Illicit drug use in English adolescent students–Results of a subgroup mediation analyses

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ABSTRACT

Background: This paper builds on the results from the study: Illicit drug use in English adolescent students – results of a cumulative mediation analyses. The study sets out to specify the most significant social learning (SL) pathways for each of the ages, regions, and gender.

Methods: Mediation analyses of a secondary dataset: Smoking Drinking Drug Use Survey 2016 (N = 12,051) on adolescents aged 11–15 years.

Results: The most important SL pathway to drug use for boys was imitation of friends and for girls it was having the “perception” that fellow peers were consuming drugs. Positive attitudes to glue was a strong SL pathway at ages 11 and 12 but not for ages 13–15 years. In the Northern parts of England positive attitudes to cannabis and in the Southern regions peer association were the strongest SL pathways to drug use.

Conclusion: The results are of relevance to policy because they confirm that drug use is a learnt behaviour and that this learnt behaviour varies for gender, region and specific ages.

Introduction

Over the last few decades researchers have been attempting to theorize why some adolescents experiment with illicit drugs whilst others do not. Some of the key constructs identified from literature reviews and needs assessments (Bloor, 2019; Donnemeyer, 1992; Frisher et al., 2007; Hawkins et al., 1992; Petraitis et al., 1995; Townsend et al., 2007; Weinberg et al., 1998) include: acceptance of favorable behavior to drug use, the availability of substances, economic status, neighborhood status, psychological characteristics, behavior problems, family-related factors, peers and genetic factors. Despite the multitude of constructs and related theories, no one theory has been able to completely explain all the inherent complexities of drug use behavior in adolescents. The issue rather is due to (a) a lack of integration and organization where theories have been considered in isolation and (b) not explicating which stage of drug use behavior from experimentation to dependence and addiction the research seeks to explain. The Social Structure Social Learning (SSSL) theory is one of the younger cross-conceptual interdisciplinary theories that emphasizes the notion that social contexts or environments shape individual behavior and therefore learning. Attempting to explain this, Akers (1998) tackled the task of simultaneously addressing epidemiological as well as etiological explanations for drug use.

This study builds on the first paper: illicit drug use in English adolescent students – cumulative mediation analyses (Wilkhu, In Submission) where mediation of the association between two of the social structural factors age, and region with drug use was noted by all four social learning variables but it was unclear which social learning variable was the most relevant for each of the subgroups. What this paper adds to knowledge is that subgroup mediation analyses allows for a differentiated understanding/ granularity of the mediation effect of social learning factor separately for each structural context that is age, gender, and region.

Research question

1) Which social learning constructs (imitation, peer association, family reinforcement, and attitudes to drugs) mediate the association between social structure (age, gender, and region) on illicit drug use?

Materials and methods

The research uses a quantitative methodology using a secondary dataset from the smoking drinking and drug use survey 2016 (SDDS 2016-SN:8320) which is a cross-sectional survey. 12,051 students aged 11–15 years (grade 7–11) from 177 secondary schools across England completed a questionnaire on smoking drinking and drug use in the autumn term of 2016. Detailed information on the sampling, materials and methods can be obtained from the data depository.

Data analysis

To identify which of the four social learning variables (imitation, peer association, attitudes, and parental reinforcement) are the most significant learning pathways to drug use a series of binary regressions were carried out. Figure 1 shows the subgroup mediation models for each of the social structure variables of interest namely age (Model 1), gender (Model 2), and region (Model 3), Details of
Model 1: Subgroup SSSL model with age only
**Direct effect of social structure on drug use via social learning = c^1**

Model 2: Subgroup SSSL model with gender only
**Direct effect of social structure on drug use via social learning = c^1**

Model 3: Subgroup SSSL model with region only
**Direct effect of social structure on drug use via social learning = c^1**

Figure 1. Subgroup mediation models.
the variables of interest can be found in illicit drug use in English adolescent students – cumulative mediation analyses (Wilkhu, In Submission). For mediation to be claimed, associations between X (age, gender, and region) and M (peer association, family reinforcement, attitudes, and imitation) were tested using multinomial regressions (imitation and attitudes as categorical variables) and ordinal regressions (peer association and parental reinforcement–ordinal variables). Descriptive data analyses are described in detail in the paper, illicit drug use in English adolescent students – cumulative mediation analyses (Wilkhu, In Submission).

