Investigating illicit drug use in adolescent students in England

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I declare that this thesis is my own work and has not been submitted for the award of a higher degree elsewhere

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List of abbreviations

SSSL	Social Structure Social Learning
SS	Social Structure
SL	Social Learning
SDDS 2016	Smoking Drinking Drug Use Survey 2016
OR	Odds Ratio
UK	United Kingdom
WHO	World Health Organization
UNICEF	United Nations Children's Fund
UN	United Nations
NDTMS	National Drug Treatment Monitoring Systems
IV	Independent Variable
DV	Dependent Variable
MV	Mediator Variable
TE	Total Effect
IE	Indirect Effect
NHS	National Health Service
MDA 1971	Misuse of Drugs Act 1971

Dedication

I would like to express my deepest gratitude to my very own marvel of superhero supervisors, guides and mentors Dr. Eugenio Zucchelli and Dr. Caroline Swarbrick for their expert guidance. I am truly very grateful for the time they have invested in helping me develop the thesis to the stage it has reached today. Second, I would like to express my gratitude to Prof. Elizabeth McDermott, Dr. Mark Limmer, Prof. Nancy Preston and Dr. Guillermo Algorta and Prof. Siobhan Reilly for their recommendations and suggestions at various stages of the thesis development.

Abstract

The Smoking Drinking Drug Use Survey of adolescents aged 11 to 15 years living in England shows that lifetime drug use by adolescents aged 11 to 15 years has increased (15% to 24%) from 2014 to 2018 (NHS Digital, 2017, 2021b). This upward trend is despite the implementation of drug policies focused on reducing supply, possession, and manufacture of illicit drugs. Based on the premise that drug use is a socially learnt behaviour, the main objective of this research is to investigate whether social learning factors (imitation, parental reinforcement, peer association and attitudes to drug use) mediate drug use in adolescents aged 11 to 15 years living in England. The second objective is to identify which social learning factors mediate drug use by ages, region, and gender.

Using the Social Structure Social Learning (SSSL) theory as a framework for the research, this study contributes to the literature by identifying a) the strongest social learning behaviour for each age, gender and region in England and b) the mechanism (mediation) by which social learning affects drug use. This research employs rich data on drug use drawn from the Smoking Drinking Drug Use Survey 2016, a cross-sectional survey of adolescents aged 11-15 years across England (as of October 2021 the data for the most recent survey 2018 was not available for analysis). Mediation analysis was used to evaluate which social learning factors mediate the association between age, gender, region and drug use. The results showed that there were differences in learning behaviours that were specific to age, gender and region. For example, the most significant social learning behaviour for drug use among boys was “imitation of friends”, whilst for females, it was “peer association” among females (i.e. having a perception that peers are using drugs). In addition, having “positive attitudes to glue” (i.e. “it is ok to try glue”) was the strongest learning behaviour for drug use among younger individuals (i.e. at ages 11 to 13). Furthermore, whilst in Northern England, the strongest learning behaviour was having “positive attitudes to cannabis”, in London peer

association was found to be the strongest learning pathway to drug use. Family disapproval of drug use (“persuade me not to take drugs”) was found to be a protective factor against drug use for all ages except for age 11 and 12 years and those living in the East Midlands and London. In these cases, strong parental disapproval (“stop me from taking drugs”) was found to be a protective factor.

This research offers two main contributions to the literature. First, it shows empirical linkages between constructs built using SSSL theory that have not been previously explored within a population of young adolescents in England. Second, it identifies the effects and degree to which social learning affects the relationship between drug use and social structure. Overall, this research also contributes to an improved theoretical rationale for existing SSSL associations; that is, social learning can behave as a mediator or a moderator depending on the context.

The evidence produced by this thesis could also have potentially relevant policy implications. More specifically, the differences in the social learning behaviours may suggest the need to implement more targeted prevention policies aimed by age, gender and regional groups of young adolescents.

Chapter 1:

1. Introduction

1.1. Background

Trade in illicit drugs is a multibillion-pound industry and it remains attractive to drug gangs and suppliers, who are constantly shifting and adapting to market conditions (Décary-Hétu & Giommoni, 2017). An example of a recent shift was the advent of cheaper, more potent and accessible synthetic drugs marketed as 'legal highs' or 'new psychoactive substances' (such as Spice, bath salts, Kitkat, Kryptonite) (Corazza et al., 2013; Corazza et al., 2014; Davies et al., 2010; Morgan et al., 2010; Morgan et al., 2013; O'Neill, 2014). Despite strict laws and regulations controlling possession and supply of illicit drugs (McCambridge & Strang, 2005; Morgan et al., 2010), the United Kingdom is considered to have the largest and most accessible dark net market for cocaine, cannabis and other drugs such as legal highs in the whole of Europe (UNODC, 2013, 2020). Unlike prescription drugs, illicit drugs carry no dosage instructions or adverse reaction warnings and vary in their toxicology profiles in terms of chemical composition, contaminants, and purity levels (Armstrong et al., 2012; Davies et al., 2010; Schifano et al., 2003). Behaviours such a drug use or crime are considered risky because they have the propensity to harm not only those who engage in them but also those around them and society in general (Ammerman et al., 2018; Smith et al., 2013; Steinberg, 2004, 2007). Hence, researchers and policy makers have been invested in finding a solution to this risky behaviour that is regarded as a problem.

1.2. Definition of drug use

In the United Kingdom, problem drug users are defined as, 'those who experience social, psychological, physical or legal problems related to intoxication and/ or regular excessive consumption and/or dependence as a consequence of their own use of drugs or other chemical substances; and those whose drug use involves, or could lead to, the sharing of injecting equipment' (Advisory Council on the Misuse of Drugs, 1982:34). The International

Classification of Diseases of the WHO (11th Edition) on the other hand defines problem drug use as use that causes mental disorders, sexual dysfunction, sleep-wake disorders and withdrawal symptoms (World Health Organization, 2019). These withdrawal symptoms can cause irreversible neuronal changes which drive uncontrolled drug seeking behaviour, or in other words, addiction (Ballantyne et al., 2012). Both these definitions appear to be attempts to conceptualise drug use behaviours as a public health problem with a focus on those who use regularly or excessively.

However, it is against this background of problematic drug use definitions, that some researchers argue that drug use of any amount, among adolescents is problematic (Spooner & Hetherington, 2005) —– simply because use of any type or quantity of illicit drugs is illegal. Still, other scholars have a different school of thought —– that drug use during adolescence is often experimental and should be considered a normative part of growing up (Aldridge et al., 2013; Briggs, 2012; Measham et al., 1994; Measham & Shiner, 2009; Parker et al., 1998). Thus, given the heterogeneity in the nomenclature, the definitions of drug use behaviours (e.g. problematic, experimental, addictive) are open to various interpretations and is beyond the scope of this research. For the purpose of this study, drug use is concerned with the consumption of illicit substances and no assumption or attempts are made to further delineate the nature of the drug use behaviour.

1.3. Why focus on adolescents?

Adolescence is a developmental and transformative period marked by the emergence of risk taking behaviours (Collado et al., 2014; Gullo & Dawe, 2008; Smith et al., 2013; Steinberg, 2007) that start during early adolescence and escalate into late adolescence (Ammerman et al., 2018; Arnett, 2014; Reyna & Farley, 2006). Evidence suggests that very few children initiate illicit drug use before eight years of age and the risk of experimentation rises during adolescence for each year between the age of 10 to 18 years (Bennett, 2014; Johnston, 2010; Sloboda et al., 2012). Furthermore, neurological changes involving rewiring of synapses in

the brain (either pruning of old or making new synapse connections, changes in the architecture of the brain such as development of the prefrontal cortex), means that adolescents are sometimes unable to make decisions and judgements based on sound reasoning (Milkman & Wanberg, 2012).

Compared to adults, adolescents who consume illicit drugs are disproportionately harmed due to their smaller physiological composition. That is, the same amount of drug can have a higher risk of adverse drug reactions in adolescents due to differences in absorption, distribution, metabolism and elimination (Poon et al., 2016; Squeglia et al., 2009). Drug users in general are susceptible to serious harm such as poisoning, paranoia, delusions, death, behavioural changes such as violence and involvement in criminal activity (Barnard et al., 2016; Meschke & Patterson, 2003; Sloboda et al., 2012). In fact, several studies also suggest that initiation of drug use in adolescence may set the stage for lifelong difficulties such as dependence, effects on memory, learning, behaviour, premature transitions to adulthood, crime and deviance (Dodge et al., 2009a; Sanchez-Marin et al., 2017; Sutherland, 2012; Wittchen et al., 2008). More specifically, exposure to illicit drug use during early adolescence between the ages of 10 to 16 (Odgers et al., 2008; Wittchen et al., 2008) increases the risk of drug dependence in adulthood and other poor outcomes such as low educational attainment and crime amongst others (Bryant et al., 2003; Dodge et al., 2009b; Moss et al., 2014; Swift et al., 2012; Townsend et al., 2007; White & Batty, 2012). This means that the window of opportunity for targeted public health intervention during this period of development to prevent progression along the drug use spectrum to dependence is very small. Therefore, this developmental stage provides a pivotal opportunity for policy makers to introduce interventions that have the capacity to either reinforce or alter drug using experiences during adolescence into adulthood (Barsky, 2014; Patnode et al., 2014; Sloboda et al., 2012).

1.4. Social costs of illicit drug use

In the United Kingdom, illicit drug use is a significant public health concern (Stead et al., 2001). Approximately 5.9 percent of the total population in the England, equating to 3.4 million, are adolescents aged between 11 and 15 years (Office for National Statistics, 2021b). Of this age group, 24 percent have used an illicit drug at least once in their lifetime in 2016 and 2018 (NHS Digital, 2021b). This statistic is supported by European research on drug use which shows that young people in the UK not only start taking drugs at an earlier age but are more likely to have consumed illegal drugs than their peers in the rest of Europe, more specifically the lifetime prevalence for cocaine, cannabis, MDMA and amphetamines in school age students (15-16 years) is 34% in the UK compared to 1.9% in the European Union (European Monitoring Centre for Drugs and Drug Addiction, 2021). Similarly, hospital admissions data show that poisoning and illicit drug related mental and behavioural disorders admissions increased by 8% from 773 in 2017/18 to 833 in 2020/21 for adolescents aged 10-15 years (NHS Digital, 2018, 2021a). During the same period there has been an increase in death rates of those aged between years due to accidental poisoning from illicit drugs from 33 (2017) to 40 (2020) (Office for National Statistics, 2021a). Data from the National Drug Treatment Monitoring System (NDTMS) however show that the number of children under the age of 15 years under treatment is at 7650 in 2020, with 168 fewer presentations from the previous year (Public Health England, 2021). Cannabis followed by ecstasy and cocaine were the most popular drugs by this cohort. The independent review of drugs (part 1) also highlighted that whilst the spend on illicit drugs in 2016/17 in England and Wales was £9.4 billion the social costs to the NHS was double that at circa £20 billion; the report also recognised that drug use in adolescents aged 11-15 years is on the increase since 2016 (Black, 2021)

One of the most consistent research findings on drug use in adolescents is that social influences are central to promoting experimentation and initiation (Akers & Sellers, 2004; Cousineau et al., 1993; Fletcher & Bonell, 2013; Hawkins et al., 1992; Meschke & Patterson,

2003; Spooner & Hall, 2002; Sutherland & Shepherd, 2001b). Over recent years there has been a growing interest in the application of the Social Structure Social Learning (SSSL) theory in studying the pathways to drug use in adolescents (Kim, 2010; Lanza-Kaduce & Capece, 2003; Solakoglu & Yuksek, 2020). Aker's SSSL theory is an integrative cross-disciplinary theory and can be applied to the adolescent age group because it encompasses some important notions: the influence of social structural location (age, gender and region for example) on adolescents and the context in which social learning exposures (parental reinforcement, peer association, imitation and attitudes to drug use) mediate drug use. In other words, this approach provides a framework to assess how these social learning factors (peer association, imitation, attitudes and parental reinforcement) mediate the relationship between age, gender, region and drug use. The utility of the SSSL theoretical framework is discussed in detail in the next chapter.

1.5. Aim and Objectives of the research—Purpose of the study

The overarching aim of this research is to identify the social learning pathways to drug use among English adolescent students for each age between 11 to 15 years using the Social Structure Social Learning Theory (SSSL) as a conceptual framework. Data representing these concepts are available from a secondary dataset called the Smoking Drinking and Drug Use Survey 2016 (SDDS 2016) (NHS Digital, 2017). As the SDDS 2016 database covers adolescents in schools from the age of 11 to 15, this age range will form the focus of the study. To achieve this goal, the research will fulfil the following objectives:

1. To identify the association between **social structural** constructs (age, region and gender) with drug use
2. To determine the association between **social learning** constructs (imitation, peer association, parental reinforcement and attitudes) with drug use
3. To determine statistically significant social learning pathways for drug use by age (11 to 15 years), by gender and by region across England.

1.6. Research Questions and Hypotheses

The corresponding research questions developed to meet the above-mentioned objectives and address the gaps identified in the literature review are:

1) **Are age, gender and region associated with drug use among adolescents in England?**

Hypothesis 1a: Older adolescents will be positively associated with drug use.

Hypothesis 1b: Being male will be positively associated with drug use.

Hypothesis 1c: There will be regional variations in drug use.

2) **Are imitation, peer association, parental reinforcement and attitudes associated with drug use?**

Hypothesis 2a: Positive attitudes towards cannabis/cocaine/ glue are positively related with drug use.

Hypothesis 2b: Imitation is positively associated with drug use.

Hypothesis 2c: Perception of high number of drug-using peers is positively associated with drug use.

Hypothesis 2d: Strong parental disapproval towards drug use is negatively associated with drug use.

3) **Do peer association, parental reinforcement, imitation and attitude to use of cocaine, cannabis and glue mediate the association between age, gender, region and drug use?**

Hypothesis 3: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between age and drug use.

Hypothesis 4: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between gender and drug use.

Hypothesis 5: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between region and drug use.

Chapter 2

2. Theoretical Framework

Over the last century researchers have attempted to theorise why some adolescents experiment with illicit drugs whilst others do not. Some the key factors responsible for drug use in adolescents that have been identified from literature reviews and a needs assessment (Bloor, 2019; Donnermeyer, 1992; Frisher et al., 2007; Hawkins et al., 1992; Townsend et al., 2007; Weinberg et al., 1998) include: acceptance of favourable behaviour to drug use; the availability of substances; economic status; neighbourhood status; psychological characteristics; behaviour problems; parental related factors; peers; and genetic factors. This chapter discusses a few of the major theories that have been used to investigate drug use over the last 50 years, the evolution of these theories, different disciplinary perspectives, and then introduces the concept of integrative theories. Finally, this chapter ends by discussing the theoretical framework used in this study— the SSSL theoretical framework.

A multitude of concepts and theories have been proposed as a means of organising knowledge, understanding and predicting drug use among adolescents. First, the existence of these multiple theories and constructs might be in part due to a lack of integration and organisation where theories have been considered in isolation. The second reason for the existence of multiple theories could be because drug use is a spectrum of behaviours ranging from experimentation and dependence and that there might be a need for different theories to explain drug use at different stages. The third reason might simply be an indicator of the complex nature and the multiple facets of drug using behaviour for e.g. trying to understand why some use only on weekends for pleasure while others use to the point of harm.

In the 1960s, studies in the field of drug use shifted emphasis from understanding drug use as a disease of the brain to understanding the processes through which individuals get

involved in drug use. Disease models although still in existence, are primarily concerned with the end stage of the drug use spectrum namely addiction or dependence which occur as a result of deficits in the functioning of the prefrontal cortex. This was a first major shift away from disease (biomedical) models to sociological and psychological models (Isralowitz, 2002; Petraitis et al., 1995). This approach finds less application in the field of cannabis (Grinspoon & Bakalar, 1995) and more recently with the new psychoactive substances or legal highs, primarily because their addictive or dependency effects have not been proven. Furthermore, most researchers acknowledge that majority of adolescents are at the experimentation end (McIntosh et al., 2006; Riedijk & Harakeh, 2017; Sloboda et al., 2012) of the drug use spectrum rather than being dependent or addicted to drugs. On this basis, it may be deduced that the disease model theory is less valuable in explaining drug use in adolescents. The earliest research pointing to the importance of environmental factors in adolescent drug use dates back to the 1970s (Bronfenbrenner, 1979; Gorsuch & Butler, 1976; Kandel, 1975). Gorsuch and Butler (1976) observed that the decision to take drugs was influenced by individual, psychological and social environmental factors (parental, peers and drug availability). It is thought that where adolescents do become addicted or dependent, psychological and perhaps even biological factors play a role (Kandel, 1975). Like Kandel (1975; 1992) they also made explicit that earlier stages of drug use are socially determined and later stages of addiction or dependence are psychologically and genetically influenced. These points are reinforced by Bronfenbrenner (1979) who goes on to elaborate that every individual is embedded in an ecological niche (their role and position in their environment), so, while individual factors play a primary role in drug use, they do so in juxtaposition with other contextual forces, for example one's age, where they live or gender.

Moving on to the 1980s, biological theories (Koob & Bloom, 1988) and early 1990s psychological theories (Bukstein, 1995; Jessor et al., 1994) were being considered in addition to the existing theories. Biological theories imply that inherited genetic traits predispose an individual to substance abuse, independently of external influences such as neighbourhoods,

peers or family. The key term here is ‘substance abuse’ which implies that this theory like disease theory models, is more applicable to individuals who are at the dependence and addiction end of the drug use spectrum and are unlikely to be solely responsible for substance abuse behaviour. In fact, Bukstein (1995) argues that it is more likely that genetic factors interact with external social factors such as parental attitude and monitoring, peers for example, that predispose an individual to high risk for substance use. Several general psychological theories subscribe to the relationships between social context and individual drug use factors. Among these, social learning theory (Akers et al., 1979) emphasises that the formation of an individual’s identity is a learnt process to external factors such as peers and family. The influence of parental or family factors in adolescent illicit drug use have been largely derived from the work of a clinical psychologist Baumrind (1966, 1967). She established a framework to understand the association between adolescent drug use and parental behaviours stating that a combination of control and warmth decrease the chances of illicit drug use. Baumrind (1967) described three typologies of parenting styles: 1) authoritarian (rigid and restrictive and where obedience is expected); 2) authoritative (a more democratic environment that honours growing autonomy); and 3) permissive (where the adolescent has freedom and no rules). On the other hand, Akers’ Social learning theory (Akers, 1973; Burgess & Akers, 1966), is underpinned by the work of psychologists such as Baumrind (1966, 1967) and Bandura and Walters (1977) and criminologist Sutherland’s (1947) crime theory — namely differential association theory. This theory is often used by sociologists and criminologists to understand crime and deviant behaviours (Cooper & Klein, 2018; Durkin et al., 2005; Lanza-Kaduce et al., 2006; Lee, 1998; Lowry et al., 2016; Pratt et al., 2010; Schaefer et al., 2015a). Sutherland (1947) posited that individuals learn the value, motives and develop attitudes for criminal behaviour depending on level of interaction with others based on the frequency, intensity, and length of interaction. However, this theory was criticised on two grounds, first, not making explicit the precise mechanisms of social learning and second due to the difficulties in testing and operationalising the theory. So, Akers

extended this theory to include four specific concepts imitation, differential association, reinforcement and attitudes.

In 1998, Akers proposed an expansion of the social learning theory perspective to include variations in society as well as encompass differences between socially differentiated groups of people within that society. For example, suggesting that there are other pathways direct and indirect apart from differentially associating with peers such as development of favourable attitudes to socially acceptable behaviours or through imitation of peers who may or may not be intimate friends and also through reinforcement. This means that a distinction between peer association and imitation of friends needs to be made when considering their association with illicit drug use. The SL theory has also been extended to include micro (individuals), meso (groups) and macro (societies) factors. As indicated in the previous chapter, this theory is known as the social structure and social learning (SSSL) theory and is discussed in detail below.

Towards the mid-1990s, there also was an increase in experimental drug use in adults and the normalisation theory was proposed to explain this phenomenon. The argument of the normalisation theory (Measham et al., 1994; Parker et al., 1998) was that use of illicit drugs became normalised or socially accepted in the same way as tobacco and alcohol use are in mainstream society. That is, as illicit drugs become more easily available and accessible, younger populations would learn to use drugs through development of positive attitudes to illicit drug use (that adolescents find it acceptable to use illicit drugs) towards initiating illicit drug use (Williams, 2016). After 1997, a downward drug use trend was noted (Office for National Statistics, 2020) and the viability of the normalisation thesis was questioned by Shiner and Newburn who were key critics of the normalisation theory (Shiner & Newburn, 1997; Shiner et al., 1999). They argued that the theory placed too much emphasis on the acceptability of illicit drug use, and MacDonald and Marsh (2002) suggested that the theory implied that drug taking is a normal behaviour. As a response to the critiques Parker (2005)

went on to explain that normalisation is a process that can be reversed (i.e. illicit drug use can be de-normalised too): it is not fixed but a multidimensional concept measuring how attitudes and illicit drug behaviour change over time. However, the authors do not fully address the critiques of overstating or generalising actual drug use as a normal activity and a lack of consensus still remains (Measham & Shiner, 2009).

Another prevalent topic is the developmental progression of drug use trajectories (Van Gundy & Rebellon, 2010) with particular focus on gateway theory (Kandel, 1975; Kandel et al., 1992). This theory assumes a sequential pattern of initiation after using specific drugs such as cannabis or ecstasy (Reid et al., 2007) as a potential gateway substance to alcohol consumption and subsequent use of drugs such as cocaine (Fergusson et al., 2006; Kandel et al., 1992). There is however a lack of clarity on the exact causal mechanisms and some ambiguities around the different interpretations leading to divergent conclusions despite similar findings (Fergusson et al., 2006; Fergusson & Horwood, 2000; MacCoun, 1998).

Clearly, while all the different strands of the literature, as previously presented, contribute to the understanding of drug use, the influence of social environments appear to stand out as a common construct central promoting experimentation and initiation of drug use among adolescents. We also know that one's social environment comprises a dynamic set of interactions between the environment and individual factors such as age and gender (Akers et al., 1979; Bandura & Walters, 1977; Griffin & Botvin, 2010; Sutherland, 2012; Sutherland & Shepherd, 2001a; Sutherland & Shepherd, 2001b; Sutherland & Shepherd, 2002; Sutherland & Willner, 1998; Unlu et al., 2014; Verrill, 2005; Vogel et al., 2015; Whitesell et al., 2014; Winfree Jr & Bernat, 1998). These interactions form social networks of parents, children and peers which, according to Baler and Volkow (2011), are modulators of gene expression, cognition, emotion as well as brain functioning and development. Integration of these theories into one model to extend the understanding of the interactions or interplay between multiple contextual factors are gaining popularity over the recent years. Rooted in psychology,

criminology and sociology, the SSSL theory is one such integrated conceptual theory that embodies these interlinkages/ interactions. It builds upon an established classical theory which is empirically supported by a large body of evidence — the social learning theory— which focuses on processes through which behaviours such as drug use are learnt (Akers & Jennings, 2019; Akers et al., 1979; Bandura & Walters, 1977; Krohn et al., 2016; Matsueda, 1982; Pratt et al., 2010; Winfree Jr & Bernat, 1998).

2.1. Social Structure and Social Learning theory (SSSL)

The SSSL is an integrative theory that emphasises the notion that social contexts or environments shape individual behaviour and therefore learning. In theorising, Akers (1998) tackled the task of simultaneously addressing epidemiological as well as etiological explanations for deviance. Akers (1998) argues that an understanding an individual's environment is key to understanding behaviours that are not the social norm, in this case drug use.

The Social Structure (SS) part of SSSL is built around four constructs, see figure 1. The first is *differential location* on social structure. The location of an adolescent in the social structure (males for example) is indicative of differences in social expectations and power relationship to other groupings (females) in society and therefore influences the adolescent's relative exposure to drug use. The measures are at societal level such as demographic composition (age, gender, race etc.).

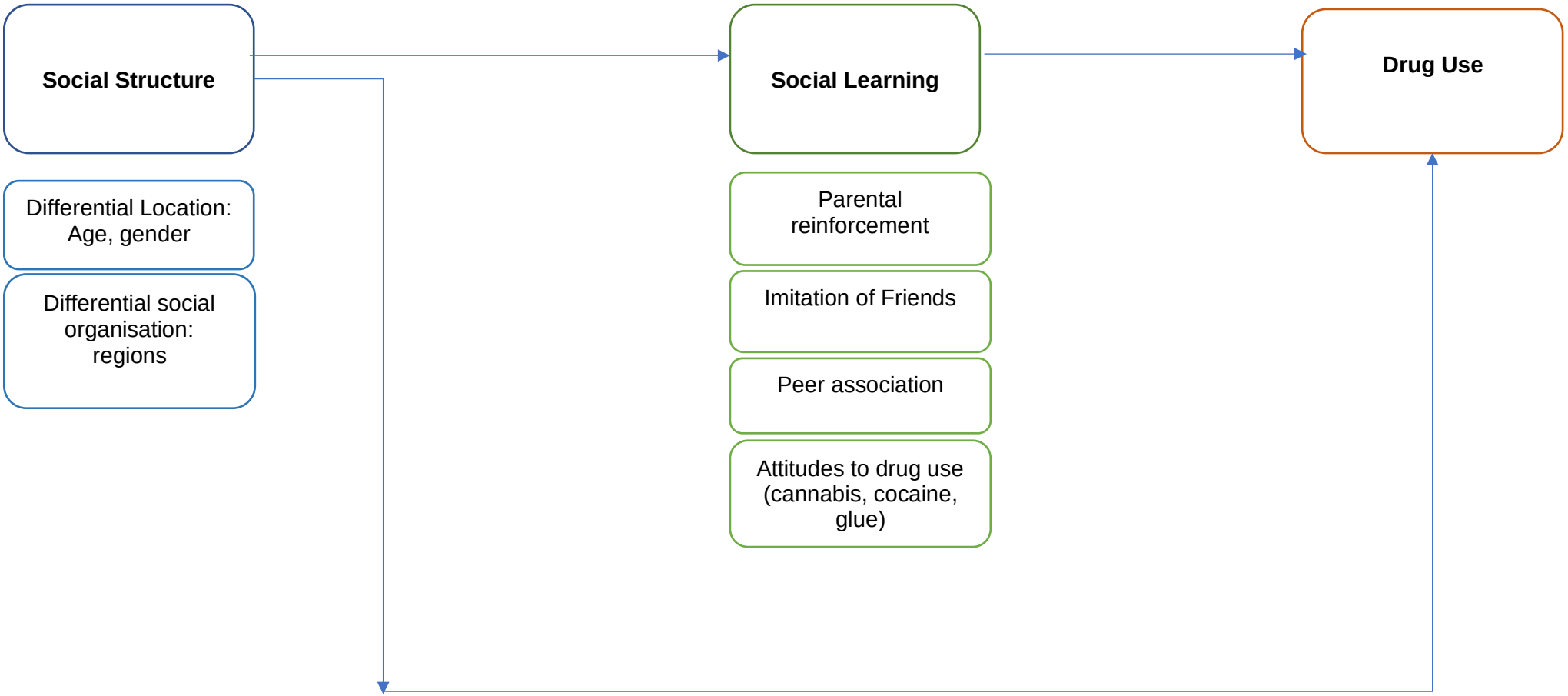
The second construct is *differential social organisation* which emphasises a larger group such as regional difference. The argument here is that a society's social organisation creates environments and opportunities that influence social learning of socially unaccepted behaviours. Examples include community size or population density, regional or geographic systems (Akers & Sellers, 2004; Lee at al., 2004). As an example, adolescents who live in socially disorganised regions are more likely to engage in substance use, because they would associate more with deviant peers, more likely to imitate and have positive attitudes to

deviance and more likely to experience reinforcing consequences (Dodge et al., 2009a; Sutherland, 2012). This construct taps unspecified or unknown combinations of the feature of the region such as culture, social background, economic status of the people living in that region.

The third structural construct–is *differential location in primary or secondary groups*. The construct refers to location of an individual in a family, work, school, church etc. The intention behind this construct is to draw on differences in community, geographical and ecological systems. The fourth construct is *theoretically defined* structural co-relates derive from other theories of crime such as anomie or social disorganisation and conflict, examples include ease of drug availability. Akers (1998) describes the construct in terms of social disorganisation and conflict, but the measures of these constructs are vaguely identified.

The Social Learning (SL) part of the SSSL theory also has four main components to the social learning theory which are: a) differential association, b) definition, c) reinforcement and d) imitation. Differential association implies that learning of drug use behaviours occurs through interaction between the individual and family or friends. Definitions are beliefs or attitudes that aid decision making of whether drug using is right (positive attitude) or wrong (negative attitude to drug use). Differential reinforcement implies that if an adolescent receives positive reinforcement for using drugs they would most likely continue to do so. Imitation refers to the copying of drug using behaviour through direct observation – i.e., the individual used drugs because friends were using it. Imitation is thought to be important for onset of drug use and may to lead to acquiring drug use if the individual sees drug use being positively reinforced by the role model (Akers, 1998).

Figure 1: Social Structure Social Learning Theory Conceptual Framework[12]



[1] Wilkhu, P., 2021. Illicit drug use in English adolescent students–result of cumulative mediation analyses. Journal of Substance Use, pp.1-10.
[2] Differential social location in reference groups such as church groups and theoretically defined structural variables such as neighbourhood crime are not tested in the study.

2.2. Empirical tests of SSSL

There have been no studies to date on the application of SSSL on drug use among adolescents in England. Seven tests, however, of the SSSL model in the field of adolescent substance misuse using secondary data have been carried out in different cultural settings, including South Korea, Turkey and United States of America (Holland-Davis, 2006; Hwang & Akers, 2006; Kim, 2010; Lanza-Kaduce & Capece, 2003; Lee et al., 2004; Schaefer et al., 2015b; Solakoglu & Yuksek, 2020; Whaley et al., 2011).The results of all these studies have in so far supported the central arguments from social structure social learning theory.

Lee et. al (2004; 2013) constructed a causal model based on the SSSL. The causal model utilising structural equation modelling, suggests that gender, age and socio-economic status (differential location in the social structure); family structure (differential location in primary and secondary groups); and community size (differential social organization) impact substance use both directly and indirectly through social learning variables. Lee et al. (2004) used a data source that was specifically designed to test the social learning theory.

Lanza-Kaduce and Capece (2017) examined the mediating effects of all four SS measures (gender, race, diverse university, Greek fraternity groups etc.) on binge drinking by students in eight universities by two SL measures: reinforcement and definitions (attitudes). They found that these two SL variables mediated *most* (but not all) of the four social structural correlates, and they were also the first to include interaction terms into the SSSL model as a means for testing for moderation. Finding five statistically significant interactions, they recommended that further research applying the SSSL theory incorporate interaction terms, especially because Aker's(1998) has not specified the application of interaction terms in the model to date.

The research by Hwang and Akers (2006) was conducted in South Korea and found results consistent with those in the United States and other western societies. Whilst this study used data from adolescent samples collected from the city of Busan, Kim (2010) later improved on

this study by using national secondary data. However, they only partially tested the SSSL model by focusing on peer and family influences.

The dissertation by Davies-Holland (2006) is a full test of the SSSL theory on substance abuse using hierarchical linear modelling. However, its major limitation is that it uses very historic secondary data from 1978 to test SSSL, making the results less relevant to the current drug usage market. Overall, the findings showed most of the social structural correlates were mediated by all four social learning variables with a few exceptions. The coefficient for gender whilst not initially significant became statistically significant once the SL variables were included in the illicit drug use model whereas the effects of poverty on the use of alcohol (having no statistically significant direct effect) became statistically significant once the SL variables were introduced suggesting a moderating effect. Based on these findings Davies-Holland (2006) suggests that the effects are not completely inconsistent with SSSL theory predictions because the SL variables interact in different ways to influence gender and poverty—not necessarily through mediation. She suggested that the SSSL model should be modified to allow for consideration of both moderation and mediation as mechanisms to drug use.

Verrill (2008) tested the idea of mediation and moderation of social learning on the relationship between SS and delinquent behaviours using structural equation modelling. Like Davies-Holland (2006), he found moderation effects and suggested that further empirical studies are required to test the theory to verify the role of SL correlates as mediators and/or moderators. Schaefer et al. (2015b) also found support for the SSSL model in examining heroin use and also cocaine use (Schaefer et al., 2015a) in Adolescents in the U.S.A. This study however only measured adolescent drug use using a single measure of assessing heroin use; including measures of multiple drugs or poly-drug use more accurately captures overall health risk and is more reflective of the current drug using landscape (Aldridge et al., 2013). The most recent test of SSSL was on data collected from a sample of 2445 Turkish students with crime and

delinquency being measured as an outcome. Negative binomial regression was used to assess the mediation pathway and only three of the SL processes (association, reinforcement and imitation) were found to mediate crime and delinquency in adolescents.

2.3. Limitations and Critique of the SSSL model

From a methodological point of view, most of the research above using regression analysis has not tested for the association between SS and SL. That is, for mediation to be present, paths need to be traced from SS to SL to Drug use (see figure 2). Instead, so far the focus has been entirely on the attenuation of SS coefficients once the SL constructs are introduced into the model. The pitfall with this method of assessing mediation is that the results might be indicating possible moderation rather than mediation. Second, Aker's does not specify the inclusion of interaction terms in his theory, there has been only one test by Lanza-Kaduce et al (2017) that has included interaction terms (to account for any associations between the independent variables and the mediator that could be affecting the outcome) and they have called for further research to test the SSSL theory with the inclusion of interaction terms. Third, most research applying the SSSL theory stop at the cumulative SSSL model. More specifically, the majority of previous papers do not go further in attempting to identify the different social learning pathways to drug use via subgroup mediation analyses.

Aker's main critic Sampson (Akers, 1999; Sampson, 1999) argued that the model was not interesting and that there are no propositions that adequately link SS to SL (Krohn, 1999). Akers' response to the critiques was that SSSL theory has intentionally been offered as an abstract elaboration of the social learning theory to improve its adequacy. That is, a cross-level conceptual integration attempts to explain how existing social structure explains delinquency (not why) through its effect on an individual's social learning (imitation, attitude, association, and reinforcement). The SSSL theory is not a propositional integration and therefore Akers is not concerned with the source of structural context, or the specific meaning attached to it by other theorists (see Akers, 1998, 1999). Akers characterises the SSSL model

as “work in progress” (1998, 2011) and calls for further tests, modifications, and critiques. He suggests that statistical mediation model cannot always adequately demonstrate that exact pathway due to an inability to control for unknown factors due to biased sampling in some cases and in other cases measurement error. Furthermore, Akers points out that it is not possible to model human behaviour perfectly and that researchers should not try and seek *deterministic* models and he consequently expects imperfect mediation by social learning correlates.

The SSSL theoretical framework has been selected because if its appropriateness, ease of application, and explanatory power. It provides a sound theoretical framework that fits well with prevailing theories in the field of research on adolescent drug use. The theory has been successfully tested on cross sectional quantitative secondary data previously (as mentioned in the previous page and the concepts in the research question relate to the theory, the connection of which has already been explained previously. The application of a social science theory in a public setting should provide unique multilevel platform at inter and intrapersonal, societal and organisational level to understand the context in which drug using behaviour occurs in adolescents.

The next chapter reviews the empirical literature based on two of the social structural correlates that is differential social location (age and gender) and differential social organisation (region) and all four of the social learning variables: imitation, peer association, parental reinforcement and attitudes to drug use.

Chapter 3

3. Narrative literature review

Many academic disciplines such as sociology, psychology, epidemiology, medicine among others have considered illicit drug use through their own analytic lens. These fields of inquiries present a number of constructs associated with illicit drug use and dependence/addition for example: age, gender, ethnicity, availability of drugs, family history of drug use, genetics, social influences, self-esteem, low bonding, conflict, peer, poverty, mental health conditions, and neighbourhood contexts.

The increase in prevalence rates of drug use in adolescents and the harms arising from it were discussed in chapter 1. An initial exploratory review in this area found a number of literature reviews on drug use in the adolescent population in England. Lloyd's (1998) literature review acknowledged the complex and often contradictory nature of evidence and emphasised that while the risk and predictive factors operate within particular context, they should not be considered as fixed but as factors that are influenced by changing environments. In 2006, Bloor conducted a literature review focusing on the gendered differences in drug use and concluded that it is simplistic to view concepts such as gender as a risk factor on its own and instead be viewed through social development models. He suggests that drug use for either gender is determined by complex interplay of factors such as parental monitoring or peer groups over time hence the need for social developmental models, He goes on to conclude that the use of integrative models should be a pre-requisite to determine the nature of the complex interaction of drug use factors.

Supporting Lloyd (1998) and Bloor (2006) is a literature review by Frisher et al., (2007). They emphasise a need to consider the multiple shifting and adapting social environments in which these risk and protective factors operate and they argue that it is within these environments that the impact of these factors should be analysed and interpreted. For example, concepts

related to family such as: roles of family substance misuse (McVie and Holmes, 2005) parental supervision support (Miller and Plant, 2010), time spent with family (Best et al., 2005) have all been shown to influence drug use in adolescents in the U.K. These include for example illicit drug use monitoring through greater parental involvement (Simons-Morton & Chen, 2009) and giving adolescents autonomy. Conversely, family conflict and poor discipline are associated with higher levels of illicit drug use in adolescents (Ryan et al., 2010). Family social structure factors such as having young parents, larger families (Reinherz et al., 2000) and divorce (Patton et al., 2002) are also positively associated with adolescent illicit drug use but once mediators such as association with drug using peers have been accounted for (Broman et al., 2008; Broman et al., 2006) there is little or no influence. As evidenced here, there are infinite ways of measuring constructs related to parental influences for example. The narrative review will be focusing on key factors namely: the role of gender, age (11-15), regional characteristics, parental approval of drug use, perception of peer drug use and individual acceptability to try drugs (attitudes).

3.1. Narrative review aim

This narrative review is guided by the SSSL theoretical framework with a focus on the following factors: age, gender, environment in particular region/neighbourhoods, parental factors, peer factors such imitation of peers and friends, perception of peer drug use and attitudes to drug use. The aim of this literature review is to review the state of knowledge on drug use in adolescents pertaining to these factors as a means of defining what is known. The first section provides a summary of empirical of evidence-based literature on the factors. This is then followed by a justification of the research showing how the topic has been studied, what the gaps are and how this study attempts to address these gaps.

3.2. Narrative review question

The review question is: *What is the association of age, gender, family, friends, peers, neighbourhoods/ regions and attitude with drug use in adolescents aged 11-15?*

3.3. Narrative review methodology

Building a literature review question as well as inclusion and exclusion criteria based on the four parts of the PICO (Patient-Intervention-Control-Outcome) due to a lack of intervention and control was challenging (Methley et al., 2014). To handle this variation, different frameworks have been developed such as the SPICE (Setting-Perspective-Intervention-Comparison-Evaluation) and SPIDER (Sample, Phenomenon of Interest, Design, Evaluation, Research type). For this study, the research question, search strategy as well as the inclusion and exclusion criteria were adapted from the SPIDER framework (Cooke et al., 2012).

