# Exposure to Cannabis in Popular Music and Cannabis Use among Adolescents

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## Abstract

**Background**—Cannabis use is frequently referenced in American popular music, yet it remains uncertain whether exposure to these references is associated with actual cannabis use. We aimed to determine if exposure to cannabis in popular music is independently associated with current cannabis use in a cohort of urban adolescents.

**Methods**—We surveyed all 9th grade students at three large U.S. urban high schools. We estimated participants' exposure to lyrics referent to cannabis with overall music exposure and content analyses of their favorite artists' songs. Outcomes included current (past 30 day) and ever use of cannabis. We used multivariable regression to assess independent associations between exposures and outcomes while controlling for important covariates.

**Results**—Each of the 959 participants was exposed to an estimated 40 cannabis references per day (standard deviation = 104). Twelve percent (N = 108) were current cannabis users and 32% (N=286) had ever used cannabis. Compared with those in the lowest tertile of total cannabis exposure in music, those in the highest tertile of exposure were almost twice as likely to have used cannabis in the past 30 days (odds ratio = 1.83; 95% confidence interval = 1.04, 3.22), even after adjusting for sociodemographic variables, personality characteristics, and parenting style. As expected, however, there was no significant relationship between our cannabis exposure variable and a sham outcome variable of alcohol use.

**Conclusions**—This study supports an independent association between exposure to cannabis in popular music and early cannabis use among urban American adolescents.

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## INTRODUCTION

Cannabis is the most common illicit drug used by children and adolescents in the United States (U.S.) (1). More than half of U.S. adolescents will experiment with cannabis and, of those who try it more than once, approximately one third will subsequently use cannabis regularly (2). Despite adolescents' lack of concern regarding potential dangers of cannabis (1), researchers are increasingly convinced of its toxicity. It is a drug of dependence, the risk of which increases with decreasing age of initiation (3). Additionally, its use is associated with use of other illicit drugs (4), poor school performance (5), depression (6), and psychosis (4,7,8). Although many factors have been associated with risk of cannabis use—including genetic predisposition, demographic characteristics, temperament, and parenting style (1-3,5)—it is not currently known to what extent music exposure among adolescents is associated with cannabis use.

American adolescents are exposed to 2.4 hours of music per day, or over 16 hours per week (9). There are few limits to youths' access to music; 98% of children and adolescents live in homes with both radios and CD/MP3 players, and 86% of 8-18 year olds have CD/MP3 players in their bedrooms (9). These figures have increased even over the past several years (9,10). Furthermore, current popular music is saturated with references to cannabis. A content analysis published by the Office of National Drug Control Policy showed that, of the top 1000 popular songs they studied, 18% referenced illicit drugs, of which cannabis was the most common (10). A more recent content analysis found that 13.6% of the top songs of 2005 according to Billboard magazine depicted cannabis use (11).

There is now convincing evidence that exposure to certain media messages increases substance use in adolescents (12-19). For instance, viewing smoking in movies prospectively predicts a substantial proportion of adolescent smoking initiation (13,20). Similarly, exposure to smoking related media promotions is associated with smoking initiation (14-17,21). Alcohol use in movies and promotions is also linked to actual alcohol use (13,22-24). Compared with movie and advertisement exposure, however, music exposure has been less commonly studied. Nevertheless, two recent studies have shown significant associations between certain sexual references in music and adolescent sexual behavior (25,26).

These relationships between media exposures and health behavior are highly plausible (27,28). The Social Cognitive Theory purports interrelationships between behaviors, environmental factors, and personal (or intrinsic) factors (Figure 1) (29). It asserts that people learn not only by direct experience, but also by exposure to modeled and positively reinforced behavior, such as that represented in popular music (**Arrow A**) (29). Risky behavior can also change exposure to risk-taking behavior in popular music, which is why **Arrow A** is bi-directional. Exposure to risk-taking behaviors in music may in turn be influenced by environmental and personal factors (**Arrow B**), and those factors may also influence risk-taking behavior directly (**Arrow C**).

However, the relationship between exposure to portrayal of cannabis and adolescent cannabis use (**Arrow A**) has not been adequately explored. One cross-sectional study of 1211 adolescents at a large high school suggested an independent dose-response relationship between overall music exposure and ever use of cannabis (30). Even after controlling for

multiple covariates, compared with adolescents with less than an hour of music use per day, those with 3-4 hours of daily music use (odds ratio [OR] = 1.90; 95% confidence interval [CI] = 1.01, 3.56) and over 4 hours of daily music use (OR = 2.70; 95% CI = 1.57, 4.63) were significantly more likely to have ever used cannabis (30). However, the independent variable for this study did not represent exposure to cannabis in music in particular; rather it represented total music exposure, independent of specific content. It would be substantially more valuable to study the relationship between specific cannabis-related content and behavior. Additionally, the outcome variable for this study was ever cannabis use, which is less clinically meaningful than current cannabis use, which is generally defined as use within the past 30 days (31).

