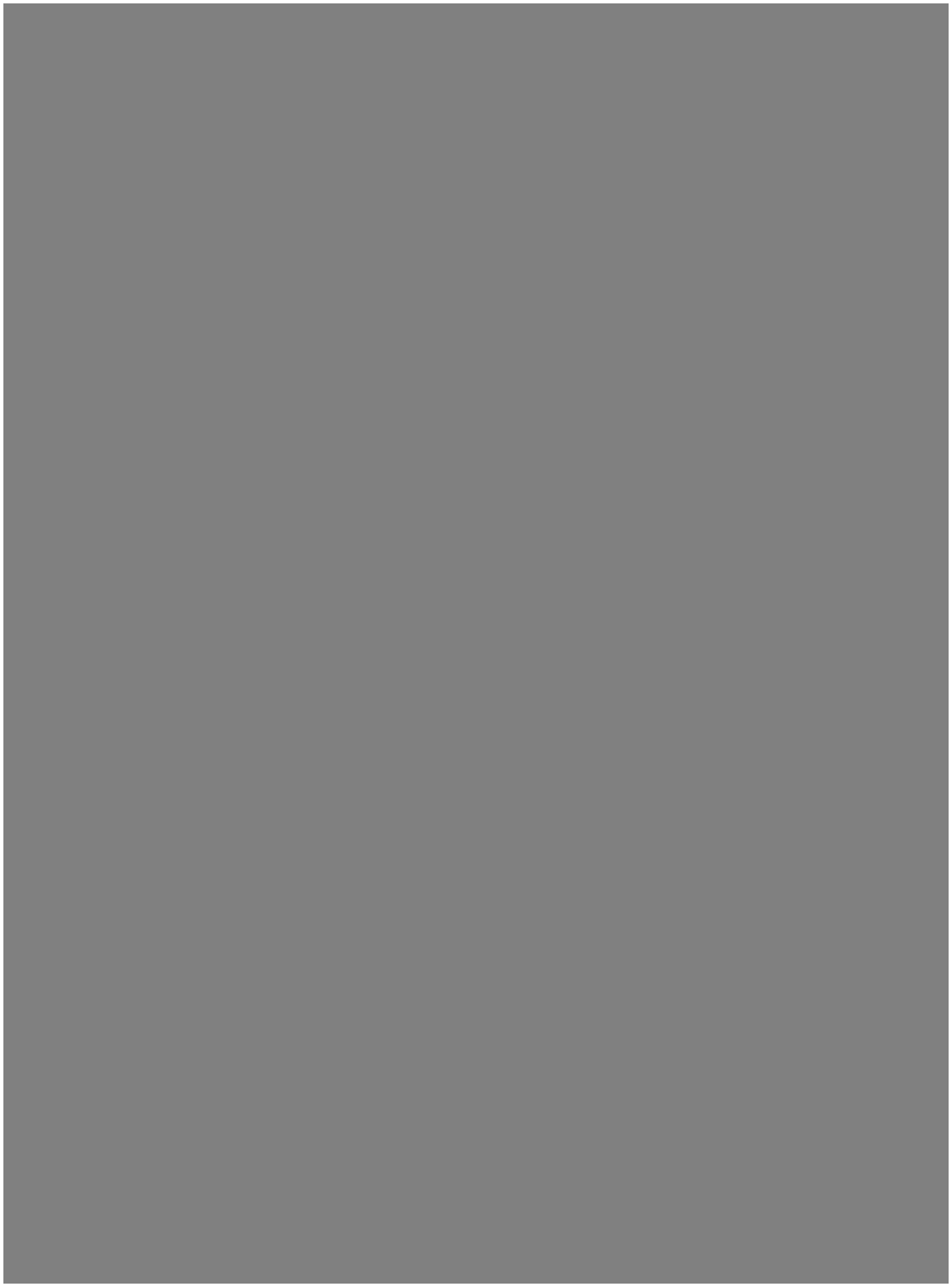
Cannabis & Young People Questionnaire