Although conducting meta-analysis is a cornerstone of systematic reviews, statistical pooling was not appropriate because the literature research question did not seek to measure interventions that require calculation of standardized effect estimates. Therefore for this study, a systematic review adopting a narrative synthesis (Popay et al., 2006) was conducted from January 2000 to June 2020.

Before embarking on the search strategy, a list of terms and concepts pertaining to the research question was drawn up. One challenge identified in the theoretical framework chapter was the existence of heterogenous, poorly defined or standardised concepts and terms. So, to ensure that relevant studies were not missed and to ensure transparency a number of strategies were employed. MeSH terms (Medical Subject Headings) were used in databases that were indexed, where it was not possible to use MeSH terms all possible synonyms were included in the search strategy. Other strategies employed were: berry picking (Bates, 1989) –– an iterative process where various techniques such as footnote chasing are used to inform the information base; pearl growing (Booth et al., 2016; Schlosser et al., 2006) –– using relevant literature to identify key words and index terms to build the search until no new papers are found; citation tracking (Papaioannou et al., 2010) and the use of database appropriate syntaxes Boolean logic queries and parentheses. These implementation of processes were an attempt achieve a balance between sensitivity (search attempt to retrieve as many relevant documents as possible via a broad search) and specificity (retrieval of documents via a small

precise search). The searches were also checked for errors such as missing a boolean operator, spelling errors, missing terms or truncation errors (Sampson et al., 2009)

3.4. Inclusion and exclusion criteria

The table below lists the inclusion and exclusion criteria for this systematic review.

Inclusion Criteria	
Sample	Age group between 11-15 years
Phenomenon of Interest	The association between drug use and age, gender, family peers, attitudes drug use, friends
Design	Qualitative, quantitative, mixed-methods and reviews
Research type	Cross-sectional, longitudinal, causal, cohort, case study, descriptive, exploratory, observational.
Location	USA, Europe, Australia
Publication	Publications in peer-reviewed journals, grey literature
Language	English
Dates	Data collected between 2000 and 2020 (inclusive)
Exclusion Criteria	
Sample	Adolescents outside the age range of 11-15
Study design	- Interventional or experimental designs - Where illicit drug use constituted alcohol abuse and or tobacco use only

	- Illicit substances were considered as risk factors for other outcomes (crime, delinquency, cyber bullying, violence etc.) - Papers that were commentaries

3.5. Narrative re-iterative literature review methods

a. Databases

1. Multidisciplinary Journal Databases: PubMED, JSTOR, SCOPus, ProQuest, EMBASE, EBSCOhost, Web of Science (core citation index)
2. Subject Specific databases: MEDLINE complete, Psycarticles, PsycINFO, SOCindex, Psycnet.apa.org, Child development and Adolescent studies, OpenDissertations, ERIC, Academic Search Ultimate.
3. Publisher databases: Science direct, Emerald, Sage Journals, Wiley, Springerlink, Oxford journals, Elsevier, T&F online, Ingenta Connect
4. Other: Greynet international
5. UK government and European publications: The European Survey Project on Alcohol and other Drugs (ESPAD), EMCDDA and Home office were also searched for additional relevant publications.
6. String searches, wildcards and truncations were also used to make the search more concise.

b. Primary search terms

A general search string using a different combinations of search terms based on the limitations of the databases were used followed by a detailed search to ensure that no papers were missed. An exploratory review was conducted earlier for definitions or alternative descriptions of ‘adolescent’, ‘substance use’ ‘drug use’ illicit drug use’ ‘youth’ ‘family support’ family knowledge’, ‘parental monitoring’ ‘parental knowledge’ ‘peers’, friends’, ‘attitude to drugs’ ‘drug

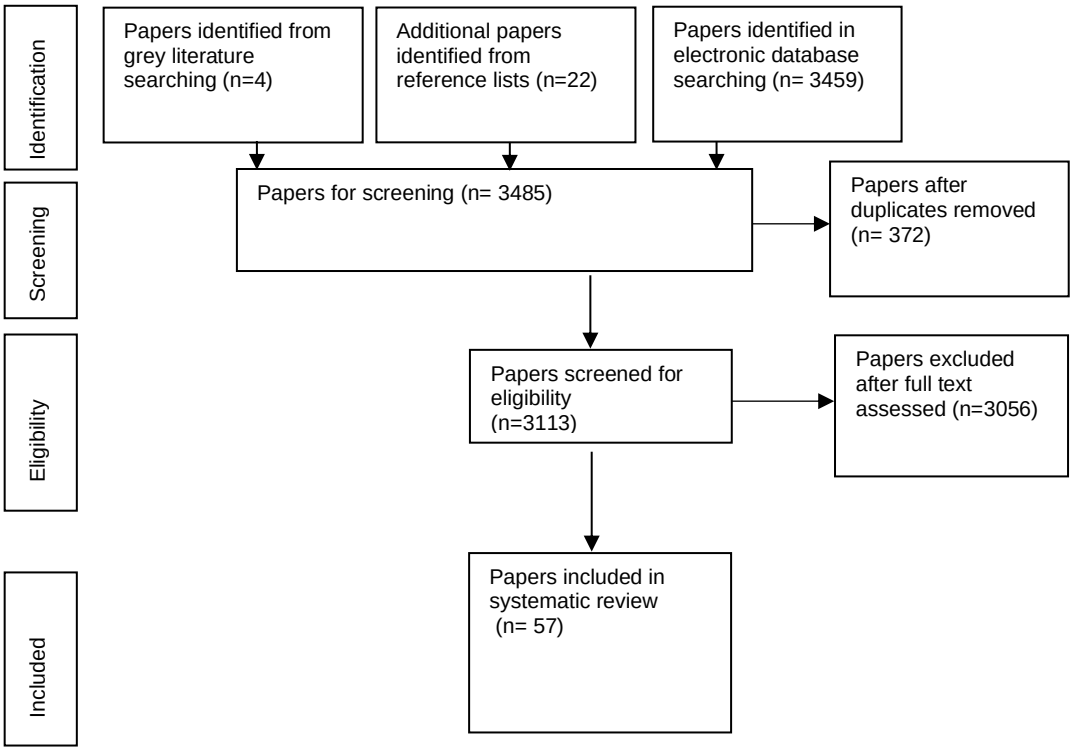
use beliefs', 'rural', 'urban' 'neighbourhoods' 'regional drug use', 'location' in journal articles. The exact search terms are listed in the Appendix.

The references cited by each relevant study were reviewed to locate additional studies and these were managed using Endnote 9 software. Alerts for new papers were set up on the respective search engines.

c. Screening

All records identified in the databases were uploaded on to Endnote 9 and duplicate records removed and were initially screened by checking the titles and abstracts. Screening was hierarchical in that a 'yes' of the first criteria lead to the consideration of the second criteria and so on. There was only one reviewer and discrepancies were resolved by revisiting the list at different stages of the literature review – reiterative process. The second stage involved retrieving full copies and assessing them for eligibility and relevance based on the inclusion criteria. The results of the search strategy are presented in the figure below.

Figure 2: Results of The Search Strategy



d. Quality assessment

There is a large choice of tools based on various study designs that can be used to appraise the quality of literature and to determine the extent to which bias in the design has been addressed. To that end, the Joanna Briggs International (JBI) critical appraisal checklist for analytical cross-sectional studies (Vardell & Malloy, 2013) was selected as a viable template (see appendix) to assess the quality of studies. This checklist is applicable to both qualitative, quantitative, and mixed method studies and has been developed by a team based in the Faculty of Health and Medical Sciences at the University of Adelaide, South Australia and approved following extensive peer review. A table including mined data with study characteristics can be found in appendix 1.

3.6. Synthesis of results

An *apriori* theoretically-driven approach was used instead if an inductive approach to synthesise the data. The thematic synthesis was driven by the contextual factors of interest in the social structure social learning theory (peer association, imitation of friends, family reinforcement, and attitudes to drugs) and the contextual factors in the social structure part that is age, gender, and region/neighbourhoods. The review of the contextual literature, while not exhaustive, provides evidence that there is an important empirical association between social learning, social structural and drug use. These studies provide an important foundation for this thesis.

3.7. Framing the literature research: key concepts and theories.

a. Gender

In the United Kingdom, it has been generally accepted that adolescent males have higher lifetime drug use rates than use rates than do females, but the gap appears to be shrinking (Wallace & Fisher, 2007). Where gender differences do exist, they are reported to be very

small (Amaro et al., 2001; Wallace et al., 2003; Whaley et al., 2016; Whaley et al., 2011) Comparison of data between old versus recent studies in the UK appear to reflect these changes. For instance, research on a UK Birth cohort (Avon Longitudinal Study of Parents and Children (ALSPAC) of children aged 10 to 16 recruited between 1991 and 1992 showed no significant differences in drug or solvent use between genders (4.4% in males and 4.7% in females) at age 15 -16 years (MacArthur et al., 2012). Aston (2015) found support for a gender gap at age 13 with males being more associated with drug use but no difference in the volume of drug use between genders at 16 years of age. The Smoking Drinking Drug Use SDSS 2016 data show a similar trend, though revealing a slightly higher consumption of illicit drugs among older females. Whether these differences reflect exposure to changing environments resulting in gendered learning remains to be tested.

In terms of specific drug use, the use of cannabis as compared to other drugs in American males and female adolescents is almost equal. Chen and Jacobson (2012) found that when cannabis is used as the only measure of substance use there is no difference between females and males in early adolescence (aged 16 years and less) but females (not males) used all substances more heavily in early adolescence (Evans-Polce et al., 2015). These results are contradicted by the findings of Cotto et al. (2010) who analysed a larger dataset from the National survey of Drug use and health (NSDUH). They found that females aged 12-17 years reported higher use of psychotherapeutic (sedatives, stimulants etc.) drugs, no difference was found for cocaine use but more males than females used cannabis. A more recent study in the United Kingdom on Scottish adolescents, reveals that gender differences are usually as a dependent on a number social contexts (Aston, 2015). For example, the study shows that drug use in males is associated with being older (aged 16), poor family factors, with higher (not lower) SES and peer drug use.

With regards to empirical studies testing social learning theory and the SSSL theory findings of the effects of the social learning process on the relationship between and gender and

deviant behaviours have been mixed. Several studies found that the effect of gender on behaviour was substantially and at times completely mediated by social learning process variables (Lee et al., 2004; Svensson, 2003; Whaley et al., 2011). Furthermore, in a test that included just one social learning variable, Whaley et al. (2011) also found strong mediation effects of differential peer association on the relationship between gender and adolescent substance use. A common premise with these studies is that the location of females on the social structure is *different* to that of males, in that social expectations and power differences influence the social learning behaviours to drug use via imitation, reinforcement, peer association, and attitudes for males differently to females. To elaborate on this, scholars have suggested that females are probably more strongly affected by parental attitude to drug use and peers more than males (Lee et al., 2004) where as others have found moderating effects of gender on substance use (Holland-Davis, 2006; Whaley et al., 2016). In fact a qualitative study by Fletcher, Bonell and Rhodes (2009) on eight females aged 14 to 15 years from a high-performing school in London shows that drug use is a way of bonding and gaining acceptance in a peer group for females, suggesting that peers are an important influence for females of this age group. Considering the research on drug use across gender, the studies suggests that the extent of any difference in drug use between boys and females is influenced by multiple social contexts and factors such as on the type of drug being studied, their location and their age.

b. Age

There is a consistent pattern indicating that, older adolescents (aged 16) are more likely to use illicit drugs than their younger counterparts (Derringer et al., 2010). Older adolescents also use many drugs at the same time (poly drug use) whilst younger adolescents use a single drug at a time but select from a wider range of substances (Derringer et al., 2010). In their survey of over 2000 adolescent students in Glasgow and Newcastle Mckeganey et al. (2004) found that by age 10 to 12, 5% had used an illegal drug and while cannabis was a popular choice, some had extended their use to heroin and cocaine. When age is examined as an

aggregate characteristic, the majority of risky behaviour occurs during adolescence, peaks around age 15 (Sutherland & Shepherd, 2001a) and declines rapidly into the 20's (McVie & Bradshaw, 2005). Interview results of 216 of 2382 ten to twelve year old students participating in a longitudinal study in Glasgow and Newcastle showed that peer pressure was a major influence at ages 10 years but was not important at age 14 years in influencing drug use (McIntosh et al., 2006). The authors posit that as adolescents grow older personal choice determines drug taking than peer pressure. This finding is supported in another qualitative study of 14-15 year olds in the UK, which finds that adolescents sense of self-identity (e.g. insecurity), in effect influences the type of peer groups that adolescents seek and this in turn influences drug using behaviour, group solidarity (Fletcher & Bonell, 2013; Fletcher, Bonell, Sorhaindo, et al., 2009). Peer associations also appear to more important for older females aged 14 to 15 years in England (Fletcher, Bonell, & Rhodes, 2009). The studies show a need for developmental approach that considers each age on its own merit needs when researching drug use in adolescents.

c. Region/Neighbourhood

Researchers have argued that communities and neighbourhoods influence adolescents' thoughts, behaviours as well as their access to better quality institutions and relationships, which then inturn influence their life course outcomes (Aslund & Nilsson, 2013; Zimmerman & Farrell, 2017) This is because neighbourhoods or regions vary in terms of their resources which can have consequences for adolescent living in that ecosystem. For instance, researchers showed that in Swedish neighbourhoods with low social capital, adolescents had double the risk of drug use compared to neighbourhoods with high social capital (Aslund & Nilsson, 2013). Another example of neighbourhood differences is the presence of neighbourhood disadvantage (Wallace & Fisher, 2007), which increase the risk of adolescents engaging drug use amongst other risky behaviours. Instead of impacting on drug use directly, neighbourhood effects condition the effects of salient learning pathways and drug use.

Furthermore, older adolescents aged 16 and 17 had higher odds of drug use compared to 12 to 13 year olds. He also found that adolescents living in poor areas had lower odds of drug use. Similarly, Zimmerman (2017) analysed longitudinal data on 1639 youth across 80 Chicago neighbourhoods to assess the extent to which neighbourhood opportunities for drug use had direct or indirect effects on adolescent drug use. He found that high levels of opportunities in neighbourhoods moderated the effects of substance use such that, negative attitudes to drug use were attenuated, and amplified the effects of peer drug use on adolescent's own drug use.

Guided by the SSSL theory, MinWoo (2015) also examined in his thesis, cannabis use in 1791 children and adolescents (aged 0 to 18 years) in 80 Chicago neighbourhoods using longitudinal data from the project on human development in Chicago neighbourhoods. MinWoo (2015) found that children and adolescents living in disadvantaged neighbourhoods were less likely to use cannabis and that mediating effect of peer association on the relationship between neighbourhood and cannabis use was not clear. These studies show that number of regional/ neighbourhood factors affect drug use in adolescents but there is a paucity of information comparing regional differences in drug use across England.

d. Adolescent attitudes to drug use

Studies on adolescent drug use suggest that adolescents are more likely to engage in drug use after (a) developing positive attitudes, (b) believing family and peers support use (reinforcement) and (c) believing that they will be using the drugs in the future (Chomynova et al., 2009; Keyes et al., 2011; Sutherland & Shepherd, 2002), suggesting that the attitudes and reinforcement of use of illicit drugs, increases the intention to use drugs. More recently Su and colleagues (2018) on examining the association between individual and contextual factors with adolescent illicit drug use found that adolescent approval (attitude) was also associated with higher likelihood of drug use. Su and colleagues (2018) also highlight the importance of including measures of attitudes to a broad range of drugs in adolescent drug use studies to

fully understand adolescent drug use behaviours (Keyes et al., 2011). Wallace and Fisher, (2007) reported that negative attitudes towards cannabis by adolescents was positively associated with higher perceived levels of peer drug disapproval as well parental disapproval and parental supervision. In particular, research shows that the positive dimensions of attitude are better predictors of behaviour such as illicit drug use (Chomynova et al., 2009) and this again depends on age, gender and type of drug. For example, Okaneku et al. (2015) showed that adolescents who are regular and occasional cannabis users had lower perceived risk (positive attitudes to drug use) and tended to be younger males. They also found that fewer adolescents perceived a risk from cannabis use in 2012 compared to 2002. Furthermore, the perceived risk by occasional users was actually lower than those who use regularly. This data appear to indicate that the acceptability of cannabis use is increasing and varies depending on the pattern of drug using behaviour. Salas-Wright et al. (2015) also measured individual attitudes/ approval of cannabis measured as 'acceptability of trying cannabis'. They found that those aged 12-14 years who strongly disapproved or somewhat disapproved were unlikely to have used cannabis in the last year but those who strongly disapproved were seven times less likely to initiate drug use compared to those who 'somewhat disapprove'. The authors argue that studies should include gradations of disapproval in their studies.

e. Parental approval and disapproval

Parental monitoring has been found to be the most consistent factor in predicting adolescent substance use (Bahr et al., 2005; Guo et al., 2002; Pokhrel et al., 2008; Rai et al., 2003; Tornay et al., 2013; Van Ryzin et al., 2012). The role of parental knowledge can be seen in a meta-analytic review by Lac and Crano's (2009) in which they found that studies using measures of parental knowledge had a more robust effect on predicting adolescent cannabis use than measures which included a variety of monitoring activities.

More recently, Mak and colleagues (2020) reported a statistically significant association between cannabis use and low parental knowledge (not parental monitoring) of adolescent

activities with the strongest association at age 11, this association decreased rapidly from ages 12 to 14. Like the concepts discussed above (age, gender) the size of association between any given family factor varies substantially across studies. However, as Bahr (2005) posits that neither parental monitoring nor knowledge is likely to constrain drug use if parental attitudes are tolerant of adolescent drug use. In other words, adolescents are also more likely to develop favourable attitudes to drugs if they associate frequently with those who have favourable attitudes to drug use and families like peers are likely to be important influences. In his study Bahr (2005) compared the effects of parental monitoring and parental attitudes on cannabis use and other illicit drugs separately and the findings were remarkable. Parental attitude was a stronger predictor of drug use as compared to parental monitoring for both cannabis use and other illicit drug use (heroin and cocaine). When peer effects are introduced however, the influence of parental monitoring increases for both categories but decreases for parental attitudes by almost threefold. There generally has been more consistent evidence on the effect of parental attitudes on adolescent drug use. Becoña and colleagues (2013) also found that adolescents who perceived their parents as being permissive towards substance use (approve or have favourable attitudes) were more likely to use cannabis and the opposite effect is noticed for parents who disapprove of illicit drug use (Fagan et al., 2013; Olsson et al., 2003; Su & Supple, 2014). Overall, it appears that parental attitudes have a larger influence on adolescent drug use compared to parental monitoring.

f. Imitation of Friends

It has been postulated that peer groups are not as influential because of the influence from best friends or close friends through imitation results in drug use through direct observation rather than perceived use of peers who may not be friends. The findings that imitation is a stronger social learning pathway to drug use than peer association has been demonstrated by (Clark & Lohéac, 2007; Kawaguchi, 2004; McVicar & Polanski, 2012) in that friends are more relevant than peers in adolescent groups. To elaborate further the influence of friends or close peers appear to be stronger than class peers in adolescent groups when tested

together (Kawaguchi, 2004). More recently, McVicar and Polanski (2012) showed that drug use by friends resulted in 35% point increase in cannabis use in adolescents compared to 0.28% point increase for perceived peer (classmate use). Contrary to these studies, SSSL studies that have tested imitation (Holland-Davis, 2006) have found weak effects of imitation in the SSSL models and called for further research on the imitation variable. The reason for this is that the measure for imitation used in these studies has been indirect or proxy such as: observing a role model taking drugs. Given the evidence presented, this research employs a direct measure of imitation of actual use of drugs by the adolescent as a result of interactions with drug taking friends (not peers) — a more proximal measure as compared to perception of peer or role model drug use. This then also ensures that that there is a distinction between friends and peers and actual use versus perceived use which will be discussed below.

g. Peer association- perception of peer drug use

The literature shows that peer drug use is the most robust and consistent predictor of adolescent drug use (Allen et al., 2012; Chomynova et al., 2009; Su & Supple, 2014; Zimmerman & Farrell, 2017). When comparing the influence of peers versus parents on hard drug and cannabis use separately in adolescents Allen et. al (2003) found that peers and friends are a greater source of influence relative to parents where harder drugs such as heroin or LSD are concerned but there was not much of a difference in the influence on cannabis use. More research is needed to test whether peer perception mediates drug use differently across different ages, regions, and gender in adolescents in England. Sutherland and Shepherd (2001b) explored the social aspects of drug use in 4516 pupils aged 11-16 in a stratified sample of five schools in England. Within this sample of English adolescents, they found a strong relationship between drug use and the social factors including coming from a non-intact family and favouring peer over family amongst others. The most important point here is that many of these relationships were age-sensitive with drug use peaking at age 15. The authors show that a constellation of behaviours (religious beliefs, friends, and parents' opinions of drug use etc.) are related to adolescent drug use and these are complex and age

sensitive. For example, a higher (19%) percentage of students who valued their friends' opinions took illicit drugs compared to those who valued their parent's opinions (13%), and these differences were more apparent at older age groups (13 to 15 years). For example,14 year old adolescents were more likely to use cannabis due to peer association as compared to other ages (Bryant et al., 2003). This could be explained by the need to establish status and facilitate a sense of belonging to a group and the added security that comes with it (Fletcher, Bonell, & Rhodes, 2009; Fletcher, Bonell, Sorhaindo, et al., 2009). The same effects were noted the meta-analytic study by Allen et al. (2003) on the influence of parents and peers on drug use, in this review they found that effect size of peer influence on adolescent drug taking varied by substance and that it was the effect size for peer influence on cannabis use was one of the largest and on alcohol use the least. This influence increased as the age increased for cannabis but not for drugs such as heroin or cocaine where the influence remained relatively stable. On the other hand, they found that as age increased parental influence had a negative relationship with the use of drugs such as cocaine and heroin but not for alcohol suggesting the need to study effects of parental and peer influences on different classes of drugs separately by age. These results however did not clearly state the nature of parental and peer influences or age range of the subjects. Wang et al. (2009) also demonstrated a higher co-relation between adolescent cannabis use and perceived peer cannabis use, the latter which has been shown to be overestimated especially by females (Henry et al., 2011). The findings from Scalco (2016) replicate the findings of Henry et al 2011 that an adolescents own use biases the misperceptions of peer use (perceived peer drug use). In both these studies though they assess perceived drug use of close friends (termed as peers) but as illustrated above (under imitation of friends) when a drug use by friends is differentiated from drug use by peers the results are different in that friends are more influential than peers (McVicar & Polanski, 2012). This suggests that peer and friend drug use should be measured as separate entities.

3.8 Limitations of the narrative review

This narrative literature review is limited by the fact that there was only one reviewer and that some of the literature has come from secondary sources such as unpublished papers and dissertations. Analysing and drawing conclusions from inconsistent empirical literature findings are inconsistent is difficult. Unlike meta-analysis the narrative literature review contains the problems of both Type I (false positive) and Type II (false negative) errors(Collins & Fauser, 2005; Greenhalgh et al., 2005; Popay et al., 2006). This is because unlike meta-analyses, narrative reviews do not generally employ a means to reduce or eliminate these errors. In this review however, systematic review processes were adopted to reduce errors in content and increase reliability such as comprehensive and objective data analyses and validation(Collins & Fauser, 2005).

3.9 Conclusion

The aim of the literature review was to review the state of knowledge on drug use in adolescents aged 11 to 15 years pertaining to age, gender, region, perception of peer drug use, imitation, family reinforcement and attitudes to drug use. The literature review showed that age, gender, region, peers, and family factors were frequently measured determinants of drug use in adolescents. Furthermore, the relationship between structural constructs (age, region and gender) and drug use appear to be influenced by number of contextual factors such as peers, attitudes and family factors. Furthermore, the mechanism of influence (mediation or moderation) varies depends on the contextual variable being measured. There was also lot of heterogeneity in conceptualisation (single concept having many definitions or vice versa many concepts having one definitions – the jingle jangle fallacy). Although Akers has tried to articulate SSSL theory to prevent the jingle jangle fallacy by adequately connecting concepts to arguments and mechanisms of behaviour, the research testing SSSL to-date has also used a varied level of measurement for some of the constructs. Another finding of the literature review was that the research on drug use in adolescents has centred around one

drug or a group comprising mainly of cannabis, tobacco and alcohol use. A handful have focussed on a wider range of drugs. This could explain the heterogenous nature of the mixed findings. There was also a paucity of literature on explanations of drug use in adolescents across all the regions in England as a whole. The literature and theoretical review also show that to date this level of subgroup mediation analysis examining family, friend, peer and attitude effects on the use of drugs (reflecting the current drugs in the market, using the most recent dataset) for each developmental age in the adolescent students aged 11-15 years in England has not been conducted

Using SSSL as a framework, the social learning pathways to drug use via imitation of friends, peer drug use perception, parental approval and attitudes will be examined for *each* age for males and females separately and for each of the nine regions in England. Whilst previous SSSL studies have supported a mediation effect of SL constructs on age and drug use (Akers, 2011; Holland-Davis, 2006; Solakoglu & Yuksek, 2020), none have compared the mediation effects of SL on each age. These studies have tested the SSSL model by aggregating all the variables in to one model, this thesis will be differentiating out the individual effects of mediation on each of the structural variables. The point is to determine how and under what circumstances these social structure factors (age, gender and location) are related to illicit drug use. The aim of this study will be to provide an even richer account of the interplay between social learning and social structure of illicit drug use. Taking this path, this study seeks a differentiated understanding of social factors on drug taking behaviour for each gender, age and location in adolescent students aged 11 to 15 years in England. This study is a first step to examining drug use behaviour in this cohort. This study will add granularity to the current research on peers from a social learning perspective testing if peer association and imitation of friends mediate the relationships for specific different ages, gender and location. A fuller account of using these specific social contexts of illicit drug use can be used as the basis for the design of even more effective prevention and harm reduction policies.

Chapter 4

4. Methodology

4.1. Purpose

The main purpose of this study is to identify statistically significant social learning mediators (imitation, peer association, attitudes and parental reinforcement) of the relationship between drug use and each gender, age and region in the adolescent population in England aged 11-15 years by applying the Social Structure Social Learning (SSSL) theory to the Smoking Drinking Drug use (SDDS) 2016 secondary dataset.

4.2. A realist ontology

Methodology is a combination of practices and techniques which makes assumptions on the nature of reality and underlying implicit postulates on human behaviour (Kuhn, 1962). Most research, including this research, are grounded in a particular perspective and world view, and as such, all knowledge is partial, fallible and to some extent incomplete.

This research is a deductive theory testing approach delineated by core assumptions on ontology (realism), epistemology (positivism), human nature (determinism) and methodology (nomothetic). That is, the reality of harm from illicit drug use exists external to social actors, that it can be prevented or reduced and can be increasingly known by accumulating more complete information (Guba, 1990).

There are different terms for realism, including critical realism (Archer et al., 2013; Bhaskar, 1975, 1998), experiential realism (Lakoff et al., 1987), subtle realism (Hammersley (2002; Hammersley, 2011), emergent realism (Julnes et al., 1998), natural realism (Putnam, 1983, 1992, 1999), innocent realism (Haack, 1998; 2011), and agential realism (Barad, 2007). The distinctive feature of these forms of realism is that they deny that one has any objective or

certain knowledge of the world, and they accept the possibility of alternative valid accounts of any phenomenon. Lakoff (1987) highlights this distinction as follows:

“Scientific objectivism claims that there is only one fully correct way in which reality can be divided up into objects, properties, and relations. Scientific realism, on the other hand, assumes that "the world is the way it is," while acknowledging that there can be more than one scientifically correct way of understanding reality in terms of conceptual schemes with different objects and categories of objects. (1987, p. 265)”

Putnam , 1992) emphasises this view even further by stating that the main tenants of realism is that the world or reality (drug use in this case) is independent of one’s beliefs or how one would envision it to be–that is to say it is what it is and reality can only be viewed from within an individuals’ conceptual schemes. Realism also maintains that a persons' social and environmental context has a causal influence on their beliefs and perspectives. This is very much in line with the viewpoint posited by Akers (1997) in that social learning (imitation, definition, differential reinforcement and differential association) is influenced by ones structural and social environment. In this study, belief or perception, is measured by asking “how many your own age do you think take drugs?” (peer association). Imitation effects are measured by asking “why they used drugs the first time” and personal attitudes to different classes of drugs are measured by asking: “do you think it is O.K. to try cannabis?, “do you think it is O.K. to try cocaine” and “do you think it is O.K. to try sniff glue?”. The fourth social learning construct, parental reinforcement is measured by asking “what would your family do if you started taking drugs?”. These questions are asked with in the social context of interaction with peers and family. From a realist point of view, a persons’ beliefs or perspectives are in fact separate phenomena which interact with the social contexts. Applying a realist ontology provides a world view that allows for better appreciation of interrelationships between people, beliefs and social organisations (Archer et al., 2013). Realists also support the use of structural variables in research by arguing that structures within societies such as age, gender, ethnicity and residence region, exist, that is they are real, and support their use as either dependent or

independent variables in empirical/ statistical causal analysis of societies using regression. Akers' (1998) Social Structure and Social Learning (SSSL) theory posits that one's location in the social structure, as indicated by age, gender or location affects one's chances of learning deviant behaviour (such as drug use) because these locations shape one's exposure to learning processes such as peer associations, reinforcements, attitudes and imitation. Also, Lawson (1999) claims that some structures such as age and gender can be durable, that these durable structures should be referred to as structures and be seen within the context of other social action (Williams, 2000a). There also is wide agreement among realists that these social structures undergo continual change within wider social reality, and vary depending on geographical region (Sayer, 1992, ch. 2-3).

As qualitative research has been the mainstay of realist research, realists such as Sayer (1992, 1999) and Fleetwood (1999) are sceptical about the use of quantitative data and multivariate statistics in realist lead research. They do not accept that underlying interpretations are true and therefore deny that they are an accurate depiction of reality. Kemp and Holmwood (2003) on the other hand do not dispute the presence of event regularities (as seen in a regression analysis for example) and agree that the absence of any regularity does not necessarily mean that there is an absence of causality. They are however sceptical of the true value arising from quantitative data analysis.

Olsen (2005) counters this view point by showing that there is capacity for multivariate statistics to support warranted arguments and that learning can occur through the way analytical studies are interpreted. By way of analysis of bivariate and multivariate empirical data analysis using logistic regression as an example, Olsen was able to show that interpretation does not need to be reductionist. Other authors have previously suggested some solutions to the use of empirical analysis in realist based research such as using the researchers subjective interpretation to decide which associated factors can be considered as casual (Harré, 1998) while other researchers allude that making true causal links are a matter of having a good theory (Olsen, 2007, 2012; Olsen & Morgan, 2005) or this could be achieved

by analysing supplementary qualitative data – mixed methods (Olsen, 2012; Sayer, 1992). On the other hand, it can be argued that research practices should not always dependent or determined by philosophical paradigms. Patton (2002), Tashakkori and Teddie (1998) claim that having these philosophical disagreements on the intrinsic links between certain research methods with particular philosophical disagreements is not fundamental. They argue that methods should be used on the basis of practical utility. That is to say, methodologies or research for that matter can be informed by a number of paradigms that is not necessarily associated to a single philosophical stance (Greene, 2007; Greene et al., 2008; Maxwell & Mittapalli, 2010). This view of reality predicates the other assumptions too (positivist epistemology, human nature, and methodology). The reference to nature of humans is deterministic rather than voluntary in that humans live in an already structured society and behaviour is therefore determined by their environment. The key research implications of this perspective is that the researcher is neither affected by, nor do they affect the subject of the research (Remenyi & Sherwood-Smith, 1998). The researcher should be able to set aside their own values and interests to identify true explanations that may be of causal nature and laws that can account for regularities in human social behaviour (Easterby-Smith et al., 1991).

In order to achieve this, generalisation of results from a large sample size is necessary thus entailing a deductive process. This approach requires a quantitative conceptual operationalisation which means reducing the problem to small elements and knowledge on this reality can be discovered through measurement and observation (Giddens, 1976) – positivist epistemology. Use of illicit drugs is illegal and highly stigmatised and this poses a challenge of objectively capturing this type of sensitive information in adolescents. Previous studies (Neuman, 2013; Wahyuni, 2012) show that nomothetic methods in the form of a self-report survey as compared to routinely collected indirect measures (referrals for treatment, arrests and police seizures) allow replicability (Creswell, 2013), that is, generation of similar results by different researchers if a similar research process and statistical tests are used.

In addition to the social learning constructs described above, both cumulative and sub-groups analysis for age, gender and regional location are included in the data analysis plan to investigate any differences in social learning pathways. This viewpoint is very much in line with that of Robinson (1950) who states that researchers should not make statements or draw inferences about individual behaviour by analysing aggregate behaviour. This is because in doing so a researcher risks committing ecological fallacy. Similarly, atomistic fallacy occurs when inferences are drawn about groups, when analysing individual behaviour (Diez-Rouz, 1992, Hannan, 1971, 1985). It is important to mention here, that (Akers, 1997) deems a fully causative and deterministic mediational model as inappropriate for human behaviour and ought to be abandoned. Akers also hypothesises that the variations in the social learning constructs by age, are created by drug use behaviour each age. He also acknowledges that it is common in research to collapse all the ages in to one group but it may mask age dependent associations. They also found significant variations in the rates of adolescent drug use among the rural and urban communities at the macro level (Krohn et al., 1984). That is, based on the SSSL theory regional differences in normative and social structure traditions, result in differing rates of adolescent drug use behaviour because of differences in associating with delinquent peers, or developing attitudes favourable to delinquency or parental influence and so on.

4.3. Research design

The study will be based on a quantitative methodology involving secondary data from the most recent Smoking Drinking and Drug Use among Young People Survey (SDDS) dataset collected in 2016. The SDSS 2016 was a cross sectional national study based on a self-completion survey including 12,051 pupils aged between 11-15 years (Grade 7-11) from 177 secondary schools across England in the autumn term of 2016.

The Department of Health and the NHS Information for Health and Social Care Commission (HSCIC) fund the National Foundation for Educational Research (NFER) and the National

Centre for Social Research (NatCen) with IPSOS MORI taking over from 2016 to carry out surveys on smoking, drinking and drug use among secondary school students in England. The survey has been repeated biannually since 1982, annually from 1998 until 2014 and then biannually again from 2016. The methodology and questions were changed for 2016 so cross-sectional data from previous years could not be pooled to increase the number of observations.

Previous research applying the SSSL theory in the United States and Korea have mainly used secondary datasets some of which were cross-sectional (Akers et al., 1979; Lanza-Kaduce & Capece, 2003). As this study is focused on the adolescent population in England, the following databases were searched for appropriate data on adolescent drug use: the UK data service (https://www.ukdataservice.ac.uk/); open data published by local authorities (https://data.gov.uk/); the national archives (www.nationalarchives.gov.uk); and NHS England - connecting for health organisation data service - data files of NHS organisations.

It was important to identify a database that was easy to obtain, included a nationally representative sample and included all variables needed to empirically test the SSSL theory. There are currently three national datasets on substance misuse among young people namely: a cross-sectional national survey series, the Smoking Drinking and Drug use survey (1982 -2016) (National Centre for Social Research, 2015); and the two seven-year Longitudinal Studies of Young People in England (LSYPE 2004-2010): the Youth Cohort Study (YCS) (Office for National Statistics, 2008) and the British Crime Survey (Office of Population Censuses and Surveys Social Survey Division, 2000), a cross sectional survey which was replaced by the SDDS in 1982.

The SDDS was selected because a) it includes the age range of interest; b) contains data on a comprehensive range of drugs; and c) includes all the variables of interest. The database and codebook were available free of charge, although permission had to be sought to obtain

the dataset. While the use of longitudinal information would have been potentially useful, the age groups included in longitudinal survey such as the YCS and LSYPE were older than the age groups of interest for this research. In addition, the above-mentioned longitudinal surveys only include measures of alcohol and cannabis use.

4.4. Strengths and limitations of the SDDS Secondary Dataset

The SDDS data set is large, nationally representative, and comprehensive. Given the size of the data set, the total cost of conducting the SDD 2016 cross-sectional survey to the NHS was estimated to be £450,000 (NHS Digital, 2017) which would have been cost and time prohibitive for a PhD researcher to collect data at this scale. This database comprises of data from 12,051 self-administered questionnaires and employs cognitive tested questions appropriate for the 11-15 year old age group to improve reliability and external validity. Notwithstanding this there are some pitfalls associated with secondary data analysis (Johnston, 2017).

First, it might be difficult to achieve perfect consistency between the information included in large secondary datasets, that are typically collected for a variety of purposes, and specific theoretical approaches. Yet, in this case, the SSSL theory was used to guide the selection of the database and the analysis of the data. The first step involved the identification of critical variables suggested by the SSSL theory and those used in previous research. The SDDS 2016 database contained all the variables of interest with respect to the research question, had a large representative sample size, was freely available as well as easily manageable using standardised statistical software.

The second limitation is that the SDDS 2016 survey is based on self-report measures of behaviours that are potentially disapproved and self-incriminating and this may potentially lead to response bias or inaccurate response (Delaney-Black et al., 2010; Percy et al., 2005; Williams & Nowatzki, 2005). This could be in the form of exaggeration of use due to social desirability or under reporting of use (Macleod et al., 2005), misinterpretation of the questions,

or recall failure (Cottler et al., 1994; Harris et al., 2008). To address this limitation as best as possible, researchers conducting the SDDS 2016 survey put several mechanisms in place such as developing cognitive based questions (checking the understanding and interpretation of questions being asked by the respondents), using clear and concise language, distancing two negative outcomes to reduce the influence on order effects of context and question (Podsakoff et al., 2012). Results from previous research[3] has shown that the Smoking Drinking Drug Use Surveys includes reliable measures for assessing drug use.

4.5. Characteristics of the sample and sampling procedure

The database used for this study includes information collected from a representative sample of the English population between 11-15 years of age. More specifically, it comprises information on 12,051 participants gathered via self-administered questionnaires, employing cognitive tested questions appropriate for this age group, in order to improve reliability and external validity. Multi-stage probability design was applied whereby schools were selected first, followed by classes using random sampling techniques (NHS Digital, 2017). This design was changed from that used in the previous SDD surveys to allow the inclusion of further schools and increase the number of students participating. Pupil referral units and special schools were not included in the survey. As a result, 68 students on average per school participated in the survey as compared to 35 students in the previous years. Different numbers of schools were sampled in each region based on the response rates in the previous two SDD surveys (this means that almost equal numbers of schools participated in each region).