Data are split to subgroup level for the analysis first for age (Model 1), then for gender (Model 2), and finally for region (Model 3).

Results

Model 1: age subgroup analysis (Table 1)

For 15-year-old boys the most significant social learning measure 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 ≤ .001), 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 mediator and also almost the social learning variables were 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, family 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 (authoritative) was insignificant but strong parental disapproval was a significant protective factor for all age groups.

Model 2: gender subgroup analysis (Table 2)

For boys the strongest risk factor social learning measure 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 girls, 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.

Model 3: region subgroup analysis (Tables 3–5)

North West
Positive attitudes to cannabis and cocaine, unsure attitude to cannabis and family 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 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, family reinforcement, and positive attitude to glue.

East Midlands
Social learning variables that are significant 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 latter two being protective rather than risk factors. The association between drug use for adolescents living in the East Midlands is therefore moderated by unsure attitudes to cannabis and cocaine use, positive attitude to cannabis (being the strongest moderator) and strong parental disapproval.

West Midlands
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
Positive attitudes to cocaine (OR = 18.63, p ≤ .03), positive attitude to cannabis (OR = 8.05, p ≤ .001) and family reinforcement were the only significant moderators of drug use.

London
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.

South East
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 family reinforcement.
Table 1. Age 11 subgroup mediation model.

| 11 years | 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 | -.28 | .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 R² | .52 |

| 12 years | 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 R² | .65 |

| 13 years | 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 | 0.00 | -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 | 1.00 | .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 R² | .50 |

| 14 years | 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 |

(Continued)
Table 1. (Continued).

Model 1: SS→SL→DU

| 11 years                          | Exp(B) | Sig  | B    | S.E. |
|-----------------------------------|--------|------|------|------|
| 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 |      |      |      |
| Nagelkerke Pseudo R²              | .58    |      |      |      |

Model 1: SS→SL→DU

| 15 years                          | 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 |      |      |      |
| Nagelkerke Pseudo R²              | .66    |      |      |      |

*(values rounded off to 2 dp) **region and gender controlled for.

Table 2. Gender (boys and girls) subgroup mediation model.

Model 2

|                     | Boys                | Girls               |
|---------------------|---------------------|---------------------|
|                     | Exp(B)  | Sig  | B    | S.E.  | Exp(B)  | Sig  | B    | S.E.  |
| Attitude Cannabis- OK | 8.25   | .00  | 2.11 | .26  | 7.82   | .00  | 2.06 | .15  |
| Attitude Cannabis- Not Sure | 2.93   | .00  | 1.07 | .37  | 4.93   | .00  | 1.60 | .21  |
| Attitude Cocaine-OK | 1.18   | .74  | .17  | .51  | 1.30   | .58  | .27  | .28  |
| Attitude Cocaine- Not Sure | .65    | .32  | −.43 | .43  | .31    | .00  | −1.17| .25  |
| Attitude Glue-OK    | 1.33   | .35  | .29  | .31  | 2.75   | .00  | 1.01 | .16  |
| Attitude Glue Not Sure | .78   | .41  | −.24 | .30  | .97    | .92  | −.03 | .15  |
| Fam. Reinf. Strongly disapprove | .07    | .00  | −2.70| .21  | .05    | .00  | −2.97| .20  |
| Fam. Reinf. disapprove | .04    | .00  | −3.17| .45  | .08    | .00  | −2.52| .34  |
| Peer Assoc. Most or all | 11.91  | .00  | 2.48 | .48  | 15.30  | .00  | 2.73 | .32  |
| Peer Assoc. Half or less | 2.56   | .00  | .94  | .29  | 4.06   | .00  | 1.40 | .15  |
| Imitation            | 27.60  | .00  | 3.32 | .50  | 4.01   | .00  | 1.39 | .34  |
| Model Fit            |        |      |      |      |        |      |      |      |
| Chi-square           | 711.26 |      |      |      | 907.58 |      |      |      |
| Nagelkerke Pseudo R² | .58    |      |      |      | .62    |      |      |      |

*(values rounded off to 2 dp) **region and age controlled for.