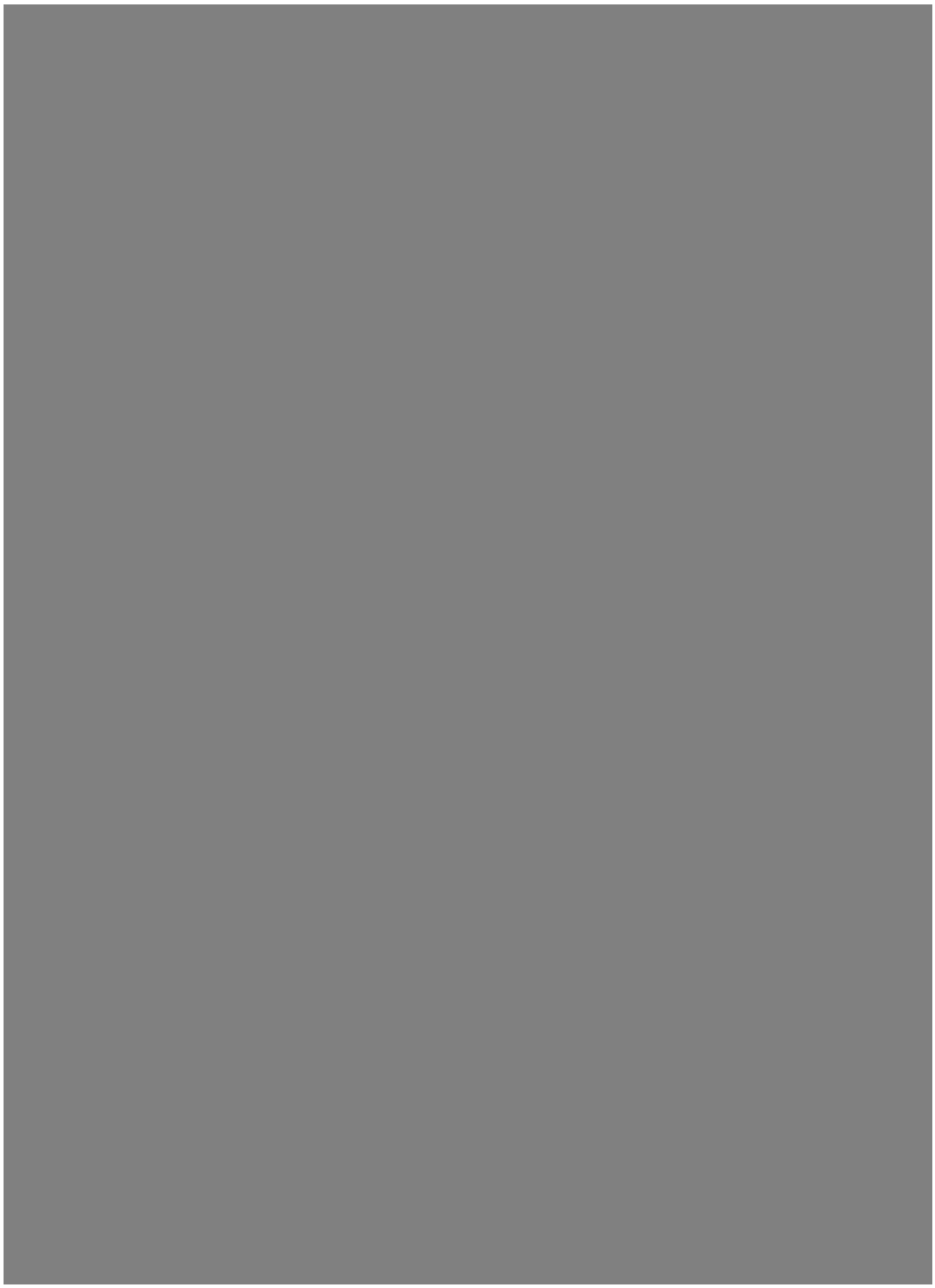


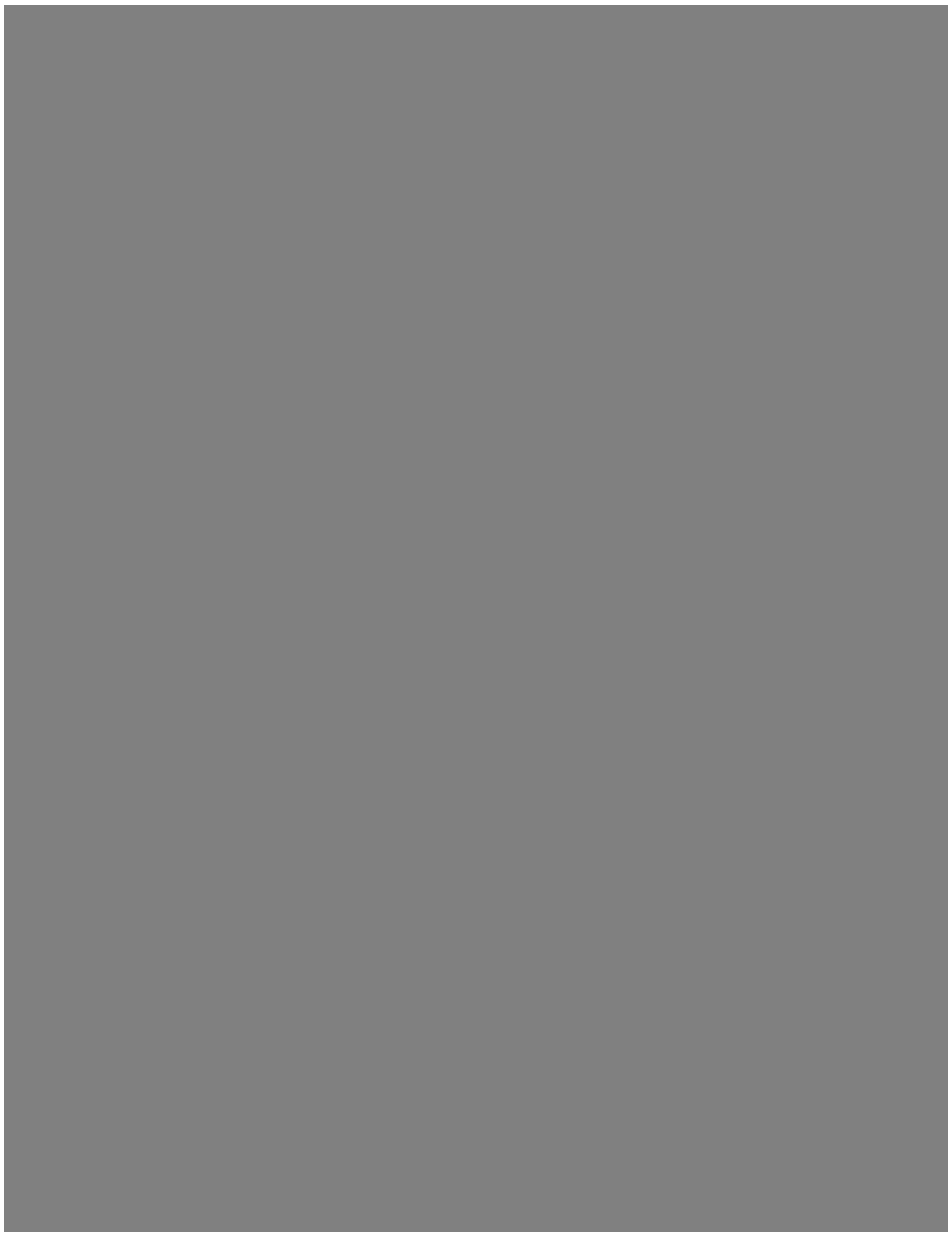