For each of the regions, systematic stratified sampling was used by the research team to select the schools at random from the Department of Education's register for England and Wales – Edubase. Prior to school selection, Edubase was sorted in the following manner:

[3] Section A8 of Health and Wellbeing of 15-year-olds in England - Main findings from the What About YOUth? Survey 2014

type of school (academy, independent, foundation, community, voluntary aided/controlled); single sex or mixed and local authority deprivation score. The probability of each school being selected is proportional to the number of children in year 7-11 that is larger schools in each region had a higher chance of being selected. For each of the 646 schools selected three classes were sampled thereby counterbalancing the chance of a larger school being selected at this stage of sampling. That is, one class from year 7 and 8 (age 11 and 12) and two classes from year 9, 10 and 11 (age 13, 14 and 15). More classes from the older cohort were sampled to ensure adequate final samples (based on low response rates from the older years in the previous surveys) and to increase the precision of estimates as risk taking behaviour is more prevalent in this group (0.6% for 11 year olds and 18.2% for 15 year olds – SDD 2014). All students in the selected classes were deemed eligible to participate. Next each of the schools were randomly allocated to six groups of equal size using the same set of stratifiers used to select the schools, thereby ensuring that each of the six groups had a representative sample in each school year. Once this was done, alphabetically ordered lists for each relevant year was obtained and one class was sampled using a Kish grid which is a pre-assigned table consisting of random numbers that is used to select survey respondents (Kish, 1949; McBurney, 1988). This technique uses equal probability sampling cases at random in the event multiple cases are eligible for inclusion e.g. multiple year 7 classes. By the time the survey took place most of the 11 year olds had turned 12 years of age meaning that this age does not have equal representation as the 12 to 15 year olds. Similarly, to ensure that each region had equal numbers of schools participating, selection weights were used. This weighting methodology[4] was the same that was used in the 2014 SDD survey.

These four modifications: increase in student samples, equal representation for each age group 12 to 15 year olds, equal representation of each region, cognitive based questions and

[4] Smoking Drinking and Drug Use among young people in England 2016: Appendices; Paul Niblett, responsible statistician, Lifestyles Team, NHS Digital; https://files.digital.nhs.uk/publication/j/b/sdd-2016-app1.pdf

inclusion of new psychoactive, allow for greater generalisability, validity, applicability and reliability than the previous SDD surveys (NHS Digital, 2017). IPSOS MORI contacted participating schools via letters, e-mails and calls to encourage them to participate. Participating students were given letters with survey details to take home to their guardians and parents were asked to reply if they did not want their child/children to take part in the survey — passive consent. IPSOS MORI interviewers made arrangements for the three classes in each school to fill in an anonymised questionnaire on the same day, where possible in their classrooms, under the interviewer's supervision and exam conditions. The purpose of this was to reduce the probability of systematic reporting bias.

There were two types of questionnaires, one with a focus on drugs and the other on smoking. These were given out alternately so that no two students sitting next to each other would be completing the same questionnaire. Pupils could request help if they did not understand a question. Absent students were interviewed on a separate occasion or with other classes taking part at different times. Of the 636 eligible schools, 177 agreed to take part. From 177 schools there was a response rate of 93% from students totalling 12,051 eligible completed questionnaires. The overall response rate was 26% at school level. As with previous surveys, the reasons given by the schools for not participating included lack of time, lack of interest, already taking part in other surveys and problems with arranging administrative support.

4.6. Sampling and non-sampling errors

Sampling error occurs when the sample differs from the population as a whole (Fowler Jr, 2013). Samples are subsets of the population from which they are drawn which means they are an approximation of the population. So due to random differences in the characteristics of each sample, each sample produces slightly different estimates. Sampling errors, therefore cannot be completely avoided but can be reduced through ensuring careful sample designs, ensuring that the sample are large enough and that multiple contacts are made to assure a

response that is representative. Standard errors were calculated for key outputs namely age, gender and region and reported alongside other data in the tables in Chapter 5.

Non-sampling errors however can arise at any stage of the survey from planning to when data are being analysed. There are five specific components of non-sampling errors as identified by Biemer and Lyberg (2003). These are: specification, frame, nonresponse, measurement, and processing error. The methodology for the SDD survey has been running since 1982 without major changes, however some significant changes were introduced to reduce the impact of non-sampling errors. These were changes in the descriptions of legal highs, use of street names of drugs and cognitive testing to check the respondents' a) understanding of the questions, b) the processes of information retrieval and c) interpretation of the meaning of specific words and questions. Non-response error is one type non-sampling error that occurs when the pupils taking part in a survey are not representative of all students (Groves & Peytcheva, 2008). To reduce non-response error a number of processes were put in place, including onsite surveys and enlisting the cooperation of the schools, parents and students. Despite these measures, there were instances where response rates varied by region, for this reason, non-response bias was mitigated by using weights using population totals (Thomas et al., 2005).

4.7. Reliability of answers and recall accuracy

Given that the use of drugs in this age group may be experimental or occurring in episodes rather than habitual, questions were asked on use in the last week, month and year to prompt memory recall and thus minimising data loss due to incomplete answers (Bradburn et al., 1979; Gray, 1955). Several other strategies were employed such as collecting information in school periods instead of at home and repeated confidentiality assurances which were backed up by survey procedures that respected privacy and confidentiality to encourage honest answers, which would otherwise be concealed or exaggerated (Delaney-Black et al., 2010; Macleod et al., 2005; Percy et al., 2005; Williams & Nowatzki, 2005)

To obtain independent verification of pupil responses, a fictional drug called “Semeron” was included in the 2016 survey and only 0.17% of students reported taking this drug. This appears to suggest that most students do not systematically over report their drug use in this case (NHS Digital, 2017). There is a risk of under reporting because students may not wish to admit drug taking behaviour for fear of how this will be perceived or simply because they might not want to admit such behaviours (Macleod et al., 2005; McNagny & Parker, 1992; Williams & Nowatzki, 2005). Notwithstanding, this previous analysis of older SDD surveys has shown that SDD provides a reasonable measure of illicit drug use per se[5] in that up to 1998 saliva samples were measured for half the SDD population and these results matched those from the self-reported SDD data. Furthermore in 2003 the prevalence rates of cannabis use was almost double that of the results reported from the Offending Crime and Justice Survey which was administered at home (same population). The researchers concluded that adolescents answer more honestly when answering in a non-home settting. In the same way, the adolescents may be influenced to select the options showing that they do partake in drug use to impress their friends or peers. Although some researchers have argued that objective measures of drug use via urinalysis or hair analysis would provide more reliable answers to drug use (Macleod et al., 2005). However, there are two issues with this measure, first relying exclusively on these methods does not always improve validity due to problems with false negatives and samples are difficult to collect in the time the researchers are allocated to conduct the survey in school (Macleod et al., 2005). Second, some illicit drugs such as LDS or cannabis are only present in such minute quantities that can be difficult to detect or might be quickly metabolised by some individuals and not detected in urinalysis (Williams & Nowatzki, 2005). Third, there are associated ethical concerns with collecting hair or urine samples. The optimal drug use assessment approach as applied by the SDDS methodology

[5] Section A8 of Health and Wellbeing of 15-year-olds in England - Main findings from the What About YOUth? Survey 2014: https://files.digital.nhs.uk/publicationimport/pub19xxx/pub19244/what-about-youth-eng-2014-rep.pdf

is to put in place conditions such as interviewer-interviewee distance, use of cognitive based questions to improve self-reporting (Beck et al., 2002; Harris et al., 2008).

4.8. Validity of Questionnaire

Prior to the pilot field work, IPSOS MORI conducted cognitive testing across four schools located in different parts of the country. The primary purpose of the initial cognitive testing in the 2016 was to fulfil the following objectives: testing the wording of new questions, testing understanding of existing wording of some questions, understanding whether the terminology to clarify some terms were still relevant, such as drug names and use of the term legal highs. This process improves the validity of the questionnaire in that the questions reflect the real meaning of the concepts under consideration (Babbie 1989) and reduce recall bias (Percy et al., 2005).

4.9. Ethical Approval, confidentiality, transparency, and security

The study was approved by the Faculty of Health and Medicines Research Ethics Committee at Lancaster University (FHMREC). This study is analysing an anonymised secondary dataset which means that there is no possibility of identifying nor interacting with the survey participants and this is also in-line with the Data Protection Act 1998 (UK Government, 2018). Parents or legal equivalents were asked for informed and voluntary passive consent for participation in the survey. This dual consent process is considered in view that students under 18 years may be vulnerable to coercion (Mathers et al., 1998). As this is a standard access data (because the data is anonymised), the terms and conditions of access include acceptance of an End User License (EUL) which is agreed during user and All data were anonymised and student data files available at the UK Data Archive does not contain identifiable data and is under disclosure control to reduce any chances of individuals being identified. This data can only be distributed under the End User Licence agreement with contains the conditions outlining how the data may be used and stored. The list of schools that took part is not known to NHS digital (NHS Digital, 2017).

4.10. Drug use (Dependent Variable)

The behaviour of interest in the study is drug use by adolescent students aged 11 to 15 years. Accordingly, the dependent variable used in the statistical analysis is based on the question "'When did you last use or take (drug name)?" for each of the following drugs: cannabis; methamphetamine; speed and other amphetamines; LSD; ecstasy; poppers; tranquilisers; heroin; magic mushrooms; methadone; crack; cocaine; ketamine; mephedrone; glue; gas; aerosols or solvents; nitrous oxide; legal highs; or other non-prescription drugs. The SDDS 2016 dataset included data that can be used to build prevalence measures of drug use. The measure of prevalence is based on use within a reference period comprised: drug use in the last month; drug use in the last year; and drug use over their lifetime (ever used drugs) Lifetime drug use was composite derived variable of: drugs used last year, drug used last month, ever used drugs.

Of these three drug use measures, drug use in the **last year** was selected as dependent variable for three reasons. First drug use in the last year is more likely to capture adolescents who are: a) occasional users (who may use a few times a year but not have necessarily used last month), b) as well as regular users (at least once a month) and c) experimental users (who may have only tried certain drugs once) as compared to using the measure of drug use in the last month. Second, this research aims to examine the learning pathways to drug use under the premise that drug use is a socially learnt behaviour. Therefore, using drug use last year would allow more robust interpretations of the associations between the social learning factors (which are learnt over time through interactions) and drug use in the last year. Third, it can be argued that compared to 'ever' drug use, drug use in the last year and last month are not only more indicative of recent drug use but are less prone to issues with recall and under reporting and therefore of greater epidemiological value. Notwithstanding, to check for robustness of the data, cumulative mediation analysis (model 3) was carried out for each of these three measures of drug use (last year, last month and lifetime use). The purpose of this

exercise was to establish whether lifetime and recent drug use involve different social learning pathways to drug use.

Table 1: Coding for dependent variable: Drug use in the last year (Y)

Drug use	Response	Code	Number
Used drugs last year (all drugs grouped)?	Used drugs in the last year	1	1529
	Did not use drugs in the last year	0	7773

4.11. Social Structure (Independent Variables)

This study includes two of the four dimensions specified in the SSSL theory. First age and gender are indicators of differential location in social structure and region is the indicator for differential social organisation. (Akers, 1998, 2011). Lee et. al (2004) have tested the SSSL models with community size (rural, urban, or suburban) as an indicator of differential social organisation and following suit this study uses region to operationalise social organisation. Gender was included among the independent variables. Respondents were asked to select the relevant answer to the question “are you a boy or a girl?”

Table 2: Coding for the Independent variable: Gender

Gender	Response	Code	Number
Are you a boy or a girl?	Boy	0	5817
	Girl	1	6006

Age was assessed by asking the respondents to select an age from 11 to 17 years for the question ‘how old are you now?”

Table 3: Coding for the Independent variable: Age

Age	Response	Code	Number
How old are you now?	11	1	1792
	12	2	2128
	13	3	2746
	14	4	2439
	15	5	2777

As for region, the survey researchers allocated each of the respondents one of nine regions based on their school location, see table 4 for the coding for each region.

Table 4: Coding for the Independent variable: Region

Region	Code	Numbers
North East	1	2100
North West	2	1706
East Midlands	3	966
Yorkshire and Humber	4	1929
West Midlands	5	853
East of England	6	1456
London	7	390
South East	8	1207
South West	9	1444

4.12. Social Learning (Mediating Variables)

Peer association: association with peers who use drugs is one of the strongest predictors of drug use in adolescents (Catalano et al., 2004; Hawkins et al., 1985; McVicar & Polanski, 2012). As postulated in chapter 2 the theoretical framework and in studies operationalising the SSSL framework, peer influence is measured through the perception of peer drug use (Akers, 2011; Kandel et al., 1992; Kim et al., 2013; Lee et al., 2004). Akers (1998) had developed the boys town survey to collect data specific to the social learning variables and in this survey differential association was measured by asking respondents to report the number of peers or friends they perceived were engaged in a particular behaviour.

In this study differential association (one of the four components of social learning) was operationalised by specifying differential association with peers. All respondents were asked based on a Likert scale: “How many people your own age do you think take drugs (including sniffing glue or other solvents)”. Respondents selected from the following options: “All of them; most but not all; about half; some of them; and none of them”. It should be noted, this measure of differential association could be interpreted as peers in the respondents social circle or peers nationally. These five categories were recoded (see table 22 in appendix) into three ordered categories: all or most of my friends are taking drugs; half or less than half; and none of my friends.

Table 5: Coding for the mediator variable: Peer Association

Peer Association	Response	Code	Frequency
How many people your own age do you think take drugs?	Most or all	0	265
	Half or less	1	3696
	None	2	1839

Attitude

Guided by the information from the literature and theoretical review, this research tests the attitude to different classes of drugs: cocaine which is a class A drug, cannabis a class B drug and glue which is covered by the Psychoactive Susbtances Act (2016) (Home Office, 2016). Class A drugs such as cocaine according to the Misuse of Drugs act 1971 (Home Office, 1971), carry the highest penalty for possession, supply and consumption. Cocaine is also the most difficult to get hold of comparatively and is taken for dramatic/profound stimulant effects; cannabis is a suppressant/ depressant which means it has the opposite effect to cocaine (Fothergill et al., 2009; Palamar, 2014; Schaefer et al., 2015a; Seddon, 2008), Glue on the other hand is governed by the Psychoactive Susbtances Act (2016) (Home Office, 2016) which is focused on sanctions related to supply by retailers to those suspected of using glue for psychoactive effects with no sanctions for possession. The data from the SDD survey (2016) shows that prevalence of positive attitudes to cannabis, glue and cocaine have increased from 2014 (9%, 7%, 2% respectively) to 2016 (11%, 8%, 3%), with cannabis having a higher acceptability and preference for use in this age group than the other two drugs (Mayet et al., 2012; McCambridge & Strang, 2005; Swift et al., 2012; Taylor et al., 2012). In this study the attitude was operationalised in line with other studies testing the SSSL (Kim et al., 2013; Schaefer et al., 2015a). Testing the attitudes to these three different drugs should provide an insight to whether there are regional, age and gender differences in preferences for these drugs.

Attitude to drug use was captured using three items to capture the participants' perceptions by asking: "Do you think it is OK for someone your age to do the following?: Try taking cannabis (OKcan1); cocaine (OKcoc1); or sniff glue (OKvs1) to see what it's like". All respondents were required to answer the question. Answers included: "It's OK, it's not OK, and don't know".

Table 6: Coding for the mediator variable: Attitude Cannabis

Attitude Cannabis	Response	Code	Frequency
Do you think it is OK for someone your age to do the following? Try taking cannabis	It's OK	0	1179
	Don't know	1	1005
	It's not OK	2	9425

Table 7: Coding for the mediator variable: Attitude Cocaine

Attitude cocaine	Response	Code	Frequency
Do you think it is OK for someone your age to do the following? Try taking cocaine	It's OK	0	305
	Don't know	1	791
	It's not OK	2	10450

Table 8: Coding for the mediator variable: Attitude Glue

Attitude glue	Response	Code	Frequency
Do you think it is OK for someone your age to do the following? Try sniffing glue?	It's OK	0	880
	Don't know	1	1708
	It's not OK	2	9063

Parental reinforcement

Guided by the literature review and SSSL theory, for this measure the survey question captured this measure well: 'What would your parents do if you started taking drugs: Stop me, persuade me not to, do nothing or encourage me' is in line with questions used in a previous study testing the SSSL theory (Solakoglu & Yuksek, 2020).

If the respondent had answered that they had never taken drugs or taken drugs only on one occasion, they skipped directly to a question about family feelings if the respondent started taking drugs. The question on 'how do you think your family would feel if you started taking drugs?' had the most responses and will be used in this study because it applied to the entire sample of 12,051 students, unlike the previous two questions. Responses included: 'they would try to stop me' (1), 'they would try to persuade me not to take drugs' (2), 'they would do nothing' (3), 'they would encourage me to take drugs' (4), 'Don't know' (5), 'Try to stop me'. The variables 'Stop me' was recoded as strongly disapprove (1), the variable 'persuade me not to' was recoded as disapprove (2) and the variables 'don't know, do nothing and not applicable (not applicable refers to respondents who chose multiple answers (-1)) were recoded as neither approve or disapprove (3). Five respondents reported that their parents would encourage them to take drugs, so this was coded as missing data, see table below for recoded variables.

Table 9: Coding for the Mediator variable: Parental Reinforcement

Differential Reinforcement	Response	Code	Frequency
How do you think your family would feel if you started taking drugs?	Strongly disapprove (Stop me)	0	3829
	Disapprove (Persuade me not to)	1	430
	Neither approve nor disapprove	2	7171

Imitation of friends

This study employs a direct measure of imitation of actual use of drugs by friends who are in the closer inner circle of the adolescent — a more proximal measure as compared to perception of peer drug use (peer association construct in SSSL) — thereby ensuring that that there is a distinction between the two constructs. The operationalisation of this fourth and final SL construct is in line with Akers recommendation of how imitation should be operationalised (Akers, 1998, 2011)

Therefore, imitation was measured by asking: “Why did you try drugs for the first time?” Answers included: “I wanted to get high or feel good; because my friends were doing it; because it is cool; it was a dare; I had nothing better to do; I wanted to see what it was like; I wanted to forget my problems; just because I was offered it; other reasons; I don’t remember; I don’t know”.

The database contained a derived variable of imitation which was coded as yes because my friends were doing it (1) and other (2). The response “because my friends were doing it” was recoded as 0 as this this the category of interest and other reason was recoded as 1.

Table 10: Coding for the Mediator variable: Imitation

Imitation	Response	Code	Frequency
Took drugs for the first time because friends were doing it	Yes	0	171
	No	1	11522

4.13. Analysis

This section describes the procedure for analysis for each of the hypotheses. IBM SPSS version 24 for Mac was used to process the data and to conduct all the data analyses. The secondary dataset had been cleaned, weighted and saved in a SPSS format ready for use by Ipsos MORI who were commissioned by National Centre for Social Research on behalf of the HSCIC to collate the data. The data is owned by the HSCIC- health and social care information centre and is stored on the UK data service website.

4.14. Mediation Analysis

The primary purpose of this analysis is to test the proposition that SL (M) mediates the association between SS (X) and Drug Use (Y). Mediation analysis is a method that is used to quantify the sequence in which an independent variable exerts an effect on a dependent variable through a third variable — a mediator variable. The mediation process requires a

minimum of three independent variables (X), one dependent variable (Y) and a mediator (M) which is supposed to lie on the pathway between Y and X (Baron & Kenny, 1986; Judd & Kenny, 1981; MacKinnon et al., 2007; Preacher, 2015; VanderWeele, 2016; Von Eye et al., 2009).

Guided by the SSSL theoretical framework a parallel multiple mediator model was deemed the most appropriate to provide an accurate assessment of mediating effects (O'Rourke & MacKinnon, 2015). Given measures of all four mediators (Imitation, peer association, parental reinforcement, attitudes) were collected together in the survey and because there is no current theoretical reasoning for one mediator to leading to another, parallel mediation was considered appropriate. If one mediator however was the cause of another mediator, then serial mediation would be an appropriate choice. In this case, parallel mediation of the four social learning mediators is proposed to analyse the relationship between social structure and drug use (see figure 3, 4 and 5). Specifically, parallel mediation is used to understand the relative roles of each mediator in influencing the association between social structure (as defined by age, gender and region) and drug use.

Second, to conduct the parallel mediation, binary logistic regression (Baron & Kenny, 1986) mediation will be used given that the outcome is binary and that the variables are categorical. Baron and Kenny (1986) proposed a widely cited method of investigating mediation through a series of three simple regression models. The first step tests whether the independent variable predicts the dependent variable, second step tests whether the independent variable predicts the mediator and third, the independent variable and mediator should predict the dependent variable.

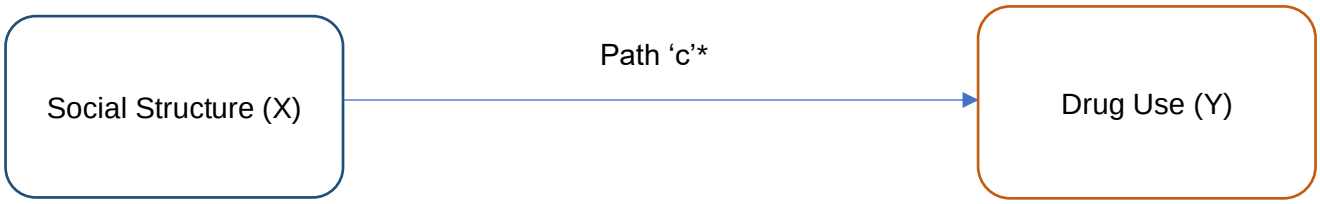
The third point is based on MacKinnon's (2007) logic that significant mediation can exist despite there being no significant association between an independent variable and dependent variable. Therefore, following this argument, all three independent variables (age,

gender and region) regardless of association with the dependent variable (drug use) will be tested in the mediation models.

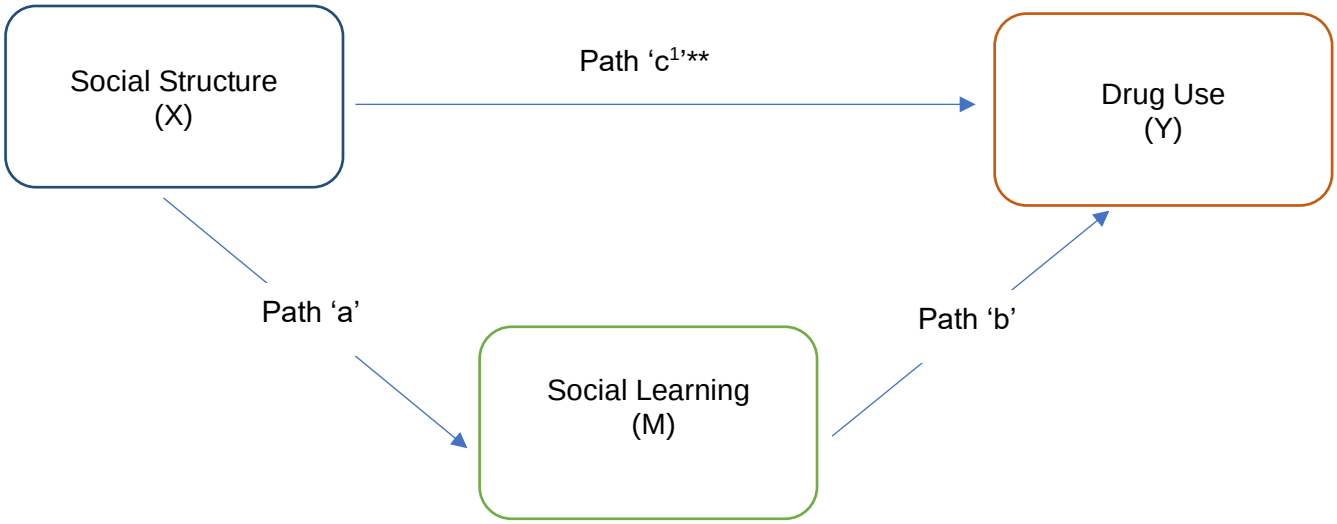
The social structure part of the SSSL theory will be tested first (Model 1), followed by the social learning theory part (Model 2) and then a mediation SSSL model with both the social structure and social learning constructs (Model 3). This will be followed by repeating the regression analysis but with predictor and mediator interaction terms included in the model (Model 4). Statistically significant interactions will provide richer and detailed information on the observed effects. Section 4.18 provides more details on the models. Sub-group analyses were conducted to explore how social learning behaviours vary for specific regions (Model 5), age (Model 6) and gender (Model 7).

Whilst Models 1 to 3 are geared towards testing for mediation part of the hypothesis. Model 4 (the model with interactions) is of interest because it provides an insight in to whether two or more social learning and social structure variables have a joint effect beyond their separate effects on drug use. The inclusion of interaction terms can provide an indirect test of moderation too, but on its own it cannot constitute a test of moderation itself (Wu & Zumbo, 2008). What this means is that to allow a meaningful interpretation of the data including the interaction terms, a sound conceptual understanding of the theory is necessary (Kramer et al 2001). Wu and Zumbo (2008) and Kraemer et. al (2002) also point out that a true moderator is uncorrelated with the other independent variables. So, in this study, subgroup analyses were also conducted in addition to testing for statistical interactions, thus making it a variable-based approach (Hall & Sammons, 2013). To explain this further, Hall and Sammons (2013) argue that variable based distinction refers to the use of methods such as sub-group analyses to emphasise statistical differences between units of analysis, in this study they are: gender groups, specific age groups and specific regions.

Figure 3: Social Structure Social Learning Theory Mediation Pathway[6]



*Total effect of social structure on drug use = c



**Direct effect of social structure on drug use via social learning = c^1

The total effect (path c) from X to Y is partitioned into a direct effect (path c^1) of X on Y and an indirect effect of X on Y through M (path ab) as depicted in figure 3. Full mediation is indicated by the results if the relationship between X and Y is eliminated entirely when M is controlled for, that is when $c^{1'}$ is not statistically significant. Partial mediation is indicated by the reduction in c^1 when M is introduced but the association between X and Y remains statistically significant. See figure 3 for an explanation of the paths. The X to M regression analyses should confirm whether a particular social learning variable is behaving as a mediator.

[6] Wilkhu, P., 2021. Illicit drug use in English adolescent students–result of cumulative mediation analyses. Journal of Substance Use, pp.1-10.

Log (B)/ Odds ratio that is the exponentiation of the beta coefficients used in the regression and not the unstandardised coefficients as indicated in the original Baron and Kenny (1986) model were selected for interpretation in this study. This is because standardisation enables two things, first, it offers an objective scale corresponding to variables that might not have a metric and second it allows comparison of different predictor variables effects within the same models. Based on this, log beta coefficients will be used as parameters for the interpretation for the mediation models.

Throughout the analyses in this study, two tailed tests are used to evaluate the hypotheses credibility. A standard level of p values of 0.05 is accepted for determining statistical significance. This method for analysing mediation was also used by researchers with similar variable characteristics who were applying the SSSL model (Lanza-Kaduce & Capece, 2003, 2017; Lanza-Kaduce et al., 2006; Schaefer et al., 2015a, 2015b). The other methods most commonly used in SSSL studies (with different data characteristics) include ordinary least squares (Hwang & Akers, 2006; Whaley et al., 2016), structural equation modelling (Holland-Davis, 2006; Whaley et al., 2011) and negative binomial regressions (Cooper & Klein, 2018).

There are a number of challenges to testing mediation given the nature of the data and the theoretical framework. First the SSSL framework has four mediators and the data variables are categorical, second the outcome variable is binary and the data are not distributed normally. Third, there is also the possibility of potential non-linear relationships and interactions amongst the predictor variables (age, gender, region) and the mediator variables (imitation, peer association, parental reinforcement, attitudes). For that reason, a binary logistic regression mediation model as emphasised by Baron and Kenny (1986) was deemed the best fit for assessing mediation (Lacobucci, 2012).

Binary logistic regression does not require a linear relationship between drug use and the independent variables, the residuals (error terms) are not required to be normally distributed,

third homoscedasticity is also not required. There are still however some conditions that need to be met. First, ensuring that the sample size was large enough to cater for the expected probability of the least frequent outcome (imitation). That is, given that this study has nine independent variables, and the expected probability of the least frequent outcome (imitation) was .014, then the minimum sample size of 6,428 would be needed (10*9/.014), this data set has a sample size of 12,051. Second, logistic regression requires the observations to be independent and not for example matched pairs of variables. Also, the model should account for multicollinearity, therefore presence of multicollinearity among the independent variables was ruled out using Cramer's V correlation coefficient by testing for zero order correlations (Field, 2018) (see page 77 for results). As in parallel mediation the number of indirect effects are as many as there are mediators, this process is also helpful in determining if any of the SL variables drive mediation more than the others or if all four SL variables contribute to it. Within this approach, while the four mediators are allowed to be correlated, they cannot be *causally* associated (Hayes, 2013). Hence, considering that the four mediators are assessed in the same questionnaire, there is no theoretical reason to conclude that one SL factor would lead to another (in line with the SSSL theoretical framework) (Akers, 1998). That is for example, having a perception of a higher number of peers using drugs would not lead to parental approval or disapproval of drug use or vice versa or having positive attitudes to cannabis would not lead to parental approval of drug use or vice versa. It is equally important to point out that a true mediational relationship may exist even if mediation is not proven due to the presence of a complex set of associations among the variables (MacKinnon, Fairchild, & Fritz, 2007). Subgroup mediation analyses should be able to highlight cases of mediation not identified in the cumulative mediation analysis. Another point is that given the cross-sectional nature of the data, causation should not be inferred from the mediation analyses. This is because unlike longitudinal data the sequence of events are not followed over time but over a discrete time periods which means that temporal causation cannot be inferred (Imai et al., 2010; O'Rourke & MacKinnon, 2015; Pearl, 2014; Valeri & VanderWeele, 2013). However, given the nature of the data and the conceptualisation of SSSL framework, which was designed to imply

causation, causation could be inferred to a degree for e.g. route a) is less plausible: imitation ->males -> drug use as compared to the proposed route b) males -> imitation -> drug use.

4.15. Descriptive statistics

First a series of standard descriptive statistics were performed to explore the characteristics of the adolescents included in the sample. The socio-demographic data include: age, region; gender; and drug use in the last year for the 12,051 students in the dataset. Similarly, frequency of responses to the social learning variables (mediators) namely: attitudes to cannabis, cocaine and glue use, as well as differential reinforcement of parental approval and disapproval to drug use, imitation of drug use and differential peer association (how many own age use drugs) were examined.

The descriptive statistics were also used to understand the frequencies of the different variables and identify the number of missing data for each variable. Although there is no consistent definition of what constitutes an acceptable proportion of missing data for valid statistical inferences to be made, values of 5% or less to 20% or less of values have been proposed (Little & Rubin, 2014; Tabachnick & Fidell, 2001). Missing data can have a statistically significant effect on the conclusions drawn from the data. The most common approach used by researchers has been to omit the cases with the missing data also known as list-wise deletion (Curley et al., 2019; Stavseth et al., 2019). However, Tabachnick (2007) asserts that missing data patterns should be considered alongside the proportion of missing. For this dataset, a missing value tabulated pattern analysis was carried out using SPSS and there was just one pattern of jointly missing data that occurred in more than 1% of the cases, this was for “drug used in the last year”. That is, 189 cases from the entire dataset had missing patterns for ‘drug used in the last year’ and attitude to cannabis, cocaine and glue use. Considering the descriptive statistics and the patterns of missing data and the relatively small number of missing data it can be concluded that the missing data is unlikely to be an issue and because the statistical power of the dataset is high, list-wise deletion was deemed

appropriate for the analyses. Also, this method of dealing with missing cases will allow fair comparisons of the various models being tested in this study.

4.16. Correlation analyses

After testing for frequencies, cross tabulation was carried out to analyse the patterns and trends between the subgroups in the independent (age, gender and region) and mediator variables (peer association, peer imitation, parental reinforcement and attitudes) with drug use.

As all the variables are categorical, not rank ordered and some have more than two categories, a contingency table was set up to evaluate intercorrelation using Cramer's V (φ_c) which indicates how strongly two categorical variables are associated (Cramér, 1999).This analysis was carried out to identify variables that have statistically significant correlations. This is because, variables that are highly correlated lead to biased regression coefficient estimates and inflated standard errors.

A measure of association based on chi-squared test of independence, the Cramer's magnitude of effect can be interpreted as 0 equaling no association between two categorical variables and values bigger than 0.25 indicating very strong associations (Akoglu, 2018).

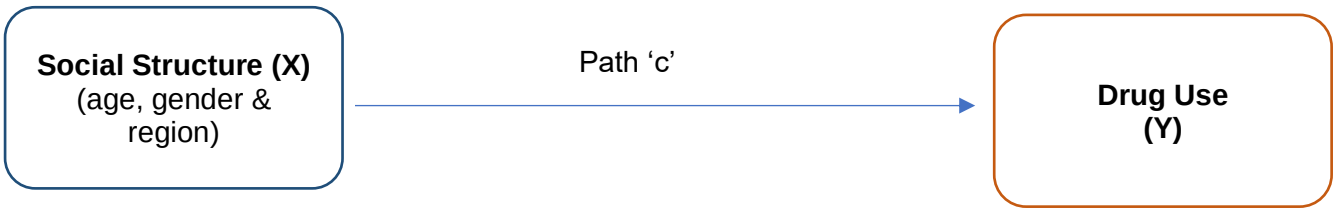
4.17. The Models

a. Model 1: Social Structure Model

The first step involves testing for the statistical association between the independent variables (age, gender and region) and drug use using binomial logistic regression to obtain odds ratio coefficient 'c' which is the exp(B)/ log odds ratio to determine the extent of the association

between X and Y (see hypotheses 1a, 1b, 1c). This will produce a measure of association between each relevant factor considered and drug use, while holding all other factors constant.

Figure 4: Model 1 Social Structure Model[7]

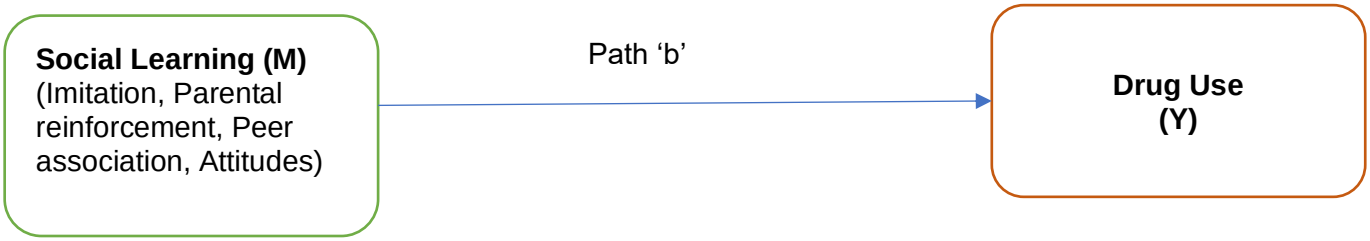


b. Model 2: Social Learning Model

The second step involves using binomial logistic regression to test for the statistical association between the mediating variables (differential association, differential reinforcement, imitation, and attitude) and drug use, (see corresponding hypothesis 2a, 2b, 2c).

For Hypothesis 2a, 2b, 2c, 2d binomial logistic regression was applied to test the statistical association between drug use (Y) and the social learning mediator variables (M): imitation, attitude to drug use differential reinforcement, differential association. In this case, only the four social learning variables: peer imitation, peer association, attitude and reinforcement are included in the model.

Figure 5: Model 2 Social Learning Model[8]

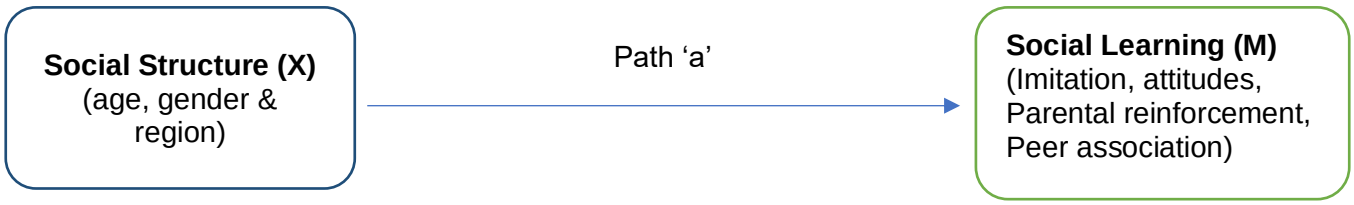


[7,7] Wilkhu, P., 2021. Illicit drug use in English adolescent students–result of cumulative mediation analyses. Journal of Substance Use, pp.1-10.

c. Model 3: Cumulative SSSL Mediation model

The final step to establish mediation involved including all the variables in a single model to obtain a new coefficient value c^1 using binomial regression (see figure 2). However, for a full mediation effect to be considered true there must be an association between the independent variable and the mediator variable, that is social structure (X) and social learning (M). Therefore, before the cumulative SSSL model was run, a series multinomial and ordinal regressions were estimated to establish correlations between SS (X) and SL(M) variables thus testing for association between X and M. Specifically, a multinomial logistic regression analysis was carried out for four of the nominal social learning variables as the dependent variable for each of these models namely imitation and attitudes to cannabis, attitude to cocaine and attitude to glue given the categorical nature of the variables. Ordinal logistic regression was performed for the ordinal social learning variables namely: peer association and parental reinforcement.

Establishing path 'a' (Multinomial and Ordinal regression) [9]

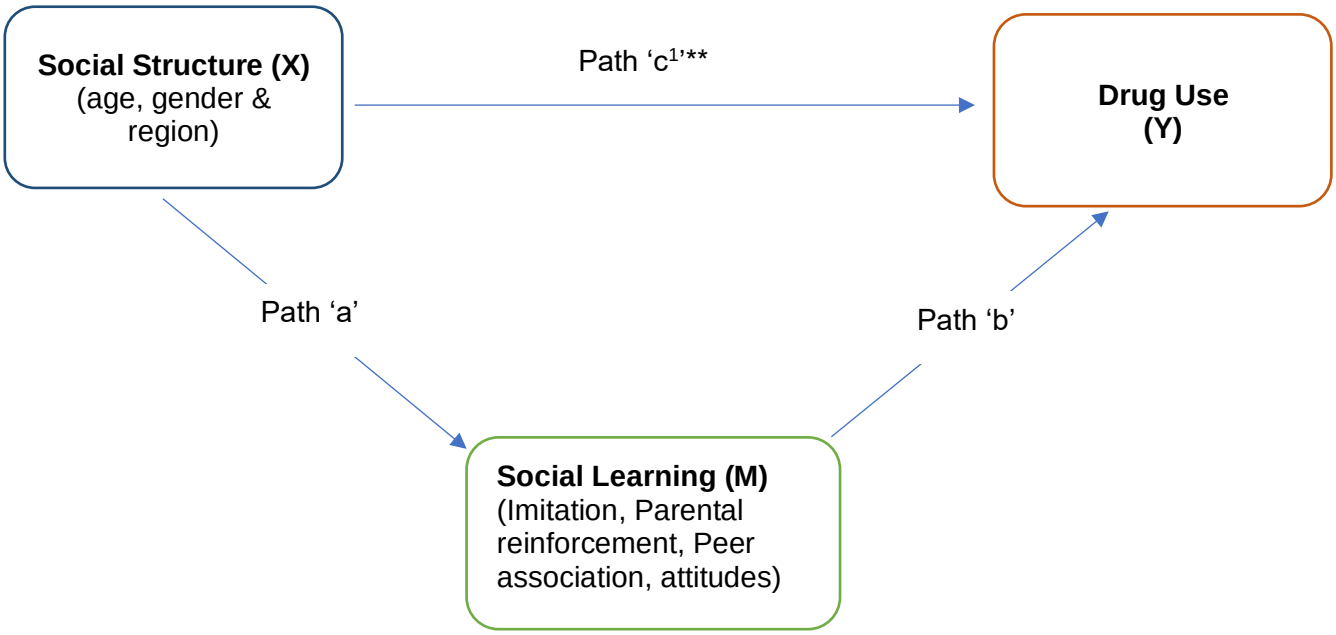


The data from these regressions aid in the interpretation of the results yielded by the full SSSL models. That is, there must be a statistically significant path of association from X to M (path a) and then from M to Y (path b) for mediation to be considered between X and Y via M (path c^1). Model 3 is the fully adjusted model with all three social structural variables (X) and all four

[9] Wilkhu, P., 2021. Illicit drug use in English adolescent students–result of cumulative mediation analyses. Journal of Substance Use, pp.1-10.

social learning mediator variables (M) and drug use to assess the magnitude and effect size with which of the association between social structure variables (X) and drug use (Y) changed.