The purpose of this study was to determine if exposure to cannabis in popular music is independently associated with current and ever cannabis use in an urban cohort of adolescents. We hypothesized that exposure to cannabis content in popular music would be independently associated with cannabis use, even after controlling for relevant covariates.

## METHODS

### Design, Setting, and Participants

For this cross-sectional analysis, we used baseline data from a randomized trial comparing two different anti-smoking programs (32). We surveyed all students enrolled in ninth grade health classes at three large high schools located in urban, low- to middle-income areas of Pittsburgh, PA. Overall, approximately half of students at these schools are African-American and about half of students receive free or reduced school lunch through federal programs.

### Procedures

We received University of Pittsburgh Institutional Review Board approval for this study (IRB #606146). Students provided assent on computer terminals, and parents were informed about the survey and offered the opportunity to refuse participation. Students entered all information directly onto computer terminals in school computer laboratories. In the rare circumstance that there were not sufficient numbers of computer terminals, they completed the questionnaires on paper. They did not enter their names or any other unique identifiers in either format.

### Measures

**Primary Independent Variable: Cannabis Exposure in Popular Music—**In order to estimate cannabis exposure, we had students report (A) the number of hours per day they listen to music; and (B) their favorite musical artist. Through a detailed content analysis, we computed the number of cannabis references in each artist's most popular songs (11). We then computed an exposure score (number of cannabis exposures in music per week) by multiplying each student's self-reported hours per week listening to music by the number of cannabis references per hour in their favorite artist's songs. Finally, we categorized that score into tertiles: low exposure, medium exposure, and high exposure. We have used similar methods in the past in order to successfully estimate content-specific media exposures (26). Division into tertiles for this exposure score was driven by the distribution of data. Because about one-third of the sample had exposure of zero according to this scale, it was appropriate to conduct analyses using the independent variable as categorical rather than continuous.

Methods for the content analysis have been previously described in detail (11). In brief, two coders independently analyzed lyric transcripts of the top 794 songs from 2005, 2006, and

2007 according to Billboard Magazine's year end charts for cannabis references. Our coders used a dichotomous variable to indicate explicit cannabis use. They had excellent inter-rater reliability and easily resolved all initial differences (11). That manuscript presents a table featuring multiple examples of references to use of cannabis and other substances (11).

**Secondary Independent Variable: Number of Songs with Cannabis—**In order to determine the robustness of the findings from our primary independent variable, we also used a second exposure measure, which was the student's favorite artist's raw number of songs that contained cannabis references. Although this exposure variable did not seem as specific as our primary variable, we decided *a priori* to use this as a secondary exposure measure because it also seemed to have strong face validity. We grouped this variable into three categories: 0 songs with cannabis, 1-2 songs with cannabis, and 3 or more songs with cannabis. We selected these cut-off points since they roughly divided the sample into thirds.

**Dependent Variables: Current and Ever Cannabis Use—**Our primary outcome measure was current cannabis use, defined as use of cannabis, even a puff, in the past 30 days (yes or no). Our secondary outcome measure was ever cannabis use, even a puff (yes or no).

**Other Variables—**We collected data on a number of socio-demographic characteristics that have been related to cannabis use in prior studies. These included age, race, gender, parental education, and school grades (1-3,7,8). We also included 6 items from Jackson's validated scale measuring two dimensions of authoritative parenting—responsive parenting and demanding parenting—since these constructs have been associated with substance use in the past (33). In these scales, students were asked to indicate their agreement on a Likert-type scale with items such as "My parents listen to what I have to say" (responsive parenting) and "My parents have rules that I must follow" (demanding parenting). To measure sensation seeking, which is also commonly associated with substance use, we used Stephenson's 4-item scale that has been well-validated against larger measures (34). In order to measure rebelliousness, we used three Likert-type items from Smith and Fogg's scale (35) in which students reported their agreement with the following statements "When rules get in the way I sometimes ignore them," "Sometimes I enjoy seeing what I can get away with," and "I sometimes get myself into trouble at school." We also collected information about alcohol use, including consumption of a complete alcohol drink (A) ever; and (B) over the past 30 days.

## Analysis

Descriptive analyses were used to summarize sample characteristics across cannabis use outcomes. We used bivariate and multivariable analyses to assess associations between our independent variables (cannabis exposure and number of songs with cannabis) and cannabis use (current and ever) outcome. We used logistic regression for all models, and our models controlled for all covariates. For all analyses, we used a two-tailed α of 0.05 to define statistical significance.

We also conducted two additional sets of analyses to determine the robustness of our results. First, we also conducted all analyses with alcohol use (current, ever) as the dependent variable instead of cannabis use. We did this in order to investigate whether any relationship we found between cannabis exposure in popular music and behavior was not simply due to our exposure variable being a marker for high risk behavior in general. Second, we conducted analyses using the independent variable of generic exposure to media rather than specific exposure to cannabis in music. We did this in order to investigate whether any

relationship we found between cannabis exposure in music was not simply driven by overall exposure to media.