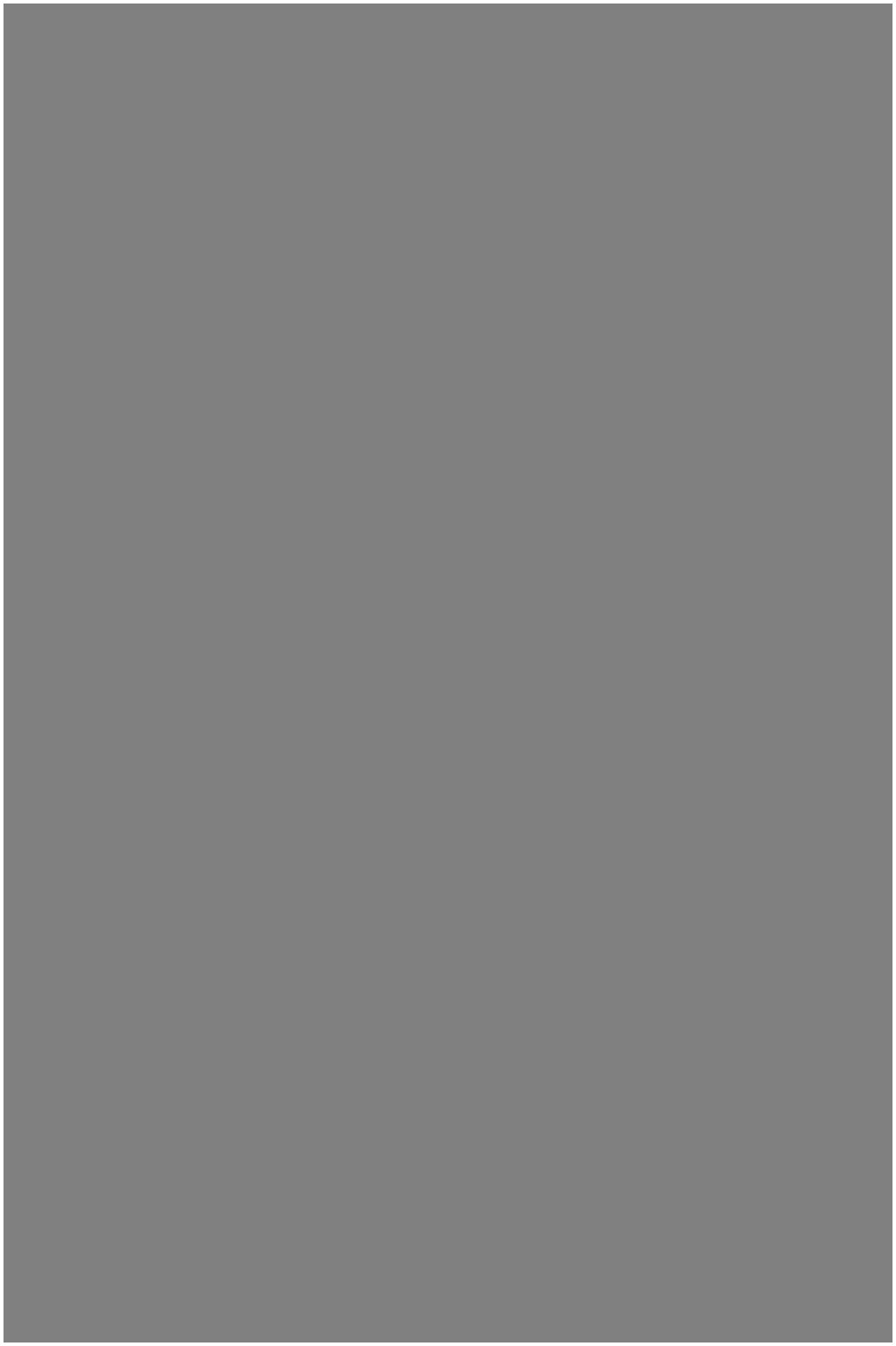