Figure 6: **Model 3 Step 2 Cumulative SSSL model only (binary logistic regression)**[10]



**Direct effect of social structure on drug use via social learning = c^1

For the purposes of this study, if a reduction in regression coefficient (OR) or the OR is reduced to zero and the association between X and Y is rendered **not statistically significant** with the addition of the social learning variables then a full mediation effect is present, ***provided*** there is also a statistically significant association between the social structure (X) and social learning (M) variable as well. If there is a reduction in the regression coefficient (OR) but the association between X and Y remains statistically significant, then a partial mediation effect will be present **provided** there is a statistically significant association between X and M.

[10] Wilkhu, P., 2021. Illicit drug use in English adolescent students–result of cumulative mediation analyses. Journal of Substance Use, pp.1-10.

If, however an increase in magnitude of the OR is noted **and** association between X and Y remain statistically significant, then a possible moderator effect can be assumed, ***whether or not*** there is an association between the social structure (X) and social learning (M) variable (Baron & Kenny, 1986; Montoya, 2019; O'Rourke & MacKinnon, 2015). The moderator effect is supported if the interaction (path c^1) is statistically significant.

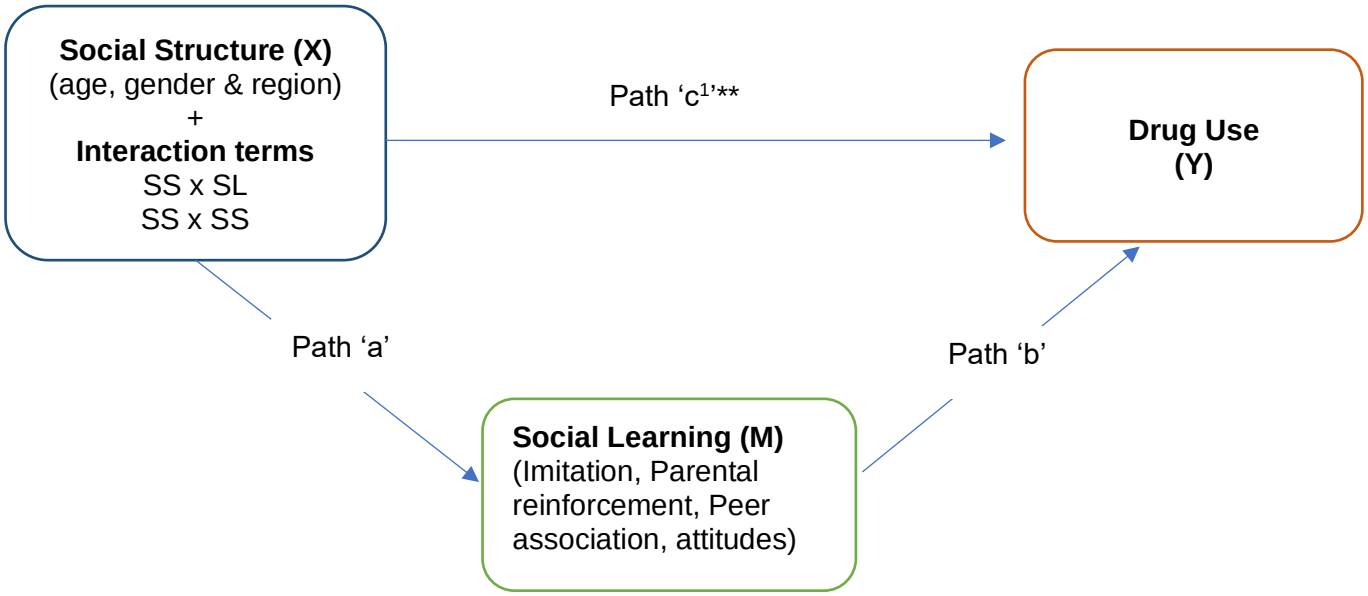
d. Model 4: Cumulative SSSL Mediation model with interactions

The addition of interaction terms into the mediation regression model is expected to expand the understanding of associations between the variables. Statistical interactions between independent variables (age, gender and region) and mediators (social learning variables) implies that the variables have a combined effect in eliciting a third effect, this is a non-causal bidirectional association (Kraemer et al., 2002). Vanderweele and Vansteelandt (2014; 2016; 2010) suggest that a statistically significant $X_{(n)}.M_{(n)}$ interaction indicates that the effect of $M_{(n)}$ on the drug use is a function of $X_{(n)}$ and as the value of the latter changes so does the effect.

Interaction effects between the SS and SL variables and, also between the SS variables were examined in the cumulative/full SSSL model. The main variables (X and M) were included because a failure to do so would have resulted in the artificial inflation of the significance of the interaction (Aiken et al., 1991).

Statistically significant interaction terms also indicate uncertainty about the importance of main effects of the independent variables and that the effect of one variable is dependent on one or more variables. Only statistically significant interaction terms will be reported.

Figure 7: Model 4 Cumulative SSSL model with interaction terms

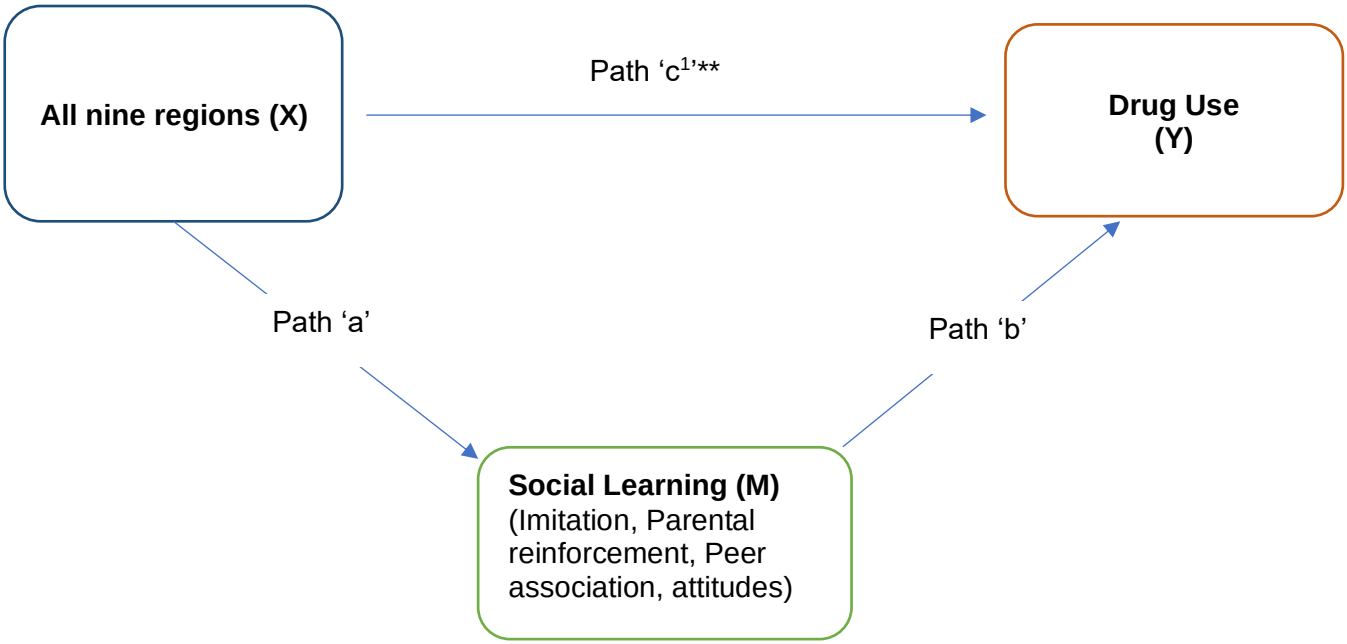


**Direct effect of social structure on drug use via social learning = c^1

e. Model 5, 6, 7: Subgroup SSSL Mediation models.

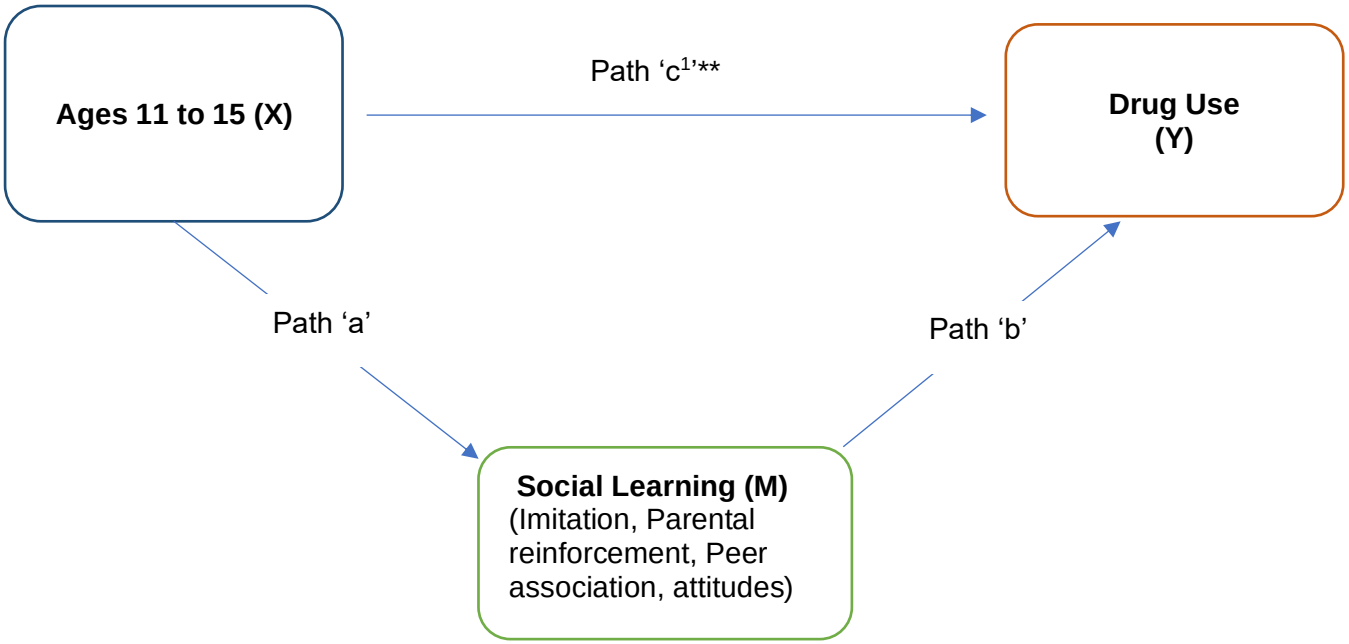
The final goal of the study was to identify which of the four social learning variables is the strongest learning pathway for age, gender and region. The regression analysis will be the same as model 3 except that the output will be split for each subgroup (age, region and gender). Data are split to subgroup level for the analysis first for region (Model 5), then for age (Model 6) and finally for gender (Model 7). These models are used to test hypothesis 3, 4 and 5.

Figure 8: Model 5 Subgroup SSSL model with region only [11]



**Direct effect of social structure on drug use via social learning = c^1

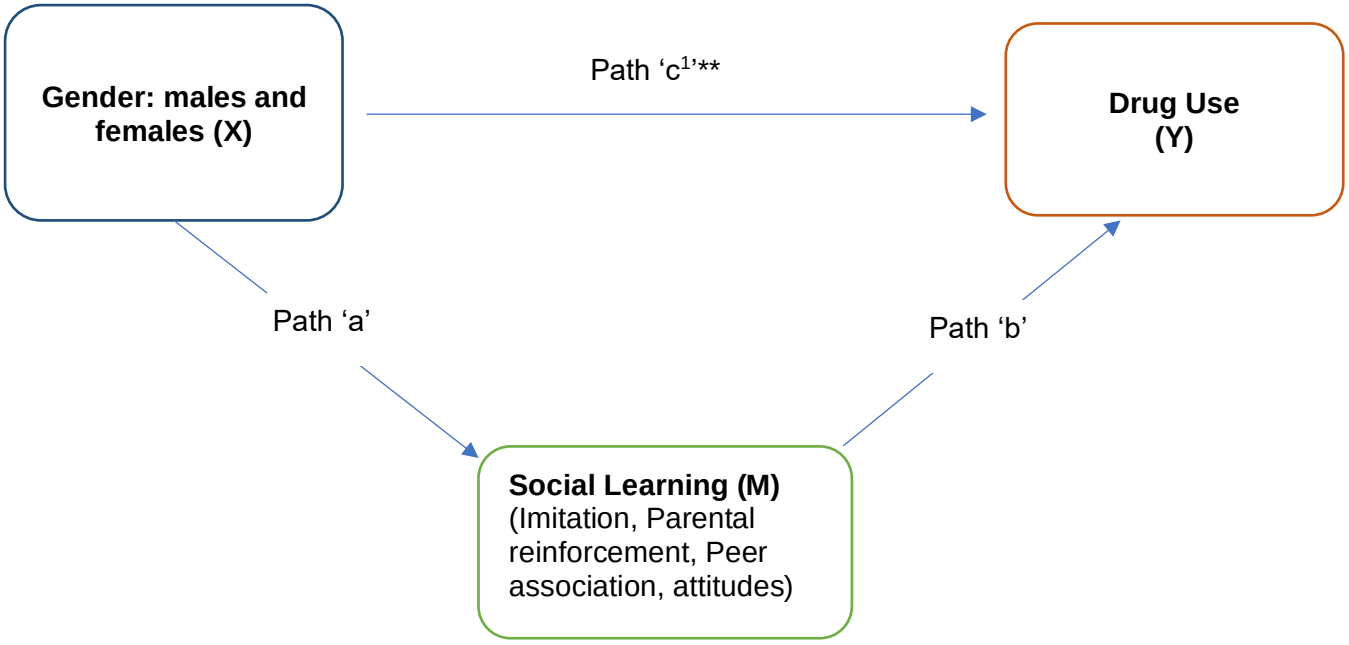
Figure 9: Model 6 Subgroup SSSL model with age only



[11] Wilkhu, P., 2021. Illicit drug use in English adolescent students–Results of a subgroup mediation analyses. *Journal of Substance Use*, pp.1-8.

**Direct effect of social structure on drug use via social learning = c^1

Figure 10: Model 7 Subgroup SSSL model with gender only



**Direct effect of social structure on drug use via social learning = c^1

For every model described a goodness of fit test will be conducted to understand how well the observed variables contribute to the fitted model in comparison to a null model. The 'omnibus test of model coefficients' output will provide information on the overall test of the model (Doornik & Hansen, 2008). A significant decrease in the -2 Log Likelihood (-2LL) in the new model with relevant variables seen in the omnibus test of model coefficients (represented by X^2 test) means that the new model is a statistically significantly better fit than the null model (Doornik & Hansen, 2008).

For logistic regressions, there are different types of pseudo R^2 that can be used to quantify the quality of regression (Aldrich and Nelson 1984; Cragg and Uhler 1970; Horowitz 1982; Maddala 1983; McFadden 1974; Nagelkerke 1991). In this study, the Nagelkerke's R^2 was used to explain the variation in the outcome explained by the model. A combination of X^2 values from the omnibus test of model coefficients and Nagelkerke's R^2 from the model summary table (which is an adjusted Cox & Snell R^2) was used in this study to assess

goodness of fit of the models with statistical significance based at $p<0.05$. If the mediators are too highly correlated, it may lead to multicollinearity, which in turn would affect the significance and estimation of the indirect relationships with drug use (Hayes & Rockwood, 2017; Igartua & Hayes, 2021). In this circumstance, the effects of the mediators on drug use would be attenuated to the degree to which the mediators are correlated (Williams & MacKinnon, 2008).

If moderation instead of mediation is at work, social learning is the circumstance by which the relationship between social structure (age, gender, region) and drug use exists (Hayes & Rockwood, 2017; Montoya, 2019). That is, moderation implies that the strength and direction of the causal relationship between social structure and drug use changes as a function of social learning. (Baron & Kenny, 1986). This is an important point to note because (see also Chapter 2), Akers (1998,1999) posits that social learning mediates the association between social structure and risky behaviours (drug use). One study (Verrill, 2005) testing the SSSL theory found moderation effects as well as mediating effects by social learning. The authors however used interaction terms as a way for testing for moderation and suggested further tests to confirm the findings. Holland-Davies (2006) in her thesis found overall support for mediation by social learning variables for drug use but she also found moderation effects when certain social structure variables (poverty for instance) increased and became statistically significant in the final mediation model for alcohol only and not in the models testing for cannabis use. She suggested that the model be modified to include moderated mediation.

Akers (2011) acknowledges that the suggestions are reasonable and could strengthen the validity of the SSSL theory. He does however take the stance that the overall research findings, even though the body of research is small, are favourable to the SSSL model suggesting that the social learning theory mediates the social structural effects. Akers welcomes the results of further research as it becomes available to make clearer whether the model should be left as it is or modified. In keeping with this statement, this study investigates mediation only as per the original model specification. The next chapter reports the results from each of the analyses steps outlined here.

Chapter 5

5. Results

First a description of the characteristics of the independent, dependent and mediating variables are provided below. Second, the results of correlations analysis amongst all the variables (age, gender, region, drug use, imitation, attitudes, family reinforcement and peer association) are presented. Third the results of the binomial logistic regression to test for association between SS (age, gender and region) and Drug use (SS Model 1) and SL (imitation, attitudes, family reinforcement and peer association) and Drug use (SL Model 2), the full SSSL mediation (SSSL Model 3) followed by results from the inclusion of the XM interaction. Statistically significant X-M interactions would show that the effect of M on drug use is a function of X and this effect changes as the values for X change (for e.g. age changes the effect of M on drug use also changes) in the cumulative SSSL model (Model 4). Finally, the results for the sub-group SSSL mediation analyses, that is for Model 5 (Region SSSL model), Model 6 (Age SSSL model) and Model 7 (Gender SSSL model) are presented to explain the involvement of the mediators. In instances where sample sizes were small, (particularly pertaining to the sub-group mediation analyses where the observations were significantly reduced) large odds ratios and standard errors were observed after excluding for multicollinearity.

5.1. Assumptions in the interpretation of the results

The survey was carried out in the autumn of 2016 and the age of the student at the point of time when the survey was conducted was captured. This means that interpretation of any age associations with drug use in the last year must be taken with a caveat because it represents an age range and not a specific age. For example, for students who were 11 years old at the time of survey, some might have just turned 11 whereas a proportion of the 11-year-old

students would also include those who are on the cusp of turning 12 years but were still 11 years when they used drugs last year. Given this variation in interpretation age at which the student might have been last year, it was decided that the interpretation of results for any association with drug use last year would apply to the student's age at the point of data collection. A second assumption in interpreting the data is that due to the differences in temporal ordering of events, for example, drug use was measured as any drug use in the last year and parental reinforcement was assessed at the time the questionnaire was administered implies that the latter (exposure) should by default precede the outcome (Lagnado & Sloman, 2006; Rottman & Keil, 2012). However, the exposure variables are in fact social learning factors that are learnt over time through interactions and reinforcements. Akers (1998) in fact postulates that past, present and future drug use are dependent on individual beliefs that are developed over time through observation, interaction and reinforcement of behaviours learnt from social and environmental influences. Based on this theoretical reasoning, drug use in the last year can be related to the social learning pathways to drug use (imitation, peer association, family reinforcement etc.) that have been learnt over a time period, even though the questions on the outcome and exposures were asked at the same time. This reasoning was applied in the interpretation of the data.

5.2. Descriptive data analysis

Data analysis was conducted on data from a survey sample of 12,051 students to provide descriptive data on:

- Social Structure (independent) variables: gender, region, age
- Outcome (dependent) variable: number of adolescents who used *drugs in the last year*
- Social Learning (mediator) variables: imitation, attitude to cannabis use, attitude to cocaine use, attitude to sniffing glue, parental reinforcement of drug use, and peer association.

A cross tabulation of all the variables against drugs used last year with Cramer's V correlation values, are presented in table 12.

Results from the descriptive analysis show that out of the total number of respondents more females (8.3%) than males (8.0%) used drugs in the last year. Within gender comparisons however revealed that a higher proportion of males had used drugs (16.8%) than females (15.9%). Reported drug use was the highest for 15-year-old adolescents (6.9%) compared to 11-year-old adolescents (1.0%). Overall, the number of respondents reporting drug use increased with age.

Across England, adolescents living in the Northern parts of England reported the highest percentages of drug use: North East (2.7%), North West (2.6%) and York and Humber (2.3%), whereas adolescents in London reported the least drug use (0.8%). These numbers are reflective of the number of respondents for each of the regions. However, within region comparisons reveal that a higher proportion of the total respondents from London (22.8%) and 18.4% from South East reported using drugs. Comparatively, in the South West of England only 13.8% of respondents from the region had used drugs in the last year. East Midlands, West Midlands and East of England, based on the number of respondents for that region, had similar number of drug use proportions in their regions at 16.3%, 16.3% and 15.9% respectively.

Adolescents who reported positive attitudes cannabis had a higher frequency of drug use (6.8%) compared to those with a positive attitude to glue (3.7%) and positive attitude to cocaine (1.7%). Also, of note is that more adolescents were unsure about whether it was acceptable to use glue (14.1%), compared to cocaine (6.3%) and cannabis (8.1%). Another important observation was minimal difference in drug use between the percentage of adolescents with positive attitudes to cocaine (1.7%) and those who were unsure (1.6%). A similar trend was reported for adolescents unsure of glue use who used drugs last year (3.0%)

and those who had positive attitudes to glue use and drug use last year (3.7%). In fact, a higher proportion of students who were unsure of glue use reported consuming drugs last year (3%), compared to those who were unsure about cocaine and cannabis use. At the opposite end of the spectrum, the difference in percentages of adolescents who used drug used last year was clearer between the groups who reported positive attitude to cannabis (6.7%) and those who were unsure (2.0%). The overall trend for attitudes to all three drugs, indicates that drug use is highest in those who report positive attitudes followed by those who are unsure and the lowest in those who reported negative attitudes.

1.5% of adolescents who reported imitating friends, took drugs in the last year compared to 0.3% who also reported imitation but did not consume drugs in the last year. With regards to peer association, although a higher frequency of drugs used last year was observed for those who reported that half or less of their peers used drugs last year (12.6%) compared to those who reported most or all of their friends used drugs (2.6%); within group comparisons show that drug use was highest in those having the perception that most or all of the peers use drugs 54.5%.

More adolescents (2.3%) who reported that their parents would try to stop them from taking drugs (strong disapproval) took drugs in the last year, compared adolescents who reported that their parents would try and persuade them not to take drugs (0.4%) (disapproval). Comparatively 14% of the total respondents with parents who neither approved nor disapproved, reported using drugs last year.

Turning to the correlation table, the results reveal that drug use was correlated to all the variables except for gender (φ_c=.01, p<.26). The correlation between parental reinforcement and region (φ_c=.03, p<.32); gender and parental reinforcement (φ_c=.01, p<.71), imitation and gender (φ_c=.01, p<.24) and imitation and region (φ_c=.02, p<.83) were not statistically significant. The coefficient for the correlation between attitudes to cocaine and cannabis was

only slightly above 0.5 (Cohen, 1988) at φ_c =.59 to warrant concerns of multicollinearity (table 12b). Furthermore, in view of Akers (1998, 2011), peer association, parental reinforcement, imitation and attitudes are all indicators of the same construct of social learning, which means that some sort of multicollinearity among these variables is to be expected, nevertheless.

Table 11: Descriptive Statistics

Variable φ_c / (p-value)	Total cases & Missing cases	Category	Not Used Drugs Frequency/(%)	Used Drugs Frequency/ %
Gender*DrugsUsed (φ_c=.01 p=.26)	**9137 (75.8%)** **2914 (24.2%)**	**Boy (1)** % **Total** %within Gender **Girl (2)** %Total %within Gender	3625 39.7% 83.2% 4017 44.0% 84.1%	**733** 8.0% 16.8% **762** 8.3% **15.9**%
Age 11-15*DrugsUsed (φ_c=.21 p<.001)	9176 (76.1%) 2875 (23.9%)	**11 (1)** %within Total %within Age **12 (2)** %within Total %within Age **13 (3)** %within Total %within Age **14 (4)** %within Total %within Age **15 (5)** %within Total %within Age	**1261** 13.7% 93.3% **1472** 16.0% 91.0% **1801** 19.6% 86.7% **1513** 16.5% 80.7% **1623** 17.7% 72.0%	**91** 1.0% 6.7% **145** 1.6% 9.0% **276** 3.0% 13.3% **362** 3.9% 19.3% **632** 6.9% 28.0%
Region*DrugsUsed (φ_c=.06 p<.001)	9302 (77.2%) 2749 (22.8%)	**North East (1)** %within total %within Region **North West (2)** %within Total %within Region **York&Humber (3)** %within Total %within Region **East Midlands (4)** %within Total %within Region **West Midlands (5)** %within Total %within Region **East England (6)** %within Total %within Region **London (7)** %within Total %within Region **South East (8)** %within Total %within Region **South West** (9) %within Total %within Region	**1332** 14.3% 84.4% **1031** 11.1% 80.9% **1222** 13.1% 85.2% **617** 6.6% 83.7% **551** 5.9% 84.1% **972** 10.4% 83.7% **237** 2.5% 77.2% **803** 8.6% 81.6% **1008** 10.8% 86.2%	**247** 2.7% 15.6% **244** 2.6% 19.1% **212** 2.3% 14.8% **120** 1.3% 16.3% **104** 1.1% 15.9% **189** 2.0% 16.3% **70** 0.8% 22.8% **181** 1.9% 18.4% **162** 1.7% 13.8%

Attitude Cannabis*DrugsUsed (φ_c=.45 p<.001)	9121 (75.7%) 2930 (24.3%)	**It's Ok to try (1)** %within Total %within Att. Can **It's not OK (2)** %within Total %within Att. Can **Don't Know (3)** %within Total %within Att. Can	**391** 4.3% 38.7% **6699** 73.4% 90.8% **555** 6.1% 75.7%	**620** 6.8% 61.3% **678** 7.4% 9.2% **178** 2.0% 24.3%
Attitude Cocaine*DrugsUsed (φ_c=.22 p<.001)	9087 (75.4%) 2964 (24.6%)	**It's Ok to try (1)** %within Total %within Att. Coc **It's not OK (2)** %within Total %within Att. Coc **Don't Know (3)** %within Total %within Att. Coc	**100** 1.1% 39.4% **7087** 78.0% 85.8% 4**26** 4.7% 74.6%	**154** 1.7% 60.6% **1175** 12.9% 14.2% **145** 1.6% 35.4%
Attitude Glue*DrugsUsed (φ_c=.26 p<.001)	9149 (75.9%) 2902 (24.1%)	**It's Ok to try (1)** %within Total %within Att. Glue **It's not OK (2)** %within Total %within Att. Glue **Don't Know (3)** %within Total %within Att.Glue	**392** 4.3% 53.6% **6262** 68.4% 87.9% **1011** 11.1% 78.4%	**340** 3.7% 46.4% **866** 9.5% 12.1% **278** 3.0% 21.6%
Imitation *DrugsUsed (φ_c=.25 p<.001)	9044 (75.0%) 3007 (25.0%)	**Friends were taking (1)** %within Total %within Imitation **Other reason (2)** %within Total %within Imitation	**30** 0.3% 18.5% **7628** 84.3% 85.9%	1**32** 1.5% 81.5% **1254** 13.9% 14.1%
Peer Association *DrugsUsed (φ_c=.29 p<.001)	4699 (39.0%) 7352 (61.0%)	**Most or all (1)** %within Total %within peer assoc. **Half or less (2)** %within Total %within peer assoc. **None(3)** %within Total %within peer assoc.	**101** 2.1% 45.5% **2418** 51.5% 80.7% **1410** 30.0% 95.3%	**121** 2.6% 54.5% **580** 12.3% 19.3% **69** 1.5% 4.7%
Parental Reinforcement *DrugsUsed (φ_c=.21 p<.00)	8871 (73.6%) 3180 (26.4%)	**Strongly disapprove (1)** %within Total %within Parental Reinf. **Disapprove (2)** %within Total %within Parental Reinf. **Neither (3)** %within Total %within Parental Reinf.	**2928** 33.0% 93.4% **321** 3.6% 89.9% **4136** 46.6% 76.9%	**208** 2.3% 6.6% **36** 0.4% 10.1% **1242** 14.0% 23.1%
Total (N)	12051			

Table 12: Correlation matrix (φ_c pvalue)

Variable Cramer's φ_c (pvalue)	Gender	Age 11-15	Region	Drug Used last year	Attitude Cannabis	Attitude Cocaine	Attitude Glue	Imitation	Parental Reinforcement	Peer Association
Gender	1									
Age 11-15	.03(.02)	1								
Region	.09(.00)	.06(.00)	1							
Drug Use in the last year	**.01(.26)**	.21(.00)	.06(.00)	1						
Attitude Cannabis	.03 (.00)	.24 (.00)	.04(.00)	.45 (.00)	1					
Attitude Cocaine	**.02 (.22)**	.09(.00)	.04(.02)	.22 (.00)	.59(.00)	1				
Attitude Glue	.03 (.02)	.06(.00)	.04(.00)	.26 (.02)	.37(.00)	.43(.00)	1			
Imitation (Why took drugs for first time)	**.01 (.24)**	.06(.00)	**.02(.83)**	.25 (.00)	.14(.00)	.08(.00)	.09(.00)	1		
Parental Reinforcement (Family feelings if started taking drugs)	**.01 (.71)**	.04(.00)	**.03(.32)**	.21 (.00)	.10(.00)	.08(.00)	.09(.00)	.04(.00)	1	
Peer Association (How many own age take drugs)	.09(.00)	.30(.00)	.07(.00)	.29(.00)	.16(.00)	.10(.00)	.12(.00)	.14(.00)	.15(.00)	1

5.3. Regression Analyses

a. Model 1: Social Structure Model

This test is used to explore the statistical association between the dependent variable and the independent variables. This section reports the results of the first research question: **is social structure associated with drug use in the last year?**

- **Hypothesis 1a:** Older adolescents will be positively associated with drug use.
- **Hypothesis 1b:** Being Male will be positively associated with drug use.
- **Hypothesis 1c:** There will be regional variations in drug use

The social structure model contains the three social structures (age, gender and region) and drug use variables. A binary logistic regression was performed to explore the association of age, gender and region on the likelihood that the adolescents used drugs in the last year. The logistic regression model shows a statistically significant, χ^2 (13) = 438.3 p≤0.001 and the model explained 8% (Nagelkerke R^2) of the variation in drug use in the last year and correctly classified 84% of the cases. The model fit, Wald χ^2 statistic shows a statistically significant contribution by region (χ^2 =30.2, p≤0.001), age (χ^2 =375.7 p≤0.001) but not by gender (χ^2=.88, p≤.349).

The likelihood of using drugs increases with age. More specifically, 11-year-old adolescents were 0.19 times likely to have used drugs in the last year than their 15-year-old counterparts. Adolescents in the London area were 2 times more likely to have used drugs in the last year as were those living in North West (1.4 times), East of England (1.3 times) and South East (1.45) times more likely to have used drugs than those living in the South West. Gender is not statistically significantly associated with drug use in this model. Given the paucity of literature on regional differences in adolescent drug use, South West was used as the last reference category as proxy. However, for future research, socio economic status or deprivation for example can be used to justify choice of a region.

Table 13: Association between Age, Gender, Region and Drug Use Last Year

	Social Structure Model			
	Exp(B)/ Odds Ratio	Significance (p value)	B	S.E
11 years	.19	.00	-1.69	.12
12 years	.25	.00	-1.38	.10
13 years	.38	.00	-.978	.08
14 years	.61	.00	-.50	.08
15 years	-	-	-	-
Male	1.06	.35	.06	.06
Female	-	-	-	-
North East (1)	1.18	.16	.16	.11
North West (2)	1.44	.00	.37	.12
York & Humber (3)	1.12	.32	.12	.12
East Midlands (4)	1.30	.06	.26	.14
West Midlands (5)	1.06	.70	.06	.14
East England (6)	1.30	.03	.26	.12
London (7)	2.03	.00	.71	.17
South East (8)	1.45	.00	.37	.12
South West (9)	-	-	-	-
Model Fit				
Chi-square	438.28 (df. 13)	.00		
Nagelkerke Pseudo R^2	.08			

b. Model 2: Social Learning Model

This regression analysis addresses the second research question: **do social learning constructs (imitation, peer association, parental reinforcement and attitudes to drugs) mediate the association between social structure (age, gender and region) on illicit drug use?**

Hypothesis 2a: Positive attitudes towards cannabis/cocaine/ glue are positively related with drug use.

Hypothesis 2b: Imitation is positively associated with drug use.

Hypothesis 2c: Perception of high number of drug-using peers is positively associated drug use.

Hypothesis 2d: Strong parental disapproval towards drug use is negatively associated with drug use.

Like the social structure model, this model contains only the social learning and drug use variables. A binary logistic regression was performed to investigate the effects of peer association, peer imitation, parental reinforcement and attitudes (to cocaine, cannabis and glue use) on the likelihood that adolescents used drugs in the last year. The logistic regression model shows a statistically significant χ^2 (11) = 1626.60 p≤0.001 and the model explained 59% (Nagelkerke R^2) of the variance in drug use and correctly classified 86% of the cases. The model fit wald χ^2 statistic show that attitudes to cannabis (χ^2 = 189.63 df(2), p≤0.001), cocaine (χ^2 = 7.34 df(2), p≤0.03), glue use (χ^2 = 19.58 df(2), p≤0.001), peer association (χ^2 = 81.30 df(2) p≤0.001), parental reinforcement (χ^2 = 418.43 df(2), p≤0.001) and imitation (χ^2 = 57.09 df(1), p≤0.001), contributed significantly to the model. All social learning measures were statistically significantly associated with drug use.

The peer association variable has the strongest influence on drug use compared to any of the other social learning variables. Adolescents who perceived that most or all of their peers own age were taking drugs were themselves 14 times more likely to have taken drugs in the last year compared to adolescents who perceived that none of their peers took drugs. Consistent with previous research and the correlation matrix results above, drug use is highly correlated with peer association (Akers, 2011), more than any other social learning variable.

In addition, adolescents with a positive attitude to cannabis use were 9.8 times more likely to have used drugs in the last year compared to those with a negative attitude. Furthermore, those who had unsure attitudes to cocaine had lower odds of drug use in the last year. Comparatively, those with positive attitudes to glue who had twice the odds of having used

drugs in the last year. This data indicates that the acceptability of cannabis is the greatest followed by glue and cocaine. Those who reported having taken drugs for the first time because of imitating friends, had 8.5 times the odds of drug use in the last year. This result is an improvement on previous SSSL models where imitation has been the weakest SL measure Akers (1998,2011) (Hwang & Akers, 2006). Adolescents who reported strong parental disapproval (stop me from taking drugs) and disapproval (persuade me not to take drugs) were 0.07 times likely to have used drugs in the last year (OR=.07).

In summary, having 1) positive attitudes to cannabis and glue, 2) imitation of friends who use drugs and 3) have a perception that peers use drugs are associated with increased drug use. On the other hand, both types of parental reinforcement (strong disapproval and disapproval) and not being sure about cocaine use are associated with decreased drug use.

Table 14: Model 2: Association between SL Mediator variables and drug use.

	Social Learning Model			
	Exp(B)/ Odds Ratio	Significance (p value)	B	S.E
Attitude Cannabis- OK	9.78	.00	2.28	.17
Attitude Cannabis- Not sure	4.22	.00	1.44	.23
Attitude Cocaine-OK	1.08	.81	.08	.33
Attitude Cocaine- Not sure	.47	.01	-.76	.29
Attitude Glue- OK	2.13	.00	.76	.19
Attitude Glue Not sure	.81	.28	-.21	.20
Fam Reinf. Strongly disapprove	.06	.00	-2.75	.14
Fam Reinf. disapprove	.07	.00	-2.74	.27
Peer Assoc. Most or all	14.40	.00	2.67	.30
Peer Assoc. Some or less than half	3.47	.00	1.24	.20
Imitation- Yes	8.46	.00	2.14	.28
Model Fit				
Chi-square	1626.61 df (11)	p<.001		
Nagelkerke Pseudo R^2	.59			

c. Model 3: Cumulative Social Structure Social Learning Model

This regression analysis addresses the third research question: **Do peer association, parental reinforcement, imitation and attitude to use of cocaine, cannabis and glue mediate the association between age, gender, region and drug use?**

Hypothesis 3: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between age and drug use.

Hypothesis 4: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between gender and drug use.

Hypothesis 5: a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be statistically significant mediators in the association between region and drug use

Before running the complete SSSL model, multinomial and ordinal regressions were run between the SS (X) and SL (M) variables to test for association between X and M. There must be a significant path of association from X to M to Y for mediation to be considered. An SPSS ordered logistic regression, or PLUM (Polytomous Universal Model) was selected for the two ordinal SL (M) variables, namely peer association and parental reinforcement and multinomial logistic regression was run for the categorical variables which were imitation and attitudes to drug use. The SS (X) variables were age, gender and region. One of the assumptions underlying ordered logistic regression is that the relationship between each pair of outcome groups should be the same. This is also known as the proportional odds assumption or the parallel regression assumption. The null hypothesis is that there is no difference in the coefficients between models, so a non- statistically significant chi-squared value should be obtained. The proportional odds test however indicated that the assumption was violated for

the association between peer association and age (χ^2 =22.99, df(4), p≤.001) and region (χ^2 =105.26, df(8), p≤.001) and for parental reinforcement and age (χ^2 =11.89, df(4), p≤.02), therefore multinomial regressions for these associations were run instead. A more viable option would have been to run a partial proportional odds model (PPOM) (Christensen, 2018), however SPSS does not allow for this. Given the discrepancies and/or differences in results, caution would have to be exercised if STATA or SAS were used to carry out the PPOM analyses (O'Connell & Liu, 2011). So, for that reason multinomial regression was carried out using SPSS.

