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Is it the music? Peer substance use as a mediator of the link between music preferences and adolescent substance use

Juul Mulder^{a,*}, Tom, F.M. Ter Bogt^b, Quinten, A.W. Raaijmakers^c, Saoirse Nic Gabhainn^d, Karin Monshouwer^e, Wilma, A.M. Vollebergh^b

^a Scientific Research and Documentation Centre, Ministry of Justice, P.O. Box 20301, 2500 EH The Hague, the Netherlands

^b Department of Interdisciplinary Social Sciences, Utrecht University, the Netherlands

^c Department of Education, Utrecht University, the Netherlands

^d Department of Health Promotion, National University of Ireland, Galway, Ireland

^e Trimbos Institute, National Institute of Mental Health and Addiction, Utrecht, the Netherlands

A B S T R A C T

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Both music preferences and the substance use behavior of peers are important elements in explaining adolescent substance use. The extent to which music preference and peer use overlap in explaining adolescent substance use remains to be determined. A nationally representative sample of 7324 Dutch school-going adolescents (aged 12–16) provided data on music preferences, substance use behaviors and perceived number of peers using substances. Factor analyses showed that preferences for eight music genres factored into four styles: Pop (chart music, Dutch pop), Adult (classical music, jazz), Urban (rap/hiphop, soul/R&B) and Hard (punk/hardcore, techno/hardhouse); substance use was indicated by smoking, drinking, and cannabis use. Structural equation modeling revealed that the relationship between music preference and substance use was either wholly or partially mediated by perceived peer use. Music can model substance use and fans of different types of music may select friends with use patterns that reinforce their own substance use inclinations.

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Both music preferences (Arnett, 1991; Forsyth, Barnard, & McKeganey, 1997; Miranda & Claes, 2004) and peer substance use (Petraitis, Flay, & Miller, 1995; Simons-Morton, Chen, Abroms, & Haynie, 2004; Ter Bogt, Schmid, Nic Gabhainn, Fotiou, & Vollebergh, 2006) have been consistently associated with adolescent substance use. In addition it is clear that music is an important socializing agent (Knobloch, Vorderer, & Zillmann, 2000; Lull, 1985; North, Hargreaves, & O'Neill, 2000; Rentfrow & Gosling, 2006), and thus both music preferences and substance use behaviors are shared among friends. Questions remain as to the nature of the relationship between music preferences, substance use and peer use. This study extends previous research by simultaneously modeling these three components. It aimed at disentangling the extent to which the link between music preferences and substance use can be explained by co-occurring peer use. Second, in previous work only a limited number of music genres have been investigated, mostly so among relatively small samples of young people. In this study the connection between music and substance use is investigated for a wide range of music types, among a nationally representative sample of Dutch adolescents.

* Corresponding author. Tel.: +31 (0)70 370 6561; fax: +31 (0)70 370 7948.

E-mail address: j.mulder@minjus.nl (J. Mulder).

Liking loud and energetic types of music, such as the harder forms of rock, rap, and dance music, co-occurs with increased levels of alcohol, cannabis, and tobacco consumption (Arnett, 1991; Forsyth et al., 1997; Miranda & Claes, 2004), compared to liking softer, more melodic and thus more easily accessible music. These relationships have been found across countries and population groups; for example tobacco, alcohol and cannabis use have been associated with heavy metal in the US (Arnett, 1991), in Canada (Lacourse, Claes, & Villeneuve, 2000), and Australia (Martin, Clarke, & Pearce, 1993), with rap/hip-hop in Canada (Miranda & Claes, 2004), and rave in Scotland, UK (Forsyth et al., 1997), and both Dutch and Californian dance-party fans are more likely to have used alcohol, cannabis and other club-drugs such as MDMA (Chen, Miller, Grube, & Waiters, 2006; Ter Bogt & Engels, 2005). Overall previous studies have reported higher levels of substance use among listeners of more conspicuous, 'louder' music genres compared to listeners of gentler, more melodic music.

Why is music associated with substance use?

The explanation of this link between music preference and substance use behaviors is still a matter of debate, and both social learning and self-matching selection hypotheses have been proposed. In line with social-cognitive learning theory, both the behavior and lyrics of admired artists may have a modeling effect through mentioning, using or even celebrating smoking and alcohol use as desirable behaviors (Brown & Witherspoon, 2002; Gruber, Thau, Hill, Fisher, & Grube, 2005; Herd, 2005; Robinson, Chen, & Killen, 1998; Wingood et al., 2003), thereby constituting both a potential risk or protective factor, depending on expressed values (Giles & Maltby, 2004; Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004; Maxwell, 2002; Petraitis et al., 1995).