### Sample

Of the 1198 students who were eligible during the first three years of data collection, 1132 (94%) completed the survey. Of those, 959 had complete exposure data (i.e., they selected as their favorite artist one who had at least one top song over the years 2005-2007). This represented 80% of those eligible. The final sample was 52% female and 55% African-American. The average age was 15.1 years (standard deviation [SD] = 0.9, range 11.5-21.2).

## RESULTS

### Music Exposure and Cannabis Use

Participants were exposed to an average of 21.8 hours of popular music per week (SD = 18.1) and an estimated 40 cannabis references in music per day (SD = 104). Twelve percent of the sample (N = 108) had used cannabis in the past 30 days, and 32% (N = 286) of participants had ever used cannabis.

### Bivariate Analyses

Current use of cannabis was associated with higher exposure to cannabis in music, having a favorite artist with a higher number of songs with cannabis references, older age, lower grades, less demanding parenting, less responsive parenting, higher sensation seeking, and higher rebelliousness (Table 1). Ever use of cannabis was associated with higher exposure to cannabis in music, having a favorite artist with a higher number of songs with cannabis references, older age, Black race, lower grades, less demanding parenting, higher sensation seeking, and higher rebelliousness (Table 1).

While increasing cannabis exposure in popular music was associated with increased current and ever cannabis use (Figure 2, **Panel A**), cannabis exposure was not associated with current and ever alcohol use (Figure 2, **Panel B**).

### Primary Multivariable Analyses

In our primary analysis that controlled for all covariates, exposure to cannabis in music was independently associated with current cannabis use ($P_{\text{trend}}$ = .04). Compared with those in the lowest tertile of exposure to cannabis in music, those in the highest exposure tertile had nearly double the odds of having used cannabis in the past 30 days (OR = 1.83, 95% CI = 1.04-3.22; Table 2, Column 2). Other factors independently associated with current cannabis use included older age, lower grades, lower demanding parenting, and higher sensation seeking (Table 2, Column 2). Although there was a trend toward those with higher exposure to cannabis in music and having ever used cannabis, this trend was not statistically significant in the adjusted model (Table 2, Column 4).

### Secondary Multivariable Analyses

We conducted similar analyses with the secondary exposure measure—the student's favorite artist's number of songs with cannabis—in order to determine the robustness of the primary analyses. This exposure variable was also independently associated with current cannabis use ($P_{\text{trend}}$ = .02). Compared with those with the lowest exposure (favorite artist with 0 songs with cannabis references), those with the most exposure to cannabis (favorite artist with 3+ songs with cannabis references) had nearly double the odds of having used cannabis in the past 30 days (OR = 1.92, 95% CI = 1.09-3.38; Table 3, Column 2). In addition, this exposure variable was independently associated with ever cannabis use ($P_{\text{trend}}$ = .02).

Compared with those in the lowest tertile, those with the most exposure to cannabis in music had nearly double the odds of having ever used cannabis (OR = 1.67, 95% CI = 1.11-2.51; Table 3, Column 2).

### Additional Analyses

There were no statistically significant multivariable relationships between either of the cannabis exposure variables and either of the alcohol outcomes (data not shown). Additionally, there were no statistically significant multivariable relationships between overall media exposure and either outcome variable (data not shown).

## DISCUSSION

This study demonstrates that, among our sample of young adolescents, high exposure to cannabis in popular music was independently associated with higher levels of current cannabis use. Whereas there were consistent and significant relationships between cannabis exposure variables and cannabis outcomes, there were no significant relationships between cannabis exposure variables and sham alcohol outcomes. It is valuable that this study examined a large proportion of African-American participants who are at higher risk for cannabis smoking. This study was also innovative in that it used intensive algorithms to estimate exposure to cannabis-related content.

Our findings build on those of previous studies suggesting that exposure to specific content in popular music may be a risk factor for adolescent risk-taking behavior (36,37). Although most studies linking music and behavior have involved sexual behavior, this study extends those findings to the realm of substance use. Whereas previously it had been suggested that overall music exposure (non-content specific) was associated with cannabis use (30), this study suggests that exposure to cannabis-specific content may be particularly potent.

Although music lacks the visual elements of film and television, there are reasons why references in popular music may be as potent in its relationship with adolescent health behavior. First, there is rapidly increasing exposure to popular music, whereas exposure to films is much lower and exposure to television is decreasing (9). Also, music is known to be highly related to personal identity: young people often model themselves in terms of dress, behavior, and identity after musical figures (38-40), and the Social Cognitive Theory specifies that those with perceived similarity to behavior models will be more likely to imitate those behaviors.