The results for these two parameters for both ordinal and multinomial regression can be found in tables 16 to 21. The results for this analysis (X to M) show that positive attitudes to glue are positively and statistically significantly associated with age 11 and 12 and the North East region. Adolescents who were not sure whether to use glue were positively and statistically significantly associated with being male. Positive attitudes to *cocaine* are statistically significantly and positively associated with ages 11 to 14 years, adolescents who were not sure whether to use cocaine were positively associated with 11 to 13 years of age and the North East Region. Positive attitudes to *cannabis* are statistically significantly and positively associated with age 11-14 years, being male and adolescents in the East Midlands. Not being sure whether it is acceptable to try cannabis is statistically significantly and positively associated with adolescents in the North East. *Imitation* of friends is statistically significantly and positively associated with 11-14 years only but not with gender and region. *Strong parental disapproval* is positively and statistically significantly associated with age 11 and 12 whereas parental disapproval is positively and statistically significantly associated with age 12 years. No statistically significant associations for gender and region with parental reinforcement were noted. Having the perception that **most or all** peers own age are using drugs is positively and statistically significantly associated with age 11 to 14 years, being male and adolescents in the North East and North West regions. Whereas having the perception

that **half or less** of the peers own age are using drugs is positively and statistically significantly associated also with age 11 to 14, being male and with adolescents living in the North West, Yorkshire and Humber, West Midlands and London. In summary not all social learning variables were associated with all the social structure variables.

In final step (that is after testing for the association between SS (X) and SL (M), a binary logistic regression was performed to test the ***cumulative*** SSSL model. This model includes the effect of peer association, peer imitation, parental reinforcement and attitudes (to cocaine, cannabis and glue use) on the social structural predictors (age, gender and region) of drugs in the last year. The logistic regression model was statistically significant, χ^2 (24) = 1610.64, p≤0.001. The cumulative SSSL model explained 60% (Nagelkerke R^2) of the variance in drug use and correctly classified 86% of the cases. The results indicate that cumulative model is an improvement on the SS model (8%) (Model 1) and SL model (Model 2) which explains 59% of the variance.

As expected, the odds of drug use became not statistically significant for all social structural variables once the social learning variables were introduced except for 11-year-old adolescents. 11-year-old adolescents are now 0.49 times compared to previously being only 0.19 times likely to have used drugs in the last year after the introduction of social learning variables compared to 15-year-old adolescents. The retention of significance and the increase in odds might imply that social learning variables (all except being unsure of glue and parental disapproval) appear to **moderate** drug use in this age group.

Following the causal steps path tracing rules X to M to Y, positive attitude to glue, cocaine, cannabis and unsure attitude to cocaine and cannabis, imitation, both types of parental disapproval and having the perception that friends were using drugs mediated drug use in 12-year-old adolescents. For ages 13 to 14 years drug use was mediated by positive attitudes to

cannabis, cocaine, unsure attitudes to cannabis imitation of friends and having the perception (any number) that friends use drugs.

Similarly, the odd ratio of drug use in the North West, East of England, London and South East regions became insignificant after the introduction of social learning variables. Drug use by adolescents in the having the perception that peers were using drugs mediated drug use in the North West (both categories) and London (half or less). Drug use was also mediated in the North West by positive attitudes to glue use. As there were no associations between East England and South East with social learning variables, mediation cannot be claimed.

Gender as with the remaining regions remained insignificant after the introduction of social learning variables indicating that there was no mediation.

Table 15: Cumulative SSSL Model for Drugs used Last Year (3916 cases/ 32.5%)

	Model1 SS–>DU		Model 2 SL–>DU		Model 3 SS–>SL–>DU			
Drugs used Last Year	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	B	SE
11 years	.19	.00			.49	.02	-.71	.30
12 years	**.25**	**.00**			**.63**	**.06**	-.46	.24
13 years	**.38**	**.00**			**.95**	**.77**	-.06	.19
14 years	**.61**	**.00**			**.84**	**.33**	-.17	.18
15 years	-	-			-	-	-	-
Male	1.06	.35			1.07	.61	.07	.13
Female	-	-			-	-	-	-
North East (1)	1.18	.16			1.27	.33	.24	.25
North West (2)	1.44	.00			**.99**	**.96**	-.01	.26
York&Humber (3)	1.12	.32			.97	.91	-.03	.26
East Midlands (4)	1.30	.06			.86	.63	-.15	.32
West Midlands (5)	1.06	.70			1.33	.35	.29	.31
East England (6)	1.30	.03			**.76**	**.32**	-.27	.27
London (7)	2.03	.00			**2.02**	**.05**	.70	.36
South East (8)	1.45	.00			**1.07**	**.82**	.06	.28

South West (9)	-	-			-	-	-	-
Attitude Cannabis- OK			9.78	.00	**8.57**	**.00**	2.15	.19
Attitude Cannabis- Don't know			4.22	.00	**3.92**	**.00**	1.37	.24
Attitude Cocaine-OK			1.08	.81	1.18	.64	.17	.35
Attitude Cocaine- Don't know			.47	.01	**.46**	**.01**	-.77	.30
Attitude Glue- OK			2.13	.00	**2.00**	**.00**	.71	.20
Attitude Glue Don't know			.81	.28	.85	.40	-.17	.20
Fam Reinf. Strongly disapprove			.06	.00	**.06**	**.00**	-2.78	.14
Fam Reinf. disapprove			.07	.00	**.07**	**.00**	-2.73	.27
Peer Assoc. All or most			14.40	.00	**12.04**	**.00**	2.49	.31
Peer Assoc. Half or some			3.47	.00	**3.00**	**.00**	1.10	.27
Imitation			8.46	.00	**8.40**	**.00**	2.13	.28
Model Fit								
Chi-square	1610.64 df(24)	p<.001						
Nagelkerke Pseudo R^2	.600							

d. Model 3: Comparison with lifetime drug use and recent drug use as independent variables.

To understand if different statistically significant social learning pathways influence the association between different types of drug use, (lifetime and recent drug use), the mediation model was replicated using two different independent variables representing lifetime (ever used drugs) and recent drug use (drugs used in the last month) from the secondary dataset. The tables (table 40 and 41) can be found in the appendix. The results were interesting in that *peer association* (OR=12.04, p≤.001) was the strongest social learning variable in the original model (drugs used last year) while *imitation*, (OR=264, p≤.001), was found to be the strongest social learning variable in the model for lifetime drug use. The model for drug use last month did not produce statistically significant results. The differences could possibly be highlighting respondents who used drugs last month are systematically behaving in a

different way to those with life-time drug use (ever used). This highlights that there might be a difference in types social learning behaviours depending on what spectrum of drug use the respondents are at. It may also be recent drug users are less likely to have self-reported drug use due to the stigma attached with drug use (as discussed in the methodology chapter 4). This is an area of further research, but the point of this exercise was to highlight that there are differences in results based on which spectrum of drug use is measured as reflected by the type of questions asked and timeframe for drug use. The rest of the analysis continues with the original independent variable which is a measure of drug use in the last year. The reasons for selection of drug use last year have been discussed extensively in 4.10.

e. Model 4: SSSL Model with Interactions

To explore the existence of moderating effect of SS measures (age, gender and region) on the association between SL (imitation, peer association, parental reinforcement and attitudes) and drug use, a binomial logistic regression with all possible interaction terms within the cumulative SSSL model was run. The syntax for the SSSL model with interactions can be found in table 22 in the appendix (the corresponding results table were too large to be included among the main text here).

The logistic regression SSSL model with interactions shows a statistically significant, χ^2 (243) =1967.88, p≤0.001. The model explained 70% (Nagelkerke R^2) of the variance in drug use and correctly classified 94% of the cases. These Nagelkerke R^2 result indicates that the cumulative SSSL model with interactions model appears to explain a larger proportion of the variation in the dependent variable around its mean. However, the larger χ^2 value indicates that the observed and that the expected values are not close and therefore is a poorer fit to the SSSL model comparatively. Furthermore, of the interaction terms that entered this model, it is important to note that all these terms have standard errors greater than 0.5, so the results must be interpreted with caution. Females who used drugs last year are more likely to report

imitation of friends (OR=7.05 p≤.02 SE=.86) and positive attitudes to glue (OR=63.16 p≤.002 SE=1.34). 11-year-old adolescents who reported positive attitudes to glue were 62 times more likely to have used drugs last year as compared to 15-year-old adolescents (OR=62.16, p≤.002, SE 1.34). 12-year-old adolescents reporting parental disapproval were 22 times more likely to have used drugs (OR=21.96 p≤.003 SE=1.03), also those of the same age group who had the perception that most or all peers use drugs were nearly 133 times more likely to have used drugs (OR=132.82 p≤.01 SE=1.98). 12-year-old adolescents with positive attitudes to glue (OR=18.70 p≤.001 SE=.86) and positive attitudes to cannabis were nearly 19 and 587 times (OR=586.68 p≤.001 SE=1.90) more likely to have used drugs, respectively. 12-year-old adolescents who took drugs for the first time because they imitated friends were 15 times more likely to have taken drugs in the last year (OR= 15.05, p≤.02 SE=1.18). The associations for drug use and 12-year-old adolescents living in the West Midlands, East England and the South East were also statistically significant.

At Age 13 having a positive attitude to cocaine (OR=.02 p≤.03 SE=1.87) and glue (OR=7.45 p≤.002 SE=.66) were also statistically significant for drug use last year whereas at age 14 having the perception that most or all of the peers take drugs was statistically significant for drug use last year (OR=.05 p≤.02 SE=1.2), In addition the association between age 14 and adolescents living in North East England was also found to be statistically significant for drug use (OR=8.37, p,≤.04, SE=1.02).

Adolescents living in East of England had statistically significant positive associations with imitation (OR=.05 p≤.02 SE=1.26), positive attitudes to cocaine (OR=142.12 p≤.03 SE=2.34) to drug use. Adolescents living in London who were not sure if it was acceptable to use cocaine were 1075 times (OR=1075.15 p≤.02 SE=2.91), and 26 times more likely (if they reported not being sure about glue use) to report drug use in the last year (OR=26.32 p≤.03 SE=1.50). This is a very large statistically significant odds ratio and a plausible reason for this is that there were very few cases in the subgroups, that is, there were very few respondents in

London reporting unsure cocaine use attitudes and drug use in the last year, resulting in a rare but significant odds ratio.

Adolescents living in the North West reporting positive attitudes to cannabis were 11 times likely to report drug use in the last year (OR=10.59 p≤.01 SE=.89), and those reporting positive attitudes to cocaine were less likely to have used drugs in the last year (OR=.02 p≤.03 SE=1.91). Adolescents living in East Midlands reporting strong parental disapproval were less likely to use drugs (OR=.09 p≤.04 SE=1.20). Each of these interactions are unique and no obvious trends were identified.

Subgroup Models: The analyses above were able to answer whether or not the social learning factors mediated or explained drug use for the social structure factors examined. The data in the table did not however explain which social learning pathway was most significant for a specific age, gender and region but instead applied to all the social structure variables in the analyses. To understand whether there were differences in the social learning pathways, the regression analyses were repeated with for split cases focusing on subgroups (for example age 11 only). The results are presented below.

f. Model 5: Region subgroup SSSL models

All regional subgroup SSSL mediational analysis models were statistically significant. The data tables 23 to 31 for each of the regions can be found in the appendix.

North East

The three types of analyses (cumulative mediation (Model 3), mediation with interaction terms (Model 4) and subgroup mediation (Models 5-7) provide different insights. Model 3 showed that the association between drug use and the North East region was insignificant and remained insignificant after adding the social learning variables when testing for mediation. However, when interaction terms were introduced in the mediation model (Model 4) one interaction was shown to be statistically significant and for those aged 14 years in the region. The subgroup analysis (Model 5) shows that there are, in fact, some social learning pathways that are statistically significant and with varying

degrees of magnitude. The results from the subgroup regression analyses reveal that the strongest social learning pathway of drug use in the North East were positive attitude to cannabis (OR=15.82, p≤.001) and imitation (OR=13.42, p≤.001) (see table 23). Strong parental disapproval was statistically significantly associated with low likelihood of drug use (OR=.09, p<.00, S.E.=.37). Attitudes to cannabis and attitudes to glue were not statistically significant social learning variables.

To summarise the findings, most social learning variables except for attitudes to cocaine and glue, moderate the association between drug use and adolescents in the North East region. Positive attitude to cannabis is strongest social learning moderator of drug use. Drug use is also statistically significant for 14 year old adolescents living in the North East.

North West

From the subgroup analysis the strongest learning pathway for drug use for the North West was attitudes to cannabis. Peer association (most or all) was the next social learning pathway with a strong magnitude of effect. Positive attitudes to cocaine and glue were also found to be statistically significant. The latter results are similar to those obtained from the model with interaction terms in Model 4, (see section above), but the subgroup analysis however revealed a further significant social learning pathway which is parental reinforcement (OR=.07, p≤.001). In summary positive attitudes to cannabis and cocaine, unsure attitude to cannabis and parental reinforcement moderate the association between drug use and adolescents living in this region; and from model 3, we know that peer association (both types), and positive attitudes to glue were found to mediate drug use in this region. Most importantly, adolescents living in this region were much more likely to have used drugs in the last year (36 times) if they had positive attitudes to cannabis than the North East. Imitation was not statistically significant for this region.

Yorkshire and Humber

The results of the subgroup analysis show that Imitation was the strongest social learning variable (OR=28.82, p≤.001), followed by peer association (OR=9.68, p≤.001) and the then positive attitude to

cannabis, parental reinforcement and positive attitude to glue. As the association between drug use for Yorkshire and Humber was insignificant in Model 1 and in the mediation model 3 social learning variables cannot act as mediators for drug use in this region. Based on the subgroup analysis, imitation, peer association, positive attitude to cannabis and glue and parental reinforcement moderate the association between drug use and adolescents living in Yorkshire and Humber.

East Midlands

Mediation as a mechanism for explaining drug use by social learning variables is not probable because the both Models 1 and 3 were insignificant for this region. From the interaction terms entered into the mediation Model 4, a statistically significant association between strong parental disapproval for adolescents living in this region and drug use was noted.

Subgroup analysis, show that unlike any of the regions above peer association and attitude to glue, imitation and parental disapproval are not statistically significant. Rather the social learning variables that are statistically significant with the highest magnitude for this region are not being sure about cannabis use (OR=24, p≤.02), positive attitude to cannabis (OR=19.00 p≤.01), not being sure about cocaine (OR=.01, p≤.001) and strong parental disapproval (OR=.01, p≤.001). The association between drug use for adolescents living in the East Midlands is therefore thought to be moderated by unsure attitudes to cannabis and cocaine use, positive attitude to cannabis (being the strongest moderator) and strong parental disapproval.

West Midlands

There were no statistically significant associations between West Midlands and drug use in Model 1 and in the mediation model 3 noted, so mediation by social learning variables is ruled out. However, a significant interaction term was noted for 12 year old adolescents from West Midlands and drug use. Subgroup regression analysis show that drug use for adolescents living in the West Midlands is moderated by strong parental disapproval, parental disapproval and having the perception that most or all of the peers are using drugs and imitation only. Imitation had the strongest magnitude (OR=20,

p≤.001) of effect. Attitude to cannabis, glue and cocaine had no effect on drug use for adolescents living in the West Midlands.

East of England

Mediation of the association between drug use and adolescents in East of England is ruled because no statistically significant association was noted between East England and any of the social learning variables.

However, there was a statistically significant interaction effect for 12 year old adolescents in the region and drug use as well as positive attitude to cocaine and imitation. The subgroup analysis support some of this in that positive attitudes to cocaine (OR=18.63, p≤.03), positive attitude to cannabis (OR=8.05, p≤.001) and parental reinforcement were the only significant moderators of drug use.

London

Based on the results from Model 3, peer association (half or less) mediates the association between drug use and adolescents living in London. The subgroup analysis show that peer association (most or all (OR=112.8, p≤.02) and strong parental disapproval (OR=.04, p≤.001) are the only moderators of drug use in adolescents from London. The data from the interaction terms entered into Model 4 reveal completely different data in that adolescents from London who were unsure attitude to cocaine use and glue use were associated with drug use. These associations were not noted in the subgroup regression analysis.

South East

Mediation by social learning variables was ruled out because no statistically significant association was noted between South East and any of the social learning variables. An interaction term for 12 year old adolescents living in this region was statistically significant for drug use. Furthermore, the subgroup analysis reveals that peer association was the strongest moderator of drug use (OR=138, p≤.001) followed by attitude to cannabis, imitation and parental reinforcement.

South West

There are no data for Models 1 to 4 as this was a reference subgroup in all these analyses. Subgroup regression analysis however shows a similar pattern to South East in that peer association (OR=23, p≤.01), followed by attitude to cannabis, imitation and parental reinforcement are moderators of the association between drug use and adolescents from the South West.

g. Model 6: Age subgroup SSSL models

All age subgroup SSSL mediational analysis models were statistically significant. Following the X>M>Y path tracing rules, full mediation for age 12 can be explained by all social learning variables (except unsure attitude to glue). Most social learning variables appear to moderate drug use in 11 year olds due to an increase in odds ratio, maintenance of significance in Model 3 and based on the path tracing rules. For ages 13 and 14 positive attitudes to cocaine, positive attitude to cannabis, unsure attitude to cannabis, imitation and peer association (both types mediate drug use. Being unsure about cocaine and positive attitude to glue use also mediates drug use in 13-year-old adolescents.

Turning to the subgroup analysis, the statistically significant interaction terms from model 4 were almost similar to the associations found in this analysis. For 15-year-old males the strongest social learning variable was peer association (OR=12.18, p≤.001) and for 14 year old adolescents the strongest social learning measure was positive attitude to cocaine (OR=8.21, p≤.00), followed by unsure attitude to cannabis, parental reinforcement (both types) and imitation. In 13-year-old adolescents was imitation (OR=32.87, p≤.001) was the strongest social learning variable and also almost the social learning variables were statistically significant in this model (except for unsure attitude to glue). For 12 year old adolescents, peer association was the strongest social learning measure (OR=259.41, p≤.001) followed by, positive attitude to cannabis and glue, parental reinforcement. In 11 year old adolescents, attitude to glue (OR=14.61, p≤.01) was the strongest moderator of drug use followed by strong parental disapproval.

For the younger age groups (11 and 12 years) parental disapproval was insignificant but strong parental disapproval was a statistically significant protective factor for all age groups.

h. Model 7: Gender subgroup SSSL models

Both gender subgroup SSSL models for males and females were statistically significant.

As no association was noted between drug use and gender in Model 1 and in the mediation model 3 where gender remained insignificant after the introduction of social learning variables mediation cannot be claimed. Turning to the subgroup analysis, for males the strongest social learning variable was imitation (OR=27.60, p≤.001), followed by peer association, positive attitudes to cannabis. Both measures of parental reinforcement were protective factors reducing the odds of drug use significantly. For females peer association (most or all friends are taking drugs) was the strongest risk (OR= 15.3, p≤.001) factor followed by positive attitudes to cannabis and then imitation. The subgroup analysis as with the previous models picked up more associations than the model with interactions.

5.4. Summary of results

Model 1 examines the association between the social structure variables and drug use, the relationship between X and Y. This is a good model fit at χ^2 =438.283 p≤0.001 with age 11-15 p≤0.001, χ^2 =408.986, and Region p<0.001, χ^2 =29.609 contributing most to the model and gender not contributing at all to the model p≤.349, χ^2 =.875. The regression analysis also confirms the two of the three hypothesis that there is regional variation in drug use (hypothesis 1c) and increasing age (hypothesis 1a) are associated with drug use in the last year. There is *no statistically significant association between gender* and drug use in the last year and between some of the regions (North East, York and Humber, East Midlands and West Midlands) and drug use in the last year.

Model 2 on the other hand examines the association between social learning variables and drug use in the last year, that is the relationship between M and Y. This model is a better fit than the previous model. All mediators (imitation, attitude, parental reinforcement and peer association) contribute significantly to the model χ^2 (11) = 2288.66, p<0.001 and all mediators except for unsure attitude to

cocaine and unsure attitude to glue are associated with drug use confirming hypothesis 2a, 2b, 2c and 2d.

Model 3 examines whether the social learning variables mediate the relationship between social structure and drug use in a *cumulative* model. Following the path tracing rules X to M to Y drug use was *mediated* by various social learning variables for ages 12, 13 and 14 and *moderated* by positive attitudes to glue and parental reinforcement for those aged 11. The most salient finding in this model, is that the magnitude of social learning pathways varied for each of the ages and this was highlighted in the explanation of data relating to model 3 above. Drug use was mediated by a few (not all) of social learning variables in the North West and London. Another observation was that the model with interactions at times did not pick up some statistically significant associations that were found in the subgroup analysis.

There are key messages the outcomes of the analysis: 1) there are regional, gender and age-related variances in the social learning behaviours and 2) the sub-group models revealed associations that were not found to be statistically significant in the *cumulative* SSSL model with interaction terms 3) social learning did not mediate the association for all of the social structures examined in this research and drug use. These results will be discussed in much more detail in line with the literature and hypotheses in the next chapter.

Chapter 6

6. Discussion

The central aspect of the study was to determine significant social learning pathways that explain drug use behaviour for a specific age, gender and geographical region in adolescent students in England aged 11-15. The conceptual underpinning in this study is the Social Structure Social Learning Theory (SSSL), which posits that an adolescent's age, gender or region affects their chances of learning drug use through four social learning processes namely imitation, peer association, parental reinforcement and attitudes to drugs.

The research questions being addressed in this study are:

1. Are age, gender and region associated with drug use?
2. Are imitation, peer association, parental reinforcement and attitudes associated with drug use?
3. Do peer association, parental reinforcement, imitation and attitude mediate the association between age, gender, region and drug use.

First, the results of the Social Learning (SL) Model are discussed, second, the Social Structure (SS) Model and the *cumulative* SSSL are discussed jointly and finally, there is a discussion on the subgroup models. Findings for the second part of the results will be organised by age, gender and region. Discussions for each of these structural contexts will be in relation to the hypotheses presented in chapter 1 as well as in relation to the relevant literature in the field.

6.1. Social learning (SL) model

a. Imitation of friends and Peer association

Akers (1998) posits that by interacting with different social groups (be it family, friends or peers), individuals are exposed to the behaviours and attitudes of those in the social groups

as well as group norms and values. Differential association (in this study peer association) is said to provide the social context for exposure to attitudes, imitation and reinforcement to occur (Akers et al., 1979). The results in this study are very much in line with this conceptual elaboration of the social theory in that it found that peer association was the strongest social learning pathway to drug use. To be specific, adolescents perceiving that most or all peers were taking drugs were 14 times more likely to have used drugs and having the perception that less than half of their peers take drugs was associated were 3.5 times to have taken drugs compared to those who those who perceived that none of their peers took drugs.

Adolescents who reported imitation were 8.5 times more likely to have used drugs in the last year compared to those who did not imitate their friends. This result is contrary to the argument made by some researchers that friends have more of an influence on drug use than peers (Clark & Lohéac, 2007; Kawaguchi, 2004; McVicar & Polanski, 2012). Researchers employing the SSSL framework have also found perception of peer drug use to be the most robust and consistent predictor of drug use and when pitted against imitation, this construct performs much better (Cooper & Klein, 2018; Duncan et al., 2014; Holland-Davis, 2006; Hwang & Akers, 2006; Solakoglu & Yuksek, 2020).

However, imitation, having previously been one of the weaker social learning pathways in studies using the SSSL framework (Hwang & Akers, 2006; Kim, 2010; Lanza-Kaduce & Capece, 2003; Lee et al., 2004), was found to be a fairly strong social learning pathway in this study. One explanation might be that the studies measured imitation indirectly through observation of role models and stopped short of asking about the respondent's *own* drug use *as a result* of observing drug use. Akers acknowledged this shortfall of using indirect measures and suggested that a stronger measure of imitation is required (Akers, 2011; Akers & Jennings, 2019). This study therefore used a direct measure for imitation as described by social learning theory (Akers et al., 1979; Burgess & Akers, 1966; Sutherland Edwin & Cressey Donald, 1947) by asking the respondent about their *own* drug use after observing their friends

drug use. In fact, studies that did operationalise imitation as a direct measure, found, similar to the outcome in this study, that imitation is the second strongest social learning measure after peer association (Cooper & Klein, 2018; Kim, 2010; Kim et al., 2013).

Based on the results, both hypotheses 2c (Perception of high number of drug-using peers is positively associated drug use) and 2b (Imitation is positively associated with drug use) are supported and are in line with recent studies testing the effects peer association and imitation on adolescent drug use.

b. Attitudes to cannabis, cocaine, and glue

This is the first study to have tested the effects of attitudes to three different types of drugs separately in an SSSL framework. Class A drugs such as cocaine according to the Misuse of Drugs Act 1971 are the most harmful of the three classifications (A, B and C). This class also carries the most severe judicial penalties for possession, supply and production. Cocaine is also thought of as 'hard drug' by users which implies that causes dependency and is taken for dramatic/profound effects whereas cannabis has the opposite effect to cocaine and is regarded by users as being in the 'soft drug' category because it acts as a suppressant/ depressant (Fothergill et al., 2009; Palamar, 2014; Schaefer et al., 2015a; Seddon, 2008). However, cannabis a class B drug whereas glue although not a scheduled or classified illegal drug, is known to give users a high upon inhalation and the easiest to access of all the three.

In this study, positive attitudes to cannabis had the strongest association to drug use than positive attitudes to glue. The association between positive attitudes to cocaine and drug use was insignificant. These results replicate and extend previous research that adolescent attitudes towards drug use in particular cannabis directly influences adolescent's own tendency to engage in substance use (Akers, 2011; Cheung et al., 2016; Hwang & Akers, 2006; Jang, 2002; Mason et al., 2014; Musher-Eizenman et al., 2003; Palmqvist & Santavirta, 2006; Rezaei, 2017; Van den Bree & Pickworth, 2005; Wallace & Fisher, 2007; Wittchen et

al., 2008). The most important point to note here is that both types of attitudes to cannabis and glue (positive attitudes and being unsure) were important social learning pathways to drug use compared to negative attitudes. This is the first study that measures whether the unsure attitudes to various drugs are associated with drug use. The fact that 6.3% of the respondents reported that they did not know if it was acceptable to try cocaine, 14.1% did not know if it was acceptable to try glue and 8.1% did not know if it was acceptable to try cannabis suggests that many adolescents are not familiar or aware of drug laws governing the use of illicit drugs as per the Misuse of Drugs Act 1971. Glue does not fall under the Misuse of Drugs Act 1971 and is freely available to buy, therefore it was not unexpected to note that a higher percentage (14.1%) of adolescents were unsure if it was acceptable to try glue. Infact, 3% of those who were unsure of glue use, 2% of those unsure of cannabis use and 1.6% of those who were unsure of cocaine use reported using drugs. Based on these results examiniation of the extent of unsure attitudes on actual drug use is an area that that warrants further research. Hypotheses 2a (positive attitudes towards cannabis/cocaine/ glue are positively related with drug use) was partially supported with no statistically significant associations between positive attitudes to cocaine and drug use.

c. Parental reinforcement

This study tested whether parental reaction to the knowledge of adolescents' drug use would reinforce their drug use behaviour, that is 'what would your parents do if you started taking drugs?'. There is a substantial body of literature supporting the salience of positive parenting (Hussong & Smith, 2018; Koning et al., 2011; Kuntsche & Kuntsche, 2016) as protective factors in preventing illicit drug use in adolescence. In a test of SSSL on Turkish students, Solakoglu and Yuksek (2020) found that parental reaction (how their parents would react if they would engage in cannabis use) has a negative impact on delinquency. A similar application of the SSSL theory in South Korean high school students, parental reaction to

alcohol use by adolescents was risk factor but parental supervision was a protective factor learning pathway for alcohol use (Kim and Akers 2013, Hwang and Akers 2003).

Looking at the data, 2.3% of adolescents reported *strong* parental disapproval and drug use in the last year compared to 0.4% who reported parental disapproval and drug use and not surprisingly 14% of adolescents who reported that their parents were ambivalent of the adolescent's drug use had taken drugs in the last year. Within group comparisons, however, paint a different picture in that drug use is higher, as the level of disapproval decreases. This finding is supported by the results of the cumulative analyses where strong parental disapproval was found to be slightly more protective than parental disapproval. The subgroup analyses did unmask the differences within groups. Strong disapproval was more protective than disapproval in females and the opposite was seen in males. The results of the subgroup analyses showed that both measures of parental disapproval: 'strong parental disapproval' and 'disapproval' had statistically significant associations with drug use. This perhaps is the most interesting finding of the study, that is the protective role of *strong* parental disapproval on drug use across all age groups, regardless of the region they were living in or of gender. For ages 11 and 12 years strong parental disapproval mediated the association between age and drug use. For all other structural variables strong parental disapproval was a moderator of drug use. Except for London, East Midlands and aged 11 and 12 parental disapproval only (try and persuade me not to take drugs rather than stop me from taking drugs) was also a protective factor. This shows that at younger ages that is ages 11 and 12 and for all adolescents living in London and East Midlands strong parental disapproval rather than parental disapproval appears to be more of a protective factor for drug use. The results from this study may suggest that there might be a social cultural context to adolescent drug use in the case of parental attitude to drug use. The findings support the hypothesis 2d that strong parental disapproval towards drug use is negatively associated with drug use.

6.2. Social Structure (SS) and full SSSL models

a. Gender

The results focusing on gender in literature review in chapter 3 on gender were sometimes contradictory on the differences between males and females in drug use. One of the goals of this study was to examine the effect of gender on drug use to pinpoint any differences in drug use learning pathways for females and males. Although the descriptive data analysis revealed that more males than females had used drugs in the last year (albeit the difference was only 0.3%), the association however with drug use was not statistically significant as evident in the crosstabulation, correlation matrix and model 1 regression analysis. That is, there was no difference between males and females for drug use. In the cumulative mediation SSSL model, the adjusted regression coefficients (odds ratios) for gender were slightly attenuated became even more statistically insignificant suggesting a possibility of a mediation effect. The results of the cumulative mediation analyses suggest that there was no strong evidence for statistically significant differences in the drug use outcomes between males and females when adjusting for other variables in the model.

When the effects of gender were examined using the subgroup analyses, the results were different. Expanding on this, it is clear from both the models for gender that the same social learning pathways are important for both, but imitation is the most important risk factor for males and peer association is an important risk factor for females. The key point here is that these findings are consistent with SSSL theory, in that Akers acknowledged in 2006 (Lanza-Kaduce et al., 2006) that the social learning pathway will interact in different ways to impact males and females differently and he called for a thorough testing of the SSSL model in different contexts. Akers (2009, p. 338) posited, when he developed the theory in 1998 that males more than females will engage in delinquent behaviours than females because females are exposed to higher social control by their families and are likely to follow a more confirmative behaviour pattern than males. In fact, his argument has been supported by

several studies that found that the effect of gender was partially or fully mediated by the social learning process (Lanza-Kaduce & Capece, 2003; Lee et al., 2004; Whaley et al., 2016; Whaley et al., 2011). There is only one unpublished study which presented within a thesis (Holland-Davis, 2006) that found the effect of gender on cannabis use increased and became statistically significant, this should be taken with the caveat that this dataset used in the study is approximately 30 years old.

Although, hypothesis 4 is not supported by the results, there are significant points to take note of here. First the *social learning pathways to drug use for* females *were different to males.* Imitation was the most important learning pathway for males, followed by peer association, then attitudes to cannabis and glue. Whereas for females, the strongest learning pathway was peer association, followed by having a positive attitude to cannabis, and imitation. These results resemble those of (Whaley et al., 2016) who found that peer pressure and peer approval affect both males and females cannabis use. What this study adds to the empirical literature is that imitation of *friends* is more important in males than in females. The cumulative SSSL model with interaction terms did not pick up on any gender effects, this could be attributed to possible masking effects of other variables or subgroups in the model.

Based on these results both hypothesis 1b (being male will be positively associated with drug use) and hypothesis 4 (a) differential association, b) differential reinforcement, c) imitation and d) attitudes will be statistically significant mediators between gender and drug use) are not supported by the results.

b. Age

The correlation analysis showed that age is statistically significantly associated with not just drug use but all the social learning variables too. The percentage of reported drug use last year increased with increasing age with 6.9% of 15 year olds reporting drug use compared to 1.0% of 11 year olds. The results of the Model 1 regression showed that odds ratio of 14 year

olds having used drugs in the last year are three times higher compared to an 11 year old indicating that age was significantly associated with drug use. This finding is supported by other studies on adolescents in the United Kingdom in that there is a consistent pattern of older adolescents being more likely to use illicit drugs than younger adolescents (Bennett, 2014; Bloor, 2006; Frisher et al., 2007; Sutherland & Shepherd, 2001a).

The results of the cumulative and the subgroup SSSL models, also show that drug use was mediated by social learning variables for all ages except for age 11. Having positive attitudes to glue was the greatest risk factor for drug use in 11 year olds increasing the risk of drug use by 14 times and strong parental disapproval was the only protective factor against drug use. At age 12, two more social learning behaviours in addition to positive attitudes to glue become statistically significant: perception of drug use of peers and having positive attitudes. For example, having the perception that most or all of their peers use drugs increases the risk of drug use 259 times in 12 year olds. The influence of peer perception of drug use decreases for 13 and 14 year olds year olds but increase again in 15 year olds. To summarise the key points, positive attitude to glue is only a risk factors for younger adolescents aged 11 and 12 but not for older adolescents aged 13 and above. Having a positive attitude to cocaine also is only statistically significant for the 13 year olds where it plays a protective role rather than a risk factor.

These findings with regards to age and social learning factors are consistent with studies testing social factors on adolescents in England, Sutherland et al (2001) also found an age-sensitive element to the relationship between substance use and social factors such as peer opinions, family structure, polydrug use with a peak at age 15.

Based on these findings, hypothesis 1a (older adolescents will be positively associated with drug use) is supported by the findings and hypothesis 3 (a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue will be

statistically significant mediators in the association between age and drug use) can be partially supported because a mediating effect as per the cumulative model was observed for all ages except for adolescents aged 11.

c. Region

The results of the descriptive analyses showed that London had the highest percentage for reported drug use in the last year (22.8%), followed by North West of England (19.1%), South East England (18.4%) and the with the least reported drug use in the last year in the South West (13.8%). In the SS Model 1 regression analysis showed that adolescents in London were 2 times likely to have used drugs in the last year than those living in the South West. North West, East of England and South East were also significantly associated with drug use but the North East, York and Humber, East and West Midlands were not.

As with age, following the path tracing rules in the cumulative mediation model, social learning variables were found to mediate drug use in a few regions only. The subgroup analyses showed that the social learning behaviours also varied by region. In the northern parts of England, positive attitudes to cannabis were found to be strong social learning behaviours whereas in the Yorkshire and Humber regions imitation was the strongest statistically significant social learning behaviour. Across the East Midlands and West Midlands both attitudes to cannabis (positive and unsure) and imitation of friends were found to have strong statistical significance. In the southern most parts of England (London, South East and South West), having the perception that peers use drugs was the strongest social learning behaviour. Based on these findings the hypothesis 1c that all regions will be associated with drug use and hypothesis 5 as per the cumulative mediation analysis (a) peer association, b) parental reinforcement, c) imitation and d) attitudes to use of cocaine, cannabis and glue are statistically significant mediators in the association between region and drug use) are partially supported.

This is the first study in England examining the social learning pathways to drug use for adolescents of this age across all nine regions. Region is the second of four measures of social structural constructs in Aker's (1998) SSSL theory—differential social organisation. This societal construct captures cumulative-level characteristics of a community composed of known and unknown social structural correlates that empirically influence drug use through social learning constructs. That is the region in which the adolescent lives provides an opportunity for influencing social learning pathways and ultimately drug use. Neighbourhood/ community variances in drug use both directly and indirectly through social learning behaviours are consistent with the findings of some researchers. Using data from the Boys Town study, Lee et al. (2004) showed that community size and socio-economic status impacted drug use through social learning variables both directly and indirectly. Similarly, Bellair, Roscigno and McNulty (2003) who tested macro-level measures of labour market and community disadvantage with violent behaviour, whilst Osgood and Chambers (2000) who found differences in drug use in populations living in rural and urban communities. In investigating influences of neighbourhood characteristics on youth attitudes Wright et al (2016) found adolescents living in neighbourhoods that were tolerant of drug use (this is a composite of alcohol, cannabis and tobacco) had positive attitudes to drug use and that neighbourhood characteristics had limited direct effects of adolescent drug use and this could explain why in some cases there were no direct effects for some regions but indirect effects through social learning pathways (e.g. attitudes) were noted.

It might be postulated that the regional differences could be arising due to regional health inequalities, for example Ellis (2010) study on regional differences show that the levels of drug use (all drugs), life expectancy and childhood obesity (year 6) are worse in the northern parts of England compared to the southern. There are also regional variations in crime related to drug offences with the highest recorded in the London, followed by South West and the least number of police recorded drug offences in the North East for year ending June 2016 (Office for National Statistics, 2016). Differences in socio-economic status (Gauffin et al., 2013;

Sutherland, 2012), neighbourhood processes such as drug availability (Choi et al., 2006; Dupéré et al., 2012; Gilliard-Matthews et al., 2015; Lambert et al., 2004; Willits et al., 2011; Winstanley et al., 2008; Yun, 2015; Zimmerman & Farrell, 2017), labour market (Bellair et al., 2003) social capital (Aslund & Nilsson, 2013). This research is the first step in identifying that there are indeed regional differences in the social learning behaviours of drug use in the adolescent populations living in England but warrants further research.

6.3. Strength of the study

The relatively large sample size and nationally representative population is an important strength of the study in that it allows the opportunity to compare the differences in drug use between groups. This study also has clearly highlighted the lens with which the research problem around drug use in adolescents is being viewed and studied and this has shaped the methodology employed to answer the questions. From a methodological point of view, the application of subgroup analyses was useful in delineating which social learning behaviours were statistically significant in males, females, at each age and for region. Many studies tend to restrict their studies by controlling for structural variables or by grouping the structural variables which can lead to masking of valuable information. Another strength of the study is that distinction between peers and friends were made in the way the questions were framed. Parental reinforcement was measured using parental approval/disapproval/ ambivalence to drug use and imitation was operationalised not as an observed but as a direct action. Finally, the study has considered a wide range of the types of illicit drugs used by this age group including legal highs and volatile substances whereas most studies evaluate just one substance or a composite index of the combination of alcohol, tobacco and cannabis. This is important because the acceptability of the use of licit drugs compared illicit drugs depending on the social norms e.g. alcohol use or smoking may result in a difference in social learning pathways and for this reason tobacco and alcohol were not included in the composite drug use variable.

6.4. Limitations of the study

The findings of this research should be viewed in light of several limitations. First, the SDDS 2016 survey is based on self-report measures on behaviours that are potentially disapproved and self-incriminating which can generate methodological response bias and inaccurate reporting (Delaney-Black et al., 2010; Percy et al., 2005; Williams & Nowatzki, 2005). This could be in the form of exaggeration of use (Macleod et al., 2005), misinterpretation of the questions, recall failure or not being familiar with the terminology in the survey (Cottler et al., 1994; Harris et al., 2008). To address this limitation as best as possible, researchers conducting the SDDS 2016 survey put several mechanisms in place such as developing cognitive based (how the respondents interpret and understand the meaning of the questions), clear and concise language, distancing two negative outcomes to reduce the influence on order effects of context and question (Podsakoff et al., 2012). Finally, given that the use of drugs in this age group may be experimental or occurring in episodes rather than habitual, questions were asked on use in the last month, year and lifetime to prompt memory recall and also to minimise data loss due to incomplete answers. The survey used several strategies such as collecting information in school periods instead of at home and repeated confidentiality assurances which were backed up by survey procedures that respected privacy and confidentiality to encourage honest answers which would otherwise be concealed or exaggerated. To obtain independent verification of pupil responses a fiction drug Semeron was included in the 2016 survey and 0.17% of students reported taking this drug lending to the view that most students do not exaggerate their drug use (NHS Digital, 2017). Strengths and limitations of the methodology were discussed in detail in chapter 4.