An alternative suite of explanations focus on personality factors hypothesized to underpin both music preference and substance use behaviors (Carpentier, Knobloch, & Zillmann, 2003; Dollinger, 1993; Hansen & Hansen, 1991). Traits such as rebelliousness (Carpentier et al., 2003) and sensation seeking (Litle & Zuckerman, 1986; McCown, Keiser, Mulhearn, & Williamson, 1997; Zuckerman, 1994) may help explain the association between preferences for louder, more conspicuous forms of music and risk-taking behaviors such as substance use. However, although Chen et al. (2006) controlled for sensation seeking, the associations between music preference and substance use remained significant.

From a psychosocial perspective (Miranda & Claes, 2004) it is assumed that adolescents prefer the music that resonates with their own behaviors and perceptions; that is reflective of their 'psychosocial realities' (Arnett, 1996; Roe, 1995). In this perspective, both the liking of music and the choice of consuming or refraining from tobacco, alcohol and cannabis use is part of a broader lifestyle. Adolescents may also choose friends that fit into their lifestyle, and these friends may either enhance or discourage substance use. Music preference can be predictive of friendship formation (Knobloch et al., 2000; Selfhout, Branje, Ter Bogt, & Meeus, 2009), implying that music is a key element of peer culture, and peer culture, in turn, may drive substance use.

The present study

This study aimed to extend this previous work by modeling a potential mechanism underlying the association between music preferences, self-reported substance use and the perceived substance use by peers, and poses the question whether, and if so to what extent, perceived peer substance use mediates the relationship between music preference and own substance use.

Over the past decades, factor analytical research on the structure of people's music preferences has shown that underneath a variety of genre preferences a distinct number of styles (factors) can be discriminated. Consistent styles have included guitar-driven Rock (containing genres such as hard rock and punk), electronic Dance (comprising genres such as trance and techno), Afro-American influenced style called Urban (e.g., soul, R&B and rap/hip hop), high(er)-culture style of music (e.g., classical music and jazz), and an easy to listen to, easily accessible Pop style, such as can be found in the Charts (Christenson & Peterson, 1988; Delsing, Ter Bogt, Engels, & Meeus, 2008; Rentfrow & Gosling, 2003; Roe, 1985; Stevens, 2001; Tillekens, 1993). Results of a recent study (Mulder et al., 2009) indicated that both punk and techno-hardhouse were associated positively with substance use. Although punk is close to rock music and techno-hardhouse is, musically, a type of dance music, both genres can also be described as loud, non-mainstream music. As this study sought to disentangle the associations between music preferences, peers' substance use and self-reported substance use, the louder forms of Rock and Dance music are collapsed into a single factor: Hard music. Hence, four types of music styles that are well-known and wholeheartedly embraced or passionately disliked among Dutch adolescents are the subject of this study: Rock, Hard, Adult-oriented (jazz and classical music) and Urban music.

Substance use is modeled in this study by tobacco, alcohol and cannabis use. These three types of substance use are obviously distinct substance use behaviors, but they do cluster together, and have been shown to indicate a single underlying construct of substance use (Duncan, Duncan, & Hops, 1998; Johnston, O' Malley, & Bachman, 2002; Kendler, Schmitt, Aggen, & Prescott, 2008). Moreover, these three types of substance use are related to similar outcomes (Riala, Hakko, Isohanni, Jarvelin, & Rasanen, 2004). Finally, all three types of substance use are mentioned quite frequently in popular music, especially in the popular genre rap/hip hop (Herd, 2005; Primack, Dalton, Carroll, Agarwal, & Fine, 2008; Roberts, Christenson, Henriksen, & Bandy, 2002; Roberts, Henriksen, & Christenson, 1999). Therefore the three types of substance use are modeled together in this study.