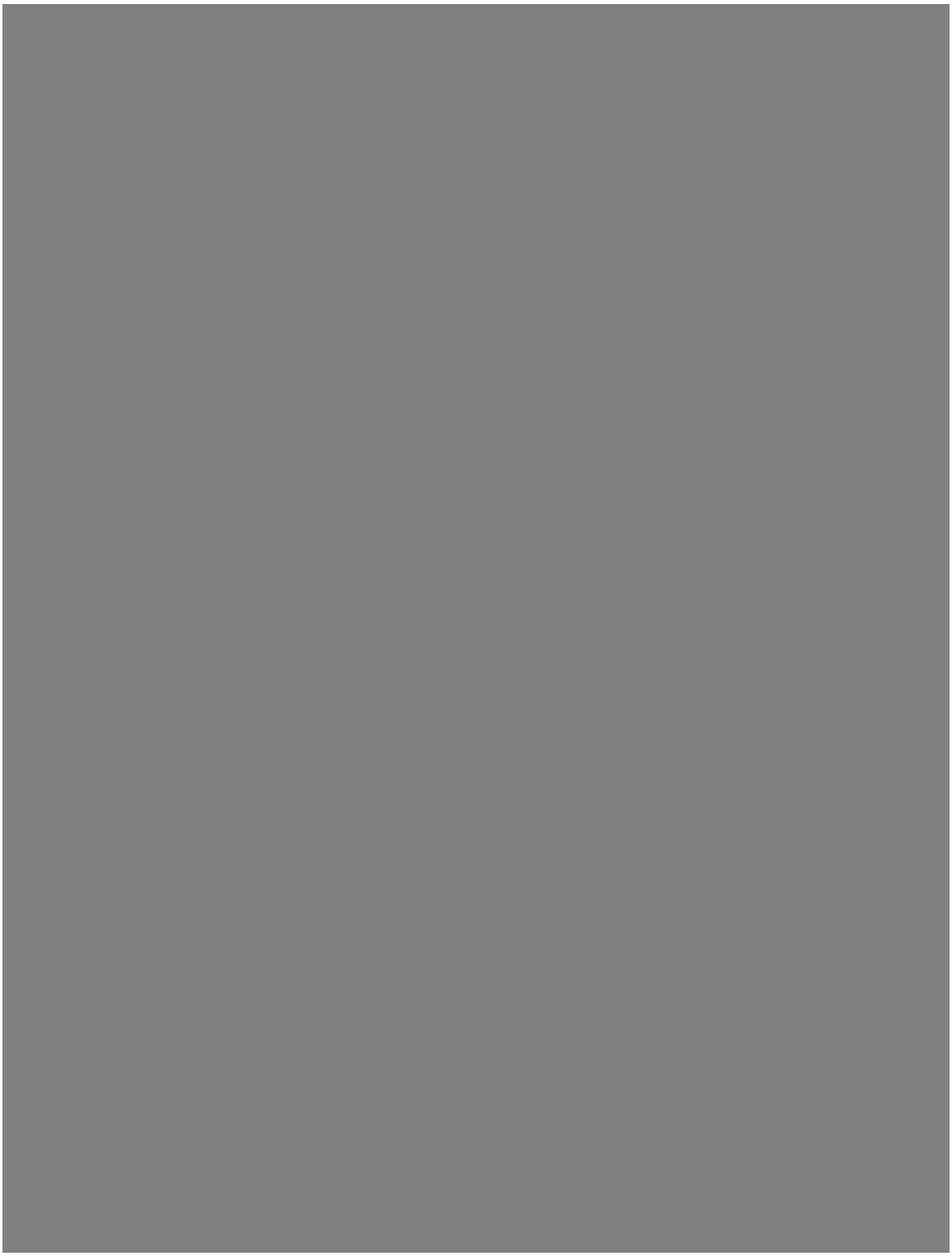


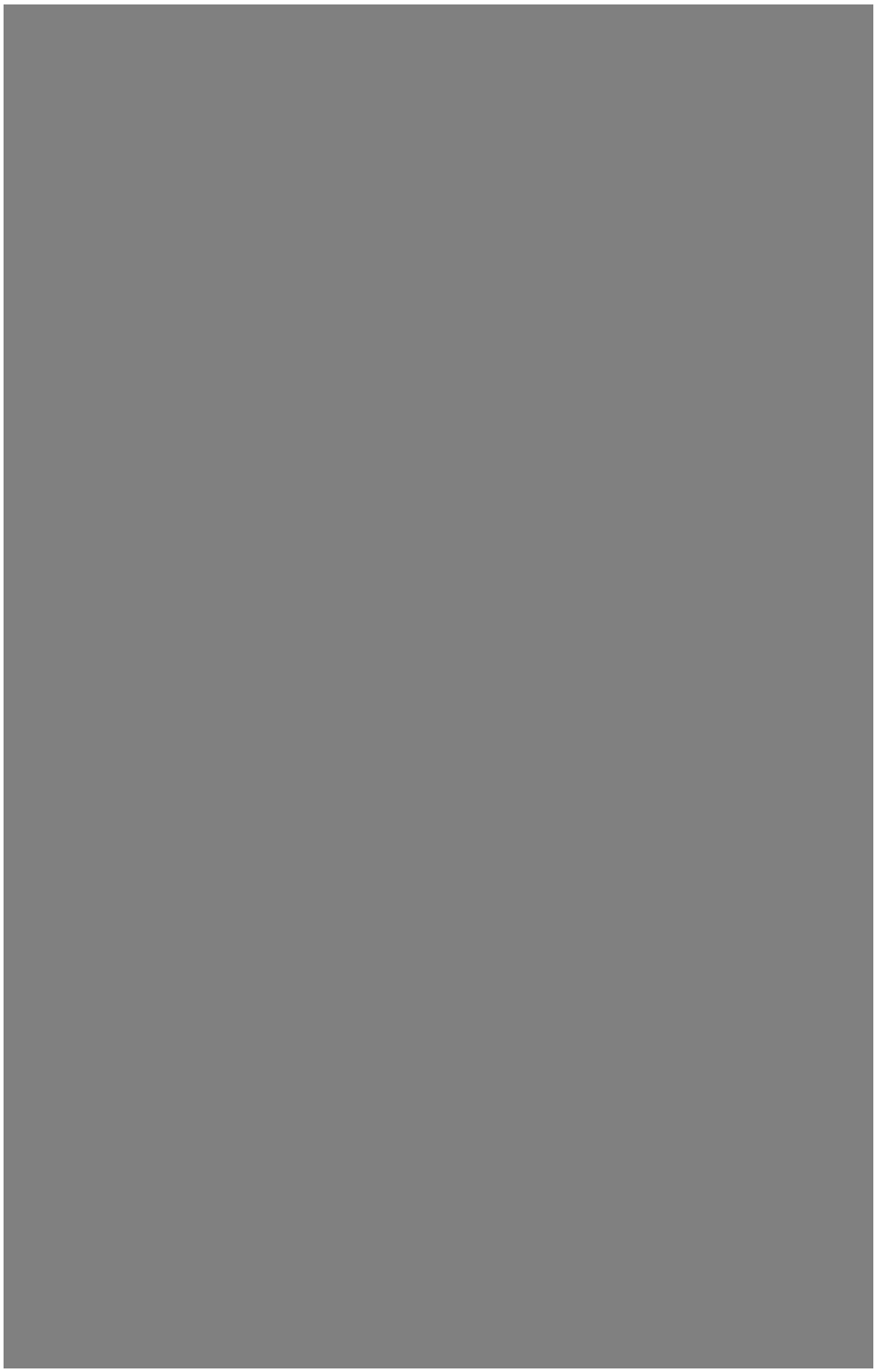


