Music preference and substance use in adolescence:

The mediating effect of substance use norms of friends

Master Thesis Youth Studies
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Abstract

The aim of this longitudinal study was to test whether the substance use norms of friends are an underlying mechanism in the relationship between music preference and substance use by adolescents (alcohol and smoking). To test this data from the Social Network Analysis of Risk behaviour in Early adolescence (SNARE) project was used. The adolescents in the sample (N=1,648) ranged from the age of 11 to 15 years (M_{age}=13.12). The data was collected through self-reports. Music preference was grouped into seven clusters using a K-means cluster analysis: '*Unconventional*', '*Afro-American', 'Rock', 'Dance', 'Pop', 'Omnivores' & 'Anti's*'. The results from the multivariate logistic regression analysis showed that, with an exception for adolescents in the '*Omnivore*s' and '*Rock*' clusters, all music clusters showed a higher risk of substance use compared to the '*Pop*'-cluster. The mediating effect was only found to be significant for the music cluster '*Unconventional*' for both alcohol and smoking. The results from this study highlight the importance for prevention and intervention programmes to target adolescents with preferences for non-mainstream music and adolescents who have friends with high pro-substance use norms.

Keywords: music preference, alcohol, tobacco, injunctive norms, adolescence

Samenvatting

Het doel van deze longitudinale studie was om te onderzoeken of normen van vrienden tegenover middelengebruik een onderliggend mechanisme zijn in de relatie tussen muziekvoorkeur en middelengebruik bij adolescenten (alcohol en roken). Hiervoor werd gebruik gemaakt van data van het Social Network Analysis of Risk behaviour (SNARE) project. De adolescenten (N=1648) varieerden tussen de leeftijd van 11 en 15 jaar ($M_{leeftijd}$=13.12). Data werd verkregen middels zelfrapportage. Muziekvoorkeur is gegroepeerd in zeven clusters met behulp van een K-means clusteranalyse: '*Onconventioneel*', '*Afro-American', 'Rock', 'Dance', 'Pop', 'Omnivoren' & 'Anti's*'. Resultaten van de multivariate logistische regressie analyse laten zien dat, met uitzondering van adolescenten in de '*Omnivoren*' en '*Rock*' clusters, alle muziekcluster een hoger risico hadden op middelengebruik vergeleken met de '*Pop*'-cluster. Het mediatie-effect was alleen significant voor de muziekcluster '*Onconventioneel*' voor zowel alcohol als roken. De resultaten laten het belang zien dat interventie en preventie programma's zich richten op adolescenten met een voorkeur voor niet-mainstream muziek en op adolescenten met vrienden met positieve normen tegenover middelengebruik.

Trefwoorden: muziekvoorkeur, alcohol, roken, injunctieve normen, adolescentie

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Introduction

In the Netherlands, substance use (alcohol and smoking) by adolescents often starts at an early age. Research from the Trimbos-institute showed that a significant proportion of fifteen year olds in 2013 reported to have consumed alcohol (69%) and tobacco (36%). Early substance use has damaging consequences on the health of adolescents (Trimbos-instituut, 2014). Adolescent brains are in a state of development which makes them vulnerable to the effects of alcohol. An area of the brain, known as the hypothalamus, is particularly at risk. Damage to this area can negatively affect the development of adolescents' cognitive skills (Welsch, 2013). Smoking is equally damaging and can lead to diseases such as cancer and heart disease (Hoeymans et al., 2010). Moreover, adolescents are highly vulnerable to the development of nicotine dependence (Pietersen & Willemsen, 2005). Given the potentially serious consequences of early substance use, it is important to investigate the risk factors associated with substance use by adolescents.

Several studies have shown that music preference is a predictor of substance use by adolescents (Lozon & Bensimon, 2014). However, there is still uncertainty about the underlying mechanism in this relationship. It appears that music preference plays an important role in the formation of friendships. Adolescents with the same interests (including music preference), norms and values find each other and form groups of friends (Selfhout et al., 2009). Furthermore, the Peer Cluster Theory (PCT) (Oetting & Beauvais, 1986) states that adolescent substance use is commonly linked to a group activity taking place in peer clusters. These peer clusters determine the times and places of substance use. A consequence of this is that where pro-substance use norms are present within a peer cluster, this can lead to a higher level of substance use by the adolescents (Kobus, 2003).

This current study investigates the related question of whether substance use norms of friends can explain the relationship between music preference and substance use by adolescents. This particular question does not appear to have been investigated before. Because of the longitudinal design, this study can shed light on the role of friends as a mediator in the relationship between music preferences and substance use. These results are important for the prevention and reduction in early substance use.

Relationship between music preference and substance use

The relationship between music preference and substance use has been frequently studied. Lozon and Bensimon (2014) described the relationship between music preference and behaviour in a systematic review of 56 articles (of which 31 included adolescents). This

research identified a number of music preferences which are positively related to norm-breaking behaviour such as aggression or substance use. These music preferences are described in literature as non-mainstream and consist of the genres 'Rock', 'Rap' and 'Dance' (Lozon & Bensimon, 2014). A cross-sectional study conducted by Mulder et al. (2009) studied approximately 7,000 adolescents (12 to 16 years) in the Netherlands. The study showed that the same genres identified by Lozon and Bensimon (2014) are associated with higher levels of alcohol use and smoking. In contrast, a preference for classical music and pop is associated with lower levels of alcohol use and smoking. Generally non-mainstream music is positively related to substance use. Mainstream music (pop music) and music that adults prefer (for example classical music) are negatively related to substance use (Mulder et al, 2009). Consistent with these findings is a recent study on fifteen year olds in Europe by Ter Bogt et al. (2012) which showed that a preference for dance music is also positively associated with both alcohol use and smoking.

Music preference for adolescents in the Netherlands can also be divided into different clusters based on a preference for a certain music style. Ter Bogt et al. (2003) conducted a cross-sectional study of 908 Dutch adolescents and found six different clusters based on music preference: 1) '*Pop*' (preference for Dutch and Top40 music), 2) '*Afro-American*' (preference for Rap, Soul and R&B), 3) '*Rock*' (preference for Alternative, Hard Rock and Metal), 4) '*Dance*', 5) '*Omnivores*' (preference for all music styles) and 6) '*Anti's*' (no preference for any music style). There does not appear to have been any research on the relationship between these music clusters and substance use of the adolescent. Research on this is important because clusters can provide a method to distinguish and compare groups of adolescents based on music preference by using a more person-centred approach rather than a variable-centred approach. Furthermore, previous studies on the relationship between music preference and substance use have focused solely on youth with a preference for one specific genre (i.e., Rock, Dance, Afro-American or Pop). There are so far no studies on adolescents who have a preference for all the genres (Omnivores) or adolescents who have no preference (Anti's). This gap in research will be investigated in the current study through an explorative analysis.