Our findings may have implications for substance abuse education. Given that we found exposure to cannabis in music to be common (approximately 40 references per day), health lessons related to cannabis are likely to be dwarfed in young people's minds by the "lessons" they learn through music lyrics' representations of cannabis. It may be useful for health educators, health professionals, and curriculum designers to become familiar with the messages young people receive about substance abuse in their music, so that they can more effectively counter these messages. Innovative interventions and creative techniques are needed to encourage young people to think critically about the veracity of the substance use messages they receive in their media and to understand the very real consequences of these behaviors. One way of doing this may be to include more "media literacy" training — whereby young people learn to analyze and evaluate media portrayals of substance use and sexual behavior —in substance use programming (41-43). As media literacy related to tobacco use has been shown to be inversely associated with actual tobacco use in adolescents (43,44), media literacy may also be a valuable concept to address with other substances such as cannabis.

Our study was limited by its cross-sectional design. Although it is theoretically plausible that the music exposures precede cannabis smoking, further longitudinal research is needed to assess the directionality of **Arrow A** in Figure 1. This study was also limited in that we estimated exposure to cannabis in music based on only one favorite artist. However, because adolescents are much less likely than adults to listen to multiple types of music (9), it is likely that the content of an adolescent's favorite artist is largely representative of his or her overall exposure. Additionally, although we were able to control for a number of personal and environmental covariates, this data set did not provide peer cannabis use, which would be useful to examine in future studies. Similarly, we were not able to include other measures of overall genre preference in these analyses, which may be valuable to include in future analyses. Finally, it should be noted that coding elements such as cannabis representation in popular music can be subjective. It is for this reason that we employed a complex coding methodology and ensured that inter-rater agreement was adequate (11).

In summary, adolescents are heavily exposed to references to cannabis in popular music, and this exposure is associated with cannabis use among adolescents. These results provide support for the need for further research and educational intervention in this area.

## Acknowledgments

## REFERENCES

1. Heyman RB, Anglin TM, Copperman SM, et al. American Academy of Pediatrics. Committee on Substance Abuse. Marijuana: A continuing concern for pediatricians. Pediatrics. 1999; 104:982–5. [PubMed: 10506247]

2. Gruber AJ, Pope HG Jr. Marijuana use among adolescents. Pediatr Clin North Am. 2002; 49:389–413. [PubMed: 11993290]

3. Hall WD. Cannabis use and the mental health of young people. Aust N Z J Psychiatry. 2006; 40:105–13. [PubMed: 16476127]

4. Raphael B, Wooding S, Stevens G, Connor J. Comorbidity: cannabis and complexity. J Psychiatr Pract. 2005; 11:161–76. [PubMed: 15920390]

5. Lynskey M, Hall W. The effects of adolescent cannabis use on educational attainment: a review. Addiction. 2000; 95:1621–30. [PubMed: 11219366]

6. Degenhardt L, Hall W, Lynskey M. Exploring the association between cannabis use and depression. Addiction. 2003; 98:1493–504. [PubMed: 14616175]

7. Green B, Young R, Kavanagh D. Cannabis use and misuse prevalence among people with psychosis. Br J Psychiatry. 2005; 187:306–13. [PubMed: 16199787]

8. Arseneault L, Cannon M, Witton J, Murray RM. Causal association between cannabis and psychosis: examination of the evidence. Br J Psychiatry. 2004; 184:110–7. [PubMed: 14754822]

9. Rideout, V.; Roberts, D.; Foehr, U. Generation M: Media in the Lives of 8-18 Year-olds. Kaiser Family Foundation; Menlo Park, CA: 2005.

10. Roberts, DF.; Henriksen, L.; Christenson, PG. Substance Use in Popular Movies and Music. Office of National Drug Control Policy; Washington, DC: 1999.

11. Primack BA, Dalton MA, Carroll MV, Agarwal AA, Fine MJ. Content analysis of tobacco, alcohol, and other drugs in popular music. Arch Pediatr Adolesc Med. 2008; 162:169–75. [PubMed: 18250243]

12. Gidwani PP, Sobol A, DeJong W, Perrin JM, Gortmaker SL. Television viewing and initiation of smoking among youth. Pediatrics. 2002; 110:505–8. [PubMed: 12205251]

13. Sargent JD, Beach ML, Adachi-Mejia AM, et al. Exposure to movie smoking: its relation to smoking initiation among US adolescents. Pediatrics. 2005; 116:1183–91. [PubMed: 16264007]

14. Centers for Disease Control and Prevention. Cigarette Smoking Among Adults: United States, 2004. MMWR. 2005; 54:1121–47. [PubMed: 16280969]

15. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. JAMA. 1998; 279:511–5. [PubMed: 9480360]

16. Altman DG, Levine DW, Coeytaux R, Slade J, Jaffe R. Tobacco promotion and susceptibility to tobacco use among adolescents aged 12 through 17 years in a nationally representative sample. Am J Public Health. 1996; 86:1590–3. [PubMed: 8916525]

17. Wakefield M, Flay B, Nichter M, Giovino G. Role of the media in influencing trajectories of youth smoking. Addiction. 2003; 98(Suppl 1):79–103. [PubMed: 12752363]

18. Columbia University Center on Addiction and Substance Abuse. Teen tipplers: America's underage drinking epidemic. Columbia University; New York, NY: 2002.

