The relative importance of perceived substance misuse use by different peers on smoking, alcohol and illicit drug use in adolescence

Vanessa Er[a], Rona Campbell[b], Matthew Hickman[b], Chris Bonell[c], Laurence Moore[d], James White[e,*]

[a] Department of Health Services Research and Policy, London School of Hygiene and Tropical Medicine, 15-17 Tavistock Place, London, WC1H 9SH, United Kingdom
[b] Population Health Sciences, Bristol Medical School, University of Bristol. Canynge Hall, 39 Whatley Road, Bristol, BS8 2PS, United Kingdom
[c] Department of Social and Environmental Health Research, London School of Hygiene and Tropical Medicine, 15-17 Tavistock Place, London, WC1H 9SH, United Kingdom
[d] MRC/CSO Social and Public Health Sciences Unit, University of Glasgow, 200 Renfield Street, Glasgow, G2 3QB, United Kingdom
[e] Centre for Trials Research, College of Biomedical and Life Sciences, Cardiff University, 4th Floor, Neuadd Meirionnydd, Heath Park, Cardiff, CF14 4YS, United Kingdom

A R T I C L E   I N F O

Keywords:
Illicit drugs
Alcohol
Smoking
Peers
Adolescents

A B S T R A C T

Background: Substance use by young people is strongly associated with that of their peers. Little is known about the influence of different types of peers. We tested the relationship between perceived substance use by five types of peers and adolescents' use of illicit drugs, smoking, and alcohol consumption.
Methods: We used data collected from 1285 students aged 12–13 as part of a pilot cluster randomized controlled trial (United Kingdom, 2014–2016). The exposures were the perceived use of illicit drugs, smoking and alcohol consumption by best friends, boy or girlfriends, brothers or sisters, friends outside of school and online. Outcomes were self-reported lifetime use of illicit drugs, smoking and alcohol consumption assessed 18-months later.
Results: The lifetime prevalence of illicit drug use, smoking and alcohol consumption at the 18-month follow-up were 14.3%, 24.9% and 54.1%, respectively. In the fully adjusted models, perceived substance use by friends outside of school, brothers or sisters, and online had the most consistent associations with outcomes. Perceived use by friends online was associated with an increased risk of ever having used illicit drugs (odds ratio [OR] = 2.43, 95% confidence interval [CI] = 1.26, 4.69), smoking (OR = 1.61, 95% CI 0.96, 2.70) and alcohol consumption (OR = 2.98, 95% CI = 1.71, 5.18).
Conclusions: Perceived substance use by friends outside of school, brothers and sisters and online could be viable sources of peer influence. If these findings are replicated, a greater emphasis should be made in interventions to mitigate the influence of these peers.

1. Introduction

Illicit drug use, smoking, and alcohol consumption (henceforth known as substance misuse) is relatively common among young people (Inchley et al., 2016). In the United States (US), the 2017 Monitoring the Future Study found that among 12-18-year olds, 33% have taken an illicit drug, 17% have ever smoked, and 42% consumed alcohol (Johnston et al., 2018). Globally, there is much geographical variation in substance misuse prevalence, with tobacco use most common in Western Europe and African countries, alcohol use in Europe, Australasia and North America, and cannabis use in Australasia, North

America and western Europe (Degenhardt et al., 2016). Substance misuse by young people is strongly associated with that of their peers (Fergusson et al., 2008; Leung et al., 2014; Simons-Morton and Farhat, 2010; Van Ryzin and Dishion, 2014), but the influence of specific type of peer has received less attention. We could find only one analysis of a cluster randomized control trial (cRCT) that found boyfriends/ girlfriends and best friends smoking was associated with an increased risk of weekly smoking in 12–13-year olds (Holliday et al., 2010), but it did not examine use by friends outside of school, siblings or online friends. The omission of online friends may be an important gap, as the time young people spend online has increased globally (Bucksch et al.,

2016), and the potential influence of online peers is not covered in existing preventative interventions (MacArthur et al., 2016). To address these gaps, we examined the association of perceived substance use by five different types of peers with adolescents' own substance use.