A possible explanation for the relationship between music preference and substance use is the influence of friends. It appears that adolescents select their friends based on shared interests (including music preference). These friends have the potential to influence adolescents into displaying norm-breaking behaviour. Adolescents with a preference for non-mainstream music have an increased chance of being exposed to friendships where norm-breaking behaviour, such as substance use, occurs more frequently (Selfhout et al., 2009).

Norms of friends as mediator in the relationship between music preference and substance use

Social norms can be divided in descriptive norms (perception of what others do) and injunctive norms (perception of the expectations and values that the other has of the behaviour) (Rimal & Real, 2005). In this study injunctive norms of friends will be investigated. The study will explore adolescents' perceptions of how normal their friends think smoking or the excessive consumption of alcohol is. This has been found to be a good predictor for substance use among adolescents (Borsari & Carey, 2003). A longitudinal study from Eisenberg et al. (2014) of 2,248 adolescents in America and Australia showed that both descriptive and injunctive norms are predictors of alcohol use among adolescents. In addition, a cross-sectional study among 271 sixth graders showed that the intention to smoke was significantly correlated with the perceived injunctive norm (Zaleski et al., 2013).

So far there are no studies on the mediating effect of injunctive norms of friends in the relationship between music preference and substance use. However, a cross-sectional study from Mulder et al. (2010) did find a mediating effect of substance use of peers. This study showed that for the genre 'Urban' the relationship was fully mediated by substance use of peers. For the other genres (Dance, Adult-Orientated, Pop) the relationship was partially mediated. This suggests that adolescents in these non-mainstream groups were more likely to have friends with higher substance use levels. This in turn led to the adolescents using more substances. Because this study was cross-sectional, no statement can be made about the direction of the relationship. Substance use of peers was measured as a descriptive norm with the question: 'How many of your peers drink alcohol or smoke tobacco?'. Because descriptive norms and injunctive norms are strongly related (Rimal & Real, 2005), it is plausible that music preference is not only related to actual substance use among friends, but also to the injunctive substance use norms of friends.

The mediating effect of substance use norms of friends can be explained by the Music Marker Theory (MMT) and the PCT. First, MMT (Ter Bogt et al., 2013) argues that youth in their early adolescence have few chances to break rules because of the restrictions in their environment such as their family homes or school. Adolescents start listening to the music of their own choice in the privacy of their own room and therefore develop a 'mainstream' or 'non-mainstream' music preference. In this stage of adolescence, norm-breaking behaviour such as substance use is not yet prevalent. As the adolescent grows up they are less restricted and generally spend more time with their peers, which can lead to norm-breaking behaviour.

Adolescents regard themselves as having more similarity with peers that listen to a similar music style. In non-mainstream peer groups positive attitudes towards substance use are more prevalent than in mainstream groups. This might be due to a substance supporting culture in non-mainstream music scenes (Ter Bogt et al., 2013). Second, PCT (Oetting & Beauvais, 1986) states that adolescent substance use is nearly always directly linked to a group activity taking place in peer clusters. Peer clusters are a small subset of a peer group, often consisting of a small group of close friends. Peers share ideas and beliefs about substance use and establish group norms for substance use. The peer clusters then determine the time and places of substance use. Within substance using peer clusters, substance use plays an important part in defining the group and shaping its typical substance using behaviour (Oetting & Beauvais, 1987).

Essentially, adolescents develop their preferences for mainstream or non-mainstream music in their early adolescence. From this time onwards they also begin to select friends with shared preferences (including music preference) and values (Ter Bogt et al., 2013). The similarity and values that groups of friends share provide the basis for substance use norms to develop. Although the choice of music occurs prior to the development of substance use norms, it can still indicate the likelihood of having friends with high or low pro-substance use norms. This normally means that adolescents with a preference for mainstream music will exhibit substance use norms generally accepted by mainstream society and adolescents with a preference for non-mainstream music will not. The pro-substance use norms of adolescents in the non-mainstream group may become stronger because of socialisation processes (Kobus, 2003). In addition, the pro-substance use norms in friendship groups may provide the foundation for actual substance use to occur (Oetting & Beauvais, 1987).

Current study

The aim of this longitudinal study was to test whether the substance use norms of friends are an underlying mechanism in the relationship between music preference and substance use. Substance use in the current sample is divided into alcohol use and smoking. Cannabis use was almost non-existent because of the relatively young age of the participants. Music preference will be grouped into clusters prior to analysis. The expectation is that similar clusters will be found as in the Ter Bogt et al. (2003) study.

First, the relationship between music preference and substance use will be investigated. On the basis of previous studies it is expected that music preference will be a predictor for both alcohol use and smoking (Lozon & Bensimon, 2014). The expectation is that clusters including