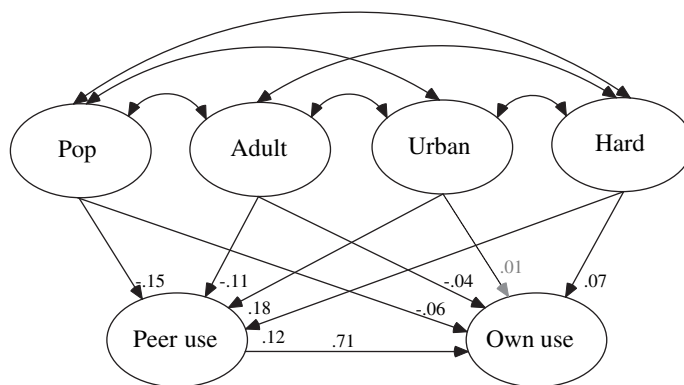


Fig. 1. Music taste, self-reported substance use, and the mediator peer use. Note: The model depicts the standardized β -coefficients indicating peers' and own use, and covariances between music preference factors. For sake of clarity, the indicators of the latent factors and their estimated error variances are not depicted. Model fit indices: $\chi^2(62) = 1,409.09$, $p < 0.01$, CFI = .962, RMSEA = .056, with $.054 \leq 90\% \text{ CI} \leq .059$.

In sum: this study aimed at modeling substance use as connected to four distinct types of music preferences, with peer substance use potentially mediating this relationship (See Fig. 1).

Method

Sample

The data were derived from the 2003 Dutch National School Survey on Substance Use (DNSSSU), a cross-sectional study conducted every 4 years since 1984, which is supported by the Dutch Ministry of Health, Welfare and Sport. The sample was obtained by using a two-stage random sampling procedure from all secondary schools in the Netherlands. Schools were stratified according to level of urbanization and drawn proportionally to their number in the corresponding urbanization level. Within each school, a maximum of five classes (depending on school size) were randomly selected. The 10, 11, 17 and 18 year olds were excluded, because at these ages school students are not representative for the Dutch adolescent population. Most 10 and 11 year olds are still attending primary education and some 17 and 18 year olds have already left school (in the Netherlands school is compulsory up to age 16). The resulting sample comprised 7324 students (mean age 13.91 years). The school response rate was 72% (192 out of 268 schools). Non-response mainly had to do with participation in other research (65%). Responding and non-responding schools did not differ on urbanization level or school size. Within classes an average of 7% of the students were not included, primarily due to illness. Parents were informed of the topic of the study and were free to indicate whether they did not want their children to participate in this study by returning a letter or an e-mail (passive consent). No parent objected to having his/her child participate.

Data collection

The DNSSSU is a survey that targets substance use and its correlates among adolescents in the Netherlands. The question format is derived from other large scale investigations into substance use such as the European Schools Project on Alcohol and Drugs (Europe), the WHO Health Behavior in School-aged Children study (Europe and US) and Monitoring the Future (US). Student data were collected by questionnaire, administered in regular classes by trained assistants. These assistants briefly introduced themselves and the study, and asked the students to answer the questions as best as they could. They stressed the anonymity of the process. Questionnaires did not ask for the names of students. After students completed the questionnaires, these were collected, and put into an envelope that was sealed in front of their eyes. Teachers were asked to either leave or take a place at the back of the classroom.

Measures

Music preference was assessed by presenting eight music genres that students rated on 5-point scales ranging from 1 'dislike strongly' to 5 'like very much'. The genres were representative of those readily available to Dutch youth (Mulder, Bogt, Raaijmakers, & Vollebergh, 2007; Ter Bogt, Raaijmakers, Vollebergh, Van Wel, & Sikkema, 2003); chart-based music, Dutch pop, rap/hip-hop, soul/R&B, punk/hardcore, techno/hardhouse, jazz and classical music.

Perceived peer substance use was assessed by asking "how many of the boys and girls you hang out with do the following things"; which was answered for smoking cigarettes, drinking alcohol, and using cannabis at least once a week on a five-point scale with the options 'none', 'a few', 'half', 'most', and 'all'. For the sake of brevity, this factor will be referred to as peer use in the sections below.

Frequency of cigarette smoking was assessed by asking students how often students smoked cigarettes, with the response options: 'never', 'not in past 4 weeks', 'less than one a week', 'less than one a day', '1–5 a day', '6–10 a day', '11–20 a day', and 'more than 20 a day'. This was measured on an eight point scale, with higher scores reflecting more intense use.

Past-month alcohol use and lifetime cannabis use were assessed by asking respondents to indicate the number of times they had used alcohol during the past month, and cannabis ever in their life, both with the response options ranging from 0 to 40 times or more. These were assessed on 14 point scales, with higher scores reflecting more use.

Preliminary analysis

The first step in model development was testing of the separate components. Exploratory factor analysis (EFA) using unweighted least squares (ULS) extraction with direct oblimin rotation was employed. The latter procedure takes relatedness of the scores into account, while the more commonly used method Principal Components Analysis with Varimax Rotation assumes independence of identified components. Eigenvalues had to be larger than 1.