2. Methods

2.1. Study population

The study consisted of students aged 12–13 years in 12 schools in Wales (United Kingdom) who participated in the ASSIST + Frank pilot cRCT between 2014 and 2016, which investigated the acceptability of two school-based peer-led drug prevention interventions: ASSIST + FRANK and FRANK friends. The aim of these interventions was to prevent or delay experimentation with drugs. The illicit drug prevention components were delivered in UK Year 9 (age 13–14), when population-level prevalence data indicated drug use was low but gradually increasing with age (7% of 12-year olds had ever used compared to 19% among 14-year olds) (Health and Social Care Information Centre, 2015). ASSIST + FRANK was a peer-led smoking prevention intervention delivered in UK Year 8 (ages 12–13) followed by a drug prevention adjunct in Year 9; FRANK friends was a standalone peer-led drug prevention intervention in Year 9. The information on illicit drugs was taken from the UK national drug education website: www.talktofrank.com.

The study sampled from publicly funded state secondary schools which had not received a smoking prevention intervention (ASSIST) in the past two years. Schools that responded first to a postal invitation were recruited. Around 20% of participants in the study were eligible for free school meals (a marker of parental disadvantage), while the average percentage across Wales at the time was 17.5%. Participants completed the questionnaire prior to randomization (September to October 2014) and at follow-up, 18 months later (March to May 2016). All participants gave informed consent, and ethical approval was received from Cardiff University School of Social Sciences Research Ethics Committee (SREC/ 1103). Full details about the study and its design are described elsewhere (White et al., 2017). The reporting of this study conforms to the STROBE statement.

2.2. Measures

2.2.1. Exposure variables

The exposure variables were perceived use of any illicit drug, smoking, and alcohol consumption by peers self-reported by participants at baseline. Types of peers include best friends, boy/girlfriends, brothers/sisters, online friends (e.g., friends on Facebook, Twitter), and out-of-school friends. Responses for each type of peer were requested for the three substances and options were 'Yes', 'No', 'I don't know', and 'I don't have any'.

2.2.2. Outcome variables

The outcome variables were self-reported lifetime smoking, alcohol consumption and illicit drug use assessed at the 18-month follow-up (see online supplement for the list of drugs included). Illicit drug use was assessed using questions from the ALSPAC cohort (Avon Longitudinal Study of Parents and Children, 2007). Updated street names were provided for all drugs. Smoking was assessed using measures from the Health Survey for England (Health and Social Care Information Centre, 2013). Alcohol consumption, of a whole alcohol drink, was assessing using a question from the 2013 Smoking, Drinking and Drug Use survey (Fuller and Hawkins, 2014). Participants who had ever used an illicit drug, smoked a cigarette, or consumed a whole alcoholic drink were classified as lifetime users.

2.2.3. Covariates

Covariates were identified *a priori* based on previous studies

showing an association with both lifetime substance misuse and peer substance misuse. They included demographic characteristics (age, sex, ethnicity) and socioeconomic status (receipt of free school meals, housing tenure (owned, rented, other/ don't know), and the amount of pocket money participants receive per week).

2.3. Analyses

To mitigate against a loss of power and investigate possible bias resulting from a non-random pattern of missing data, we used multiple imputation by chained equations to impute missing exposure and covariate data for participants with complete outcome data. Prior to imputation, a likelihood ratio test was used to compare models with and without an interaction term between exposures and sex and each socioeconomic status variable. As there was no evidence of an interaction, we did not include interactions in the imputation model. We imputed 20 imputed datasets each with 10 cycles of regression switching. The imputation model contained all variables included in the analyses along with perceived prevalence of drug use and smoking among school friends and the frequency of drug offers in the past year. Results from the 20 datasets were then combined using Rubin's rules (Rubin, 2004).

To test differences in baseline characteristics according to lifetime illicit drug use, smoking and alcohol consumption, we used logistic regression for categorical variables and analysis of variance for continuous variables. For each type of peer, we estimated odds ratios (ORs) and 95% confidence intervals (CI) for the association between peer use and lifetime illicit drug use using multilevel logistic regression models (students nested within schools). Models were repeated for smoking and alcohol consumption. We pooled data, as there were no differences in substance misuse between arms in the pilot cRCT (White et al., 2017) nor an interaction between trial arm with peer use or gender in the association with substance misuse outcome measures. Participants who indicated that a peer did not use the substance in question were used as the reference group. Models were initially adjusted for demographic characteristics and socioeconomic variables (Model 1) then mutually adjusted for perceived peer use (Model 2). For example, when estimating association between perceived boy/girlfriend use and adolescent's substance misuse, we adjusted for the perceived use by best friend(s), brother/sister(s), friends outside of school(s) and online friends(s). To explore the possibility of peer influence (whereby participants use substances because of exposure to peer use), we conducted a subgroup analysis by excluding existing users at baseline. Analyses also compared results from the complete case sample to assess any bias that may have been introduced. Owing to the greater precision offered, the imputed datasets were used for primary analyses. All analyses were performed using Stata, version 14.1 (StataCorp, College Station, TX USA).