non-mainstream music ('*Dance*', '*Afro-American*' and '*Rock*') are associated with higher risk of alcohol use and smoking than '*Pop*' music. The clusters '*Omnivores*' and '*Anti's*' in relation to '*Pop*' is explorative and can lead to results showing either more or less substance use in comparison to the '*Pop*'-cluster (see figure 1). The second relationship investigated is between norms of friends and substance use of the adolescents. On the basis of previous studies and the PCT (Oetting & Beauvais, 1986) it is expected that pro-substance use norms of friends can lead to more substance use of the adolescent. The third relationship investigated is between music preference and pro-substance use norms. According to the MMT (Ter Bogt et al., 2013) it is expected that a preference for non-mainstream music ('*Dance*', '*Afro-American*' and '*Rock*') is associated with higher scores on pro-substance norms of friends than '*Pop*' music. Finally, the mediation effect of norms of friends on the relationship between music preference and substance use will be investigated. The expectation is that the relationship between music preference and substance use by adolescents can be explained by the alcohol and smoking norms of friends (see figure 1).
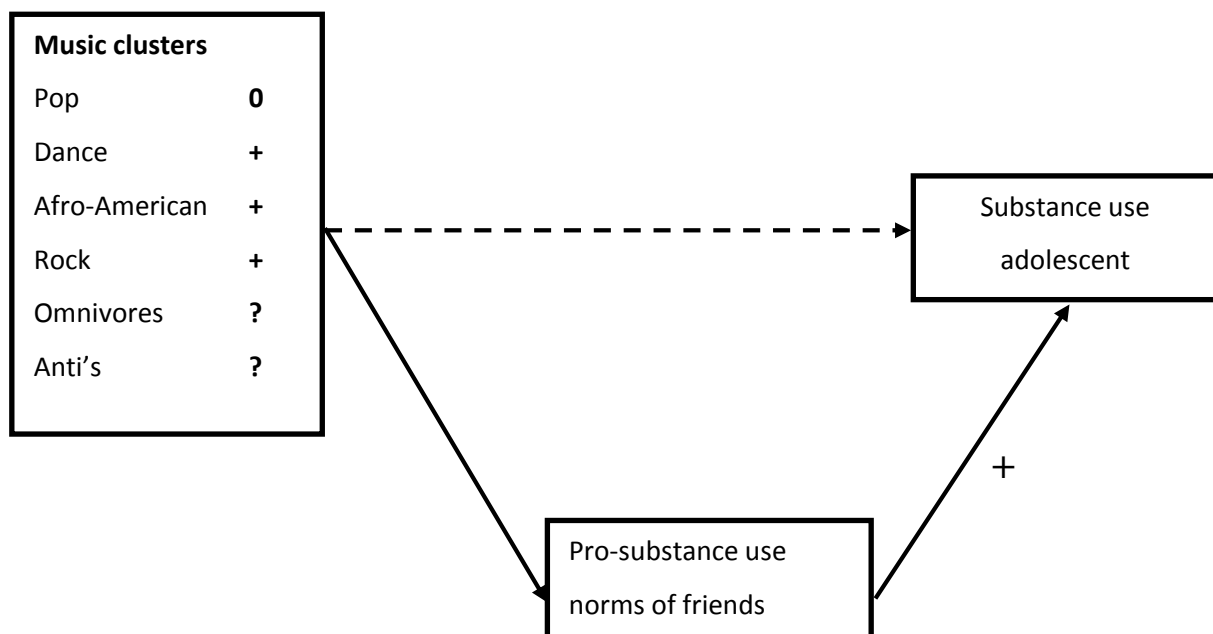
Music clusters	
Pop	**0**
Dance	**+**
Afro-American	**+**
Rock	**+**
Omnivores	**?**
Anti's	**?**

Substance use adolescent

Pro-substance use norms of friends

+

Figure 1. The mediating effect of norms of friends in the relationship between music preference and substance use of the adolescent

Method

Design & Procedure

The current study used data from Social Network Analysis of Risk behaviour in Early adolescence (SNARE). SNARE is an ongoing longitudinal research project for the social and behavioural development of adolescents. The research design was approved by the ethics commission of the Faculty of Social Sciences at the University of Utrecht. The participants are from two high schools in the middle and north of the Netherlands. All first and second year students were asked in 2011-2012 to participate in the project. The parents of the students were informed with an information letter. When students or parents did not want to participate they were asked to indicate this within ten days. 28 students refused to participate in the study. The following year (2012-2013) all new first years were also asked to participate. The current study uses T1-T3 of both cohorts. The survey periods were October(T1), December(T2) and April(T3). During the survey a teacher and at least one researcher was present. The researcher introduced the study and provided instructions to the students. After which students completed the questionnaire on a computer. The surveying was during class hours (45 minutes). Students who failed to attend the sessions completed the questionnaire within a month. Anonymity and privacy of the participants was maintained.

Sample

A total of 1,790 participants took part in this study. Participants who were absent on T1, T2 or T3 were removed from the sample (N=131). There was also one participant removed who had an extreme value on age (17.7 years old). The sample size after these participants were removed was 1,658 participants. Students were between 11 and 15 years old (M_{age}=13.12, SD=.70). Of the participants 50.1% were girls, 44.8% were enrolled in lower education (LWOO, VMBO-B, VMBO-T) and 55.2% in higher education (HAVO, HAVO/VWO, VWO). 94.9% of the participants were born in the Netherlands.

Measurements

Music preference. Music preference (T1) was measured as 'What is your favourite music style?'. Participants could choose between 'Alternative rock', 'Foreign pop music', 'Folk', 'Hardhouse', 'Heavy metal', 'Gothic', 'House, Dance, Trance', 'Jazz', 'Classical music', 'Dutch pop', 'R&B', 'Reggae', 'Rap & Hip-hop', 'Rock', 'Techno' and 'Dubstep'. Multiple answers were possible (Ter Bogt et al., 2003).

Substance use norms of friends. Alcohol and smoking norms of friends (T2) were measured using two items: 'My friends think it is normal when I drink a lot' and 'My friends think it is normal when I light up a cigarette (Harakeh et al., 2004). The response categories consisted of a 5-point Likert-scale (from 'completely disagree' to 'completely agree'). A high score represented high pro-substance use norms.

Alcohol use. Alcohol use of the adolescent (T3) was measured as 'How many times did you drink alcohol since the last questionnaire?' (Huizink et al., 2006). This meant that alcohol use was measured over a period of three months. The participants could choose from 14 response categories (0, 1, …30-39 and 40 or often). Because of the skewed distribution within this variable, it was dichotomised between 'drinker' and 'non-drinker'(reference category).

Smoking. Smoking of the adolescent (T3) was measured with the question 'How many cigarettes did you smoke on average since the last questionnaire?' (Huizink et al., 2006). As with alcohol smoking behaviour was measured over a three month period. The participants could choose from 'I didn't smoke since the last questionnaire', 'Less than one cigarette a week', 'Less than one cigarette a day', '1-5 cigarettes a day', '6-10 cigarettes a day', '11-20 cigarettes a day ' and 'More than 20 cigarettes a day'). Because of the skewed distribution within this variable, it was dichotomised between 'smoker' and 'non-smoker'(reference category).

Covariates. This study controlled for the variables gender (T1) and age (T1). Previous research showed that boys use more substances than girls and older adolescents use more substances than younger adolescents (Mulder, 2009). Gender is measured as a dichotomous variable, with girl as reference category. This study also controlled for alcohol use (T1) and smoking (T1) because of the change in these variables over time.