The EFA of the music preference ratings indicated four latent music preference factors with two indicators in each factor. The reduction to four factors explains 64.48% of the variance in preference scores, and is similar to the structure identified in previous research (Christenson & Peterson, 1988; Stevens, 2001; Ter Bogt et al., 2003; Tillekens, 1993). Factor loadings of the supposed dimensions varied between 0.45 and 0.94. Following this, preference ratings of techno/hardhouse and punk/hardcore were modeled as having one underlying, latent variable named Hard, and preferences for Chart-based and Dutch pop music functioned as indicators of Pop. Urban was represented by ratings of rap/hip hop and soul/R&B. Preference for jazz and classical music served as indicators for the construct Adult-oriented music.

Based on previous reports in the literature (e.g., Bailey, Hill, Oesterle, & Hawkins, 2006; Hansen et al., 1987; Li, Pentz, & Chou, 2002), self-reported use of tobacco, alcohol and marijuana and was each considered to represent a single underlying substance use construct, as was perceived number of peers using these substances. The EFA on these substance use measures showed factor loadings varying between 0.48 and 0.86. The reduction to latent constructs explained 47.7% of the variance in self-reported substance use, and 55.1% of perceived number of peers using the same substances.

Analysis

Structural equation modeling (SEM-modeling, in AMOS 7.0.0), Maximum Likelihood estimation was employed. Mediation requires significant relationships among all three components of the model (Baron & Kenny, 1986), (i.e., music ratings, self-reported substance use, and peer use). The Sobel test was used to test the statistical significance of a possible mediation effect. The potential moderation of the relationships between components by gender and age group was investigated in multi-group analyses.

Results

The most popular genres were chart-based, Dutch pop music, rap/hip hop and soul/R&B, which were rated positively by most respondents. Punk/hardcore and techno/hardhouse were rated more negatively. Jazz and classical music were least popular. Substance use prevalences in this sample were as follows: 33.5% had smoked cigarettes, 57.8% had used alcohol in the last month, and 15.9% had used cannabis. Perceived number of peers using substances, with the categories most and all taken together, was reported at 17.9% for cigarettes, 33.9% for alcohol and 5.1% for cannabis.

The three relationships of the model were first modeled separately as a prerequisite for modeling mediation effects (Baron & Kenny, 1986). Table 1 displays the standardized beta coefficients of the separate models for music preference and self-reported substance use, and the model for music preference and perceived number of peers using. The strong positive relationship between perceived number of peers using substances and self-reported substance use is shown below in Fig. 1. In addition, testing of the hypothesized mediation effects using the Sobel Test indicated significant effects, with Sobel's z-values ranging from -10.54 to 10.84 ($p < 0.001$). The R^2 for self-reported substance use is large (0.55), with both peers' substance use and music preferences contributing significantly.

Table 1

Summary of two separate models: standardized regression weights of music preferences on substance use and on peer use.

	Own use ^a	Peer use ^b
Pop	-.28	-.15
Adult	-.17	-.10
Urban	.25	.17
Hard	.17	.12

Note: All β -coefficients significant at $p < 0.01$.

^a Model fit indices for this model are $\chi^2(37) = 1,088.50$, $p < 0.01$ CFI = .959, RMSEA = .062, with $.059 \leq 90\% \text{ CI} \leq .066$.

^b Model fit indices for this model are $\chi^2(37) = 1,151.03$, $p < 0.01$ CFI = .954, RMSEA = .064, with $.061 \leq 90\% \text{ CI} \leq .067$.

Fit estimates for the initial overall model indicated a nearly adequate model fit (Byrne, 2001) with $\chi^2(64) = 3,749.35$, $CFI = .901$, $RMSEA = .089$, and $.086 \leq 90\% CI \leq .091$. However, a measurement model with adequate fit is a prerequisite for testing structural relationships. Thus variances of similar indicators of the two latent constructs own and peers' substance use were allowed to correlate, since these correlations reflect correlated measurement error for identical measures. Subsequently, model fit improved to adequate, (i.e. $\chi^2(62) = 1,409.09$, $CFI = .962$, $RMSEA = .056$, with $.054 \leq 90\% CI \leq .059$). Fig. 1 displays the final model.

Fig. 1 depicts the standardized beta coefficients, and Table 2 displays the direct, indirect, and total effects based on these standardized beta-coefficients. Preference for music styles is differentially associated with own or peer use (β s vary between -0.15 and 0.18). Comparison of total versus indirect effect values indicates the substantive importance of the mediation mechanism, as well as the importance of the additional direct link.