A second limitation is that the adolescents were the only source of information including the parental reinforcement measures. It could have been possible that parents answering that question could have provided more confidence in the data and results. (Smetana, 2008, Kerr et. a. 2010).

Third, some of the results with high standard errors and large odds ratios should be interpreted with caution due to small subsample sizes. One of the problems with analysis of subgroups is that there is a higher likelihood of a statistically significant false positive result and the more groups investigated (e.g. nine regional subgroups versus two gender subgroups) the more likely it is to find a statistically significant effect due to chance. The opposite is also true in that as the subgroups are much smaller than the study, there are not enough participants for an effect to be detected (e.g. very few students reported having a positive attitude to cocaine compared to cannabis) thereby resulting in a false negative result—thus failing to detect an effect when there is one. So any conclusions must be drawn with caution (Brookes et al., 2001). The fourth limitation pertains to the type of mediation analyses used to analyse the data in this study. Due to the categorical nature of some of the mediators and the binary nature of the outcome the traditional causal approach was found to be the most suitable. The traditional meditation approach is a 'total effect approach ($c>c^1$)' compared to the contemporary mediation approach which measures indirect effects only (X to M and M to Y). There are some researchers who argue that mediation can exist even though the total effect is insignificant, and it should not be used as a gatekeeper for tests for mediation. This can happen simply either because the sample size is underpowered or because some of the steps that this method is contingent upon are not met, for example inferential significance tests are not met for step 1: X is associated with Y (MacKinnon et al., 2007; Preacher, 2015). Furthermore quantification of magnitude of mediation effect may be more useful for some researchers rather than distinguishing between full and partial mediation (Shrout & Bolger, 2002).

A fifth limitation is that there wasn't a way of differentiating between drug use across the continuum, that is distinguishing problematic drug use from experimental/ social drug use. This is important, as the learning pathways for problematic drug use versus experimental drug use could be entirely different. The results from the cumulative mediation analysis comparing different drug use types (last month, last year and lifetime/ever used) revealed differences in the social learning pathways. This is also an area that requires repeating and further research.

Throughout this study, the term drug use refers to drug use in the last year. No assumptions or attempts were made to determine differentiate whether this type of drug use by the adolescents was experimental (first time use), occasional or regular. The drugs referred to in this study are the ones that were included in the survey as depicted in table 1.

Sixth, this is also a secondary analysis of an existing dataset and has limitations that are traditionally linked with secondary data analyses. That is that the data is situational and was not collect for the intents and purposes of this study (Johnston, 2017). It is worth noting, however, that the dataset was of considerable breadth studying many factors relevant to adolescent drug use (Koziol & Arthur, 2011) and also relevant to what is currently known to be factors associated with drug use in young people

Another limitation is single items are used to measure the SSSL constructs in this study. Constructs such as peer drug use perception that are operationally defined by a single item can lead to reliability and validity concerns. Researchers (Netemeyer et al., 2003; Spector, 1992) argue that whilst asking a single question may have value in terms of practicality, cost and reducing interviewee fatigue, it cannot measure construct validity or reliability. This is because reliability is an important psychometric premise for any measure. Each construct in the SSSL theory will be defined by a single item which can lead to reliability and validity concerns (Postmes et al., 2013; Wanous & Hudy, 2001; Wanous et al., 1997). Researchers usually use multiple items to measure any particular construct reliably. However, when constructs such as measuring attitudes is unambiguous, concrete or double concrete (that is the object is clearly defined and can be identified because it has a clear singular meaning), a single item to measure the construct should suffice (Bergkvist, 2015). Also, if the constructs are judged to be sufficiently homogeneous during the course of the research process (as in this study – guided by the specification of the SSSL framework) instead of being broad and heterogeneous, they can be adequately operationalised using a single item (Postmes et al., 2013).

Finally, the research adopts a realist stance which is that harm from illicit drug use exists, that it is external to social factors and that these factors can be progressively understood (mapped) by collecting and examining information (Guba, 1990). As Crotty (1998) puts it, assumptions will be made at every stage of the research and these assumptions shape the way the research questions are understood, influence the methods, choice of theoretical framework and the interpretation of the findings. With this said, science is fallible and the chosen SSSL framework is not a unique way of analysing the empirical world in that the depth of insight gained in this research is at the cost of breadth of scope of the factors studied and vice versa.

6.5. Main contributions of this study

This study provides several contributions to the literature on drug use. The first contribution is that no studies to date on adolescent drug use in England have used national-level data to specifically examine adolescent drug use as it relates to the SSSL theoretical perspective. Second, the study employs a comprehensive and latest dataset for drugs abuse to date namely the Smoking Drinking and Drug Use (SDSS 2016) database, that reflects the current drug market trends (questions on legal highs, volatile substances and nitrous oxide have been included for the first time since 1982). The third main contribution is the application of subgroup mediation analysis— previously all SS and SL variables have been aggregated into one model to test for mediation. This approach provides a granular/ richer understanding of which SL variables have a larger mediating effect on specific structural variables.

This study is innovative in that it attempts to embrace the complexity inherent in adolescent development and drug use behaviours by adopting an integrative cross conceptual model that allows drug use to be feasibly studied. In doing so, the results have produced new findings in the context of adolescents aged 11-15 in England through the use of a subgroup models to specify the exact social learning mechanisms at play. The results are of also of relevance to policy because they confirm a) that drug use in this age group is a learnt behaviour and b) that

this learnt behaviour varies by gender, region and specific ages. Furthermore, these learning pathways can either behave as mediators or moderators to drug use depending on the structural context, that is the same social learning factor can be a mediator in one context but a moderator in another. The results also underline the value of targeted rather than blanket drug prevention policies for harm reduction and first use prevention or delay thereof in this age group. The study has also shown that the effects of peer drug use perception and the effects of imitating friends, types of parental reinforcement through approval, disapproval or ambivalence and individual attitudes to drug use need to be considered separately for any social structural construct being studied. Finally, this research suggests that the SSSL theory is useful as a robust and fluid framework for studying illicit drug use in adolescent populations in England because it allows data to behave naturally rather than imposing a propositional fit.

Chapter 7

7. Conclusion

This research began as an investigation of testing whether social learning behaviours mediate or explain drug use in the adolescent student population in England aged 11 to 15 years. Chapter 1 introduced the problem which was an increase in the number of adolescents using drugs and subsequent harm as a result. A review of the various theories in chapter 2 used to study drug use in adolescents showed that there a move by researchers towards the application of integrated theoretical frameworks that encapsulate environmental, social and contextual factors. Selection of the SSSL theory as viable integrative framework to address the research questions: 1. Is social structure (age, gender and region) associated with drug use?, 2. is there an association between social learning (imitation, peer association, parental reinforcement and attitudes) and drug use? and 3. does social learning mediate the effects of social structure on drug use? was discussed in detail in chapter 3. The theory contents that drug use is a learnt behaviour and that these learnt behaviours vary for each age, gender and region. The SSSL framework was also used to shape the methods employed to address the research problem (chapter 4). The results in chapter 5, demonstrate that the study has achieved what it set out to do: a) only age and four of the nine regions were significantly associated with drug use whilst gender was not and, b) that all social learning variables (imitation, peer association, parental reinforcement, attitudes to drugs) were associated with drug use. Based on the SSSL theory, social learning should mediate the relationship between drug use and age, gender, and region. So, once the associations with drug use was established, cumulative and subgroup regression analyses were run to delineate the strongest social learning factor responsible for the association between drug use and a particular social structure variable. This served as the basis for the final research question; does social learning mediate the association between social structure and drug use? Whilst the research did not confirm the mediating mechanism for all social learning variables between age, gender,

region, and drug use as per the SSSL theory, it did find that social learning behaviours varied depending on the context. The research also found that some social learning factors were larger drivers of the association between drug use and age/gender/region. The findings illustrate the complex nature of drug use and are a significant finding for policy intervention.

The second finding was that with every year of adolescent development (each age between 11 and 15 years), different social learning behaviours came in to play. The same observations were made for gender and region. The third significant finding was that having the perception that peers use drugs compared to imitation of friends was a stronger social learning behaviour at different ages of the adolescent's life course (except for age 13 and 14 years). The fourth and notable finding is that at age 13 years almost all the social learning factors (except for unsure attitude to glue use) are significant) this observation was not seen for the other ages.

These findings are important because, they show that drug using behaviour varies significantly year on year, region to region and also varies for males and females. It is also important to note that the subgroup analyses approach rather than the cumulative mediation approach was more useful in delineating the exact social learning behaviours involved (Grice et al., 2015; Von Eye et al., 2009).

The findings also show that the SSSL theoretical framework appears to be flexible enough to allow the unique interactions between social and structural factors to be uncovered without trying to force an absolute propositional fit. It works well as a conceptual integration model that reveals the complex interplay of variables that are tested using its framework.

7.1. Significant contribution to knowledge

The contribution to knowledge on drug use in English adolescents by this study has been accomplished in four ways. First by way of using a recent nationally representative and a *recent* quantitative secondary data set means that the findings might be applicable to the

adolescent population today; second the dataset includes responses to a comprehensive array of drugs including the most recent entries into the drug markets, thus improving the relevance, reliability and generalisability of the results with regards to drug use. As noted in the literature review 'drug use' in most studies refer commonly to cannabis use or a combination of cannabis with a range of other drugs. Third, while most research on the application of the SSSL theory for drug use in *adolescents of this age group* has taken place outside of England, this study affords new insights into the interaction of individual, environmental and learning behaviours on drug use specific to England and the knowledge generated from this investigation builds upon the empirical evidence for SSSL theory. Fourth and most importantly this research is original in that it has shown the value of subgroup models in specifying which social learning behaviours are strongly associated with drug use for specific groups.

This is also the only research in England for this age group that has studied the mainstream risk and protective factors via the SSSL as a framework. Finally, the study is significant for policy makers in that the results can offer suggestions towards the consideration of adolescent specific drug prevention policies (separate to that of adults) with targeted prevention methods, thereby reducing the public health and economic burden as a result of harm from drug use.

7.2. The contribution from a theoretical perspective

Of the previous studies on drug use applying the SSSL, only a small number of studies tested the association between X and M (Solakoglu & Yuksek, 2020) and accounted for interactions (Lanza-Kaduce & Capece, 2017; Verrill, 2005). This is also the only SSSL study to have tested mediation beyond the cumulative model to specify the social learning pathways that are most important in explaining drug use for each sub-group (age, gender and region). A mediation effect can only be proven when an association can be path traced from X to M to Y and the reduction of adjusted coefficients with the introduction of M in the X and Y model cannot be claimed to be mediation on its own. This research suggests that social structural and social

learning variables relate, go together, but not just the way that Akers (1998) has referred to in his model, that is through mediation only. In chapter 2 (theoretical chapter) it was discussed that that Akers (1998) had not fully specified the SSSL model and he acknowledges that he has made no linking proposition and calls for further research to inform adjustments and modifications. It is suggested that conceptualisations of how an intervening variable can achieve (or fail to achieve) its effect can be advanced by allowing the models to be tested for both mediation and moderation. In other words, allowing for tests for mediation and moderation or mediated moderation or moderated mediation has potential to direct and refine the SSSL theory (Fairchild & McQuillin, 2010) and have the potential to extend the generalisability and validity of the research and positively impact practice(Akers, 2011).

7.3. Implications for Policy

The results from this study indicate that the developmental period between 11 and 15 years of age is a significant period of impact in view of the influence of family and peers (imitation of friends, family reinforcement and peer association) factors and individual attitudes to drug use. Policies that draw upon emerging evidence base - evidence informed policies (Bennett & Holloway, 2010) and carefully consider the true and complex nature of illicit drug use are more likely to make a significant contribution to reducing drug use at individual and population level. In other words, policy level interventions for adolescents need to be multifaceted and targeted at specific ages, gender and regions. Also, because inequalities in health are shaped earlier in the lifecycle during childhood and adolescence and sustained across the life course (Marmot et al., 2010), there is value in investing in the early years to prevent initiation into drug use and harm reduction in this population. The harm reduction approach acknowledges that it is difficult to completely eliminate drug use in this population and therefore focuses on reducing harm from use of illicit drugs (Monti et al., 2001).

Currently in the United Kingdom, the drug policy is focused on treatment of drug use in the under 18's. The Joint Strategic Needs Assessment (JSNA) process supported by Public

Health England's alcohol and drugs team focuses on local planning, commissioning and contract monitoring processes substance misuse treatment need among under 18s. Second, the majority of the adolescents of this age group who use drugs do so on a social basis and are at the far end of the spectrum to addiction. Policies must ensure that the JSNA process includes primary and secondary prevention approach of service provision for users at the social use end of the spectrum not just problematic drug use/ addiction (Bloor, 2019; Boland, 2008).

The results from the data show that strong parental disapproval was the only protective factor (from all the gradings of the measurement for disapproval) for ages 11, 12 and for those living in London and East Midlands. This phenomenon requires greater understanding of the population and regional nuances and further investigation given research findings such as that by Calafat et al. (2014) showing that indulgent parenting styles are more protective against drug use as compared to authoritarian parenting in the European adolescent population (including UK) or into parental permissiveness (Becoña Iglesias et al., 2013) or parental knowledge (Fernandez-Hermida et al., 2013; Mak et al., 2020). This is because parenting processes are also closely intertwined with characteristics of communities and regions (Choi et al., 2006), so overall, there needs to be a concerted effort in drug use prevention in the adolescents on a community or regional level rather than school focused interventions.

Finally, the UK drug policy should include support for civil and advocacy groups, and community-based organisations. The SSSL framework can be used to test risk factor concepts as means to detect adolescents who are at risk or who use drugs occasionally (secondary prevention measures). Leveraging on social, political, and economic contexts in which drug use occurs, these community-based organisations can play a major role in education and advocacy efforts that seek to address drug use in their own communities. Leadership provided by the organisations can communicate drug prevention and awareness issues through

newsletters, social media, blogs to underscore the importance drug use as a public health issue in adolescence.

This study has demonstrated that the SSSL could also operate as a flexible framework to complement routine data on substance misuse in adolescents in identifying the true nature of drug use in adolescents. This information will assist policy makers to identify priority regions and plan targeted interventions for specific ages and for males and females specifically. This information could contribute to an understanding the epidemiology of drug use in the adolescent population and enables policy makers and local authorities to prioritise regions with high risk of drug use that may require special attention.

7.4. Implications for Practice

The results have shown that there appears to be a need for tailoring harm reduction and drug initiation prevention policies based on specific ages, gender and regions. As a start, health care organisations such as GP practices or school nurses and school health and well-being leads or charities such as 'Re-solv' could ask screening questions at every clinical encounter with an adolescent. This should especially be in place for the increasing number of younger adolescents being admitted to hospital as a result from harm caused by drug use. This approach would very much be in line with the current public health initiative –– Making Every Contact Count (MECC). The first and subsequent encounters would serve multiple purposes:

1) It would help with breaking barriers around talking about drug use topics that are relevant for particular ages, gender and regions,
2) The information provided by the adolescents would help build a knowledge base that would:
    i. Help tailor the intervention specific to the needs of the adolescent
    ii. Mobilise and foster new working alliances with a multidisciplinary team for example with mental health professionals or local drug action teams

iii. Inform local/ community intelligence about demand and supply of illicit drugs in the area and
iv. Assist in developing preventative and management action plans that are in line with the school or community context.

The current drugs policy the 2021 Drug Strategy (Home Office, 2021)focuses on reducing demand and building resilience and confidence through school based prevention strategies. The approaches under this area, include making information for young people on drugs freely available through a dedicated website for young people called 'talk to Frank', expanding youth offending teams, promotion of the 'rise above' digital hub. Yet the study showed that a fairly large proportion of adolescents did not know if it was acceptable to try glue, cocaine and cannabis. The services offered on these digital technology platforms can be tailored guided by good quality evidence, to develop targeted interventions for specific ages, gender and based on learning pathways in a specific region. For example, in regions where having positive attitudes to cannabis was found to be a strong statistically significant pathway to drug use (North West, East Midlands and South East regions), more information on legal classification, use and harm of cannabis could be made available for the adolescents to access and make informed decisions.

The evidence relating to specific regions can also be used as a guide to tailor drug education and promote primary prevention interventions through local schools and communities with a view to modify attitudes, and normative perceptions. Currently, schools in the England provide classroom-based interventions under the Personal Social and Health Education (PSHE). This is currently part of the Children and Social Work Act, 2017 and provides an opportunity to discuss topics that are of interest to young people. There is evidence to show that school and community-based prevention programmes play an important role in prevention. Such roles include, impeding the first occurrence of drug use and in harm reduction thus reducing use and subsequent harms from the use of those drugs (Faggiano et al., 2008; Midford, 2010).

These prevention programmes should also include targeted information for those who are unsure of whether it is acceptable to try certain drugs (unsure attitudes). Classroom based interventions, on the other hand, have been found to be ineffective by some researchers in reducing harm from drug use and they suggest that interventions focusing on creating inclusive school environments are more useful (Faggiano et al., 2014; Faggiano et al., 2008; Giannotta et al., 2014; Vigna-Taglianti et al., 2009). Markham et al. (2015; 2012) suggest changing focus from trying to understand 'how drug use occurs as a response to school experience' to 'what do schools do that causes drug use in adolescents'. Notwithstanding this, the lack of effectiveness of school-based interventions, however, are also highlighted in a recent systematic review by Degenhardt et al. (2016). The findings show that whilst the evidence for school-based prevention is impacted by methodological issues but interventions that involve skills training are more effective than provision of just information (Lilja et al., 2007).

The research also recommends that the sustainability of any tailored multidisciplinary service delivery model should be underpinned by an integrated digital technologies and information systems without compromising on confidentiality.

7.5. Implications for further research

It should be recognised that the identification of these learning pathways specific to the adolescent population aged 11- 15 years in England, in relation to their social structure is only an initial step towards gaining a better understanding of the complex relationships and underlying mechanisms between drug use and these factors. Most importantly this research showed that subgroup mediation analysis and the inclusion of interaction terms revealed significant differences in the learning behaviours to drug use depicting complex heterogeneity of the drug using behaviour. Implications for future research in light of these differences among the English adolescent sample are as follows. First, the cross-sectional nature of the survey meant that it was not possible to make causal interpretations and determine the temporal sequence of the mediation relationships that were identified for age 11 and London. Future

studies should use longitudinal studies to truly examine the social learning pathways to drug use following each adolescent through the years. These studies would also provide sufficient statistical power to ensure that the results obtained from interaction effects are not inflated and give a true picture of the drug using behaviour. Second, further research using multilevel analysis between individual, school level and neighbourhood level characteristics on the learning pathways for drug use would give more nuanced and detailed view on the nature of the interactions amongst the variables. There have been a number of studies showing school level influences on drug use (Carney et al., 2014; Fletcher, Bonell, & Rhodes, 2009; Fletcher et al., 2010; Markham, 2015; Markham et al., 2012; Ttofi et al., 2016).

Further analyses should also investigate what factors play a role in influencing adolescents to change to regular drug use patterns versus those who are experimenting with drug use. Distinguishing between both types of use in the context of the SSSL framework is worthy of attention as they might be associated with different social learning pathways. Alcohol use and tobacco use were not examined alongside drug use and therefore further research could investigate whether there are any differences in learning pathways for these substances compared to the substances studied in this thesis. Given the regional differences in social learning pathways to drug use, whilst outside the remit of this PhD study, it might be useful to also explore any differences in observed patterns of drug use across different ethnicities.

Other settings such as secure children's homes, secure training centres, special education units or youth offending institutes in addition to mainstream schools, should be considered not only as a way of capturing as many young people as possible from this age group but including populations that are most vulnerable to drug use (Burkhart et al., 2011; Hairon, 2007; McCrystal, 2009). Furthermore, the use of modern technology should be considered in administering the survey. For example, the use of mobile phone apps or computer assisted self interview questions (Cotto et al., 2010; Scalco et al., 2016) to increase response rates in

schools can help reduce the administrative burden (Wu et al., 2013), improve the response rates and it is also a medium that adolescents are accustomed to.

The use of multiple combination of substances namely alcohol, tobacco and other drug (ATOD) is also recognised as a significant public health issue in adolescents (Ives & Ghelani, 2006; Murphy et al., 2013; Ogilvie et al., 2005). Critically alcohol use accounts for a larger percent (7 percent) of disability-adjusted life years (DALYs) compared to illicit drug use (2 percent) (Gore et al., 2011) and further research should include adolescent drinking and smoking along with other illicit drugs as a priority.

The gap in knowledge addressed by this study was to determine which social learning pathways explain drug use in specifically in males, females, by age and by region for adolescent students living in England. The methodology chapter outlined the theoretical framework and methods employed to address this gap. The results showed that drug use is a learned behaviour and is specific for age, gender and region. In conclusion, this research successfully achieved its stated goals of identifying significant social learning pathways to drug use specific for gender, age and region.

Appendix

8. Appendix

Table 16: Attitude to Glue and SS Multinomial regression

Attitude to Glue	**Social Structures**	Exp(B)	Sig	B	S.E.
Its ok to take glue	11 years	.38	.00	-.96	.15
	12 years	.69	.01	-.37	.11
	13 years	.81	.04	-.21	.10
	14 years	1.11	.29	.10	.10
	15 years	-	-	-	-
	Male	.93	.28	-.08	.07
	Female	-	-	-	-
	North East (1)	.51	.00	-.67	.14
	North West (2)	.70	.01	-.26	.14
	York&Humber (3)	.77	.05	-.26	.13
	East Midlands (4)	.77	.10	-.27	.16
	West Midlands (5)	.80	.17	-.22	.16
	East England (6)	.93	.58	-.07	.13
	London (7)	.81	.35	-.21	.22
	South East (8)	.94	.65	-.06	.14
	South West (9)	-	-	-	-
Not sure	11 years	.84	.06	-.17	.09
	12 years	.95	.53	-.05	.08
	13 years	.92	.29	-.08	.08
	14 years	1.06	.44	.06	.08
	15 years	-	-		
	Male	.87	.01	-.14	.05
	Female	-	-		
	North East (1)	.96	.64	-.05	.10
	North West (2)	.89	.29	-.11	.11
	York&Humber (3)	.85	.12	-.16	.10
	East Midlands (4)	1.06	.62	.06	.12
	West Midlands (5)	.85	.21	-.16	.13
	East England (6)	1.00	.97	-.00	.11
	London (7)	1.14	.40	.13	.16

	South East (8)	.94	.56	-.07	.11
	South West (9)	-	-	-	-
	Model Fit				
	Chi-square	128.52 df (26)	P<0.001		
	Nagelkerke Pseudo R^2	.015			

Table 17: Attitude to Cocaine and SS Multinomial regression

Attitude to Cocaine	**Social Structures**	Exp(B)	Sig	B	S.E.
Its ok to use	11 years	.09	.00	-2.42	.35
	12 years	.21	.00	-1.55	.22
	13 years	.27	.00	-1.33	.18
	14 years	.64	.00	-.44	.14
	15 years	-	-	-	-
	Male	1.07	.60	.06	.12
	Female	-	-	-	-
	North East (1)	1.38	.14	.32	.22
	North West (2)	.86	.53	-.16	.25
	York&Humber (3)	1.55	.05	.44	.22
	East Midlands (4)	.96	.88	-.04	.29
	West Midlands (5)	1.10	.74	.09	.28
	East England (6)	1.08	.77	.07	.25
	London (7)	.81	.61	-.21	.42
	South East (8)	.76	.33	-.28	.28
	South West (9)	-	-	-	-
Don't Know	11 years	.67	.00	-.40	.13
	12 years	.58	.00	-.55	.12
	13 years	.71	.00	-.34	.11
	14 years	.93	.51	-.07	.11
	15 years	-	-		
	Male	1.14	.08	.13	.08
	Female	-	-	-	-
	North East (1)	1.51	.00	.41	.14
	North West (2)	1.14	.40	.13	.15
	York&Humber (3)	1.16	.31	.15	.15
	East Midlands (4)	1.15	.44	.14	.18

	West Midlands (5)	1.09	.63	.09	.18
	East England (6)	1.22	.22	.20	.16
	London (7)	1.13	.60	.13	.24
	South East (8)	1.00	.98	-.00	.17
	South West (9)	-	-	-	-
	Model Fit				
	Chi-square	128.52 df (26)	P<0.001		
	Nagelkerke Pseudo R2	.02			

Table 18: Attitude to Cannabis and SS Multinomial regression

Attitude to Cannabis	Social Structures	Exp(B)	Sig	B	SE
Its ok	11 years	.01	.00	-4.26	.34
	12 years	.04	.00	-3.20	.19
	13 years	.12	.00	-2.09	.11
	14 years	.40	.00	-.91	.08
	15 years	-	-		-
	Male	1.33	.00	.28	.07
	Female	-	-	-	-
	North East (1)	.84	.18	-.17	.13
	North West (2)	1.07	.60	.07	.13
	York&Humber (3)	1.01	.97	.01	.13
	East Midlands (4)	.72	.04	-.34	.16
	West Midlands (5)	.83	.21	-.19	.15
	East England (6)	.97	.79	-.04	.14
	London (7)	.82	.37	-.20	.22
	South East (8)	.92	.56	-.08	.14
	South West (9)	-	-		-
Don't Know	11 years	.43	.00	-.84	.12
	12 years	.41	.00	,-.89	.11
	13 years	.55	.00	-.59	.10
	14 years	.81	.02	-.22	.09
	15 years	-	-	-	-
	Male	1.12	.10	.11	.07
	Female	-	-	-	-
	North East (1)	1.47	.00	.38	.13

	North West (2)	1.24	.11	.21	.14
	York&Humber (3)	1.05	.70	.05	.14
	East Midlands (4)	1.06	.73	.05	.16
	West Midlands (5)	.87	.43	-.14	.17
	East England (6)	1.14	.36	.13	.14
	London (7)	1.10	.67	.09	.21
	South East (8)	1.03	.82	,03	.15
	South West (9)	-	-	-	-
	Model Fit				
	Chi-square	1345.13 df (26)	P<0.001		
	Nagelkerke Pseudo R^2	.16			

Table 19: **Imitation and SS Multinomial regression**

Took drugs first time because friends were doing it	**Social Structures**	**Exp(B)**	**Sig**	**B**	**S.E**
Yes	11 years	.13	.00	-2.03	.43
	12 years	.38	.00	-.96	.25
	13 years	.43	.00	-.84	.22
	14 years	.65	.03	-.43	.20
	15 years	-	-	-	-
	Male	.85	.32	-.16	.16
	Female	-	-	-	-
	North East (1)	.98	.96	-.02	.31
	North West (2)	1.13	.69	.12	.31
	York&Humber (3)	.99	.98	-.01	.31
	East Midlands (4)	1.33	.41	.29	.34
	West Midlands (5)	.84	.66	-.18	.40
	East England (6)	1.35	.33	.30	.31
	London (7)	1.04	.93	.04	.51
	South East (8)	1.09	.80	.09	.34
	South West (9)	-	-		
	Model Fit				
	Chi-square	51.48 df (13)	P<0.001		
	Nagelkerke Pseudo R^2	.03			

Table 20: Parental Reinforcement and Region and Gender – Multinomial regression

Region	Social Structures	Exp(B)	Sig	B	S.E.
	North East (1)	1.03	.68	.03	.07
	North West (2)	1.11	.20	.10	.08
	York&Humber (3)	.99	.90	-.01	.07
	East Midlands (4)	1.02	.85	.02	.09
	West Midlands (5)	.96	.64	-.04	.09
	East England (6)	1	1.0	-.00	.08
	London (7)	.88	.30	-.13	.12
	South East (8)	1	.96	.00	.08
	South West (9)	-	-	-	-
	Model Fit				
	Chi-square	4.84 df (8)	p<.78		
	Nagelkerke Pseudo R^2	.00			
Gender	Male	1.01	.85	-.01	.04
	Female	-	-	-	-
	Model Fit				
	Chi-square	.03 df (1)	p<.85		
	Nagelkerke Pseudo R^2	.00			
Parental Reinforcement and Age – Multinomial regression					
Strongly disapprove (Stop me)	Intercept	Exp(B)	Sig	B	S.E.
	11 years	1.29	.00	.26	.07
	12 years	1.24	.00	.21	.06
	13 years	1.12	.06	.12	.06
	14 years	1.13	.05	.12	.06
	15 years	-	-	-	-
Disapprove (Persuade me not to)	11 years	1.03	.84	.03	.16
	12 years	.69	.03	-.38	.17
	13 years	.91	.50	-.10	.14
	14 years	.77	.09	-.26	.15
	15 years	-	-	-	-
	Model Fit				
	Chi-square	29.10 df (8)	p≤0.001		
	Nagelkerke Pseudo R^2	.00			

Table 21: **Peer Association and Age and Region – Ordinal regression**

How many own age take drugs	Social Structure	Exp(B)	Sig	B	S.E.
Most or all	11 years	.03	.00	-3.62	.30
	12 years	.05	.00	-3.03	.21
	13 years	.13	.00	-2.08	.20
	14 years	.34	.00	-.97	.19
	15 years	-	-	-	-
	North East (1)	1.93	.02	.75	.29
	North West (2)	2.04	.01	.83	.29
	York&Humber (3)	1.29	.63	.25	.31
	East Midlands (4)	1.42	.42	.35	.36
	West Midlands (5)	1.07	.78	.07	.38
	East England (6)	1.83	.09	.60	.32
	London (7)	2.35	.10	.86	.39
	South East (8)	.93	.65	-.08	.37
	South West (9)	-	-	-	-
Half or less	11 years	.06	.00	-2.85	.12
	12 years	.11	.00	-2.25	.11
	13 years	.22	.00	-1.53	.11
	14 years	.49	.00	-.71	.12
	15 years	-	-	-	-
	North East (1)	.91	.45	-.09	.12
	North West (2)	.74	.02	-.31	.13
	York&Humber (3)	.77	.03	-.27	.12
	East Midlands (4)	.82	.17	-.20	.15
	West Midlands (5)	.66	.01	-.42	.15
	East England (6)	.94	.61	-.07	.13
	London (7)	.52	.00	-.66	.19
	South East (8)	.82	.15	-.19	.14
	South West (9)	-	-	-	-
	Model Fit				
	Chi-square	1124.57 df (24)	p≤0.001		
	Nagelkerke Pseudo R^2	.23			
Peer association and Gender – Ordinal regression					
	Male	1.40	.00	.34	.06

	Female	-	-	-	-
	Model Fit				
	Chi-square	39.21 df (1)	p≤.001		
	Nagelkerke Pseudo R^2	.01			