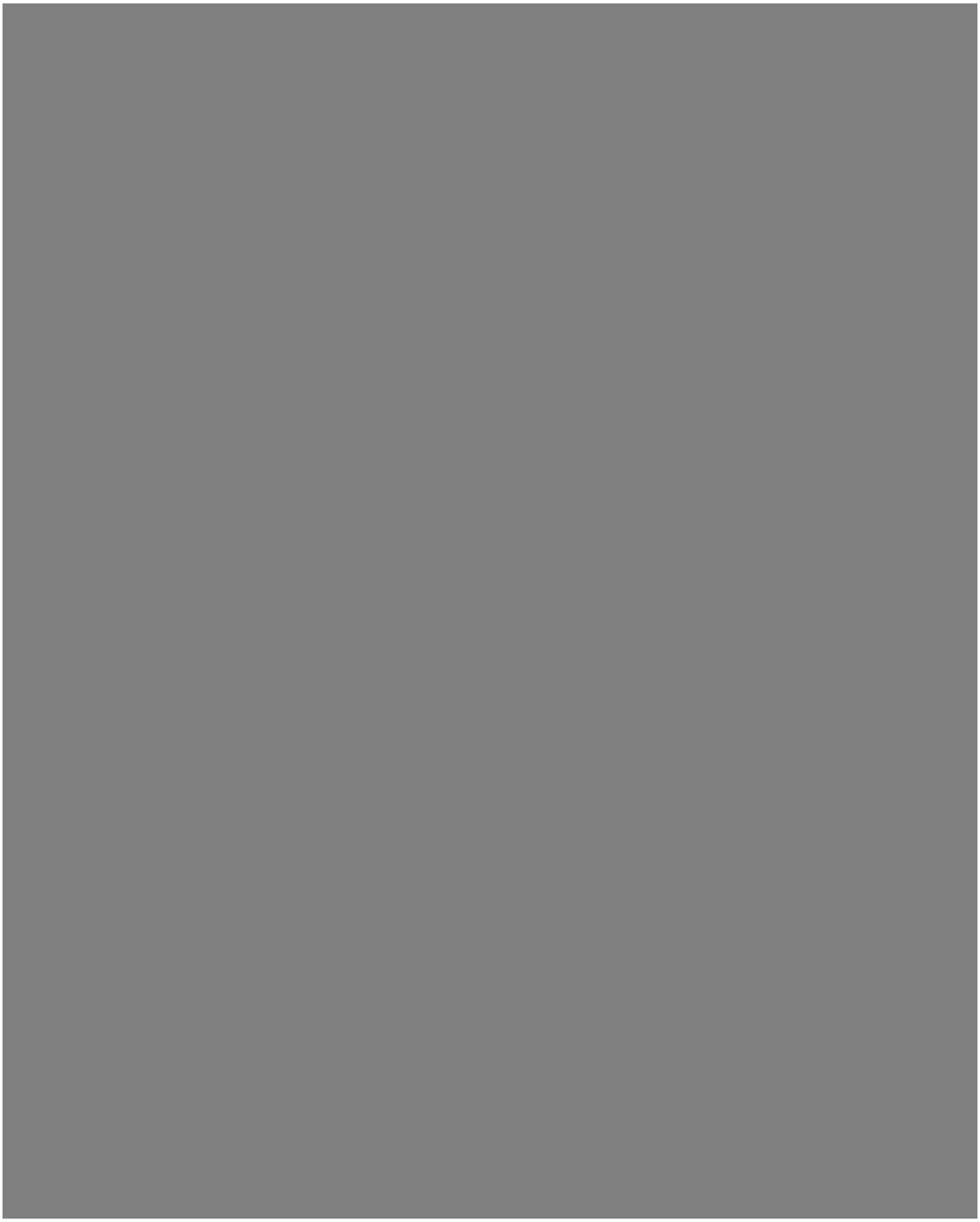






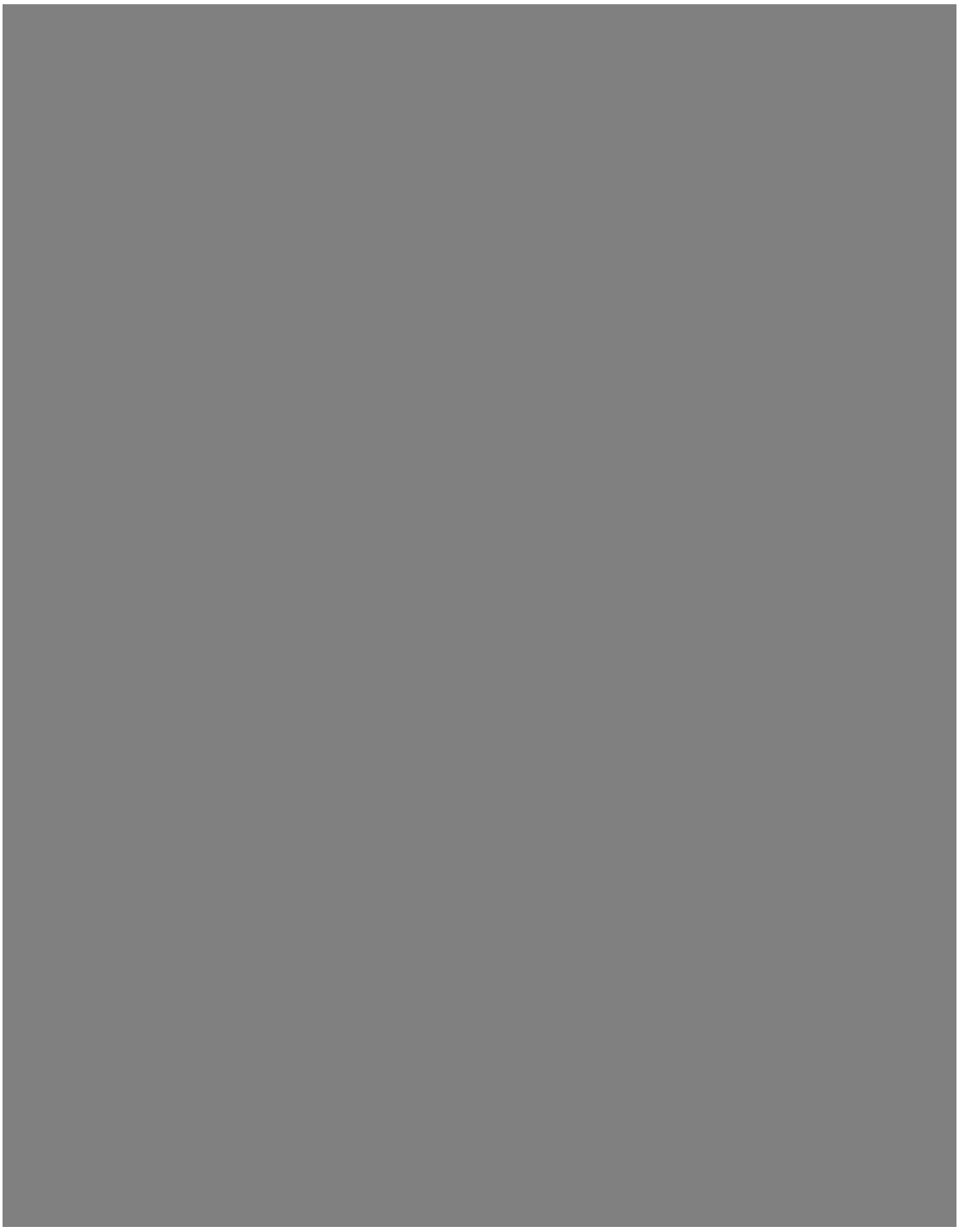