19. Gruber EL, Thau HM, Hill DL, Fisher DA, Grube JW. Alcohol, tobacco and illicit substances in music videos: a content analysis of prevalence and genre. Journal of Adolescent Health. 2005; 37:81–3. [PubMed: 15963915]

20. DiFranza JR, Wellman RJ, Sargent JD, et al. Tobacco promotion and the initiation of tobacco use: assessing the evidence for causality. Pediatrics. 2006; 117:1237–1248.

21. Arnett JJ, Terhanian G. Adolescents' responses to cigarette advertising: Exposure, liking, and the appeal of smoking. Tobacco Control. 1998; 7:129–133. [PubMed: 9789930]

22. Wakefield M, Szczypka G, Terry-McElrath Y, et al. Mixed messages on tobacco: comparative exposure to public health, tobacco company- and pharmaceutical company-sponsored tobacco-related television campaigns in the United States, 1999-2003. Addiction. 2005; 100:1875–83. [PubMed: 16367989]

23. Hollingworth W, Ebel BE, McCarty CA, et al. Prevention of deaths from harmful drinking in the United States: the potential effects of tax increases and advertising bans on young drinkers. J Stud Alcohol. 2006; 67:300–8. [PubMed: 16562413]

24. Austin EW, Chen MJ, Grube JW. How does alcohol advertising influence underage drinking? The role of desirability, identification and skepticism. J Adolesc Health. 2006; 38:376–84. [PubMed: 16549298]

25. Martino SC, Collins RL, Elliott MN, et al. Exposure to degrading versus nondegrading music lyrics and sexual behavior among youth. Pediatrics. 2006; 118:e430–41. [PubMed: 16882784]

26. Primack BA, Douglas EL, Fine MJ, Dalton MA. Exposure to sexual lyrics in popular music and sexual experience among an urban population of adolescents. American Journal of Preventive Medicine. 2008 In Press.

27. Borzekowski, D.; Strasburger, VC. Tobacco, alcohol, and illicit drugs. In: Calvert, S.; Wilson, BJ., editors. Handbook of Media & Children. Blackwell; Boston, MA: 2008. p. 432-452.

28. Strasburger VC, Hendren RL. Rock music and music videos. Pediatr Ann. 1995; 24:97–103. [PubMed: 7724257]

29. Bandura A. Social cognitive theory: An agentive perspective. Annual Review of Psychology. 2001; 52:1–26.

30. Primack BA, Kraemer KL, Dalton MA, Fine MJ. Association between media exposure and marijuana and alcohol use in adolescents. Substance Use and Misuse. 2008 In Press.

31. Monitoring the Future. Monitoring the Future, Results from 2007. University of Michigan; Ann Arbor, MI: 2008.

32. Primack BA, Fine D, Yang CK, Wickett D, Zickmund S. Adolescents' impressions of antismoking media literacy education: qualitative results from a randomized controlled trial. Health Educ Res. 2008

33. Jackson C, Henriksen L, Foshee V. The Authoritative Parenting Index: predicting health risk behaviors among children and adolescents. Health Educ Behav. 1998; 25:319–37. [PubMed: 9615242]

34. Stephenson MT, Hoyle RH, Palmgreen P, Slater MD. Brief measures of sensation seeking for screening and large-scale surveys. Drug Alcohol Depend. 2003; 72:279–86. [PubMed: 14643945]

35. Smith, GM.; Fogg, CP. Psychological antecedents of teenage drug use. In: Simmons, R., editor. Research in community and mental health: An annual compilation of research. JAI; Greenwich, CT: 1979. p. 87-102.

36. Brown JD, L'Engle KL, Pardun CJ, et al. Sexy media matter: exposure to sexual content in music, movies, television, and magazines predicts black and white adolescents' sexual behavior. Pediatrics. 2006; 117:1018–27. [PubMed: 16585295]

37. Collins RL, Elliott MN, Berry SH, et al. Watching sex on television predicts adolescent initiation of sexual behavior. Pediatrics. 2004; 114:e280–9. [PubMed: 15342887]

38. Keen AW. Using music as a therapy tool to motivate troubled adolescents. Social Work in Health Care. 2004; 39:361–73. [PubMed: 15774401]

39. Mark A. Adolescents discuss themselves and drugs through music. Journal of Substance Abuse Treatment. 1986; 3:243–9. [PubMed: 3586073]

40. Took KJ, Weiss DS. The relationship between heavy metal and rap music and adolescent turmoil: real or artifact? Adolescence. 1994; 29:613–21. [PubMed: 7832025]

41. Thoman, E. Skills and strategies for media education. The Center for Media Literacy; 2003.

42. Buckingham, D. Media education: literacy, learning, and contemporary culture. Blackwell Publishing; Malden, MA: 2003.