South West

Subgroup regression analysis shows a similar pattern to South East in that peer association (OR = 23, p ≤ .01), followed by attitude to cannabis, imitation, and family reinforcement are moderators of the association between drug use and adolescents from the South West.

Discussion

The central aspect of the study was to determine significant social learning pathways that explain drug use behavior for a specific age, gender and region in adolescent population in England aged 11–15. The conceptual underpinning in this study is the SSSL, which posits that an adolescent’s age, gender
or the location in which they live in affects their chances of learning drug use through four social learning processes which are imitation, peer association, parental reinforcement, and attitudes to drugs.

Table 3. Regional subgroup (North) mediation model.

| SS --> SL --> DU | North East | North West | Yorkshire & Humber |
|------------------|------------|------------|---------------------|
| **Exp (B)**      | **Sig**    | **B**      | **S.E.**            |
| Attitude Cannabis- OK | 15.82      | .00        | 2.99                | .27                  | 36.61 | .00 | 3.60 | .55 |
| Attitude Cannabis- Not Sure | 6.10      | .00        | 1.85                | .33                  | 6.54  | .00 | 1.88 | .64 |
| Attitude Cocaine-OK | .96        | .95        | 0.88               | .46                  | .03   | .15 | 3.58 | 1.41 |
| Attitude Cocaine- Not Sure | .34      | .37        | 1.11               | .41                  | .31   | .15 | 1.78 | .82 |
| Attitude Glue-OK | 1.70        | .35        | 0.77               | .35                  | 4.10  | .15 | 1.41 | .59 |
| Attitude Glue Not Sure | .66        | .42        | 0.29               | .30                  | .51   | .26 | 0.6B | .65 |
| Fam. Reinf. Strongly disapprove | .06      | .00        | 2.61               | .33                  | .07   | .00 | 2.65 | .46 |
| Fam. Reinf. disapprove | .01        | .00        | 4.40               | 1.11                 | .07   | .00 | 2.64 | .77 |
| Peer Assoc. Most or all | 11.50      | .00        | 2.87                | .59                  | 12.51 | .01 | 2.52 | .90 |
| Peer Assoc. Half or less | 5.55       | .00        | 1.93                | .28                  | 1.96  | .15 | .11 | .66 |
| Imitation | 13.42       | .00        | 2.64                | .76                  | 8.41E+9 | 1.00 | 22.85 | 7387 |
| **S.E.**          | **Sig**    | **B**      | **S.E.**            |
| Model Fit Chi-square | 307.57      | df (13) | p < .001          | | 290.97 | df (13) | p < .001 | | 245.30df (13) | p < .001 |
| Nagelkerke Pseudo R² | .64        | .72        |

*(values rounded off to 2 dp) **gender and age controlled for.

Table 4. Regional subgroup (Midlands) mediation model.

| SS --> SL --> DU | East Midlands | West Midlands | East England |
|------------------|---------------|---------------|--------------|
| **Exp (B)**      | **Sig**    | **B**      | **S.E.**            |
| Attitude Cannabis- OK | 19.00      | .01        | 2.94                | 1.13                 | 2.95  | .09 | 1.08 | .64 |
| Attitude Cannabis- Not Sure | 23.98      | .02        | 3.18                | 1.33                 | 2.76  | .03 | 1.02 | 1.04 |
| Attitude Cocaine-OK | .38        | .46        | 0.13               | .33                  | .24   | .23 | 1.13 | 1.19 |
| Attitude Cocaine- Not Sure | .05        | .00        | 0.44               | 1.76                 | 5.20  | .18 | 1.65 | 1.23 |
| Attitude Glue-OK | 4.57        | .09        | 1.28                | .89                  | 3.30  | .14 | 1.19 | .82 |
| Attitude Glue Not Sure | .90        | .91        | 0.49               | .93                  | .51   | .40 | .68 | .82 |
| Fam. Reinf. Strongly disapprove | .01        | .00        | 3.67               | 0.83                 | .07   | .00 | 2.64 | .51 |
| Fam. Reinf. disapprove | .00        | .00        | 20.98               | 8577                 | .09   | .01 | 2.47 | .91 |
| Peer Assoc. Most or all | 4.36        | .31        | 2.91                | 1.44                 | 15.17 | .02 | 2.72 | 1.21 |
| Peer Assoc. Half or less | 1.69       | .62        | 1.55                | 1.07                 | 3.07  | .11 | 1.12 | .70 |
| Imitation | 5.54       | .09        | 1.62                | 1.02                 | 19.75 | .00 | 2.98 | 1.04 |
| **S.E.**          | **Sig**    | **B**      | **S.E.**            |
| Model Fit Chi-square | 155.94      | df (13) | p < .001          | | 84.52 | df (13) | p < .001 | | 188.97df (13) | p < .001 |
| Nagelkerke Pseudo R² | .76        | .48        | .58                |