Table 22: SS and SL Interaction Terms Syntax

```
DATASET ACTIVATE DataSet3.
LOGISTIC REGRESSION VARIABLES DrugsUsedLastYear
  /METHOD=ENTER Imitation1 AttitudeCannabis AttitudeCocaine AttitudeGlue Reinforcement
    PeerAssocSmall Gender age1115 region Gender*age1115*region Gender*age1115 age1115*region
    Gender*region Gender*Imitation1 AttitudeCannabis*Gender AttitudeCocaine*Gender AttitudeGlue*Gender
    Gender*Reinforcement Imitation1*age1115 AttitudeCannabis*age1115 AttitudeCocaine*age1115
    AttitudeGlue*age1115 Reinforcement*age1115 Imitation1*region AttitudeCannabis*region
    AttitudeCocaine*region AttitudeGlue*region Reinforcement*region Gender*PeerAssocSmall
    PeerAssocSmall*age1115 PeerAssocSmall*region
  /CONTRAST (Imitation1)=Indicator
  /CONTRAST (AttitudeCannabis)=Indicator
  /CONTRAST (AttitudeCocaine)=Indicator
  /CONTRAST (AttitudeGlue)=Indicator
  /CONTRAST (Reinforcement)=Indicator
  /CONTRAST (Gender)=Indicator
  /CONTRAST (age1115)=Indicator
  /CONTRAST (region)=Indicator
  /CONTRAST (PeerAssocSmall)=Indicator
  /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

Table 23: SSSL Model for North East

North East	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	15.82	.00	2.99	.27
Attitude Cannabis- Not Sure	6.10	.00	1.85	.33
Attitude Cocaine-OK	.96	.95	-.08	.46
Attitude Cocaine- Not Sure	.54	.37	-1.11	.41
Attitude Glue- OK	1.70	.35	.77	.35
Attitude Glue Not Sure	.66	.42	.29	.30
Fam. Reinf. Strongly disapprove	.06	.00	-2.61	.33
Fam. Reinf. disapprove	.01	.00	-4.40	1.11
Peer Assoc. Most or all	11.50	.00	2.87	.59
Peer Assoc. Half or less	5.55	.00	1.93	.28
Imitation	13.42	.00	2.64	.76
Model Fit				
Chi-square	307.57 df (13)	p<.001		
Nagelkerke Pseudo R^2	.64			

*age and gender included in the model.

Table 24: SSSL Model for Drug use Last Year for North West

North West	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E
Attitude Cannabis- OK	36.61	.00	3.60	.55
Attitude Cannabis- Not Sure	6.54	.00	1.88	.64
Attitude Cocaine-OK	.03	.01	-3.58	1.41
Attitude Cocaine- Not Sure	.31	.15	-1.17	.82
Attitude Glue- OK	4.10	.02	1.41	.59
Attitude Glue Not Sure	.51	.29	.68	.65
Fam. Reinf. Strongly disapprove	.07	.00	-2.65	.46
Fam. Reinf. disapprove	.07	.00	-2.64	.77
Peer Assoc. Most or all	12.51	.01	2.52	.90

Peer Assoc. Half or less	1.96	.31	.67	.66
Imitation	8.41E+9	1.00	22.85	7387
Model Fit				
Chi-square	290.97 df (13)		p<.001	
Nagelkerke Pseudo R^2	.72			

Table 25: **SSSL Model for Yorkshire and Humber**

Yorkshire and Humber	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	3.04	.00	1.11	.53
Attitude Cannabis- Not Sure	.98	.39	**-.03**	.87
Attitude Cocaine-OK	3.24	.62	1.18	1.0
Attitude Cocaine- Not Sure	1.44	.40	.36	1.11
Attitude Glue- OK	1.17	.00	.15	.65
Attitude Glue Not Sure	.29	.32	-1.24	.66
Fam. Reinf. Strongly disapprove	.02	.00	-3.77	44
Fam. Reinf. disapprove	.04	.00	-3.27	.76
Peer Assoc. Most or all	9.68	.00	2.27	.91
Peer Assoc. Half or less	2.60	.00	.96	.54
Imitation	28.815	00	3.36	.98
Model Fit				
Chi-square	245.30df (13)	p<.001		
Nagelkerke Pseudo R^2	.64			

Table 26: **SSSL Model for East Midlands**

East Midlands	Model 5 SS–>SL–>DU			
Intercept	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	19.00	.01	2.94	1.13
Attitude Cannabis- Not Sure	23.98	.02	3.18	1.33
Attitude Cocaine-OK	.38	.46	.01	1.33
Attitude Cocaine- Not Sure	.01	.00	-.44	1.76
Attitude Glue- OK	4.57	.09	1.28	.89

Attitude Glue Not Sure	.90	.91	.49	.93
Fam. Reinf. Strongly disapprove	.01	.00	-3.67	.83
Fam. Reinf. disapprove	00	1.00	-20.98	8577
Peer Assoc. Most or all	4.36	.31	2.91	1.44
Peer Assoc. Some or less than half	1.69	.62	1.55	1.07
Imitation	5.54	.09	1.62	1.02
Model Fit				
Chi-square	155.94 df (13)	p<.001		
Nagelkerke Pseudo R^2	.76			

Table 27: SSSL Model for West Midlands

West Midlands	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	2.95	.09	1.08	.64
Attitude Cannabis- Not Sure	2.76	.33	1.02	1.04
Attitude Cocaine-OK	.24	.23	-1.43	1.19
Attitude Cocaine- Not Sure	5.20	.18	1.65	1.23
Attitude Glue- OK	3.30	.14	1.19	.82
Attitude Glue Not Sure	.51	.40	-.68	.82
Fam. Reinf. Strongly disapprove	.07	.00	-2.64	.51
Fam. Reinf. disapprove	.09	.01	-2.47	.91
Peer Assoc. Most or all	15.17	.02	2.72	1.21
Peer Assoc. Some or less than half	3.07	.11	1.12	.70
Imitation	19.75	.00	2.98	1.04
Model Fit				
Chi-square	84.52 df (13)	p<.001		
Nagelkerke Pseudo R^2	.48			

Table 28: SSSL Model for East of England

East of England	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E
Attitude Cannabis- OK	8.05	.00	2.09	.51
Attitude Cannabis- Not Sure	2.76	.16	1.02	.72
Attitude Cocaine-OK	18.63	.03	2.93	1.34
Attitude Cocaine- Not Sure	.23	.08	-1.49	.84
Attitude Glue- OK	2.37	.11	.87	.54
Attitude Glue Not Sure	2.01	.19	.70	.53
Fam. Reinf. Strongly disapprove	.07	.00	-2.69	.45
Fam. Reinf. disapprove	.07	.00	-2.63	.79
Peer Assoc. Most or all	14.47	.75	2.67	.79
Peer Assoc. Some or less than half	1.21	.03	.19	.59
Imitation	.84	.80	-.17	.67
Model Fit				
Chi-square	188.97df (13)	p<.001		
Nagelkerke Pseudo R^2	.58			

Table 29: SSSL Model for London

London	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E
Attitude Cannabis- OK	1.44	.73	.37	1.05
Attitude Cannabis- Not Sure	1.46	.78	.38	1.38
Attitude Cocaine-OK	1.68	.71	.52	1.38
Attitude Cocaine- Not Sure	1.78	.76	.58	1.84
Attitude Glue- OK	.60	.67	-.51	1.18
Attitude Glue Not Sure	4.00	.09	1.38	.82
Fam. Reinf. Strongly disapprove	.04	.00	-3.29	.81
Fam. Reinf. disapprove	.00	1.00	-21.76	13928
Peer Assoc. Most or all	112.75	.02	4.73	1.95
Peer Assoc. Some or less than half	19.20	.03	3.00	1.33
Imitation	1.04E+11	1.00	25.37	18692

Model Fit				
Chi-square	77.26 df (13)	p<.001		
Nagelkerke Pseudo R^2	.67			

Table 30: SSSL Model for South East

South East	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	20.24	.00	3.01	.31
Attitude Cannabis- Not Sure	6.09	.04	1.81	.44
Attitude Cocaine-OK	1.98	.58	.68	.63
Attitude Cocaine- Not Sure	1.15	.89	.14	1.03
Attitude Glue- OK	1.43	.55	.36	.60
Attitude Glue Not Sure	.46	.24	-.78	.67
Fam. Reinf. Strongly disapprove	.03	.00	-3.47	.53
Fam. Reinf. disapprove	.10	.01	-2.35	.84
Peer Assoc. Most or all	137.76	.00	4.93	1.57
Peer Assoc. Half or less	15.20	.01	2.72	1.10
Imitation	6.48	.04	1.87	.89
Model Fit				
Chi-square	206.21df (13)	p<.001		
Nagelkerke Pseudo R^2	.67			

Table 31: SSSL Model for South West

South West	Model 5 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	5.05	.00	1.62	.52
Attitude Cannabis- Not Sure	6.96	.01	1.94	.74
Attitude Cocaine-OK	3.71	.20	1.,31	1.02
Attitude Cocaine- Not Sure	.36	.20	-1.01	.80
Attitude Glue- OK	2.61	.08	.96	.55

Attitude Glue Not Sure	.79	.68	-.24	.57
Fam. Reinf. Strongly disapprove	.05	.00	-3.01	.46
Fam. Reinf. disapprove	.08	.00	-2.55	.61
Peer Assoc. Most or all	22.96	.01	3.13	1.14
Peer Assoc. Half or less	6.34	.04	1.85	.88
Imitation	3.76	.07	1.32	.74
Model Fit				
Chi-square	186.35 df (13)	p<.001		
Nagelkerke Pseudo R^2	.58			

Table 32: SSSL Model for Age 11 years

11 years	Model 6 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	.00	1.00	-19.11	25679
Attitude Cannabis- Not Sure	.00	.1.00	-25.12	13240
Attitude Cocaine-OK	6.79E+17	1.00	41.05	47659
Attitude Cocaine- Not Sure	2.03E+10	1.00	23.73	13249
Attitude Glue- OK	14.61	.01	2.68	.95
Attitude Glue Not Sure	.50	.55	-.69	1.15
Fam. Reinf. Strongly disapprove	.06	.00	-2.85	.64
Fam. Reinf. disapprove	.00	1.00	-19.60	5648
Peer Assoc. Most or all	9.77	.09	2.28	1.32
Peer Assoc. Half or less	2.47	.15	.91	.62
Imitation	2.68E+10	1.00	24.01	18470.90
Model Fit				
Chi-square	86.21 df (13)	p<.001		
Nagelkerke Pseudo R^2	.52			

Table 33: **SSSL Model for Age 12 years**

12 years	Model 6 SS–>SL–>DU			
I	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	47.03	.00	3.13	.68
Attitude Cannabis- Not Sure	1.39	.82	1.14	.65
Attitude Cocaine-OK	.58	.72	-.96	1.02
Attitude Cocaine- Not Sure	.71	.84	-1.26	.72
Attitude Glue- OK	5.90	.00	2.35	.32
Attitude Glue Not Sure	2.23	.16	1.21	.31
Fam. Reinf. Strongly disapprove	.02	.00	-3.71	.61
Fam. Reinf. disapprove	.32	.12	-1.16	.72
Peer Assoc. Most or all	259.41	.00	5.34	1.08
Peer Assoc. Half or less	6.23	.00	1.59	.34
Imitation	2.56	.21	.98	.72
Model Fit				
Chi-square	209.17 df (13)	p<.001		
Nagelkerke Pseudo R^2	.65			

Table 34: **SSSL Model for Age 13 years**

13 years	Model 6 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	6.49	.00	1.87	.30
Attitude Cannabis- Not Sure	4.52	.00	1.51	.35
Attitude Cocaine-OK	.16	.00	-1.84	.53
Attitude Cocaine- Not Sure	.38	.02	-.96	.42
Attitude Glue- OK	4.17	.00	1.43	.23
Attitude Glue Not Sure	1.11	.10	.10	.26
Fam. Reinf. Strongly disapprove	.07	.00	-2.62	.29
Fam. Reinf. disapprove	.13	.00	-2.04	.52
Peer Assoc. Most or all	5.69	.00	1.74	.57
Peer Assoc. Half or less	1.97	.00	.68	.24
Imitation	32.87	00	3.49	.66
Model Fit				
Chi-square	249.49 df (13)	p<.001		
Nagelkerke Pseudo R^2	.50			

Table 35: **SSSL Model for Age 14 years**

14 years	Model 6 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	8.21	.00	2.10	.35
Attitude Cannabis- Not Sure	4.88	.00	1.58	.47
Attitude Cocaine-OK	2.67	.13	.98	.64
Attitude Cocaine- Not Sure	.56	.31	-.58	.57
Attitude Glue- OK	1.46	.35	.38	.41
Attitude Glue Not Sure	.51	.11	-.68	.42
Fam. Reinf. Strongly disapprove	.05	.00	-3.04	.30
Fam. Reinf. disapprove	.04	.00	-3.19	.59
Peer Assoc. Most or all	2.74	.14	1.01	.69
Peer Assoc. Half or less	1.73	.25	.55	.48
Imitation	4.71	.01	1.55	.57
Model Fit				
Chi-square	336.02 df (13)	p<.001		
Nagelkerke Pseudo R^2	.58			

Table 36: **SSSL Model for age 15 years**

15 years	Model 6 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	10.22	.00	2.32	.26
Attitude Cannabis- Not Sure	4.57	.00	1.52	.38
Attitude Cocaine-OK	1.21	.70	.19	.50
Attitude Cocaine- Not Sure	.52	.15	-.66	.46
Attitude Glue- OK	.86	.68	-.15	.36
Attitude Glue Not Sure	.64	.19	-.46	.34
Fam. Reinf. Strongly disapprove	.05	.00	-2.92	.25
Fam. Reinf. disapprove	.05	.00	-3.07	.43
Peer Assoc. Most or all	12.18	.00	2.50	.67
Peer Assoc. Half or less	2.11	.18	.75	.56
Imitation	8.36	00	2.12	.48
Model Fit				
Chi-square	598.91 df (13)	p<.001		
Nagelkerke Pseudo R^2	.66			

Table 37: SSSL Model for Males

Males	Model 7 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	8.25	.00	2.11	.26
Attitude Cannabis- Not Sure	2.93	.00	1.07	.37
Attitude Cocaine-OK	1.18	.74	.17	.51
Attitude Cocaine- Not Sure	.65	.32	-.43	.43
Attitude Glue- OK	1.33	.35	.29	.31
Attitude Glue Not Sure	.78	.41	-.24	.30
Fam. Reinf. Strongly disapprove	.07	.00	-2.70	.21
Fam. Reinf. disapprove	.04	.00	-3.17	.45
Peer Assoc. Most or all	11.91	.00	2.48	.48
Peer Assoc. Half or less	2.56	.00	.94	.29
Imitation	27.60	.00	3.32	.50
Model Fit				
Chi-square	711.26 df (13)	p<.001		
Nagelkerke Pseudo R^2	.58			

Table 38: SSSL Model for Females

Females	Model 7 SS–>SL–>DU			
	Exp(B)	Sig	B	S.E.
Attitude Cannabis- OK	7.82	.00	2.06	.15
Attitude Cannabis- Not Sure	4.93	.00	1.60	.21
Attitude Cocaine-OK	1.30	.58	.27	.28
Attitude Cocaine- Not Sure	.31	.00	-1.17	.25
Attitude Glue- OK	2.75	.00	1.01	.16
Attitude Glue Not Sure	.97	.92	-.03	.15
Fam. Reinf. Strongly disapprove	.05	.00	-2.97	.20
Fam. Reinf. disapprove	.08	.00	-2.52	.34
Peer Assoc. Most or all	15.30	.00	2.73	.32
Peer Assoc. Half or less	4.06	.00	1.40	.15

Imitation	4.01	00	1.39	.34
Model Fit				
Chi-square	907.58 df (13)	p<.001		
Nagelkerke Pseudo R^2	.62			

Table 39: **Cumulative SSSL Model (8202 cases 68.1%) With all Peer Association Cases**

	Model1 SS–>DU		Model 2 SL–>DU		Model 3 SS–>SL–>DU			
Drugs used last year	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	B	SE
11 years	.19	.00			.50	.00	-.69	.16
12 years	.25	.00			.56	.00	-.58	.13
13 years	.38	.00			.77	.02	-.26	.11
14 years	.61	.00			.85	.12	-.16	.10
15 years	-	-			-	-	-	-
Male	1.06	.35			1.02	.82	.02	.08
Female	-	-			-	-	-	-
North East (1)	1.18	.16			1.20	.21	.19	.15
North West (2)	1.44	.00			1.32	.07	.27	.15
York&Humber (3)	1.12	.32			1.04	.80	.04	.15
East Midlands (4)	1.30	.06			1.25	.21	.23	.18
West Midlands (5)	1.06	.70			1.21	.29	.19	.18
East England (6)	1.30	.03			1.23	.18	.21	.16
London (7)	2.03	.00			2.02	.00	.70	.22
South East (8)	1.45	.00			1.47	.01	.38	.16
South West (9)	-	-			-	-	-	-
Attitude Cannabis- OK			11.91	.00	9.60	.00	2.26	.11
Attitude Cannabis- Don't know			3.68	.00	3.37	.00	1.24	.16
Attitude Cocaine-OK			.66	.03	.72	.08	-.34	.19
Attitude Cocaine- Don't know			.50	.00	.51	.00	-.67	.18
Attitude Glue- OK			2.78	.00	2.83	.00	1.04	.12
Attitude Glue Don't know			1.30	.02	1.37	.01	.32	.12
Fam Reinf. Strongly disapprove			.07	.00	.07	.00	-.260	.14

Fam Reinf. Strongly disapprove			.07	.00	.07	.00	-2.64	.27
Peer Assoc. Most or all			16.81	.00	14.80	.00	2.70	.25
Peer Assoc. Some or less than half			4.10	.00	3.80	.00	1.34	.11
Imitation			8.82	.00	8.94	.00	2.19	.28
Model Fit								
Chi-square	2283.37 df (24)	p<.001						
Nagelkerke Pseudo R^2	.42							

Source: Smoking Drinking and Drug Use survey 2016

Table 40: **Cumulative SSSL Model for Drugs used Ever (3962 cases/ 32.9%)**

	Model1 SS–>DU		Model 2 SL–>DU		Model 3 SS–>SL–>DU			
Drugs used Ever	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	B	SE
11 years	4.20	.03			.50	.01	.69	.28
12 years	3.15	.00			.51	.01	.67	.24
13 years	2.37	.00			.80	.26	.23	.20
14 years	1.44	.00			1.00	.98	-.00	.18
15 years	-	-			-	-	-	-
Female	.92	.12			.99	.93	.01	.14
Male	-	-			-	-	-	-
North East (1)	.90	.26			.81	.41	-.21	.25
North West (2)	.74	.00			1.01	.97	.01	.27
York&Humber (3)	.83	.06			.95	.84	-.05	.26
East Midlands (4)	.75	.02			1.32	.40	.28	.33
West Midlands (5)	.84	.16			.71	.27	-.34	.31
East England (6)	.79	.02			1.01	.99	.01	.28
London (7)	.53	.00			.59	.17	-.53	.39
South East (8)	.77	.02			.80	.41	-.23	.28
South West (9)	-	-			-	-	-	-
Attitude Cannabis- OK			9.69	.00	8.03	.00	-.2.08	.20
Attitude Cannabis- Don't know			4.46	.00	4.20	.00	-1.44	.27
Attitude Cocaine-OK			.65	.24	.72	.38	.33	.38

Attitude Cocaine- Don't know			.29	.00	.27	.00	1.32	.32
Attitude Glue- OK			4.23	.00	4.26	.00	-1.45	.22
Attitude Glue Don't know			1.07	.71	1.13	.53	-.12	.20
Fam Reinf. Strongly disapprove			.03	.00	.03	.00	3.70	.15
Fam Reinf. Strongly disapprove			.02	.00	.02	.00	3.78	.28
Peer Assoc. All or most			16.95	.00	12.84	.00	-2.55	.32
Peer Assoc. Half or some			3.45	.00	2.72	.00	-1.00	.20
Imitation			273.12	.00	264.00	.00	-5.58	.76
Model Fit								
Chi-square	2256.37 df(24)	P≤.001						
Nagelkerke Pseudo R^2	.70							

Table 41: **Cumulative SSSL Model for Drugs used Last Month (3588 cases/ 29.8%)**

	Model1 SS–>DU		Model 2 SL–>DU		Model 3 SS–>SL–>DU			
Drugs used last Month (3588/29.8%)	Exp(B)	Sig	Exp(B)	Sig	Exp(B)	Sig	B	SE
11 years	1.31	.03			.91	.66	.10	.21
12 years	.25	.12			.85	.42	.17	.20
13 years	.38	.38			.97	.88	.03	.18
14 years	.61	.53			1.07	.69	-.07	.17
15 years	-	-			-	-	-	-
Female	1.09	.26			.90	.37	.11	.12
Male	-	-			-	-	-	-
North East (1)	1.09	.55			.86	.48	.15	.21
North West (2)	.98	.91			.78	.29	.25	.23
York&Humber (3)	.91	.47			.92	.68	.09	.21
East Midlands (4)	.86	.34			1.11	.68	-.10	.24
West Midlands (5)	1.01	.94			.67	.17	.40	.29
East England (6)	.97	.84			.93	.74	.08	.22
London (7)	.94	.76			.72	.38	.33	.37
South East (8)	1.03	.85			.81	.38	.21	.24

South West (9)	-	-			-	-	-	-
Attitude Cannabis- OK					1.20	.40	-.14	.23
Attitude Cannabis- Don't know					1.10	.73	-.11	.29
Attitude Cocaine-OK					.65	.36	.39	.48
Attitude Cocaine- Don't know					1.10	.78	-.11	.34
Attitude Glue- OK					1.05	.83	.01	.25
Attitude Glue Don't know					.87	.47	.12	.20
Fam Reinf. Strongly disapprove					.82	.19	.21	.16
Fam Reinf. Strongly disapprove					.90	.67	.08	.24
Peer Assoc. All or most					1.01	.96	.01	.31
Peer Assoc. Half or some					.95	.68	.15	.14
Imitation					.74	.42	.27	.31
Model Fit								
Chi-square	11.68 df(24)	p<.98						
Nagelkerke Pseudo R^2	.01							

Table 42: Variable Codes

Variable	Question	Original Categories	Code	Recoded Categories	Code
Drug Use	Used any drugs last year. Derived Variable from the dataset	Used drugs Not used	1 2 -8 -9	Used drugs in the last year Not used Don't Know Missing	0 1
Gender	Are you a boy or girl?	Boy Girl Don't know Not answered	1 2 -8 -9	Boy Girl Missing	0 1 -8,-9
Age	How old are you now? Derived Variable from dataset	11 12 13 14 15 Don't know Not answered	11 12 13 14 15 -8 -9	11 12 13 14 15 Missing	11 12 13 14 15 -8,-9
Region	Derived from dataset	North East North West East Midlands Yorkshire & Humber West Midlands East of England London South East South West	1 2 3 4 5 6 7 8 9	North East North West East Midlands Yorkshire & Humber West Midlands East of England London South East South West	1 2 3 4 5 6 7 8 9

Peer Differential Association	How many people your own age do you think take drugs?	All of them Most, but not all About half Some of them None of them Not applicable Don't know Not answered	1 >0 2> 0 3>1 4>1 5>2 -1>2 -8 -9	Most or all Half or less None Missing	0 1 2 -9/-8
Attitude Cannabis	Do you think it is OK for someone your age to do the following? Try taking cannabis	It's OK It's not OK Don't know Not answered	1 2 3 -9	It's OK It's not OK Don't know Missing	0 2 1 -9
Attitude cocaine	Do you think it is OK for someone your age to do the following? Try taking cocaine	It's OK It's not OK Don't know Not answered	1 2 3 -9	It's OK It's not OK Don't know Missing	0 2 1 -9
Attitude glue	Do you think it is OK for someone your age to do the following? Try sniffing glue?	It's OK It's not OK Don't know Not answered	1 2 3 -9	It's OK It's not OK Don't know Missing	0 2 1 -9
Parental Differential reinforcement	How do you think your family would feel if you started taking drugs? Filter question.	Try to stop me Persuade me not to Do nothing Encourage me Don't know Not answered Not applicable	1>0 2>1 3>2 4>-9 5>2 -9>-9 -1>2	Strongly disapprove Disapprove Neither approve or disapprove Missing	0 1 2 -9
Imitation	Why did you try drugs for the first time? (Derived from dataset)	Because friends were doing it No Not answered Not applicable	1>1 0>0 -9>-9 -1>0	Because friends were doing it Other reasons Not answered	0 1 -9

Not applicable (-1) If the respondent has answered a question but their previous answers mean they should not have answered (filter = 0) the value is set to -1 "Not applicable".
Don't know (-8) When respondents selected more than one option
Not answered (-9) When respondents selected no answer.

Table 43 : List of the common names of drugs used in the survey

Drug Name	**Other names/ also known as**
Cannabis	Weed, Marijuana, Dope, Blow, Hash, Skunk, Grass, Draw, Ganja, Spliff
Methamphetamine	Speed, other Amphetamines, Crystal Meth, Whizz
LSD	Acid, Trips
Ecstasy	'E', MDMA
Semeron	fake drug. Also called 'Sem'
Poppers	Amyl nitrite
Tranquilisers	Temazepam, jellies, roofies, valium
Heroin	Brown, Smack, 'H'
Magic mushrooms	Magic mushrooms
Methadone	physeptone
Crack	Base, Rock, Stones
Cocaine	Snow, Charlie
Ketamine	'K'
Mephedrone	M-Cat, Meow, Bubble, Drone, Meph, 4MMC
Nitrous oxide,	Laughing gas, Balloons, Hippie crack.
Glue, gas, aerosols or solvents,	Butane, lighter refills
Legal highs	Come in different forms such as herbal mixtures, powders, crystals or tablets.

Table 44: FHMREC Ethical Approval

Research and Enterprise Services Division | Lancaster University

Applicant: Poonum Wilkhu
Supervisor: Elizabeth McDermott
Department: DHR
UREC Reference: RS2014/123

14 September 2015

Dear Poonum,

Re: Understanding illicit Drug use in adolescent students.

Thank you for submitting your research ethics application for the above project for review by the Faculty of Health and Medicine Research Ethics Committee (FHMREC). The application was recommended for approval by FHMREC, and on behalf of the Chair of the University Research Ethics Committee (UREC), I can confirm that approval has been granted for this research project.

As principal investigator your responsibilities include:

- ensuring that (where applicable) all the necessary legal and regulatory requirements in order to conduct the research are met, and the necessary licenses and approvals have been obtained;
- reporting any ethics-related issues that occur during the course of the research or arising from the research to the Research Ethics Officer (e.g. unforeseen ethical issues, complaints about the conduct of the research, adverse reactions such as extreme distress);
- submitting details of proposed substantive amendments to the protocol to the Research Ethics Officer for approval.

Please contact the Research Ethics Officer, Debbie Knight (01542 592605 ethics@lancaster.ac.uk) if you have any queries or require further information.

Yours sincerely,

[redacted]

Sarah Taylor
Secretary, University Research Ethics Committee

Cc Fiona Aiken, University Secretary, Professor Roger Pickup (Chair, FHMREC); Prof Stephen Decent (Chair, UREC).

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Table 45: Databases Search Examples

Recent queries in pubmed			
Search	Query	Items fou	Time
#28	Search ((((((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH])))))) NOT smoking[MeSH Terms]) NOT alcohol[MeSH Terms]) NOT prescription[MeSH Terms]	1851	07:34:47
#27	Search ((((((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH])))))) NOT smoking[MeSH Terms]) NOT alcohol[MeSH Terms]) NOT prescription[MeSH Terms] Filters: Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years Sort by: [relevance]	1851	07:34:47
#26	Search ((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))	2242	07:33:43
#25	Search ((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR	2242	07:33:43
#24	Search (adolescents[MeSH Terms]) OR child[MeSH Major Topic]	1674636	07:33:26
#23	Search (adolescents[MeSH Terms]) OR child[MeSH Major Topic] Filters: Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years;	1254457	07:33:26
#22	Search (illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]	9297	07:32:32
#21	Search (illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms] Filters: Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years;	2532	07:32:32

arch	Add to builder	Query	Items found	Time
#28	Add	Search **((((((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH])))))) NOT smoking[MeSH Terms]) NOT alcohol[MeSH Terms]) NOT prescription[MeSH Terms]**	1851	07:34:47
#27	Add	Search **((((((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH])))))) NOT smoking[MeSH Terms]) NOT alcohol[MeSH Terms]) NOT prescription[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	1851	07:34:47
#26	Add	Search **((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))**	2242	07:33:43

#25	Add	Search **((((adolescents[MeSH Terms]) OR child[MeSH Major Topic]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND (((illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]) AND (Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))** Sort by: **Relevance**Filters: **Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	2242	07:33:43
#24	Add	Search **(adolescents[MeSH Terms]) OR child[MeSH Major Topic]**	1674636	07:33:26
#23	Add	Search **(adolescents[MeSH Terms]) OR child[MeSH Major Topic]** Sort by: **Relevance** Filters: **Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	1254457	07:33:26
#22	Add	Search **(illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]**	9297	07:32:32
#21	Add	Search **(illcit, drugs[MeSH Terms]) OR street drugs[MeSH Terms]** Sort by: **Relevance** Filters: **Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	2532	07:32:32
#20	Add	Search **(drugs, illicit[MeSH Terms]) AND adolescents** Sort by: **Relevance** Filters: **Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	2245	07:31:20
#2	Add	Search **(drugs, illicit[MeSH Terms]) AND adolescents**	2468	07:31:20
#1	Add	Search **(drugs, illicit[MeSH Terms]) AND adolescents** Sort by: **Relevance** Filters: **published in the last 5 years; Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	488	07:31:16

#16	Add	Search **(((street drugs[MeSH Terms]) AND youth[MeSH Terms] AND ("last 5 years"[PDat] AND Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND ((drugs, illicit[MeSH Terms]) AND children[MeSH Terms] AND ("last 5 years"[PDat] AND Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))** Sort by: **Relevance** Filters: **published in the last 5 years; Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	89	07:30:23
#17	Add	Search **(((street drugs[MeSH Terms]) AND youth[MeSH Terms] AND ("last 5 years"[PDat] AND Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))) AND ((drugs, illicit[MeSH Terms]) AND children[MeSH Terms] AND ("last 5 years"[PDat] AND Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))**	89	07:30:23
#15	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Systematic Reviews; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	587	07:25:29
#7	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]**	42417	07:25:29
#14	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	37081	07:24:48
#13	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	37081	07:23:50
#12	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Core clinical journals; Adolescent: 13-18 years; Child: birth-18 years**	4419	07:23:45
#11	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Adolescent: 13-18 years; Child: birth-18 years**	37081	07:23:37
#10	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Adolescent: 13-18 years**	37081	07:23:33

#12	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Core clinical journals; Adolescent: 13-18 years; Child: birth-18 years**	4419	07:23:45
#11	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Adolescent: 13-18 years; Child: birth-18 years**	37081	07:23:37
#10	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English; Adolescent: 13-18 years**	37081	07:23:33
#9	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans; English**	37081	07:23:20
#8	Add	Search **(substance abuse[MeSH Terms]) AND adolescent[MeSH Terms]** Sort by: **Relevance** Filters:**Humans**	42289	07:23:17
#6	Add	Search **((abuse, substance[MeSH Terms]) AND adolescent[MeSH Terms]) OR children[MeSH Terms]**Sort by: **Relevance**	1587697	07:21:37
#5	Add	Search **((street drugs[MeSH Terms]) AND youth[MeSH Terms] AND ("last 5 years"[PDat] AND Humans[Mesh] AND English[lang] AND (jsubsetaim[text] OR medline[sb]) AND (adolescent[MeSH] OR (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))))** Sort by: **Relevance**	488	07:20:41
#4	Add	Search **(street drugs[MeSH Terms]) AND youth[MeSH Terms]** Filters: **published in the last 5 years; Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	488	07:19:33
#3	Add	Search **(drugs, illicit[MeSH Terms]) AND children[MeSH Terms]** Filters: **published in the last 5 years; Humans; English; Core clinical journals; MEDLINE; Adolescent: 13-18 years; Child: birth-18 years**	109	07:18:19

- Obituaries
- Publications
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- About

Proquest:116 results (4 selected)
Search terms: (SSSL) AND (drug use OR illicit) AND (adolescents OR youth), (drug use OR illicit) AND (adolescents OR youth)

Table 46: Evaluation of risk of bias/ quality assessment of the included studies

Y- Yes N- No U- Unclear N- Not Applicable

	Study reference	Were the criteria for **inclusion and Exclusion** in the sample clearly defined	Were the study **subjects and settings** described in detail?	Was the **exposure measured** in a valid and reliable way?	Were objective, standard criteria **used for measurement of the condition (peer/ family/ region)?**	**Were Confounding factors identified?**	**Were Strategies to deal with the confounding factors stated?**	**Outcomes measured in a valid and** reliable way?	Appropriate **analysis** used?
1.	Allen et. al 2003	N	N	U	U	N	N	U	Y
2.	Allen et. al 2012	Y	Y	Y	Y	N	N	Y	Y
3.	Aslund and Nilsson, 2013	Y	Y	Y	Y	Y	Y	Y	Y
4.	Aston 2015	N	Y	Y	Y	N	N	Y	Y
5.	Bahr et al., 2005	N	Y	Y	Y	N	N	Y	Y
6.	Becona and colleagues 2013	N	Y	Y	Y	N	N	Y	Y
7.	Borawski et al., 2003	N	Y	Y	Y	N	N	Y	Y
8.	Broman et al., 2006	Y	Y	Y	Y	N	N	Y	Y
9.	Bryant et al., 2003	N	Y	Y	Y	N	N	Y	Y
10.	Calafat et al., 2014	N	Y	Y	Y	N	N	Y	Y
11.	Chabrol, et. al, 2006	N	Y	Y	Y	N	N	Y	Y
12.	Chen and Jacobson (2012)	Y	Y	Y	Y	N	N	Y	Y
13.	Chomynova et al., 2009	Y	Y	Y	Y	N	N	Y	U
14.	Clark and Lohéac, 2007	N	Y	Y	Y	N	N	Y	Y

15.	Cotto et al 2010	Y	Y	Y	Y	N	N	Y	U
16.	Derringer et al 2010	Y	Y	Y	Y	N	N	Y	Y
17.	Evans-Polce et al., 2015	Y	Y	Y	Y	N	N	Y	Y
18.	Fagan et al., 2013	Y	Y	Y	Y	N	N	Y	Y
19.	Fletcher and Bonell, 2013	N	Y	Y	Y	N	N	Y	Y
20.	Fletcher et al 2009 Cannabis	Y	Y	Y	Y	N	N	Y	Y
21.	Fletcher et al 2009 New counterschool cultures	U	Y	Y	Y	N	N	Y	Y
22.	Guo et al., 2002,	N	Y	Y	Y	N	N	Y	Y
23.	Henry et. al .2011	N	Y	Y	Y	N	N	Y	Y
24.	Holland-Davis 2006	N	Y	Y	Y	Y	Y	Y	Y
25.	Kawaguchi, 2004	N	Y	Y	Y	N	N	Y	Y
26.	Keyes et al., 2011,	Y	Y	Y	Y	Y	Y	Y	Y
27.	Lac and Crano‘s 2009	Y	Y	Y	Y	N	N	Y	Y
28.	Lee et al., 2004	N	Y	Y	Y	N	N	Y	Y
29.	Mak et. al. 2020	Y	Y	Y	Y	N	N	Y	Y
30.	McIntosh et al 2005	N	Y	Y	Y	N	N	Y	U
31.	McKeganey et. a 2004	N	Y	Y	Y	N	N	Y	Y
32.	McVicar and Polanski, 2012	Y	Y	Y	Y	Y	N	Y	Y
33.	McVie and Bradshaw, 2005	Y	Y	Y	Y	N	N	Y	Y
34.	MinWoo (2015) PhD Thesis	N	Y	Y	Y	N	N	Y	Y
35.	Musher-Eizenman et al., 2003,	N	Y	Y	Y	Y	N	Y	Y
36.	Okaneku et al 2015	N	Y	Y	Y	Y	Y	Y	Y
37.	Olsson et al 2003	N	Y	Y	Y	Y	N	Y	Y
38.	Pokhrel et al., 2008,	N	Y	Y	Y	N	N	Y	Y

39.	Rai et al 2003	N	Y	Y	Y	N	N	Y	Y
40.	Salas-Wright 2015	Y	Y	Y	Y	N	N	Y	Y
41.	Scalco et al., 2016	Y	Y	Y	Y	Y	N	Y	Y
42.	Shih et. al 2010	Y	Y	Y	Y	N	N	Y	Y
43.	Su and colleagues 2018	Y	Y	Y	Y	Y	N	Y	Y
44.	Su and Supple, 2014,	N	Y	Y	Y	N	N	Y	Y
45.	Sutherland and Shepherd 2001a	N	Y	Y	Y	N	N	Y	U
46.	Sutherland and Shepherd, 2001b	N	Y	Y	Y	N	N	Y	Y
47.	Sutherland and Shepherd, 2002.	N	Y	Y	Y	N	N	Y	Y
48.	Svensson, 2003	Y	Y	Y	Y	N	N	Y	Y
49.	Tornay et al., 2013	N	Y	Y	Y	N	N	Y	U
50.	Van Ryzin et al., 2012	N	Y	Y	Y	N	N	Y	Y
51.	Wang et. al 2009	Y	Y	Y	Y	N	N	Y	Y
52.	Wallace and Fisher 2007	N	Y	Y	Y	N	N	Y	Y
53.	Wallace et al., 2003	N	Y	Y	Y	Y	N	Y	Y
54.	Whaley et al., 2011	N	Y	Y	Y	Y	N	Y	Y
55.	Whaley et al., 2016	N	Y	Y	Y	N	N	Y	Y
56.	Wittchen et al., 2008	N	Y	Y	Y	N	N	Y	Y
57.	Zimmerman and Farrell, 2016	N	Y	Y	Y	N	N	Y	Y

Table 47: Data Characteristics

	Study	Research type Sample and Location	Variables	Analysis	Outcome
1.	Allen et. al (2003)	Literature search. 2700 studies. Sample and location not clear. Studies focusing on adolescent substance use. Location not clear. N = 1,234,193	Source of influence (a) peer/friends/sibling or (b) parents. Type of substance (a) overall drug use, (b) tobacco, (c) alcohol, (d) cannabis, or (e) hard drugs (heroin, pills, cocaine, crack, LSD, etc.). Age? adolescent who had not graduated from high school- but what age? Inclusion and exclusion criteria discussed but not extensive.	Quantitative Used variance-centred form of meta-analysis developed by Hunter and Schmidt (1990). Coded per source of influence, type of drug and age.	e relative size of parent &peer influence varies with the age and the type of substance. For cannabis the influence of peers increased as age increased but for hard drugs influence was stable. Peer indluence grew faster. Parents influenced alcohol use most
2.	Allen et. al (2012)	Longitudinal investigation of 157 (85%) levels of drug use at 15 and 148 levels of drug use at the age 16 assessment. Also assessed at ages 13, observed interactions with mothers. Analogue measures of social skills at ages 13 -15.-report measures from early to mid-adolescence. US.	Adolescent SU of cannabis in the past 30 days. Close Friend Social SU at age 15 and 16 years but not other years.	Mixed. longitudinally with a combination of observational, analogue, sociometric, and self-report measures from early to mid-adolescence	Close friend use was a significant overall predictor of change in use over 1 yr Peer influences on SU in adolescence vary in strength. Based on qualities of the adolescent and his or her close friend
3.	Aslund and Nilsson, 2013	Cross-sectional. 7757 13–18 year olds Vestmanland	Gender, neighbourhood social capital, freq of drug use (cannabis and other)	Quantitative GLM, HLM. Self report questionnaire. Survey	Low neighbourhood social capital associated more than double the odds of having used illicit drugs.
4.	Aston (2015)	Longitudinal study. Edinburgh Study of Youth Transitions and Crime (ESYTC) 1 (n = 4300) to 81% at sweep 6 (n = 3531). Age 13 and 16., England	Ordinal drug use variable: volume of drug use, which totalled up the self-reported use of each drug (cannabis, glue or gas, ecstasy cocaine, speed, heroin, LSD, magic mushrooms, downers, poppers or something else). Parental supervision score based on whether parents knew where adolescents were going, with whom and when they would be home. Parent-child conflict/weak/strong social bonds. Named best friend's offending and drug use are direct measures of the self-reported offending or drug use.	Quantitative Multivariate regression self-report questionnaire. Survey	Diff risk factors assoc with drug use in the older, but not younger. Weak parental social bonds ass with DU at age 13 not at 16. Male and DU.
5.	Bahr et al., (2005)	Cross sectional. 4,230 adolescents from grades 7–12,	Six illicit drugs reported - past 30 days. amphetamines, sedatives, hallucinogens,	Quantitative. Negative binomial regression to estimate the effects of peer	Peer drug use had relatively strong effects of adolescent drug use.

	Peer drug use and parental attitude.	data were from a probability sample collected in an intermountain state in US 1997 Age 12 to 19 with a median age of 15.	cocaine, inhalants, and heroin. The response to each drug was dichotomized into “0” for no use and “1” Cannabis use measured separately. Peer drug use parental drug attitudes. Each adolescent was asked how wrong their parents felt it would be for them to (1) drink beer, wine, or hard liquor, (2) smoke cigarettes, and (3) smoke cannabis	and six family variables on the risk of adolescent drug use questionnaire	Parental drug attitudes, sibling drug use, and adult drug use had significant direct effects net of peer influences. In addition to indirect effects that were mediated by peer drug use. Influences of parental monitoring, were significant but small. Parental attitudes and sibling use are most important family variables. Impacts appear to be mediated completely by peers. Parental monitoring is important net of peer influences
6.	Becoña and colleagues (2013) Parental permissivenes s, control, and affect and drug use among adolescents	Cross sectional sampling was used to recruit participants from fourteen public, private and grant-assisted private schools from the island of Mallorca (seven from Palma and the remaining seven from the rest of the island). 2010 e up of 1,428 adolescents aged 11 to 19 years. Spain	Perception of parents’ permissiveness to smoking and alcohol use (MOST CLOSE to this study) cannabis use we asked: Have you ever used cannabis? The response options were: No; Yes, all my life; Yes, during the last 12 months; and Yes, during the last 30 days.	Quantitative. Path analysis was conducted using the Amos 19 (SPSS, 2006) program Survey questionnaire	Those who had tried cannabis during their lifetime perceived higher levels of parental permissiveness toward such use.
7.	Borawski et al., 2003	692 adolescents in the 9th and 10th grades (mean age = 15.7 years) Midwest US.	Male and Female.Drug use cannabis. Experimental or drug use (never trying or daily use). 3 parent variables: parental Monitoring and trust, unsupervised time.	Quantitative. Using gender-specific multivariate logistic regression analyses.	Females: PM not found to be assco with cannabis use. High level of Parental trust less cannabis use in females only.
8.	Broman et al., 2006 Friends use-check	National Longitudinal Study of Adolescent Health (Add Health), a nationally representative study of adolescents in Grades 7 through 12 in the 1994-1995, followups in 1996 and 2001 (n = 6,504). United States	Neighbourhood problem is the sum score of two questions litter trash and DUsers. Two parenting measures mother warmth and family acceptance Drug use is measured using two indicator freq and quant of alc use and Cannabis use. Peer drug use measures are taken from two questions that asked “Of your three best friends, how many drink alcohol (or smoke Cannabis) at least once a month?”	Quantitative. Structural equation modelling SEM muthen and muthen.	Family structure and DU mediated by parenting, peer use and neighbourhood. Direct impact of FS is insignificant. Strongest effect is peer use and lack of parental warmth promoters of DU, little significance for neighbourhood problems/. PU and Parenting are mediators.
9.	Bryant et al., 2003 Imitation-check Use for gender	Monitoring the Future (N = 1,897) ages 14 to 20 Level 1 in the current research, adolescent substance use was included at ages 14, 16, 18, and 20	Level 1 Monthy S//u alc tobacco and cannabi Level 2—Interindividual factors. Sarental education, Ethnicity, gender, and age. Academic achievement. School misbehavior Loneliness. School interest. Perceived school difficulty.	Quantitative. Hierarchical linear modelling.	Females increased their Cannabis use more than males. At age 14 no difference in use by low or high achievement

		Each year since 1975. 1,897 students from two cohorts (1991 and 1992) United States	None of SL varianles are of interest.		
10.	Calafat et al., 2014	11 and 19 years. 7718 Students.. six European regions: Stockholm (Sweden), Liverpool (UK), Palma de Mallorca (Spain), Coimbra (Portugal), Ljubljana (Slovenia), and Prague (Czech Republic).	Freq of Cann and illegal drugs. Parental warmth was measured using an 8-items reduced version of the Warmth/Affection. Parental strictness was measured using the Parental Control Scale. Both used to create authoritative, indulgent, authoritarian, and neglectful	Quantitative. Multivariate analysis of variance (MANOVAs)	Authoritative – warmth and strictness – parenting style and the indulgent – warmth but not strictness –associated with lower levels of SU than authoritarian and neglectful parenting styles
11.	Chabrol, et. al, (2006)	Two randomly selected high schools and a junior high school in 559 participants (275 girls, age range 13–18, Toulouse, France ,	the number of peers using cannabis Yes/NoCannabis use. Parents' opinion of cannabis use was assessed using a ten-point scale ranging from 0 (highly opposed to cannabis use) to 10 (highly in favour of cannabis use). articipants' opinion of cannabis use assessing effects of can use. 1 = disagree strongly to 7 = agree strongly.	Quantitative. Exploratory factorial analysis with VARIMAX.	Results: number of peers using cannabis was the main predictor of cannabis use. parental opinion about cannabis use was not associated with recent cannabis use. positive expectation/ attitude to cannabis use is a risk factor for cannabis use whereas negative expectation appeared to be a protective factor
12.	Chen and Jacobson (2012) gender	National Longitudinal Study of Adolescent Health (N = 20,160) longitudinal. USA	Cannabis use between the ages of 12 and 34. gender and racial/ethnic differences in developmental trajectories of alcohol use, heavy drinking, smoking, and cannabis use	Quantitative. Multilevel modeling analyses	Females : higher levels of SU than males during early adolescence from age 12 reached stationary at age 25.
13.	Chomynova et al., 2009 Attitudes via perceived risk	European School Survey Project on Alcohol and Other Drugs (ESPAD) in 2003 (aged 15–16 years) 35 European countries	Never having tried an illicit substance (cann or ecstasy). tried cannabis or ecstasy up to five times in their lifetime were regarded as experimental drug users, while those reporting higher frequency of use in the last 12 months or last 30 days were regarded as regular drug users. Perceived risk: How much do you think people risk harming themselves (physically or in other ways), if they try/take …?'. Numbers of 'don't know' answers were taken into account as well	Quantitative. Trend analysis??	abstainers assess the risks of drug use as moderate and great, while regular drug users tend to report lower risks.
14.	Clark and Lohéac, 2007 Imitation – peers and friends	National Longitudinal Study of Adolescent Health which comprises a stratified sample of 80 high schools and 52 middle schools from the U.S. 7th and 12th grades. 1994–April 1995), covered 90118 adolescents in 144 schools. The second, called In-Home I (April 1995–December 1995),	effect of peer group influence in four different risk behaviours: smoking, drinking, drunkeness, and Cannabis use Cannabis: During the past 30 days, how many times did you use Cannabis? respondents were asked to identify a number of their friends. results for two peer groups:Other adolescents in the same school and the same	Quantitative. Probit participation equation. Interviews.	Peer group effects not clear? within these schools students are sensitive to their peers' behavior.

		USA	year; and The individual's friends (if they are interviewed).		
15.	Cotto et. al 2010	National survey of Drug use and health NSDUH 12-17 yrs and 18-25yrs. From 2002-2005 50 states of Columbia. Face to face interviews. Sensitive questions are collectwed using ACASI audio computer assisted self interviewing. Multistage clustered design Sameol Total sample is 271, 978 Not clear what proportion is aged 12-17yrs USA	Females aged 12-17 yrs reported higher use of psychotehrapeitics No difference found for cocaine and more males used cannabis as compared to females.	Quantitative. Trends analysis?	Overall rates of SU were significantly higher for males than for females. tterns of use, abuse, or dependence among users differed by age group and drug. irls exceeded boys in their use of of psychotherapeutics ales generally exceeded females in meeting abuse criteria Cannabis among 12- to 17-year-olds
16.	Derringer et al., 2010	longitudinal Minnesota Twin Family Study (MTFS: 11-years-old (M = 11.70, SD = 0.43) at intake, 14-years-old (M = 14.77, SD = 0.51) at the first follow-up, and 17-years-old (M = 17.99, SD = 0.60) at the second follow-up. The final sample of those who were administered the relevant measure in person included 710 males and 676 females at intake. At first follow-up, 608 males and 648 females completed the measure and data were available from 493 males and 504 females at second follow-up. USA	Have you ever used: Cannabis or classes of substancesother controlled substances (stimulants, tranquilizers, Quaaludes/downers, cocaine, PCP/LSD/other psychedelics, and opiates) and uncontrolled substances (over-the-counter medications and inhalants)] Analysis: single-factor model, with latent trait group	Quantitative. SEM.	reported SU indicating . greater severity) in females than in males. While using these substances the trait was poorly characterized by SU in early adolescence. suggests that measurement and interpretation of adolescent SU is enhanced by the consideration of a wide range of substances.
17.	Evans-Polce et al., 2015	Four waves of data National Longitudinal Study of Adolescent Health (in 1994–95, 1996, 2001, and 2008. U.S. adolescents in grades 7–12. 37,219 person-times for gender analyses Age 14-34 USA	Cannabis use was assessed by any past 30 day use (reported on 17.4% measurement occasions).	Quantitative. Intercept-only logistic TVEMs School-based survey of adolescents surveyed	he prevalence of Cannabis use was not significantly different across gender in early adolescence. More females than makes used cannabis at age 14, same at age 15.Boys overtake after. Cannabis use, this gender disparity remained fairly constant after age 16 ata from earlier ages were collected in 1994–1995; all findings may not be generalizable to later cohorts of adolescents.