Data-analysis

For the data-analysis IBM SPSS Statistics 20 was used. First, outliers and missing values were analysed. There was a total of 9.5% missing values on all variables and no outliers. Because of the low percentage of missing values listwise deletion was used. Descriptive statistics were calculated for the variables music preference (frequencies), alcohol and smoking norms (M,SD) and alcohol use/smoking (frequencies). A paired-samples t-test was performed to test the difference in alcohol and smoking norms. To test differences between boys and girls chi-square tests were performed for the variable music preference and independent sample t-tests were used for the variables alcohol and smoking norms, alcohol use and smoking.

A K-means cluster analysis was used to identify different clusters in the data based on music preferences. A cluster analysis was performed for 5 to 8 cluster solutions. The number of clusters that gave the best solution was determined using previous findings on music clusters (Ter Bogt et al., 2012) and classification tables in the discriminant analysis. On the basis of these criteria seven clusters were chosen. This produced percentage correct predicted observations of 94.4% (Statsoft, 2013). Z-scores were used to test differences between boys and girls in the clusters. The '*Pop*'-cluster was taken as a reference category in the analyses in accordance with earlier research (Mulder et al., 2010).

The assumptions for the binary logistic regression analysis were met (absence of multicollinearity and linear relationship with the logit of the outcome variable) (Field, 2009). To test the mediation model the steps from the Baron and Kenny method were used (1986). Binary logistic regressions were performed because the outcome variables alcohol use and smoking were dichotomous. First, two separate bivariate logistic regression analyses were performed to test the effect of music preference on alcohol use and smoking. Second, these analyses were again performed this time with alcohol and smoking norms as predictors. Third, ANOVA-analyses were performed to test the relationship between music preference and alcohol and smoking norms of friends. Finally, two separate multivariate logistic regression analyses were performed. The outcome variables used were alcohol use and smoking and the predictors were music preference, alcohol and smoking norms of friends. The covariates were also added. The significance level (.05), odds ratio and 95%CI were used to determine if there was a mediation effect. A Sobel test was used to test whether the mediation-effect was significant (Sobel, 1982).

Results

Descriptive statistics

Table 1 shows that the genre 'Rap & Hip-Hop' was most popular (42.3%), the genre 'Folk' was least popular (2.2%). The table also shows that boys and girls differ significantly on music preference with exception of the music genres 'Gothic' (p=.770), 'House, Dance, Trance' (p=.080), 'Classical music' (p=.770), 'Dutch pop' (p=.341) and 'Reggae' (p=.098). The scores on alcohol norms were low (M=1.52, SD=1.04). This means that participants generally reported that their friends did not think it was normal to drink excessively. The same was found for smoking norms (M=1.50, SD=1.06). The difference in scores on alcohol and smoking norms was not significant (t(1642)=.759, p=.448). The average score on both alcohol and smoking norms was higher for boys than for girls. This difference was significant (Alcohol: t(1640)=-

3.66, $p<.001$; Smoking: $t(1640)=-2.71$, $p<.01$). Only 23.3% of the participants reported on T3 to have consumed alcohol at least once in prior three months. Boys (29.1%) drank more alcohol in the prior three months than girls (21.7%). This effect was significant ($\chi2(1,1612)=15.24$, $p<.001$). Of the participants 12.7% reported on T3 to have smoked at least once. There was no significant difference found between boys (13.9%) and girls (11.5%) for smoking ($\chi2(1,1618)=2.08$, $p=.150$).

Table 1. Descriptive statistics for music preference separated by gender

	Girls		Boys			Total	
	Count	Percentage	Count	Percentage	X^2	Count	Percentage
Alternative rock	51	6.2%	99	12.1%	16.90***	150	9.1%
Foreign pop	345	42.0%	237	28.9%	31.05***	582	35.4%
Folk	12	1.5%	24	2.9%	4.09*	36	2.2%
Hardhouse	73	8.8%	184	22.2%	56.84***	257	15.5%
Heavy Metal	34	4.1%	107	12.9%	41.35***	141	8.5%
Gothic	23	2.8%	25	3.0%	.09	48	2.9%
House, Dance, Trance	217	26.1%	249	30.1%	3.07	466	28.1%
Jazz	138	16.6%	66	8.0%	29.02***	204	12.3%
Classical music	41	4.9%	33	4.0%	.91	74	4.5%
Dutch pop	95	11.4%	88	10.6%	.30	183	11.0%
R&B	196	23.6%	128	15.5%	17.78***	324	19.5%
Reggae	55	6.6%	73	8.8%	2.75	128	7.7%
Rap & Hip-Hop	376	45.2%	326	39.4%	6.22*	702	42.3%
Rock	167	20.1%	218	26.4%	8.83**	385	23.2%
Techno, Dubstep	49	5.9%	213	25.8%	122.15***	262	15.8%

*$p<.05$,**$p<.01$,***$p<.001$*

Cluster analysis

The results of the cluster analysis are shown in Table 2. The table sets out the average scores of the music genres on the clusters. Values of .50 and higher indicate a high appreciation from the cluster members for a particular music genre. This shows that these music genres best describe the cluster (Statsoft, 2013). The first cluster consists of participants with a preference for 'Hardhouse', 'House, Dance, Trance', 'Rap & Hip-Hop', 'Rock' and 'Techno, Dubstep'. The cluster name '*Unconventional*' is chosen because this cluster is mainly characterised by a high score on 'louder' music genres. The second cluster consists of participants with a

preference for 'House, Dance, Trance', 'R&B' and 'Rap & Hip-hop'. This cluster was labelled '*Afro-American*' due to its relatively low scores for the genres 'House, Dance, Trance'. In the third cluster there are participants with a preference for only 'House, Dance, Trance'. This cluster was labelled '*Dance*'. The fourth cluster '*Rock*' consists of only participants with a preference for this music genre. The fifth cluster consists of participants without a preference for a music genre. This cluster was labelled '*Anti's*'. The sixth cluster contains the participants with a high preference for all the music genres (with exception of 'Gothic'), this cluster was labelled '*Omnivores*'. The last cluster consists of participants with only a preference for 'Foreign Pop', this cluster was labelled '*Pop*'.