The estimate of the path coefficient for peer onto own substance use is positive ($\beta = 0.71$). Preference for the Urban style is only positively associated with peer substance use; mediation is complete here ($\beta = 0.18$). Preference for Hard music is positively associated with both peer and self-reported substance use (standardized β s are 0.12 & 0.07 , respectively). Preferences for Pop and Adult-oriented music are negatively associated with both peer and self-reported substance use (respective β s Pop; -0.15 & -0.06 ; Adult: -0.11 & -0.04). Comparing the total and indirect effect values of music preference on self-reported substance use illustrates that the associations between liking of Pop, Hard, and Adult music and own self-reported substance use are substantially mediated by peer substance use.

The potential moderation of the relationships between components by gender and age was investigated in multi-group analyses, but were neither consistent nor substantial.

Discussion

This study aimed to extend previous work by modeling the structure of a hypothesized mechanism underlying the association between music preferences, self-reported substance use, and the role of perceived number of peers using substances. The hypothesized mediation mechanisms were confirmed. The substance use risks associated with preference for Urban music (soul/R&B, rap/hip-hop) were entirely mediated by perceived peer substance use. Preferences for other styles of music were indicative of both personal substance use behaviors and the perceived substance use behaviors of peers. That is, ratings of the music style labeled Hard were also positively associated with substance use, but the hypothesized mediation was partial here; both self-reported substance use and perceived numbers of peers using substances were relevant. Preferring Adult-oriented music (jazz and classical) and Pop (chart-based and Dutch pop) related negatively to substance use, both directly and indirectly. The modeled relationships were similar for groups based on gender and age.

The modeled mediation

The ratings given to the four distinct music styles related to both self-reported substance use and perceived number of peers using substances. The negative relationships between self-reported substance use and liking of Pop and Adult-oriented music suggests that adolescents who prefer these styles report less substance use, and are less likely to perceive their friends as using substances, which in turn is associated negatively with substance use of the adolescents themselves. In the case of preferences for Urban and Hard music styles, the hypothetical mediation mechanism appears to function in the following way; adolescents liking these types of music are more likely to use substances, and are more likely to perceive their friends as doing the same, which in turn is positively associated with adolescent substance use (Aseltine, 1995; Kandel, 1996). Interestingly, in contrast to ratings of Hard music, those of Urban were no longer associated directly with self-reported substance use, but were entirely mediated by perceived peer substance use. Taken together, these mediation effects suggest music preference can be conceptualized as an organizing principle in the social stratification of substance use patterns among adolescents.

The associations between music preferences and perceived peer use may be explained by viewing music preferences as both defining and shaping elements of the cultural options that adolescents have, with each option associated with aspects of lifestyle, for example appearance and leisure time activities (Golub, Johnson, & Dunlap, 2005). Consideration of these

Table 2

Total, direct and indirect effects of components on self-reported substance use with peer use in the mediation model.

	Effect values ^a		
	Total	Direct	Indirect
Pop	-.17	-.06	-.11
Adult	-.12	-.04	-.08
Urban	.14	.01	.13
Hard	.16	.07	.09

Note: All effects significant at $p < 0.01$, with the exception of the non-significant direct path from Urban preference to self-reported substance use in the full model.

^a Standardized effect values.

issues may be employed as a basis for friendship selection, as well as for defining in- and out-group boundaries (Knobloch et al., 2000; North et al., 2000; Rentfrow & Gosling, 2006). The associations between adolescents' own music preferences on the one hand, and peers' substance use on the other, favor the interpretation that music preference serves a "badge" function with implications for lifestyle (Frith, 1996; North et al., 2000; Rentfrow & Gosling, 2006); that selection of favored musical genres facilitates other-directed identity claims, which also have implications for health risk behaviors such as substance use.

The lifestyle implications are derived from the specific culture surrounding and defining a music style. Important in the relationship with substance use behaviors is the oppositional attitude inherent in the music. For instance, liking the style labeled Hard entails both techno/hardhouse, which is very much part of a culture of partying, of going out (Forsyth, 1996), and punk/hardcore, which appears to have replaced the position that heavy metal used to have in research on youth and deviant behaviors. This music can be characterized as loud, energetic guitar music, and is oppositional to adult authority, at least in image. The potential of substance use to be used by adolescents as a means to defy adult authority could well explain the association with music such as punk/hardcore and techno/hardhouse (Spijkerman, Van den Eijnden, & Engels, 2005). Therefore preference for music that is youth-cultural in orientation as opposed to adult-oriented is likely to be a marker of risk-behaviors such as substance use, both personally as well as through peers.