3. Results

3.1. Sample characteristics

Across the 12 schools, 1567 out of 1692 eligible students participated in the four arms of the cRCT: 347 in ASSIST, 419 in + FRANK, 440 in FRANK friends, and 361 in usual practice schools. Supplementary Figure 1 shows how we derived the analytical sample. Of the 1692 eligible students, 1567 (92.6% of those eligible) completed the baseline questionnaire, and of these 1460 (86.3%) completed the 18-month follow-up. There were 1285 (75.9%) students with complete outcome data. One hundred and sixty-four students had missing covariate data, leaving 1121 (66.3%) for the complete case analyses. Participants without missing outcome data were more likely to have used illicit drugs, consumed alcohol, have a best friend, boy/girlfriend, friend outside of school that used drugs, best friend, boy/girlfriend, friend outside of school and online that smoked, and best friend that used alcohol but were no different to those with missing data on other

Table 1

Odds ratios (95% CI) for the association between perceived substance use by different peers and lifetime illicit drug use, smoking, alcohol consumption (n = 1285).

	Model 1[a]	Model 2[b]
Illicit drug use		
Does not use drugs	Reference	Reference
Best Friend uses	7.57 (2.97, 19.34)	2.00 (0.60, 6.67)
Boy/girlfriend uses	7.22 (1.25, 41.56)	2.41 (0.32, 18.08)
Brothers/sisters use	5.46 (2.72, 10.95)	2.01 (0.82, 4.92)
Friends outside of school use	6.77 (4.31, 10.65)	3.22 (1.70, 6.06)
Online friends use	5.30 (3.16, 8.90)	2.43 (1.26, 4.69)
Smoking		
Does not smoke	Reference	Reference
Best Friend smokes	14.76 (6.12, 35.59)	5.44 (2.10, 14.10)
Boy/girlfriend smokes	9.21 (1.66, 50.94)	2.97 (0.46, 19.07)
Brothers/sisters smoke	4.36 (2.96, 6.42)	3.00 (1.95, 4.62)
Friends outside of school smoke	6.65 (4.62, 9.59)	3.84 (2.42, 6.11)
Online friends smoke	4.37 (2.91, 6.55)	1.61 (0.96, 2.70)
Alcohol consumption		
Does not consume alcohol	Reference	Reference
Best Friend consumes alcohol	12.47 (6.14, 25.30)	3.91 (1.75, 8.72)
Boy/girlfriend consumes alcohol	5.31 (2.06, 13.72)	0.91 (0.28, 2.98)
Brothers/sisters consume alcohol	3.18 (2.34, 4.32)	2.17 (1.53, 3.06)
Friends outside of school consume alcohol	11.65 (7.27, 18.66)	5.16 (2.98, 8.94)
Online friends consume alcohol	7.81 (4.84, 12.59)	2.98 (1.71, 5.18)

[a] Model 1 adjusts for age, gender, non-white ethnicity, and socioeconomic status (entitled to free school meals, rented council housing, < £5 per week pocket money.

[b] Model 2 adjusts for age, gender and non-white ethnicity, and socioeconomic status (entitled to free school meals, rented council housing, < £5 per week pocket money), and other peers drug use/smoking/drinking.

variables (all *P*-values < 0.05; results available on request).

3.2. Association between peer and student substance misuse

The lifetime prevalence of illicit drug use, smoking and alcohol consumption at baseline was 3.8%, 10.8% and 26.4% respectively. At the 18-month follow-up, prevalence was 14.3%, 24.9% and 54.1%. Participants who reported that peers used substances at baseline were more likely to report ever having used illicit drugs, smoked and consumed alcohol at the 18-month follow-up (see Supplementary Table 1*). Substance misuse was also more common in those living in rented accommodations (Supplementary Table 2). The minimally adjusted odds ratios for substance use across all types of peers for smoking ranged from 4.36 to 14.7, from 3.18 to 12.50 for alcohol and from 5.3 to 7.57 for illicit drug use (Table 1: Model 1). Mutual adjustment for all types of peer substance misuse led to an attenuation of all odds ratios. The largest reductions were for use by best friends and boy/girlfriends (Table 1: Model 2). The mutually adjusted odds ratios for illicit drugs, smoking and alcohol for use by friends outside of school ranged from 3.22 to 5.16, 2.01 to 3.00 for siblings, and 1.61 to 2.98 for online friends. Excluding participants who had already used alcohol and smoked at baseline attenuated estimates, particularly those for smoking (Supplementary Table 3). Odds ratios were comparable whether using the complete case or imputed data, with wider confidence intervals in the complete case sample (Supplementary Table 4).