18.	Fagan et al., 2013	Cross sectional data . Data were obtained in 2002 from 10th-grade students in public schools participating in a prior study of the dissemination of science-based prevention programming in 41 rural and suburban communities in seven states 7,349 10th-grade students and rely on of individuals who may vary in the effects of parental controls on drug use. USA	Parental Controls including parental approval of drug use amongst others like attachement to mother, father family management etc. Moderating variables: male, community, kow neighbouthood attachementm peer drug use, SU in the lifetime; number of frugs 1, 2,3 more than 4	Quantitative. self-reported data. Questionnaires regression mixture models to identify latent classes multivariate regression mixture model.	Strength of the association between weak parental disapproval and drug use was less for youth who reported more exposure to drug-using peers. This means that the effects of parental ambivalence or approval of drug use did not affect du when peers were considered!!
19.	Fletcher and Bonell, 2013 Centripetal and centrifugal forces.	Longitudinal qualitative research at two case study schools during the 2009– 2010 academic-year. Two state-funded, mixed-sex secondary schools (for students aged 11–16) were recruited Both schools were reported by students to have large, diffuse peer groups South East England and London	NVivo to aid data management and analysed using an interpretative approach. Using thematic and grounded-theory approaches, initial analyses were orientated to identifying and recording themes emerging within and across accounts, remaining sensitive to our a priori conceptual framework (e.g. counter-school groups), use of theory (e.g. dialectics between structural constraint/enablement and agency), as well as previous empirical studies. Further analyses focused on more detailed coding to interpret the meaning of, and relationships between, the initial themes and patterns)	Qualitative. Explored young people's experiences over time, students interviewed at the start of school year 10 (aged 14–15), again in the spring term, analysed using an interpretative approach. Using thematic and grounded-theory approaches, initial analyses were orientated to identifying and recording themes emerging within and across accounts, remaining sensitive a priori conceptual framework (e.g. counter-school groups), use of theory (e.g. dialectics between structural constraint enablement and agency).	While small, marginalised groups of students at Grange House engaged in heavy, frequent, potentially harmful patterns of SU, North Street was characterised by widespread use of cannabis via a centripetal force, which initially enmeshed together students seeking to stay safe and survive a potentially dangerous inner-city school environment. These social network formations appeared to be influential in shaping SU,
20.	Fletcher, Sorhaindo et al., 2009. Cannabis use and 'safe' identities in an inner-city school risk environment	Case-study research carried out at Highbridge School (pseudonym). Highbridge is a mixed-sex, comprehensive 11–16 school in London Qualitative data collected during the school year 2006–2007 through semi-structured interviews with students and teachers and via informal observations at the school.	Fourteen year-10 students (age 14–15) were interviewed in the autumn term (September–December 2006	Qualitative. Semistructured interviews. Iterative process. Interview guides and coding frameworks were informed by earlier analyses. Techniques associated with thematic content analysis and grounded theory. Data was initially coded to identify recurrent themes and patterns using open/in vivo coding based on own words; memos used to record initial hypotheses & inter-connections between emergent themes. Further analyses focused on closed/detailed coding to interpret the meaning of, and relationships between initial themes & patterns.	The school environment: a 'scary' place Safe' black boys 'Safe' black and dual-heritage girls Multiple identities: 'sweet' and 'safe'?

21.	Fletcher et al., 2009	Fifteen Year 10 students (age 14–15 years) were purposively recruited. ata were collected at the school during the 2006/07 school year. Semi-structured interviews with students took place in the autumn term case-study research carried out at Park Grove School (pseudonym). Park Grove School is a mixed-sex 11–16 school in outer London	Focus on the accounts of three female students expressing a shared counter-school identity and style to explore how drug use has become an important source of bonding, identity construction, coping and excitement for young women from disadvantaged families at high-achieving schools, including as part of strategies to resist the narrow focus schools can place on academic attainment, monitoring and discipline.	Qualitative. Data analysis: thematic content analysis and grounded theory. Semistructured interviews.	he need for students to find their place at secondary school and gain acceptance as part of a certain group. Once they had found their group, students would 'stick together': he need for students to find their place at secondary school and gain acceptance as part of a certain group. Once they had found their group, students would 'stick together': y Year 10, students at Park Grove had formed identities in these 'groups' based on their shared styles (e.g. 'goths', 'indie kids', etc.), attitudes towards school (e.g. 'geeks', 'school stars', etc.) and through the spaces they occupied at school in their free-time:
22.	Guo et al., 2002 Parental monitoring A Developmental Analysis of Sociodemographic, Family, and Peer Effects on Adolescent Illicit Drug Initiation	Longitudinal study. Urban sample of 808 children in Seattle was surveyed at age 10 in 1985 and followed prospectively to age 21 in 1996. a longitudinal study of the development of positive and antisocial behaviors. Inteviewss. multiethnic urban panel was tracked and interviewed over an 11-year period through 1996 when participants were 21 years old.	Surveys, beginning at age 12. At seven time points (ages 12, 13, 14, 15, 16, 18, and 21), respondents asked whether he or she had ever used crack, cocaine (in forms other than crack), amphetamines, tranquilizers, sedatives, or psychedelics. Respondents who indicated having ever used any one of these six types of drugs= considered to have initiated illicit drug use. Family involvement, family conflict, and family bonding. Parental control and supervision, Peer prosocial and antisocial activities	Quantitative. Discrete-time survival analysis was used to assess the effects of sociodemographic, family, and peer factors on the risk of initiation. Survey	Higher level of family monitoring&rules predicted a significantly lower risk of initiation.
23.	Henry et. al 2011 Accuracy and bias in adolescents' perceptions of friends' SU. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3749771/	Cross sectional and part of longitudinal data.. Two studies. samples (Ns = 163 and 2,194) collected data on peer nominations, perceptions of peer SU, and self-reports of SU were used in analyses. The first was collected from the second author's phd thesis and the second was taken from the saturated schools sub-sample of the National Longitudinal Study of Adolescent	Individual SU SU: "During the past six months and 30 days Friend drug use- friends were asked Perceived FRIEND use- best friends	Quantitative. Multinomial logistic regression models, fit through SAS PROC CATMOD	Females more likely than males to incorrectly perceive that their friends used Cannabis ounger participants being more conservative in their estimates of friend SU than older participants verwhelming tendency for adolescents to (mis)perceive peer SU in a direction consistent with their own use or non-use.

		Health . Addheath: 11 to 15 and 12-14 Sample was 16.7 years (range = 12.5 to 20.7			
24.	Holland-Davis, 2006	Boys Town Dataset- cross sectional survey, junior and high school, 2 mid-western communities. Grade 7 to 12.	School level data, alc, cann and illicit drug use, all 4 SL Variables. DA: how many best friends (the ones they spend the most time with) use drugs- scale. Attitudes: approve or disapprove of drugs. Reinforcement: perceived outcome associated with using a substance, bad to good. Imitation: admired model use of drugs. All four SS: DLS: age, gender and fathers ocupo, DSO: local community popln, TDSC: poverty, residential mobility, DL1/2: religiosity	Quantitative. Random ANOVA, multilevel modelling, OLS. HLM	Cannabis: when SL processes are controlled, the relationship between age and cannabis use are constant across schools. Gender remained significant in all SSSL models. Imitation became insignificant in cannabis and IL SSSL model. Cannabis and ILS use varies for each school. Majority of variabtion was between individuals than between schools.
25.	Kawaguchi, 2004	National Longitudinal Survey Youth 97 GeoCode file. The sample construction is summarized in Table 1. I used the set (10) (N=6356) a 12-17yrs	SU in the last 30 days. Those who use cannabis more than or equal to once per month is defined as a Cannabis user. ''What percentage of kids (in your grade / in your grade when you were last in school) (have / ever) used Cannabis, inhalants, or other drugs?''	Quantitative. Latent variable??	Perceived peer behavior key independent variable. Peer effects work through the endogenous effect. implies existence of the ''social multiplier.'' The causal interpretation is that the respondents systematically overestimated peer behaviors and the degree of overestimation is not negligible. robust peer effect, this study does not shed enough light on the mechanism of peer effects itself
26.	Keyes et al., 2011	Cross sectional. Combined analysis of annual surveys of secondary school students in the United States conducted from 1976 to 2007 as part of the Monitoring the Future study. Setting by adolescents in the United States. Participants A total of 986 003 adolescents in grades 8, 10 and 12	Attitudes: approved of individuals 'smoking Cannabis occasionally'. Response options included 'do not disapprove', 'disapprove' and 'strongly disapprove' Perceived peer use: How difficult it is to obtain cannabis	Quantitative. Principal analytical approach was to use multilevel models that included the period and cohort mechanistic variables, group-level disapproval. In-school surveys completed	Compared to birth cohorts in which most (87–90.9%) adolescents disapproved of Cannabis use, odds of Cannabis use were 3.53 times higher in cohorts where fewer than half (42–46.9%) disapproved (99% confidence interval: 2.75, 4.53). Adolescebts in birth cohorts that are more disapproving of Cannabis use are less likely to use, independent of their personal attitudes towards Cannabis use. Social norms and attitudes regarding Cannabis use in cluster in birth cohorts, and this clustering has a direct effect on Cannabis use after

					controlling for adolescent attitudes and perceptions of norms.
27.	Lac and Crano 2009 Parental monitoring	Meta analytic review Longitudinal and cross sectional 17 studies 35,367 particpants Year:2000–2008 Mean ages 10.5 to 18.7 years; the median respondent age was 15.6 years.	Demographic variables as well as parental knowledge of activities and relationsjops. Other monitoring- coded differently.	Quantitative. Random effects modelling??	The association between monitoring and Cannabis use in the longitudinal designs was statistically significant. t was significantly smaller in magnitude than the association that emerged in the analysis of the cross-sectional design significantly smaller in magnitude thanthat of cross-sectional designs
28.	Lee et al., 2004	Cross-sectional Boys town data 3065 male and female students Grade 7 – 12. Very old data 1970s USA secondary data analysis	Adolescent use with alcohol and cannabis Gender Age Socioeconomic status Social structure Family structure Peer association –how many friends (best friends duration frequency, intensity) use cannabis reinforcement consequences of alcohol and cannabis use and attitude - to alcohol and cannbis Imitation – observing others using alcohol and cannabis	Quantitative. Mediation analysis - lisrel Questionnaire	Imitation – weak mediating effects Other SL have substantial mediating effects More testing required e effects of the social structural variables on Cannabis use are reduced to virtually zero imitation only partially mediates the age effects on SU.
29.	Mak 2020 Age-varying associations of parental knowledge and antisocial peer behavior with adolescent SU.	Participants were followed from sixth grade (Wave 1; Cohort 1: 2002 and Cohort 2: 2003) to 12th grade (Wave 8; Cohort 1: 2009 and Cohort 2: 2010); Data from the Promoting School-Community-University Part-nerships to Enhance Resilience (PROSPER) study, the final sample consists of 8,222 adolescents, followed from Grade 6 to Grade 12 (age 11 to age 18.9), including those who newly joined the schools at the targeted grade levels.	Research Question 1: How are low parental knowledge and antisocial peer behavior associated with adolescents' past- month cigarette use, drunkenness, and Cannabis use across ages 11 to 18.9? Research Question 2: How do the age-varying associations between low parental knowledge and each of the SU outcomes differ as a function of antisocial peer behavior? Past-month SU. Parental knowledge. Antisocial peer behavio Covariates	Quantitative. time-varying effect modeling (TVEM) allowed for flexible estimation of the strength of associations between predictor and an outcome across continuous age. Direct extension of multiple regression in which regression coefficients are allowed to vary as a function of continuous time (or age).	Low parental knowledge - significant association with Cannabis use across all ages, with the strongest association at age. The association decreased rapidly from ages 11 to 14 a significant interaction between parent and peer risk factors such that low parental knowledge was less strongly associated with SU at higher levels of antisocial peer behavior.
30.	McIntosh et al 2005	Cross sectional. qualitative components. The quantitative element consisted of a survey of 2382 ten-to-twelve-year-old	Interviews initial drug of use was cannabis The effects of the absence of pressure upon group participation	Qualitative and Quantitative Thematic analysis. Quant analysis not. Survey and Interviews.	Declining role of peer influence and pressure as at risk children move into their early teenage years.

		children carried out in 47 schools in Glasgow and Newcastle. 230 children in Glasgow and Newcastle were approached for interview- rsulting sample 216. All of the children were aged 10–12 years at the time of the first interview and most were in their early teens by the time of the final interview two years later.	The role of peer pressure in relation to offers which were declined and accepted		ore likely to want to claim individual responsibility as they get older and to not want to admit that they responded to pressure Drug taking is the result of personal choice as they get older:
31.	Mckeganey et. a 2004	Department of Health's Drug Misuse Research Initiative- Glasgow and Newcastle. In Glasgow. Surveyed 1202 pupils from 34 state schools (23 primary schools and 11 secondary schools) In Newcastle surveyed 1116 ten to twelve year olds spread across seven primary, middle and comprehensive schools	Survey, drug use in the last month an past lifetime use. Family structure, family harmony, parental supervision, family interest, family disruption, drug use in the family, individual delinquency	Trends analysis	At Age ten to twelve pupils 5% have started to use illegal drugs. Most of the illegal drug use involves cannabis, in a small number of cases children had extended their drug use to include heroin, cocaine and LSD.
32.	McVicar and Polanski, 2012	Cross sectional: Drawn from the UK part of the 2003 sweep of the European Schools Survey Project on Alcohol and Other Drugs (ESPAD) Which single classes of pupils in their final year of compulsory education, i.e. aged 15 or 16 years,	Drug use in the last 30 days Perceived friend drug use Perceived peer drug use	Quantitative. Simple reduced-form regressions	Large, positive, highly statistically significant association between own use and perceived use among friends. Those that report at least a few friends that use cannabis are 35 percentage points more likely to use cannabis than those that report no friends that use cannabis. friends are the more relevant reference group for peer effects in adolescent SU and classmates that are not friends may have little or no additional influence.
33.	McVie and Bradshaw, 2005	Longitudinal. secondary data analyses of Edinburgh Study of Youth Transitions and Crime, a longitudinal research programme exploring pathways in and out of offending for a cohort of around	Self report questionnaires (annual sweeps) • Semi-structured interviews Sweep 1=4 - 96.2% (n=4,300) All 23 state secondary schools 1998 11-15 years	Quantitative. Trends analysis Perceived peer use Own drug use cannabis (alc and smoking) boys were slightly more likely to report taking drugs at each sweep at age 12,	Those who start using substances up to age 12 there is significant behavioural continuity whereby early experimentation leads to longer term use, at least during adolescence. In addition, there is strong evidence of

		4,300 young people who started secondary school in the City of Edinburgh in 1998.		and age 13 although there was no difference at ages 14 and 15. ght gender difference in the types of drugs used. boys were more likely to have used cannabis.	sequential progression from occasional use of one substance to both regular use of the same and other substances. The data presented suggest that a key transitional point in the lives of young people occurs between the ages of 13 and 14,
34.	MinWoo 2015	PhD Thesis: data from 1,791 children and adolescents residing in Chicago, Participants aged 0, 3, 6, 9, 12, 15 and 18 were qualities for recruitment if they were within six months of the age categories. Longitudinal study. This study focuses on neighbourhood cluster data and interview data from the first wave of the 9, 12 and 15 year old cohort Test the mediation effects of one of key social learning variable, differential association in the link between neighborhood & adolescents' Cannabis use.	Cannabis use never used and more than one day. Peer delinquency involvement in problem behaviours, neighbourhood disadvantage. Family structure. Age gender race ethinicity,	Quantitative. Series of OLS regression analyses. Mediation.	Neighbourhood disadvantage is linked with association with delinquent peers. children and adolescents live in the highly concentrated disadvantaged neighborhoods are less likely to use Cannabis than children and adolescents reside in less disadvantage neighborhoods. Age was mediated by differential association
35.	Musher-Eizenman et al., 2003	Cross sectional. small Midwestern town younger adolescents were 213 seventh and eighth graders (50% females) from a public junior high school in a small Midwestern town. Students ranged in age from 12 to 15 (M = 13.1 years)	Participants indicated how many of their friends use each of three substances (cigarettes, alcohol, and Cannabis) on a 5-point scale from "None" to "All" (coefficient = .89 younger sample and .73older sample Past month use of cannabis	Quantitative. A series of logistic regressions was performed to assess variables relating to use of each substance by age group and gender. Survey.	The relationship between peer use and own use might have as much to do with an adolescent's perceptions of peer use as with actual peer use levels. Moderatimng effects of gender
36.	Okaneku et al. (2015)	Cross sectional. 614579 respondents were identified National Survey on Drug Use and Health (NSDUH) is questionnaire administered to a multistage probability sample of residents of the United States	Past month use of Cannabis was assessed by the response to the question " How long has it been since you last used Cannabis or hashish? "	Quantitative. Linear regression analysis. Survey.	Regular use 12 – 17 51.4% (2002) 43.5% (2012 Occasional use 12 – 17 32.1% (2002) 26.2% 2012 Linear regression demonstrated a significant negative temporal trend from 2002 to 2012 in the perceived risk associated with smoking Cannabis once or twice a week 12-17 yrs perceived risk to cannabis use – no distinguishment between these ages. Occ < rgular.

37.	Olsson et al., 2003 Family risk factors for cannabis use: a population-based survey of Australian secondary school students	Cross sectional. total of 2848 year7, 9 and 2363 year 11 students participated in the Victorian Adolescent Health and Well-Being Survey (1999) 535 secondary schools in Victoria. Two different approaches to sampling schools were used for metropolitan and rural areas. Twelve thousand, eight hundred and sixteen early yr 7,9 and 11 a school-based random sample of 535 metropolitan and rural, government and non-government secondary schools throughout Victoria, Australia. Cannabis use was defined as 'any' and 'weekly' use in the last 30 days.	Cannabis use based on self-reported frequency. Participants were asked, 'In the last 30 days, have you used Cannabis? Cannabis use measured at the school level Parent attitudes to drug use and delinquency. The parent attitudes to drug use and delinquency scale represented the degree to which parents would think it wrong to steal, vandalize, fight, drink alcohol, and smoke cigarettes or cannabis. Family functioning. Parent – child attachment.	Quantitative. Separate logistic regression models for each of the two binary measures of cannabis use by school year. Survey	Yr 9 Permissive parent attitudes to drugs and delinquency were associated with an eightfold increase in the odds of young people using any cannabis in the last 30 days. Among year 11 students, there was again a strong association between poor parent attitudes to drugs and delinquency and cannabis use (any use or weekly use), with a five- to sixfold increase in the odds of use where parent attitudes to drugs and delinquency are permissive. Although permissive parent attitudes to drugs and delinquency showed strong independent association with cannabis use in year 11, these estimates were considerably less than the equivalent estimates in year 9
38.	Pokhrel et al., 2008	Cross-sectional study was conducted on 1,936 Hispanic adolescents of mean age 14.0 years (standard deviation = 0.4) from seven Los Angeles area schools.	effects of perceived parental monitoring elf-reported past 30 day Cannabis use.	Quantitative. Multiple logistic regression models Survey.	Parental monitoring found to have statistically significant inverse associations with cannabis use.
39.	Rai, et. al (2003).	Lomgitidinal. 6 cohorts involving 1279 low income African-American youth aged 13 to 16 years involved in community based studies conducted over a decade in an urban area. Self-reported behaviours and perceptions of parental monitoring and peer risk–involvement were assessed through structured questions 1992-1999	Perceived Parental Monitoring- whereabouts, interactions and activities. Perceived Peer Risk–Involvements	Quantitative. One-way ANOVA Multiple logistic regressions. Cochran–Mantel–Haenszel (CMH) analysis controlling for year was conducted in the combined sample of six cohorts. Survey.	Rapid increase in SU behaviors during mid-adolescence. Monitoring had a protective influence on SU behaviors. Peer involvement influenced all evaluated risk behaviours. The influences overall did not statistically change over time. Girls had significantly higher mean perceived parental monitoring scores ($p < 0.0001$). Thirteen-year-olds had significantly higher mean monitoring scores Increasing age was associated with an increase in the number of peer's perceived to be Cannabis users. No gender differences for perceive peer drug use.
40.	Salas-wright 2015 attitudes to drug use	Cross-sectional. Examining trends in disapproval and use of Cannabis among adolescents and young adults in the United States.	Cannabis use disapproval (own age and adults) lifetime and past 12-month cannabis use. Age (continuous), gender (0 ¼ female, 1 ¼ male), race/ethnicity	Trend analysis. Logistic regression. data spanning the period of 2002–2013. Survey.	Between 2002 and 2013 the proportion of adolescents aged 12–14 reporting ''strong disapproval'' of Cannabis use initiation increased

		nationally representative data spanning the period of 2002–2013. Analyses were based on self-reported measurements from 105,903 younger adolescents (aged 12–14) and two other older age groups. Examined public-use data collected between 2002 and 2013 as part of the NSDUH.			significantly from 74.4–78.9%. Concurrently, a significant decrease
41.	Scalco et al., 2016 Perceived Peer/FRIEND use	Crosssectional. ouseholds in the sampling frame (Erie County, NY. Sample 1 included 378 families and Sample 2 included 387 families for a total of 765 families. Averaging across samples, adolescents were 10-13 years old. Target and Peer Self-Reported SU. Items from the National Youth Survey (NYS) were used to assess substance use. design included three annual assessments of peer and perceptions of peer SU and six assessments of adolescent SU (N = 765; age = 10 - 13 at Wave 1; female = 53%)	Lifetime use (3 items: "Have you ever used alcohol/cigarettes without your parents' permission?" "Have you ever used Cannabis?"), past year frequency of use ("How many times in the past year have you usedalcohol/cigarettes/Cannabis?"), Target report of peer SU (close friend SU) The instructions asked the adolescent to "Tell whether or not any of your three close friends have ever used alcohol/cigarettes/Cannabis". Responses were keyed as lifetime use (1) or no lifetime use (0). perceived peer SU preceded peer SU (age=10-12 and 12-14) and another in which peer SU preceded adolescent SU and perceptions of peer SU (age=12-14).	Quantitative. Latent class analysis (LCA) and tested the natural evolution of the classes using latent transition analysis (LTA).	Three distinct pathways to the class at highest risk for later escalations in SU, two in which perceived peer SU precedes peer SU in late childhood (age: 10-12) and early adolescence (age: 12-14), and a third pathway in which peer SU precedes adolescent SU and perceptions of peer SU in early adolescence (age: 12-14). Of the first two pathways, one involved biased misperceptions consistent with a "selection" pathway, and one did not suggesting that the "overestimate" had an effect on initiation and selection of peers consistent with social norms theory. The third pathway in which peer SU preceded adolescent SU was consistent with a "socialization" or "influence" effect. As such, each pathway provides evidence consistent with selection theories, social norm theories, and social learning theories.
42.	Shih et al., 2010 Racial/Ethnic Differences in Adolescent Substance Use: Mediation by Individual, Family, and School Factors	(n = 6,038) 16 participating middle schools across three school districts in southern California received consent forms to participate in the study, and 91.8% of parents returned this form (n = 9,360). 7th and 8th graders. Surveys	Sociodemographic characteristics. Lifetime and past-month frequency Adolescent exxpectancies: cannabis use- fun,. Higher expectanices nad negative exzpectances – other people not want to be around them. Imitation of friends: future action. Family factors: respect and su. Perceived Peer us; Lifetime and last 30 day use.	Quantitative. Path analysis models tested mediation	Negative attitudes and future imitation and perceived peer use mediated drug use.

43.	Su et. al 2018	Cross-sectional.9,155 high school students (51% female; 74% European American) who completed electronic surveys in the 2009 Dane County Youth Assessment (DCYA). (age ranged between13 and 17; Mage = 15.6 years, SD = 1.08; 51% female), 84.0% o 2008 and February 2009 US	requency of substance use ranging from cigarette smoking to using inhalants during the past year Attitudes to drug use: Parental knowledge (involvement) Parental disapproval. Family dysfunction Peer SU: perceived level of drug use. Neigbourhood cohesion	Quantitative. Latent class analysis (LCA) was conducted to identify profiles of adolescent substance involvement and related problems. Multinomial logistic regression was conducted to examine associations between individual and contextual factors and latent class membership.	LCA identified four distinct profiles of adolescent SU characterized by both licit and illicit SU and related problems: Abstainers (56.3%), Alcohol-only users (25.6%), Alcohol-cigarette-Cannabis users (13.8%), and Problem polySUrs (4.3%). Peer SU was also associated with higher risk of being in the POLY. Parental disapproval or adolescent SU was also associated with lower likelihoods of being classified as POLY. dolescents' disapproval of SU was associated with lower likelihoods of being classified as ALC, ACM, or POLY users,
44.	Su and Supple, 2014 Parental, Peer, School, and Neighborhood Influences on Adolescent SU: Direct and Indirect Effects and Ethnic Variations	Cross-sectional. 5,992 students who participated in the 2000 Dane County (Wisconsin) Youth Assessment (DCYA)..	Ethnicity- 5 ethnic groups. PEER SU: perceived use of drugs PARENTAL INVOLVEMENT (monitoring and availability-) Parental disapproval (tobacco and alc)	Quantitative. Multi-group confirmatory factor analyses. Survey.	perceived their parents as caring and disapproving of substance were less likely to use substances themselves and less likely to associate with substance using peers, suggesting that parental influences on adolescent SU are both direct and indirect via peer association. perceived their parents as caring and disapproving of substance were less likely to use substances themselves and less likely to associate with substance using peers, suggesting that parental influences on adolescent SU are both direct and indirect via peer association
45.	Sutherland and Shepherd 2001a	Cross-sectional. To assess levels of regular cigarette, alcojol and drug use , Age 11 to 16 years. 28 schools in 4 LEAs in London, Midlands and North England. 28 schools. 9742 students.	Questions asked about use and extent of use of cigarettes, alcojol and illicit drugs. Some of the data rom the Adolescent Substance Abuse Questionnaire. Regular use defined as monthly use.	Analysis methods and software not clear. Not reported. Prevalence. Survey.	Drug use rose from 0.9%(11 yrs) to 14.5% at 16yrs. No gender differences. PEAK USEOF DRUGS found at age 15 years.
46.	Sutherland and Shepherd 2001b	Cross-sectional. 11-16 year olds 4516 students. 5 schools. 2 from most deprived areas in London, 2 in SE deprived area and 1 from semirural affluent area Morth midlands.	Data on drug use, contact with police, perceived academic acheivements, religious beleifs, family structure, family versus peer opinion	Quantitative. Logistic regression used to rank risk factors. Cumulative and age specific preferences. Survey	Those who thought that hteur parnts opinions matters most 13.4% used illicit substances as compared to 19.1 who valued their friends opinipos Atage 11 there as no difference between family and peer influence but as age inc. difference became more apparent

					Age 13 is important – in changing rates of substanve use with age, Family structure has weakest link- but note population.,
47.	Sutherland and Shepherd, 2002	Cross sectional. 7022, 11-16, 13 schools from LEAS NE, Midlands, London England	Prevalence of cig, alc and illegal drug use (not defined) and beleifs about continued use.	Quantitative. Trend analyes.Survey. Basic cross tabular analyses categorised by age and gender users and non-users	More 16 year olds believed they would still be using compared to younger. Window of preventative measures before age 13. 14 years. age-specific effect was found amongst current illicit drug users: 61% of 13-year oldusers believed they would still be using in a year's time compared with 77?8% of 16-year olds(po0.0001). An age effect was also noted amongst non-users with respondents belief infuture use increasing year on year from 1?2% of 11-year old non-users to 7?1% 16-year olds. No gender differences
48.	Svensson, 2003	Cross-sectional. First survey = 14-15 years of age and the other included those aged 17-18 years). f 859 students (417 males and 442 females). Of these, the 14- to 15-year-olds made up a total of 234 males and 233 females, Falkenberg, a coastal town in the south of Sweden with approximately 40,000 inhabitant	Use of narcotics. Have you ever used narcotics Parental monitoring Gender and age were entered as control variables.	Quantitative. Multivariate logistic regressions.Survey.	t females tend to be more effectively supervised than males. 14 to 15 a Poor parental monitoring was found to be significantly related to drug use for both males and females, although the effect is stronger for males.
49.	Tornay et al., 2013 Parental monitoring	Cross-sectiona. Secondary data analyses. Swiss participation in the 2007 European School Project on Alcohol and Other Drugs (ESPAD) survey. The Swiss part of the survey consisted of a nationally representative sample which included 7,611 adolescents (48.8 % boys). The sample = 418 independent classes issued from 348 public schools (8th, 9th, and 10th grades) around the country. Switzerland	Parental monitoring SES, age, gender, FS, SR Last month use cannabis and ecstasy	Quantitative. Logistic regressions.	Parental monitoring associated with decreased risk of SU among adolescents in Switzerland. Prevalence of SU decreases even with consuming peers and the protective effect of parental monitoring is strong enough to counterbalance the negative effect of peer pressure .
50.	Van Ryzin et al., 2012	Longitudinal. Secondary data analyses. Participants were 998	Parental monitoring (age 12, 13, 15,17) direct and indirect effects of parental monitoring,	Quantitative. Autoregressive baseline model and in successive steps added	Continuity in SU from age 12 to 13,

		adolescents and their families who enrolled in a randomized controlled trial of a family-based intervention project aimed at reducing adolescent antisocial behavior conducted by Dishion 2007 11 year span of study. Pacific Northwest	Cannabis use 12, 13, 15, 17. bacco, alcohol, and marijuana use-separately – last 30 days.	cross-lagged paths between parenting, peers, and SU structural equation modelling. Survey	Parental monitoring associated with lower likelihood of cannabis use. No diff between males and females
51.	Wang et al 2009	Cross-sectional. Data= US records (N= 9011) of the Health Behaviour (HBSC) 2005/2006 Survey, a World Health Organization collaborative cross-national study. grades 6 through 10	Adolescent SU was measured by asking students the number of occasions in the last 30 day: cannabis use measured separately. Parental monitoring of whereabouts measured as knowledge. Peer drug use: perceived peer drug use.	Quantitative. Multiple indicator multiple cause model, MIMIC model and SEM. Survey.	Peer use of a particular substance has higher influence on adolescent use of the same substance. Also greater influence of Cannabis-using peers on adolescent use of Cannabis . Mediating Roles of Parental Knowledge and Peer Substance Use. not find any gender differences in adoles- cent substance use
52.	Wallace and Fisher, 2007	Cross-sectional. A total of 40 416 8th grade girls and 37 977 8th grade boys, 35 451 10th grade girls and 33 188 10th grade boys, and 33 588 12th grade girls and 31 014 12th grade boys took part in the study. oss-sectional data from large, ethnically diverse, nationally representative samples of 8th, 10th and 12th grade girls. University of Michigan's Monitoring the Future study. Study design and methods:(Johnston et al2001)	Illicit drug 30 day and lifetime use.	Quantitative. Trend analysis. Survey.	a general increase in Cannabis use among 8th and 10th grade girls from 1991 to 2000 Trend data suggest that there have been important changes in girls' drug use over time and that girls' and boys' drug use patterns are converging ife-time and 30-day prevalence of illicit drug use are roughly comparable for 8th and 10th grade girls and boys. But for cannabis use boys are more likelty to have used than girls at all levels.
53.	Wallace et al., 2003	One-hundred-eight youth (37% male, 63% female) 13–20 years of age (M=16.4 years) who self-identified as Black American were recruited from grades 9–12 in high schools and youth oriented community programs located in urban economically disadvantaged neighborhoods in the New York Metropolitan area. questionnaire	Youth attitudes toward SU Parental attitudes toward high risk behaviors (not drugs)	Quantitative. HLM – hierarchical linear modelling. Survey.	In this sample of Black teenagers, the majority did not approve of SU

54.	Whaley et al., 2011	2001 – 2004 85000 students 8 – 12 grade USA. Data from 1 survey MAOD and census district level data..	Binge drinking, cannabis, ecstasy and methamphetamine use Social structure Gender Race Ethnicity Socioeconomic status Grade level Differential association – approval/disapproval of drug use by peers Social organisation – number of residents in the district	Quantitative. HLM – hierarchical linear modelling. Survey.	SES – rural and ethnicity directly affected SU Gender, age mediated by peer association which influenced drug use
55.	Whaley et al., 2016	The SU questions were modeled after the Monitoring the Future (MTF) survey (as described in Johnston et al., 2010b.	Cannabis use in l;ast 30 days. ifferential association element of social learning theory are available. Peer approval of cannabis use Peer pressure Parental approval cannabis	Quantitative. Negative binomial regression versus Poisson	Significant associations with oarent approval and peer approval of drug use. neither peer approval nor parental approval differently affected girls' and boys' cannabis use
56.	Wittchen et al., 2008	Longitudinal. Large prospective-longitudinal community survey in adolescents. The study sample is a stratified community sample aged 14–24 at baseline (N = 3021). The baseline sample was drawn from metropolitan Munich, Germany government registries in 1994 and followed-up over a 10 year period with up to three follow-up assessments. Germany	SU and SUD were assessed with the three DIA-X/MCIDI-sections for alcohol, nicotine, and medication and illicit drugs. Use more than 4 times. Sud more than 5 times??Assessed separately.	Quantitative. Logistic regressions were applied to assess group differences.	The proportion of adolescents with initiation of cannabis and other illicit drug use before the age of 14 is lower than for licit substances onset of CU before late adolescence is associated with an higher risk of cannabis and dependence. Transition to regular use doubled wach tear 5% year 1, 10% year 2 and 20% yr 3. Cannabis regular use was higher starting at 30% to 40% in year 2
57.	Zimmerman 2016	Longitudinal and cross sectional. Data came from two components of the Project on Human Development in 80 Chicago Neigh-borhoods: . 1639 youth from cohorts aged 9 (N = 825) and 12 (N = 814) who were interviewed at wave 1; a were collected on youth and their primary caregivers via self-report surveys and structured interviews across three waves of data with an average span of 4.5 years;	Adolescent SU last year. Neighborhood Opportunities for SU (drinking in public and drug selling) Peer SU : perceived peer drug use. Perceived Harm of SU : extent to which users would harm themselves. Parental SU Neighborhood-Level Control Variables : disadvantage, tolerance of drug use by 13 and 19 year olds.	Quantitative. Multilevel Rasch model, an item response theory (IRT) model with logit form, to predict the odds of SU	the odds of engaging in SU are unaffected by neighborhood opportunities for SU odds of SU are higher among youth residing in households reporting higher levels of peer SU (OR 1.49; 95 % CI 1.28, 1.74), and perceiving lower levels of harm associated with SU

		Analysis used an Item-Response Theory-based statistical approach on 6556 SU item responses from 1639 youth (49.0 % female) within 80 neighborhoods to assess the extent to which neighborhood opportunities for SU had direct and indirect effects on adolescent SU.			

Glossary

9. Glossary

Adolescent: refers to males and females aged between 11 and 16 years. These age bandings map onto the United Nations General Assembly, UNICEF, and WHO definitions of adolescence (10-19 years), youth (15-24 years) and young people (10-24 years) (UNICEF 2011).

Dependence: state of physiological need where when one stops taking illicit drugs physiological signs (withdrawal) occur.

Illicit drugs/ Controlled Drugs/ Illegal substances: term that encompasses substances classified and controlled under the Misuse of Drugs Act 1971 as dangerous or otherwise harmful when misused. The list of drugs used in the survey are listed in Table 43.

Legal Highs: substances that produce the same or similar effects to drugs listed under the MDA 1971. These are classified and controlled under the Psychoactive substances bill 2015.

Moderation: moderation effects imply that introducing a third variable changes the direction or magnitude of the association between two variables. The effect can be an enhancing (effect of the independent variable (IV) on the dependent variable (DV) is increased), buffering (effect of the IV on the DV is reduced) or antagonistic (effect of the IV on the DV is reversed).

Mediation: mediation implies where the effect of IV on the DV is through a third or a mediator variable. The relationship between IV and DV in this case is said to be indirect. The effect of the IV on the DV becomes insignificant and reduces or completely disappears after the introduction of a mediator variable .

Students: are individuals formally engaged in learning in a private or public institution.

Occasional Drug Use: Drug use that is usually circumstantial for example the adolescent may only use when at parties, social functions or when offered. This may involve intensive drug use during short period bursts followed by no drug use for some time.

Regular drug use: Drug use that occurs on a regular or frequent basis. As with occasional use, drug use may be intensive (consuming large amounts in a regular basis in a controlled fashion) or light depending on the adolescents group culture, individual and societal norms etc.

Experimental Drug Use: This may involve a single exposure to a drug or several exposures to different drugs or the same drug usually over a short term. Some adolescents may abstain following experimental use or the adolescent may subsequently adopt a different drug pattern such as occasional and then regular use as tolerance to the effects of the drugs develop.

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