The positive association between liking Urban music and substance use can be explained by previous studies which focused on one of the indicators linked to the supposed Urban music construct, that is, rap/hip hop. Rap/hip hop has been linked consistently to alcohol, cigarette and cannabis use both in terms of video and lyrical content (Herd, 2005; Roberts et al., 2002; Roberts et al., 1999), as has preferences for, especially, harder and less mainstream forms of rap/hip hop (Miranda & Claes, 2004). The substance use favoring content of rap/hip hop's videos and lyrics help explain its appeal as a non-adult-oriented type of music with an associated lifestyle.

The remaining direct associations between music preference and substance use call for an additional explanatory concept. Both music taste and substance use have been linked to the personality construct called sensation seeking (Arnett, 1991; Chen et al., 2006; Zuckerman, 1994). Liking for loud and hard music can be viewed as stemming from a need to experience intense sensations. This need can similarly become expressed in an inclination to engage in risky, reckless behaviors including substance use (Arnett, 1992, 1995). The negative associations between liking Adult-oriented and Pop music on the one hand, and substance use on the other, can be viewed as arising from low levels of sensation seeking. The relevance of Urban music was entirely explained by peer behavior, but the positive direct association between liking Hard music and substance use can similarly be viewed as arising from a disposition to seek intense stimulations.

This study's contribution lies in the modeling of a potential mechanism operating in the link between music preference and adolescent substance use. At least part of this link can be explained in terms of behavioral similarity among friends, but there is also a direct effect.

Unfortunately, we could not determine whether or not this effect reflects a disposition to seek intense experiences, which pertains to choices such as music preferences and behaviors such as substance use. An alternative explanation could be that music listening, music video watching, and behaviors of artists as related in the media influence adolescents to engage in risky behaviors such as substance use. The reported associations could also arise from an interaction between disposition and social learning from lyrics, videos, and artists. To further elucidate mechanisms of self-matching selection and social learning, additional information such as importance of music, time spent listening and degree of identification with artists and their music would help in providing a more comprehensive picture.

The role of peers can be conceived of as entailing selection, social learning, or both. Literature on peer groups and peer pressure (Brown, 1990) suggests that these associations probably reflect both selection effects; individuals select peers to befriend based on shared characteristics such as music taste (Selfhout, Branje, Ter Bogt, & Meeus, 2007) and substance use (Simons-Morton et al., 2004), as well as social learning, for example copying of behavior (Aseltine, 1995). As our study was exploratory in nature and did not entail a sketch of the longitudinal trajectory of music taste and substance use development it is not possible to reach any further conclusions on the nature and timing of these associations.

Another aspect of the data must be kept in mind when examining the results. The grouping of adolescents into classes and into schools results in hierarchically organized data, possibly leading to cluster effects. That is, children in one class and from a specific school can be expected to share attributes, such as opinions on substance use. Unfortunately, correcting for these cluster effects was not possible with the analytical method employed. Still, we prefer our approach for two primary reasons: (1) Undoubtedly, the largest part of the variance of the dependent variables is to be assumed at the respondent's level; and (2) in our approach it was possible to estimate certain parameters which would remain uncovered using a multilevel approach of the data (e.g., latent variables affecting each other; absolute fit statistics).

Nevertheless, further disentangling of the role of peers and music taste is needed. Additional information is needed to help explain why the reported mediation effects were complete in the case of Urban preferences, as opposed to the partial mediation effects regarding the other types of music preferences. For instance, more precisely defined peer clique associations and the social identities and leisure activities associated with these (Eccles, Barber, Stone, & Hunt, 2003; Mahoney & Stattin, 2000) should be included in future studies relating music tastes to peer behaviors. Other factors not included, but also known to be important for both substance use and music preference include genetic predisposition (Hopfer, Stallings, Hewitt, & Crowley, 2003), personality factors such as sensation seeking (Arnett, 1991; Bradley & Wildman, 2002; Chen et al., 2006), family factors and relationship quality (Aseltine, 1995; Kandel, 1996; Simons-Morton

et al., 2004) and the larger social environment beyond peers and music preferences, such as urban context, national policies and campaigns (Arnett, 1992). Future research enabling simultaneous testing of these inter-related factors over time is much needed.

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