4. Discussion

Perceived substance misuse by peers was associated with an increased risk of participants' lifetime drug use, smoking and alcohol consumption. These associations were attenuated after adjusting for the mutual influence of use by different types of peer and exclusion of baseline users. In the sub-group analysis exploring peer influence, the most consistent increases in risk were found for friends outside of school and online.

In agreement with previous studies, perceived smoking, alcohol consumption and illicit drug use by friends was associated with an increased risk of adolescents' own substance misuse (Fergusson et al., 2008; Leung et al., 2014; Simons-Morton and Farhat, 2010), and smoking by best friends and boy/girlfriends was associated with an increased risk in weekly smoking (Holliday et al., 2010). Other studies have found the number of best friends using alcohol use is associated with adolescent alcohol consumption (Leung et al., 2014), and using longitudinal social network data, one US cohort of 13-14-year-old students found the number of friends posting pictures of partying or drinking alcohol was associated with increases in smoking and alcohol consumption (Huang et al., 2014). We found perceived alcohol use by friends online was associated with lifetime alcohol consumption. Our analysis extends these findings to suggest that perceived alcohol use by best friends, siblings and those outside of school may also influence alcohol consumption and illicit drug use.

4.1. Strengths and limitations

The main strength of this study is that it distinguishes between five different types of peers and examined associations across illicit drug use, smoking and alcohol consumption. These assessments meant we could for the first time estimate independent associations across different types of peers. The main limitation of the study is that it cannot distinguish between peer selection and influence processes. The associations presented are exploratory and require confirmation with a longitudinal social network analysis that can rule out selection effects. The exposure variables in this study were adolescents' perceptions of peer use which may not represent actual use. One study found 12–13-year olds who were weekly smokers were more likely to overestimate the prevalence of smoking in students their age than non-smoking students (Sussman et al., 1988). In contrast, others have suggested that young people underestimate or have an accurate assessment of peer substance misuse (Pape, 2012). If lifetime users overestimated peer use it would have acted to increase the strength of associations we observed. We used lifetime measures of substance misuse so did not test whether the associations observed here extend to more frequent use of substances (e.g., monthly or weekly use) or to consumption of larger amounts of alcohol or doses of illicit drugs. We also cannot rule out bias due to unmeasured confounding, which is a common issue in observational analyses such as ours.

4.2. Implications

The present findings suggest perceived substance misuse by siblings, friends outside of school and online could be viable sources of peer influence. If these findings are replicated, a greater emphasis should be made in interventions of reducing exposure to or critical engagement with substance misuse by friends online as well as attempting to mitigate the influence of friends outside of school.

Role of funding source

manuscript; or in the decision to submit the paper for publication.

Contributors

Dr White designed the study. Drs. White and Er managed the literature searches and summaries of previous related work. Dr. Er undertook the statistical analysis, and wrote the first draft of the manuscript, with sections also written by Dr White. All authors provided critical input to multiple drafts of the paper. All authors contributed to and approved the final manuscript.

Declaration of Competing Interest

LM, RC and JW are scientific advisers to Evidence to Impact Ltd, a not-for-profit organization that licenses use of the smoking prevention intervention known as ASSIST. All other authors declare no competing interests.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2019.04.035.

References

Avon Longitudinal Study of Parents and Children, 2007. Life of a 16+ Teenager. University of Bristol, Britsol, UK.

Bucksch, J., Sigmundova, D., Hamrik, Z., Troped, P.J., Melkevik, O., Ahluwalia, N., Borraccino, A., Tynjala, J., Kalman, M., Inchley, J., 2016. International trends in adolescent screen-time behaviors from 2002 to 2010. J. Adolesc. Health 58, 417–425.

Degenhardt, L., Stockings, E., Patton, G., Hall, W.D., Lynskey, M., 2016. The increasing global health priority of substance use in young people. Lancet Psychiatry 3, 251–264.