Table 2. Results cluster analysis based on music preference

	Music clusters						
	Unconventional	Afro-American	Dance	Rock	Anti's	Omnivores	Pop
Alternative Rock	.26	.03	.02	.27	.06	**.91**	.01
Foreign pop	.34	.29	.18	.12	.00	**1.00**	**1.00**
Folk	.04	.00	.00	.02	.02	**.59**	.00
Hardhouse	**.90**	.04	.14	.04	.15	**.88**	.04
Heavy Metal	.36	.02	.03	.25	.04	**.81**	.01
Gothic	.05	.01	.02	.06	.02	.47	.00
House, Dance, Trance	**.74**	**.57**	**1.00**	.03	.00	**1.00**	.00
Jazz	.15	.15	.09	.12	.12	**.84**	.06
Classical music	.01	.03	.02	.06	.04	**.59**	.03
Dutch pop	.13	.07	.05	.10	.12	**.72**	.11
R&B	.19	**.71**	.11	.03	.09	**.75**	.04
Reggae	.18	.12	.03	.06	.05	**.91**	.03
Rap & Hip-Hop	**.72**	**1.00**	.05	.17	.42	**.97**	.21
Rock	**.70**	.20	.07	**1.00**	.00	**.97**	.11
Techno, Dubstep	**.54**	.10	.23	.10	.14	**.88**	.04
N	**105**	**272**	**195**	**173**	**485**	**32**	**380**

The differences between boys and girls based on their cluster membership were also investigated. Table 3 shows the frequencies of boys and girls within a cluster. This shows that boys and girls differ significantly on the clusters, with exception to the clusters '*Dance*' and '*Omnivores*'.

Table 3. Distribution of gender in music clusters

Music clusters	**Girls**		**Boys**	
	Count	Percentage within music cluster	Count	Percentage within music cluster
Unconventional	35$_a$	33.3%	70$_b$	66.7%
Rap & Hip-Hop	168$_a$	61.8%	104$_b$	38.2%
Dance	89$_a$	45.6%	106$_a$	54.4%
Rock	70$_a$	40.5%	103$_b$	59.5%
Anti's	211$_a$	43.5%	274$_b$	56.5%
Omnivores	11$_a$	34.4%	21$_a$	65.6%
Pop	237$_a$	62.4%	143$_b$	37.6%

Note. A difference in letters within a cluster shows a significant difference in gender within that cluster with p<.05

Bivariate logistic regression

The bivariate logistics regression showed that music preference was a significant predictor of both alcohol use and smoking (see Table 4). In regards to alcohol all music clusters differed significantly with the '*Pop*'-cluster, with exception for the cluster '*Omnivores*'. Participants in these clusters had a higher risk of drinking alcohol compared to participants in the '*Pop*'-cluster. Smoking in all music clusters, with exception to the '*Rock*'-cluster, differed significantly from the '*Pop*'-cluster. Participants in these clusters had a higher risk of smoking compared to participants in the '*Pop*'-cluster.

Table 4. Bivariate logistic regression analysis of the predictors Music preference (T1) on the outcome variables Alcohol use in the last three months (T3) and Smoking in the last three months (T3)

Music preference (clusters)	Alcohol use		Smoking	
	OR	95%CI	OR	95%CI
Pop	1	-	1	-
Unconventional	4.76***	2.93-7.75	7.29***	4.00-13.30
Afro-American	3.31***	2.26-4.83	3.37***	1.97-5.75
Dance	2.09**	1.36-3.22	2.50**	1.38-4.54
Rock	2.21***	1.42-3.45	1.46	.73-2.93
Anti's	2.00***	1.40-2.84	2.23**	1.34-3.72
Omnivores	1.40	.55-3.56	3.07*	1.07-8.76

Note. R^2= 0.053 (alcohol), R^2= 0.060 (smoking)

*OR=odds ratio; CI=confidence interval,*p<.05,**p<.01,***p<.001*

Alcohol norms were a significant predictor of alcohol use (OR=1.95, 95%CI=1.75-2.17, $p<.001$). Participants with a high alcohol norm had a significantly higher risk of alcohol use than participants with a low alcohol norm. This model explained 14.1% of the variance in alcohol use. Similarly, smoking norms were a significant predictor of smoking (OR= 2.15, 95%CI= 1.92-2.41, $p<.001$). Participants with a high smoking norm had a significant higher risk of smoking than participants with a low smoking norm. This model explained 19.2% of the variance in smoking. Results from the ANOVA-analysis showed that music preference was a significant predictor for both alcohol norms ($F(6,1622)=4.98$, $p<.001$) and smoking norms ($F(6,1622)=5.30$, $p<.001$). *Post hoc tests* showed that the 'Pop'-cluster only significantly differed from the music cluster '*Unconventional*'(p<.001) for both alcohol and smoking norms. Participants in the '*Unconventional*'-cluster had significantly higher alcohol and smoking norms than participants in the '*Pop'*-cluster. The variances for these models were respectively 1.8% (alcohol) and 1.9% (smoking).

Multivariate logistic regression

A multivariate logistic regression analysis was used to analyse whether alcohol norms would mediate the relation between music preference and alcohol use. Table 5 shows that all the paths of Figure 1 were significant. This means that, with exception for the cluster '*Omnivores*', even after controlling for the covariates, there was still a significant relationship between music

preference and alcohol use. As a result it was shown that alcohol norms of friends are a partial mediator for the cluster '*Unconventional*'. The Sobel test showed that the mediation-effect was significant ($z=4.46, p<0.05$). Of the covariates only age and alcohol use(T1) were significant predictors of alcohol use. A higher age led to a significant higher risk of alcohol use six months later.

The mediation model was also tested for smoking. All paths of figure 1 were significant (see Table 5). This means that even after controlling for the covariates, there was still a significant relationship between music preference and smoking, with exception for the clusters '*Rock*' and '*Anti's*'. This indicates that the smoking norms of friends are a partial mediator for the '*Unconventional*'-cluster. The Sobel test showed that the mediation-effect was significant ($z=4.68, p<0.05$). Of the covariates, again, only age and smoking(T1) were significant predictors of alcohol use. A higher age led to a significant higher risk of smoking six months later.