C2

Resilience Scale for Adolescents



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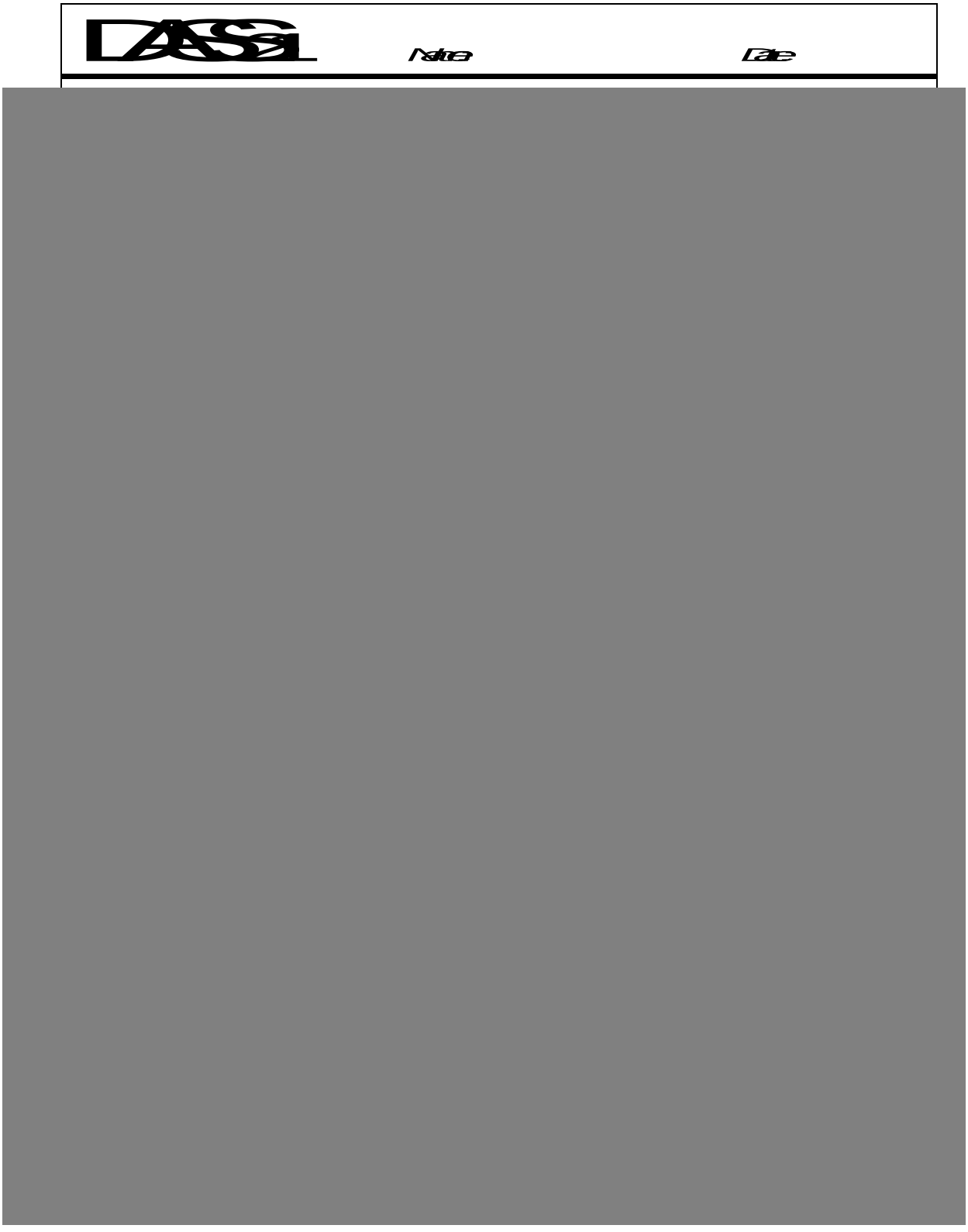

C4

Community Assessment of Psychic Experiences -Positive Symptoms Scale