Fergusson, D.M., Boden, J.M., Horwood, L.J., 2008. The developmental antecedents of illicit drug use: evidence from a 25-year longitudinal study. Drug Alcohol Depend. 96, 165–177.

Fuller, E., Hawkins, V., 2014. Smoking, Drinking and Drug Use Among Young People in England: 2013. Available from:. Health and Social Care Information Centre, Leeds. https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2013.

Health and Social Care Information Centre, 2013. Statistics on smoking: England, 2013. Available from:. Health and Social Care Information Centre, Leeds. https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-smoking/statistics-on-smoking-england-2013.

Health and Social Care Information Centre, 2015. Smoking, Drinking and Drug Use among Young People in England: 2014. Available from:. Health and Social Care Information Centre, Leeds. https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2014.

Holliday, J.C., Rothwell, H.A., Moore, L.A., 2010. The relative importance of different measures of peer smoking on adolescent smoking behavior: cross-sectional and longitudinal analyses of a large British cohort. J. Adolesc. Health 47, 58–66.

Huang, G.C., Unger, J.B., Soto, D., Fujimoto, K., Pentz, M.A., Jordan-Marsh, M., Valente, T.W., 2014. Peer influences: the impact of online and offline friendship networks on adolescent smoking and alcohol use. J. Adolesc. Health 54, 508–514.

Inchley, J., Currie, D., Young, T., Samdal, O., Torsheim, T., Augustson, L., Mathison, F., Aleman-Diaz, A., Molcho, M., Weber, M., Barnekow, V., 2016. Growing up Unequal: Gender and Socioeconomic Differences in Young People's Health and Well-being, Health Behaviour in School-aged Children (HSBC) Study: International Report From the 2013/2014 Survey. Available from:. WHO Regional Office for Europe, Copenhagen. http://www.euro.who.int/_data/assets/pdf_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf.

Johnston, L.D., Miech, R.A., O'Malley, P.M., Bachman, J.G., Schulenberg, J.E., Patrick, M.E., 2018. Monitoring the Future National Survey Results on Drug Use, 1975-2017: Overview, Key Findings on Adolescent Drug Use. Available from:. Institute for Social Research, The University of Michigan, Ann Arbor. http://www.monitoringthefuture.org/.

Leung, R.K., Toumbourou, J.W., Hemphill, S.A., 2014. The effect of peer influence and selection processes on adolescent alcohol use: a systematic review of longitudinal studies. Health Psychol. Rev. 8, 426–457.

MacArthur, G.J., Harrison, S., Caldwell, D.M., Hickman, M., Campbell, R., 2016. Peer-led interventions to prevent tobacco, alcohol and/or drug use among young people aged 11-21years: a systematic review and meta-analysis. Addiction 111, 391–407.

Pape, H., 2012. Young people's overestimation of peer substance use: An exaggerated phenomenon? Addiction 107, 878–884.

Rubin, D., 2004. Multiple Imputation for Nonresponse in Surveys. John Wiley and Sons, Hoboken, New Jersey.

Simons-Morton, B.G., Farhat, T., 2010. Recent findings on peer group influences on adolescent smoking. J. Prim. Prev. 31, 191–208.

Sussman, S., Dent, C.W., Mestelrauch, J., Johnson, C.A., Hansen, W.B., Flay, B.R., 1988. Adolescent nonsmokers, triers, and regular smokers estimates of cigarette-smoking prevalence— when do overestimations occur and by whom? J. Appl. Soc. Psychol. 18, 537–551.

Van Ryzin, M.J., Dishion, T.J., 2014. Adolescent deviant peer clustering as an amplifying mechanism underlying the progression from early substance use to late adolescent dependence. J. Child Psychol. Psychiatry 55, 1153–1161.

White, J., Hawkins, J., Madden, K., Grant, A., Er, V., Angel, L., Pickles, T., Kelson, M., Fletcher, A., Murphy, S., Midgley, L., Eccles, G., Cox, G., Hollingworth, W., Campbell, R., Hickman, M., Bonell, C., Moore, L., 2017. Adapting the ASSIST Model of Informal Peer-led Intervention Delivery to the Talk to FRANK Drug Prevention Programme in UK Secondary Schools (ASSIST + FRANK): Intervention Development, Refinement and a Pilot Cluster Randomised Controlled Trial. Public Health Res., pp. 5.