Table 5. Multivariate logistic regression analysis of the predictors Music preference (T1), Social norm (T2), Gender, Age, Alcohol use (T1) and Smoking (T1) on the outcomes variables Alcohol use and Smoking in the last three months (T3)

	Alcohol use		Smoking	
	OR	95%CI	OR	95%CI
Music preference (clusters)				
Pop	1	-	1	-
Unconventional	3.25***	1.79-5.91	4.64***	2.31-9.33
Afro-American	2.66***	1.70-4.18	2.47**	1.36-4.48
Dance	1.93*	1.17-3.21	2.06*	1.07-3.95
Rock	2.40**	1.43-4.03	1.17	.54-2.52
Anti's	1.68*	1.11-2.54	1.50	.85-2.64
Omnivores	1.49	.53-4.18	3.28*	1.06-10.10
Social norm				
Alcohol norms	1.50***	1.33-1.71	-	-
Smoking norms	-	-	1.79***	1.57-2.03
Gender				
Girl	1	-	1	-
Boy	1.23	.94-1.63	1.14	.80-1.62
Age	1.50***	1.23-1.82	1.30*	1.02-1.66
Alcohol use (T1)				
Non-drinker	1	-	-	-
Drinker	8.97***	6.60-12.19	-	-
Smoking (T1)				
Non-smoker	-	-	1	-
Smoker	-	-	9.17***	5.57-15.09

Note. R^2= 0.370 (alcohol), R^2= 0.319 (smoking)

OR=odds ratio; CI=confidence interval, *p<.05, **p<.01, ***p<.001

Discussion

The aim of this longitudinal study was to test whether substance use norms of friends are an underlying mechanism in the relationship between music preference and substance use (alcohol and smoking). In the study seven clusters were found: '*Unconventional*', '*Afro-American*', '*Rock*', '*Dance*', '*Pop*', '*Omnivores*' & '*Anti's*'. With the exception of adolescents in the '*Omnivore*s' (alcohol) and '*Rock*' clusters (smoking), all music preferences showed a higher risk of substance use compared to the '*Pop*'-cluster. The mediating effect was only found to be significant for the music cluster '*Unconventional*'. Participants in this cluster are more likely to have friends with pro-substance use norms. This in turn results in a higher risk of substance use by the adolescent.

Music clusters

Six of the identified clusters were consistent with the clusters found by Ter Bogt et al. (2003). The additional seventh '*Unconventional*'-cluster may have occurred as a result of different age ranges used in both studies. The Ter Bogt et al. (2003) sample consisted of a broader age range (12-24 years old) which led to a higher mean age (18.8 years old). Earlier research has shown that music preference of adolescents becomes more stable at an older age (Delsing et al., 2008). It is thought that as adolescents mature they form their own identity (Erikson, 1968). The '*Unconventional*'-cluster consists of a group of young adolescents with a broad taste for different 'louder' music genres. It is possible that they feel connected to this type of music, but may not have developed a stable music preference for one specific louder genre at the time of sampling.

Direct relationship between music preference and substance use

Music preference appears to be a predictor of substance use six months later. Non-mainstream clusters (e.g., '*Unconventional*', '*Afro-American*' and *'Dance)* and the '*Anti's*' show a higher risk of substance use compared to the '*Pop*'-cluster. This is consistent with previous studies (Lozon & Bensimon, 2014; Mulder et al., 2009; Ter Bogt et al., 2012).

A possible explanation for the relationship between non-mainstream music and substance use lies within the concept of subcultural affiliation (Thornton, 1995). Identification with a scene that values substance use can lead to greater substance use among its members. In non-mainstream music the value of substance use is generally higher than in mainstream music. In addition, both the behaviour and lyrics of admired artists may have a modelling effect

through the reference and depiction of their consumption of alcohol and cigarettes (Brown & Witherspoon, 2002). Future research needs to investigate subcultural affiliation as another potential mediator in the relationship between music preference and substance use. A second possible explanation is that music preference and substance use are both methods that adolescents use to express an anti-authoritarian stance. Adolescents who seek to defy authority can use both non-mainstream music and substance use to achieve this (Chen et al., 2006). Previous research has shown that personality factors such as sensation-seeking and rebelliousness are strongly related to substance use and music preference, and may act as an important confounder in this relationship (Rentfrow & Gosling, 2003). Personality was not tested in this study, so this factor cannot be analysed. It also should be noted that earlier studies that controlled for personality factors still found a unique effect for the relationship between music preference and substance use (Chen et al., 2006). This suggests that the relationship between music preference and substance use cannot fully be explained by specific personality characteristics (Arnett, 1991). Despite this, future research should take into account personality characteristics (e.g., sensation-seeking and rebelliousness) as being possible confounders.

In contrast to previous research, though consistent with the recent study by Ter Bogt et al. (2012), this study found that adolescents in the '*Rock*'-cluster were not at higher risk of smoking. A possible explanation is that the role of music genres has changed over the years. In the '80s and '90s hard rock music was popular with estranged substance using youth. Today this type of rock music is listened to by a broader audience and can therefore be seen as more mainstream (Ter Bogt et al., 2012). A second possible explanation is that rock music in other studies is often measured as the louder forms of rock music (heavy metal/punk) (Tanner et al., 2008) while in the current study the '*Rock*'-cluster did not consist of these subgenres.

There has been no earlier research on the clusters '*Anti's*' and '*Omnivores*'. This lack of research made it difficult to explain the results of the study. The results showed that participants in the '*Anti's*'-cluster had a higher risk of substance use. A possible explanation is that adolescents in the '*Anti's*'-cluster may have a strong global disliking for everything, as result of a rebellious personality. As previously stated, this personality trait can lead to a higher risk of substance use (Rentfrow & Gosling, 2003). A second possible explanation is that the '*Anti's*' are in fact a cluster consisting of adolescents with a liking for 'Rap & Hip-hop'. The results showed that the adolescents in this cluster had a relatively high appreciation for this genre (M=0.46). As a result of this the '*Anti's*' could be a non-mainstream 'Rap & Hip-Hop'-cluster in the current study.

In relation to the '*Omnivores*'-cluster, a higher risk of smoking was found but not a higher risk of alcohol use. The '*Omnivores*' show similarity in music preference with both mainstream and non-mainstream clusters. A possible explanation could be that the '*Omnivores*' have a personality which makes them want to fit into both these groups. Alcohol is regarded as more socially accepted than smoking (Cummings & Proctor, 2014). It is possible that the '*Omnivores*' both smoke and drink to fit in, but because small amounts of alcohol are consumed by both the mainstream and non-mainstream group, they are not comparatively at a higher risk of drinking. In contrast, smoking is a minority preference. The '*Omnivores*' association with a broad range of groups may expose them to the risks of this type of behaviour. Most studies on substance use take smoking and alcohol together because it measures the underlying construct of substance use (Duncan et al., 1998). As the results of the '*Omnivores*' show, some care may be needed in future research relying on this presumption. However, it should be noted that in the current study the '*Omnivores*' consisted of a small group (N=30). It is therefore possible that the results are not totally justified, and that there is in fact also a positive effect for alcohol. Information on the '*Anti's*' and the '*Omnivores*' is scarce and as a result there is still room for research into this area. Future research needs to focus on investigating whether the '*Anti's*'-cluster is in fact a non-mainstream cluster in hiding or whether the members of this group are displaying a 'global' disliking personality trait. The '*Omnivores*' also require further examination, in particular how their social interactions work and whether their preference for all music types truly exposes them to more risks of substance use.