43. Primack BA, Gold MA, Switzer GE, et al. Development and validation of a smoking media literacy scale. Arch Pediatr Adolesc Med. 2006; 160:369–374. [PubMed: 16585481]

44. Primack BA, Gold MA, Land SR, Fine MJ. Association of cigarette smoking and media literacy about smoking among adolescents. Journal of Adolescent Health. 2006; 39:465–472. [PubMed: 16982379]
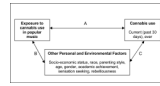
**Figure 1.**
Conceptual model.
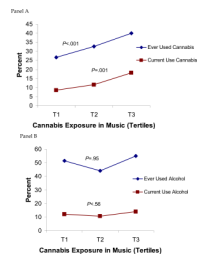
**FIGURE 2.**
These figures indicate the percentage of individuals with the indicated behavior when grouped according to exposure tertile, with T1 = Lowest tertile of exposure to cannabis in music; T2 = middle tertile; T3 = highest exposure. *P*-values refer to tests for trends based upon logistic regression analyses. Ever use of cannabis was defined as ever use, even a puff, during one's lifetime. Ever use of alcohol was defined as completion of at least one drink during one's lifetime. Current use referred to similar usage but in the past 30 days.

**Table 1**

Sample Characteristics by Cannabis Use (any use in last 30 days)

| | Whole Sample (N = 959) N* | Current Cannabis Use (N = 108) Row % | P | Ever Used Cannabis (N = 286) Row % | P |
|---|---|---|---|---|---|
| **Total cannabis exposure in music per week** [†] | | | .002 | | .001 |
| Lowest Tertile (0 references) | 439 | 8.61 | | 26.56 | |
| Middle Tertile (>0-169 references) | 248 | 11.64 | | 32.76 | |
| Highest Tertile (>169 references) | 241 | 18.22 | | 40.00 | |
| **Favorite artists' songs with cannabis** | | | .01 | | <.001 |
| 0 songs | 437 | 8.41 | | 26.44 | |
| 1-2 songs | 247 | 13.48 | | 29.13 | |
| 3+ songs | 275 | 16.34 | | 42.41 | |
| **Age** | | | .001 | | <.001 |
| ≤15 | 525 | 8.75 | | 25.25 | |
| >15 | 434 | 16.00 | | 39.75 | |
| **Gender** | | | .66 | | .61 |
| Male | 461 | 12.47 | | 30.82 | |
| Female | 498 | 11.51 | | 32.43 | |
| **Race** | | | | | |
| White | 380 | 10.68 | .33 | 26.58 | .01 |
| Black | 529 | 13.33 | .16 | 37.37 | <.001 |
| Other | 147 | 9.85 | .42 | 28.79 | .44 |
| **Maternal Education** | | | .95 | | .80 |
| Did not graduate high school | 233 | 11.76 | | 33.48 | |
| Graduated high school but not college | 328 | 11.61 | | 30.97 | |
| College degree or higher | 398 | 12.37 | | 31.18 | |
| **Grades** | | | <.001 | | <.001 |
| A's & B's | 511 | 6.34 | | 20.86 | |
| Lower than B's | 440 | 18.47 | | 44.58 | |
| **Demanding Parenting** | | | <.001 | | <.001 |
| Lowest Tertile (0-2) | 492 | 15.84 | | 37.53 | |

| | Whole Sample (N = 959) N* | Current Cannabis Use (N = 108) Row % | P | Ever Used Cannabis (N = 286) Row % | P |
|---|---|---|---|---|---|
| Middle Tertile (2.1-2.3) | 166 | 12.82 | | 29.49 | |
| Highest Tertile (2.4-3) | 292 | 5.00 | | 23.21 | |
| **Responsive Parenting** | | | .004 | | .08 |
| Lowest Tertile (0-1.7) | 394 | 16.35 | | 34.58 | |
| Middle Tertile (1.8-2.3) | 358 | 8.96 | | 31.94 | |
| Highest Tertile (2.4-3) | 199 | 8.95 | | 25.26 | |
| **Sensation Seeking** | | | <.001 | | <.001 |
| Lowest Tertile (0-1.5) | 395 | 8.22 | | 25.75 | |
| Middle Tertile (1.6-2) | 339 | 10.74 | | 31.90 | |
| Highest Tertile (2.1-3) | 218 | 20.67 | | 42.31 | |
| **Rebelliousness** | | | <.001 | | <.001 |
| Lowest Tertile (0-1.3) | 434 | 7.07 | | 20.24 | |
| Middle Tertile (1.4-1.7) | 201 | 11.52 | | 36.13 | |
| Highest Tertile (1.8-3) | 317 | 19.13 | | 44.63 | |

*Figures do not always sum to total sample size because of missing data.