*(values rounded off to 2 dp) **gender and age controlled for.

Table 5. Regional subgroup (South England) mediation model.

| Model 5 | SS --> SL --> DU | London | South East | South West |
|---------|------------------|--------|------------|------------|
| **Exp (B)** | **Sig**    | **B**      | **S.E.**            |
| Attitude Cannabis- OK | 1.44      | .73        | .37                | 1.05                 | 20.24 | .00 | 3.01 | .31 |
| Attitude Cannabis- Not Sure | 1.46      | .78        | .38                | 1.38                 | 6.09  | .04 | 1.81 | .44 |
| Attitude Cocaine-OK | 1.68        | .71        | 0.52               | 1.38                 | 1.98  | .58 | .68 | .63 |
| Attitude Cocaine- Not Sure | 1.78      | .76        | .58                | 1.84                 | 1.15  | .89 | .14 | 1.03 |
| Attitude Glue-OK | .60        | .67        | 0.51               | 1.18                 | 1.43  | .55 | .36 | .60 |
| Attitude Glue Not Sure | 4.00       | .09        | 1.38                | .82                  | .46   | .24 | .78 | .67 |
| Fam. Reinf. Strongly disapprove | .04       | .00        | 3.29               | .81                  | .03   | .00 | 3.47 | .53 |
| Fam. Reinf. disapprove | .00        | .00        | 21.76               | 13928                | .10   | .01 | 3.25 | .84 |
| Peer Assoc. Most or all | 112.75     | .02        | 4.73                | 1.95                 | 137.76 | .00 | 4.93 | 1.57 |
| Peer Assoc. Some or less than half | 19.20      | .03        | 3.00                | 1.33                 | 15.20 | .01 | 2.72 | 1.10 |
| Imitation | 1.04E+11       | 1.00        | 25.37                | 18692                | 6.64  | .08 | 1.87 | .89 |
| **S.E.**          | **Sig**    | **B**      | **S.E.**            |
| Model Fit Chi-square | 77.26      | df (13) | p < .001          | | 206.21df (13) | p < .001 | | 186.35df (13) | p < .001 |
| Nagelkerke Pseudo R² | .67        | .67        | .58                |

* (values rounded off to 2 dp) **gender and age controlled for.

Social structure and subgroup analysis (Models 1–3)

When the effects of gender were examined using the subgroup analyses (Model 2) the results were markedly different. It is clear from the subgroup models for gender that although the
same social learning pathways are important for both boys and girls, imitation appears to be the most important risk factor for boys and peer association for girls. An important point to note is that these findings are not inconsistent 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 boys and girls differently and he called for a through testing of the SSSL model in different contexts.

The results of the age subgroup models, showed that drug use was mediated by social learning variables for all ages except for age 11 where drug use was moderated. As with the other social structure variables, the mechanism to drug use varied by age. Having positive attitudes to glue was the strongest social learning pathway for drug use in 11 year olds increasing the odds of drug use by 14 times and strong parental disapproval was the only protective factor against drug use. At age 12, the mechanism to drug use changes in two ways in that not only do the number of risk factors increase but also vary in magnitude and in type. Having positive attitudes to cannabis, peer drug use perception become significant learning pathways in this age group in addition to positive attitudes to glue use. To elaborate this further, having the perception that most or all of their peers use drugs increased the risk of drug use 259 times in 12 year olds and the odds of use decreased to 6 in 13 year olds and to 3 in 14 year olds but increased again in 15 year olds to 12. Having positive attitude is a significant learning pathway to drug use in younger adolescents aged 11 and 12 but not in older adolescents aged 13–15.