Norms of friends as mediator in the relationship between music preference and substance use

The current study found that injunctive norms of friends regarding substance use can partially explain the relationship between music preference and substance use for both alcohol and smoking. This is similar to the result of the study by Mulder et al. (2010) which found that descriptive norms were a full mediator for the genres 'Dance', 'Rap' and 'Rock'. The results of the current study also showed that injunctive norms were a strong predictor for substance use. This suggests that, in line with the PCT, influence of friends can play an important role in the use of substances. Furthermore, music preference was found to be a predictor of substance use norms of friends for the '*Unconventional*'-cluster. A possible explanation consistent with the MMT is that adolescents in the non-mainstream clusters tend to select friends with a positive attitude towards substance use. The current study however only shows that there is some causality in the relationship between music preference and injunctive norms. It cannot provide

proof of selection because the possibility remains that adolescents do not actively seek out their friends. Another difficulty is that there were only three months between the measurement of music preference and substance use norms of friends. This makes it difficult to show support for the assumption in MMT that music preference develops a few years before the substance use norms of friends. To prove this assumption, future research needs to measure these variables over a longer period. To rule out the possibility that music preference and substance use norms develop at the same time, this study controlled for substance norms on T1. This showed that music preference was still a predictor of substance use norms ($p<0.01$ for smoking and alcohol). Despite the difficulties, the longitudinal design of this study made it possible to show first signs of causality in the relationships between music preference, substance use and the influence of friends.

One difference this study has with earlier research is that the current study only shows a significant mediation effect for the cluster '*Unconventional*' for both alcohol use and smoking. Mulder et al. (2010) found that descriptive norms were a mediator for all non-mainstream genres. One possible explanation for the differences in results is the difference in the type of social norm measured. The current study measured injunctive norms as opposed to descriptive norms. These norms are often strongly related, but a possibility remains that adolescents have more difficulty reporting injunctive norms and therefore tend to underreport (Rimal & Real, 2005). Another possible explanation is that Mulder's study used peer norms instead of norms of friends. Influence may derive from the desire to conform to norms valued by popular peers. It is therefore expected that adolescents are more influenced to use substances by popular peers than by their close friends (Urberg & Pilgrim, 1997). A third possible explanation is that Mulder's study did not control for substance use on T1. The effect could possibly be weaker or disappear when controlled for substance use over time.

Strengths and limitations

The current study has a number of strengths. First, it consists of a longitudinal design which makes it possible to make statements about causality. Second, music preference is determined with a cluster analysis and thereby uses a person-centred approach rather than a variable-centred approach. This makes it possible to also investigate the relationship between music preference and substance use for two groups that have never been investigated, namely adolescents with no preference ('*Anti's*') and adolescents with a preference for all music genres ('*Omnivores*').

There are a number of limitations which need to be acknowledged. First, music preference was measured on a binary scale. This is not consistent with earlier research which

used a 5-point Likert scale (Mulder et al., 2010). The binary scale also means that it is not possible to use a factor analysis on this sample. The result being that there can be no statements made about the degree to which participants' value each music genre. As consequence of this no distinction can be made between members within a cluster. Adolescents with a strong preference for a certain genre may vary strongly from those who have only a mild preference. Second, substance use was dichotomised. The original variables consisted of a 14-point scale on which participants could report the degree of substance use. The dichotomisation of these variables creates the possibility that information is lost or under reported for substance use.

Conclusions and implications

The current study shows that adolescents with a preference for non-mainstream music ('*Unconventional*', '*Dance*', '*Afro-American*') and the '*Anti's*' are at a higher risk for both the consumption of alcohol and smoking of tobacco. It also indicates that adolescents who have friends with high pro-substance use norms are more at risk of substance use. The finding that norms of friends can mediate the relationship between music preference and substance use for participants in the '*Unconventional*'-cluster confirms, to some extent, the MMT and PCT theories. The results of this study show the significant role friends can play in the relationship between music preference and substance use. This is an important factor in the development of prevention and intervention programmes. Targeting adolescents with preferences for non-mainstream music and adolescents who have friends with high pro-substance use norms may provide valuable benefits to prevention of substance use among minors.

References

Arnett, J. (1991). Heavy metal music and reckless behavior among adolescents. *Journal of Youth and Adolescence, 20*(6), 573–592. doi:10.1007/BF01537363

Baron, R.M., & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182. doi:10.1037/0022-3514.51.6.1173

Borsari, B., & Carey, K. (2003). Descriptive and injunctive norms in college drinking: A meta-analytic integration. *Journal of Studies on Alcohol and Drugs*, *64*(3), 331–341.

Brown, J.D., & Witherspoon, E.M. (2002). The mass media and American adolescents' health. *Journal of Adolescent Health, 31*(6), 153–170. doi:10.1016/S1054139X(02)00507-4

Chen, M.J.J., Miller, B., Grube, J., & Waiters, E. (2006). Music, substance use and aggression. *Journal of Studies on Alcohol, 67*(3), 373–381. doi:10.15288/jsa.2006.67.373

Cummings, K.M., & Proctor, R.N. (2014). The changing public image of smoking in the United States. *Cancer Epidemiology Biomarkers Prevention, 23*(1), 32-36 doi:10.1158/1055-9965.EPI-13-0798.

Delsing, M.J.M.H., Ter Bogt, T.F.M., Engels, R.C.M.E., & Meeus, W.H.J. (2008). Adolescents' music preferences and personality characteristics. *European Journal of Personality, 22*(2), 109-130. doi:10.1002/per.665

Duncan, S.C., Duncan, T.E., & Hops, H. (1998). Progressions of alcohol, cigarette and marijuana use in adolescence. *Journal of Behavioural Medicine, 21*(4), 375–388. doi:10.1023/A:1018730814379

Eisenberg, M.E., Toumbourou, J., Catalano, R., & Hemphill, S. (2014). Social norms and substance use behaviours in a longitudinal study of adolescents in the US and Australia. *Journal of Adolescent Health, 54*(2), S8. doi:10.1016/j.jadohealth.2013.10.031

Erikson, E. (Ed). (1968). *Identity, youth and crisis.* New York: Norton.