†Computed with favorite artist's references/hour multiplied by self-reported

**Table 2**

Odds Ratios for Marijuana Use Based Upon Total Marijuana Exposure in Music Per Week

| | Current Marijuana Smoking N = 861 | | Ever Smoked Marijuana N = 861 | |
|---|---|---|---|---|
| | OR (95% CI) Unadjusted | OR (95% CI) Adjusted* | OR (95% CI) Unadjusted | OR (95% CI) Adjusted* |
| **Total marijuana exposure in music per week** | | | | |
| Lowest Tertile (0 References) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (>0-169 References) | 1.40 (0.83-2.37) | 1.33 (0.73-2.39) | 1.35 (0.95-1.91) | 1.16 (0.77-1.73) |
| Highest Tertile (>169 References) | 2.36 (1.46-3.82)[†] | 1.83 (1.04-3.22)[‡] | 1.84 (1.31-2.60)[†] | 1.29 (0.85-1.95) |
| **Age** | | | | |
| ≤15 | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| >15 | 1.99 (1.32-2.99)[‡] | 1.85 (1.18-2.92)[‡] | 1.95 (1.47-2.59)[†] | 2.00 (1.45-2.75)[†] |
| **Gender** | | | | |
| Male | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Female | 0.91 (0.61-1.36) | 1.17 (0.74-1.85) | 1.08 (0.81-1.43) | 1.31 (0.94-1.83) |
| **Race** | | | | |
| White | 0.81 (0.54-1.23) | 1.37 (0.60-3.13) | 0.67 (0.50-0.89)[‡] | 1.50 (0.85-2.68) |
| Black | 1.34 (0.89-2.02) | 1.26 (0.56-2.82) | 1.81 (1.36-2.42)[†] | 2.12 (1.22-3.69)[‡] |
| Other | 0.78 (0.42-1.43) | 0.77 (0.36-1.62) | 0.85 (0.57-1.28) | 1.01 (0.61-1.67) |
| **Maternal Education** | | | | |
| Did not graduate high school | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Graduated high school but not college | 0.99 (0.58-1.69) | 0.98 (0.53-1.80) | 0.89 (0.62-1.29) | 0.78 (0.51-1.19) |
| College degree or higher | 1.06 (0.63-1.77) | 1.28 (0.70-2.33) | 0.90 (0.63-1.28) | 0.84 (0.55-1.26) |
| **Grades** | | | | |
| A's & B's | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Lower than B's | 3.35 (2.15-5.21)[†] | 2.79 (1.70-4.57)[†] | 3.05 (2.28-4.09)[†] | 2.41 (1.73-.3.36)[†] |
| **Demanding Parenting** | | | | |
| Lowest Tertile (0-2) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (2.1-2.3) | 0.78 (0.46-1.33) | 0.66 (0.36-1.21) | 0.70 (0.47-1.03) | 0.61 (0.39-0.96)[‡] |
| Highest Tertile (2.4-3) | 0.28 (0.15-0.51)[†] | 0.30 (0.15-0.59)[†] | 0.50 (0.36-0.70)[†] | 0.56 (0.38-0.84)[‡] |
| **Responsive Parenting** | | | | |
| Lowest Tertile (0-1.7) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.8-2.3) | 0.50 (0.32-0.80)[‡] | 0.70 (0.42-1.17) | 0.89 (0.65-1.21) | 1.21 (0.85-1.73) |
| Highest Tertile (2.4-3) | 0.50 (0.28-0.89)[‡] | 1.06 (0.54-2.07) | 0.64 (0.43-0.94)[‡] | 1.12 (0.69-1.79) |
| **Sensation Seeking** | | | | |
| Lowest Tertile (0-1.5) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.6-2) | 1.34 (0.80-2.24) | 1.38 (0.77-2.44) | 1.35 (0.97-1.88) | 1.25 (0.86-1.82) |
| Highest Tertile (2.1-3) | 2.91 (1.76-4.81)[†] | 2.80 (1.53-5.11)[‡] | 2.11 (1.47-3.03)[†] | 1.89 (1.22-2.92)[‡] |

| | Current Marijuana Smoking N = 861 | | Ever Smoked Marijuana N = 861 | |
|---|---|---|---|---|
| | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] |
| **Rebelliousness** | | | | |
| Lowest Tertile (0-1.3) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.4-1.7) | 1.71 (0.95-3.06) | 1.00 (0.52-1.92) | 2.23 (1.52-3.26)[†] | 1.79 (1.17-2.74)[‡] |
| Highest Tertile (1.8-3) | 3.11 (1.93-5.00)[†] | 1.63 (0.93-2.85) | 3.18 (2.28-4.43)[†] | 2.40 (1.62-3.55)[†] |