These findings are not inconsistent with that of Jang (2002) who argued that the nature of peer relationships and attitudes to drugs change with age; and that of Aldridge et al. (2013) who found that peer factors measured by peer pressure is associated with drug use at age 14 years. This suggests that some of the age-related differences in drug use is related to differential experiences with peers and friends through imitation and peer association and attitudes to drug use. Turning to studies testing social factors on adolescents in England, Sutherland and Shepherd (2001) also found an age-sensitive element to the relationship between substance use and social factors such as peer opinions, family structure, polydrug use and more, with a peak at age 15.

This is also the first study in England examining the social learning pathways to drug use for adolescents of this age across all nine regions (Model 3). As with age, the social learning pathways also varied by region. In the upper northern parts of England, positive attitude to cannabis was the strongest social learning pathway to drug use, whereas in the Yorkshire and Humber regions it was imitation of friends. Results were mixed in the midlands, in that in the West Midlands imitation followed by peer association were the two strong social learning pathways to drug use, where as in the East Midlands both positive and being unsure about using cannabis were strong social learning pathways to drug use. In the East of England having a positive attitude to cocaine was the strongest learning pathway to drug use. This is the only region where positive attitudes to cocaine have resulted in increased odds of drug use (18-fold). In the southern most parts of England peer perception of drug use more than any of the other social learning pathways is the (London, South East, and South West), most important social learning pathway to drug use.

There are some important points from the outcomes of the analysis: (1) although the same learning pathways are involved for both boys and girls, some are more important for boys than girls, (2) there are also significant regional and age related variances in the social learning pathways to drug use, and (3) the subgroup analysis revealed that social learning factors depending on the social structure factor being tested (age, gender, or region) can behave as either mediators or moderators of drug use.

**Strengths 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 and evaluate 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 subgroup analysis for the purposes of delineating the exact social learning pathways to drug use is a great strength of the study for each age, gender and region is an important strength of the study. Many studies tend to restrict their studies to grouping age variables, for example, which as shown in this thesis can lead to masking of valuable information. Another strength of the study is that the social learning variables were operationalized as intended by Akers (1998; Akers & Jensen, 2011) in the application of the SSSL model. The study also made distinctions between the roles peers and friends play in the pathway to drug use in the way the questions were framed.

**Limitations of the study**

The findings of this research should be evaluated considering several limitations. First, the SDDS 2016 survey is based on self-report measures on behaviors that potentially attract societal disapproval; this can generate methodological response bias and inaccurate reporting (Delaney-Black et al., 2010; Percy et al., 2005; Williams & Nowatzki, 2005). To address this limitation effectively, researchers conducting the SDDS 2016 survey put several mechanisms in place such as developing cognitive based, clear and concise language, distancing two negative outcomes to reduce the influence on order effects of context and question (Podsakoff et al., 2012). Second, some of the results with high standard errors should be interpreted with caution due to small subsample sizes. A third 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. However, based on the literature review it was decided that adolescent reports suffice (Kerr et al., 2010; Smetana, 2008).
Implications for practice

The results show a need for tailoring harm reduction and drug initiation prevention policies based on specific ages, gender and regions. As a start, based on what is known about social learning pathways to drug use for specific regions, health care organizations such as GP practices or clinicians based in educational institutions such as school nurses could ask focused screening questions at every clinical encounter with an adolescent. This is very much in line with the Making Every Contact Count (MECC) public health initiative. Local authorities may also decide to target a specific learning pathway for age or gender.

Conclusions

The results from this study indicate that the developmental period between 11 and 15 years of age for both males and females is a significant period of impact in view of the influence of proximal (imitation of friends, peer association and family reinforcement) factors and individual attitudes to drug use. Therefore, to promote more effective harm reduction and preventative services, policies must specify the distal and proximal factors that predict adolescents’ drug use behaviors and have process performance indicators to monitor the impact. This research takes the view that policy at a system level that draws upon emerging evidence base and carefully considers the true nature of illicit drug use is more likely to make a significant contribution to reducing drug use at individual and population level. Inequities in health are shaped earlier in the lifecycle during childhood and adolescence and sustained across the life course (Marmot & Bell, 2012), it is worthwhile investing in the early years to prevent initiation into drug use and promote harm reduction in this population.

Disclosure statement

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