Field, A.P. (Ed). (2009). *Discovering statistics using SPSS.* London: SAGE Publications

Harakeh, Z., Scholte, RH. J., Vermulst, A.A., De Vries, H., & Engels, R.C.M.E. (2004). Parental factors and adolescents' smoking behavior: An extension of the theory of planned behavior. *Preventive Medicine, 39*(5), 951-961. doi:10.1016/j.ypmed.2004.03.036

Hoeymans, N., Melse, J.M., Schoemaker, C.G. (2010). *Gezondheid en determinanten. Deelrapport van de Volksgezondheid Toekomst Verkenning 2010 van gezond naar beter.* Houten: Bohn Stafleu Van Loghum.

Huizink A.C., Ferdinand R.F., Ormel J., & Verhulst F.C. (2006). Hypothalamic-pituitary adrenal axis activity and early onset of cannabis use. *Addiction 2006, 101*(11), 1581 1588. doi:10.1111/j.1360-0443.2006.01570.x

Kobus, K. (2003). Peers and adolescent smoking. *Addiction*, *98*(1), 37-55. doi:10.1046/j.1360-0443.98.s1.4.x

Lozon, J., Bensimon, M. (2014). Music misuse: A review of the personal and collective roles of "problem music". *Aggression and Violent Behavior, 19*(3), 207–218. doi:10.1016/j.avb.2014.04.003

Oetting, E.R., & Beauvais, F. (1986). Peer cluster theory: Drugs and the adolescent. *Journal of Counseling and Development, 65*(1), *17*-22. doi:10.1002/j.1556-6676.1986.tb01219.x

Oetting, E.R., & Beauvais, F. (1987). Peer Cluster Theory, socialization characteristics, and adolescent drug use: A Path Analysis. *Journal of Counselling Psychology, 34*(2), 205-213. doi:10.1037/0022-0167.34.2.205

Pieterse, M.E., & Willemsen, M.C. (2005). Ontstaan en voorkomen van rookgedrag bij jongeren. In: Knol, K. (red). *Tabaksgebruik. Gevolgen en bestrijding.* Utrecht: Lemma B.V.

Mulder, J., Ter Bogt, T.F.M., Raaijmakers, Q.A.W., Gabhainn, S.N., Monshouwer, K., Vollebergh, W.A.M. (2009). The soundtrack of substance use: Music preference and adolescent smoking and drinking. *Substance Use & Misuse*, *44*(4), 514–531. doi:10.1080/10826080802347537

Mulder, T., Ter Bogt, T.F.M., Raaijmakers, Q.A.W., Gabhainn, S.N., Monshouwer, K., Vollebergh, W.A.M. (2010). Is it the music? Peer substance use as a mediator of the link between music preferences and adolescent substance use. *Journal of Adolescence, 33* 387–394. doi:10.1016/j.adolescence.2009.09.001.

Rentfrow, P.J., & Gosling, S.D. (2003). The do re mi's of everyday life: The structure and personality correlates of music preferences. *Journal of Personality and Social Psychology, 84*(6), 1236–1256. doi:10.1037/0022-3514.84.6.1236

Rimal, R.N., & Real, K. (2005). How behaviors are influenced by perceived norms: A test of the theory of normative social behavior. *Communication Research, 32*(3), 389–414. doi: 10.1177/0093650205275385

Selfhout, M.H., Branje, S.J., Ter Bogt, T.F., Meeus, W.H. (2009). The role of music preferences in early adolescents' friendship formation and stability. *Journal of Adolescence*, *32*(1), 95-107. doi:10.1016/j.adolescence.2007.11.004

StatSoft, Inc. (2013). *Electronic Statistics Textbook.* Tulsa: OK: StatSoft. Verkregen van http://www.statsoft.com/textbook/.

Sobel, M.E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In: Leinhardt, S. (Ed.). *Sociological methodology.* Verkregen van http://www.jstor.org.proxy.library.uu.nl/journals.

Tanner, J., Asbridge, M., & Wortley, S. (2008). Our favourite melodies: Musical consumption and teenage lifestyles. *The British Journal of Sociology*; 59(1), 117–144. doi:10.1111/j.1468-4446.2007.00185.x

Ter Bogt, T.F.M., Gabhainn, N.S., Simons-Morton, B.G., Ferreira, M., Hublet, A., Godeau, E., Kuntsche, E., & Richter, M. (2012). Dance is the new metal: Adolescent music preferences and substance use across Europe. *Substance Use & Misuse, 47*(2), 130-142. doi:10.3109/10826084.2012.637438

Ter Bogt, T.F.M., Keijsers, L., Meeus, W.H.M. (2013). Early Adolescent Music Preferences and Minor Delinquency. *Pediatrics, 131*(2). doi:10.1542/peds.2012-0708

Ter Bogt, T., Raaijmakers, Q., Vollebergh, W., Van Wel, F., & Sikkema, P. (2003). Youngsters and their musical taste: Musical styles and taste groups. *The Netherlands Journal of Social Sciences, 39*(1), 35–52

Thornton, S. (1995). *Club Cultures: music, media and subcultural capital.* Cambridge: Polity Press, 98-105.

Trimbos-instituut (2011). *Jaarbericht 2013/2014*, *Nationale Drug Monitor.* Utrecht.

Urberg, K.A., Degirmencioglu, S.M., Pilgrim, C. (1997). Close friend and group influence on adolescent cigarette smoking and alcohol use. *Developmental Psychology, 33*(5), 834 844

Welsch, K.A., Carson, A., & Lawrie, S.M. (2013). Brain structure in adolescents and young adults with alcohol problems: systematic review of imaging studies. *Alcohol Alcohol*, *48*(4), 433–44. doi:10.1093/alcalc/agt037

Zaleski, A.C., & Aloise-Young, P.A. (2013). Using peer injunctive norms to predict early adolescent cigarette smoking intentions. *Journal of Applied Social Psychology*, *43*(1), 124–131. doi:10.1111/jasp.12080