[*] Adjusted for all variables in the table

[†] $P<.001$

[‡] $P<.05$

**Table 3**

Odds Ratios for Cannabis Use Based Upon Favorite Artists' Songs with Cannabis References

| | Current Cannabis Smoking N = 888 | | Ever Smoked Cannabis N = 888 | |
|---|---|---|---|---|
| | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] |
| **Favorite artists' songs with cannabis References** | | | | |
| 0 songs | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| 1-2 songs | 1.70 (1.02-2.83)[‡] | 1.51 (0.85-2.67) | 1.14 (0.80-1.64) | 0.97 (0.64-1.45) |
| 3+ songs | 2.13 (1.32-3.43)[‡] | 1.92 (1.09-3.38)[‡] | 2.05 (1.47-2.85)[†] | 1.67 (1.11-2.51)[‡] |
| **Age** | | | | |
| ≤15 | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| >15 | 1.99 (1.32-2.99)[‡] | 1.75 (1.12-2.73)[‡] | 1.95 (1.47-2.59)[†] | 1.88 (1.37-2.57)[†] |
| **Gender** | | | | |
| Male | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Female | 0.91 (0.61-1.36) | 1.24 (0.78-1.95) | 1.08 (0.81-1.43) | 1.46 (1.05-2.04)[‡] |
| **Race** | | | | |
| White | 0.81 (0.54-1.23) | 1.26 (0.56-2.87) | 0.67 (0.50-0.89)[‡] | 1.43 (0.81-2.53) |
| Black | 1.34 (0.89-2.02) | 1.20 (0.54-2.68) | 1.81 (1.36-2.42)[†] | 1.91 (1.10-3.29)[‡] |
| Other | 0.78 (0.42-1.43) | 0.75 (0.36-1.58) | 0.85 (0.57-1.28) | 1.03 (0.63-1.70) |
| **Maternal Education** | | | | |
| Did not graduate high school | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Graduated high school but not college | 0.99 (0.58-1.69) | 0.97 (0.54-1.76) | 0.89 (0.62-1.29) | 0.80 (0.53-1.21) |
| College degree or higher | 1.06 (0.63-1.77) | 1.22 (0.68-2.20) | 0.90 (0.63-1.28) | 0.85 (0.57-1.29) |
| **Grades** | | | | |
| A's & B's | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Lower than B's | 3.35 (2.15-5.21)[†] | 2.63 (1.61-4.28)[†] | 3.05 (2.28-4.09)[†] | 2.37 (1.70-3.29)[†] |
| **Demanding Parenting** | | | | |
| Lowest Tertile (0-2) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (2.1-2.3) | 0.78 (0.46-1.33) | 0.72 (0.40-1.29) | 0.70 (0.47-1.03) | 0.62 (0.40-0.97)[‡] |
| Highest Tertile (2.4-3) | 0.28 (0.15-0.51)[†] | 0.31 (0.16-0.60)[‡] | 0.50 (0.36-0.70)[†] | 0.57 (0.38-0.85)[‡] |
| **Responsive Parenting** | | | | |
| Lowest Tertile (0-1.7) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.8-2.3) | 0.50 (0.32-0.80)[‡] | 0.65 (0.39-1.08) | 0.89 (0.65-1.21) | 1.16 (0.82-1.65) |
| Highest Tertile (2.4-3) | 0.50 (0.28-0.89)[‡] | 0.96 (0.50-1.85) | 0.64 (0.43-0.94)[‡] | 1.06 (0.66-1.68) |
| **Sensation Seeking** | | | | |
| Lowest Tertile (0-1.5) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.6-2) | 1.34 (0.80-2.24) | 1.33 (0.76-2.34) | 1.35 (0.97-1.88) | 1.25 (0.86-1.81) |
| Highest Tertile (2.1-3) | 2.91 (1.76-4.81)[†] | 2.77 (1.53-4.99)[‡] | 2.11 (1.47-3.03)[†] | 2.01 (1.31-3.09)[‡] |
| **Rebelliousness** | | | | |

| | Current Cannabis Smoking N = 888 | | Ever Smoked Cannabis N = 888 | |
|---|---|---|---|---|
| | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] | OR (95% CI) Unadjusted | OR (95% CI) Adjusted[*] |
| Lowest Tertile (0-1.3) | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] | 1.0 [Reference] |
| Middle Tertile (1.4-1.7) | 1.71 (0.95-3.06) | 0.98 (0.51-1.88) | 2.23 (1.52-3.26)[†] | 1.69 (1.11-2.58)[‡] |
| Highest Tertile (1.8-3) | 3.11 (1.93-5.00)[†] | 1.75 (1.01-3.02)[‡] | 3.18 (2.28-4.43)[†] | 2.32 (1.58-3.40)[†] |

[*] Adjusted for all variables in the table

[†] $P<.001$

[‡] $P<.05$