

# Risky Music-Listening Behaviors and Associated Health-Risk Behaviors

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## KEY WORDS

health risk behaviors, binge drinking, cannabis use, risky music listening, unsafe sexual intercourse

## ABBREVIATIONS

dB—decibel

dBA—dB, A-weighting filter

MP3—Moving Picture Experts Group-1 Audio Layer 3

NIHL—noise-induced hearing loss

PEL—permissible exposure limits

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**WHAT'S KNOWN ON THIS SUBJECT:** Traditional health-risk behaviors, such as problem drinking, smoking, marijuana use, and unsafe sexual behavior are interrelated and not isolated events in the life of adolescents. New health-risk behaviors are emerging: risky music-listening behaviors, which may induce hearing loss.



**WHAT THIS STUDY ADDS:** Risky music-listening behaviors are highly associated with traditional health-risk behaviors. Risky MP3-player listeners are often cannabis users. Frequent visitors of music venues are less often cannabis users, but are often binge drinkers and have sexual intercourse without using a condom.

## abstract

FREE

**OBJECTIVE:** To examine, among adolescents and emerging adults attending inner-city lower education, associations between risky music-listening behaviors (from MP3 players and in discotheques and at pop concerts) and more traditional health-risk behaviors: substance use (cigarettes, alcohol, cannabis, and hard drugs) and unsafe sexual intercourse.

**METHODS:** A total of 944 students in Dutch inner-city senior-secondary vocational schools completed questionnaires about their music-listening and traditional health-risk behaviors. Multiple logistic regression analyses were used to examine associations between music-listening and traditional health-risk behaviors.

**RESULTS:** Risky MP3-player listeners used cannabis more often during the past 4 weeks. Students exposed to risky sound levels during discotheque and pop concert attendance used cannabis less often during the past 4 weeks, were more often binge drinkers, and reported inconsistent condom use during sexual intercourse.

**CONCLUSIONS:** The coexistence of risky music-listening behaviors with other health-risk behaviors provides evidence in support of the integration of risky music-listening behaviors within research on and programs aimed at reducing more traditional health-risk behaviors, such as substance abuse and unsafe sexual intercourse. *Pediatrics* 2012;129:1097–1103

It is well known that “traditional” health-risk behaviors, such as problem drinking, marijuana use, and unsafe sexual behavior are interrelated and not isolated events in the life of adolescents.<sup>1</sup> When adolescents take 1 risk, they also tend to take other risks.<sup>2,3</sup> Moreover, these health-risk behaviors have been found to be more prevalent among adolescents of lower socioeconomic groups.<sup>4</sup>

More recently, the rapid development of digital technology has led to the production of new kinds of music players whose sound quality at higher volumes is much better, because the sound is no longer distorted,<sup>5</sup> leading to “new” health-risk behaviors: risky music-listening behaviors.<sup>6–8</sup> The sound level of these players may range between 75 and 105 dB; ear-bud type insert ear phones produce maximum levels ranging from 88 to 113 dB across different devices. In the worst scenario, it is possible to reach levels of ~120 dB.<sup>5</sup> In addition to MP3-player music exposure, many young people are exposed to high-volume music in discotheques, where mean sound levels range from 104 to 112 dB, and at pop concerts where sound levels are often even higher.<sup>9,10</sup>

Combined exposures to high-volume music can have cumulative effects with regard to hearing impairment and thus increase the risk of hearing loss. At sound levels equivalent to 90 dB, A-weighting filter (dBA) or above, the average permanent hearing loss after 10 years of exposure may reach values that produce a level of hearing loss (20 dB) that is noticeable to individual people themselves. Sound levels equivalent to 100 dBA or above may cause a permanent hearing loss of ~40 to 45 dB after 10 years of exposure.<sup>11</sup> It has been estimated that ~20% of Dutch adolescents aged 12 to 16 years are at risk for developing noise-induced hearing loss (NIHL) after 5 years because of

listening at potentially hazardous music levels.<sup>8</sup>

Thus, as with more traditional risk behaviors such as substance use and unsafe sexual intercourse, of which the adverse health consequences have been recognized as important public health issues,<sup>12</sup> risky music-listening behaviors pose a threat to young peoples’ future health.<sup>5</sup> Individuals with NIHL often have reduced psychological and social function, such as increased feelings of isolation, depression, loneliness, anger, and fear.<sup>13,14</sup> Also, it is a growing social problem that young people are limited in their choice of, or even rejected from, jobs because of preventable NIHL.<sup>9</sup>

Risky music-listening behaviors have been linked to the more traditional health-risk behaviors,<sup>15,16</sup> but interrelations between risky music-listening behaviors and traditional health-risk behaviors remain unclear. Such insight is needed to assist in the development of integrated preventive interventions. As with traditional health-risk behaviors, risky music-listening behaviors are more prevalent among youth attending lower educational levels, especially as adolescents attending prevocational education report relatively high levels of music exposure, both through head- or earphones on MP3 players as well as during discotheque attendance.<sup>17,18</sup> Therefore, the aim of this study was to examine among adolescents and emerging adults attending a lower educational level, that is, senior-secondary vocational education, associations between risky music-listening behaviors and more traditional health-risk behaviors such as substance use and unsafe sexual intercourse.

## METHODS

### Study Population and Procedure

A total of 1228 students (aged ~15–25 years) of 2 Dutch inner-city senior-secondary vocational schools were

invited to complete questionnaires about their sociodemographics and music-listening and traditional health-risk behaviors (see Appendix) under supervision at school. The response was 77.9% ( $n = 956$ ); 272 students did not complete the questionnaire because of illness, visiting a doctor or nurse, staying away without leave, or unknown reasons; resulting in a total of 956 questionnaires. We excluded 12 questionnaires because of an age of >25 years; thus, 944 questionnaires were used in the analyses. Participants’ ages ranged from 15 to 25 years (mean 18; SD 2). A total of 63% were female, and 66.3% were of non-Dutch ethnicity. Table 1 gives an overview of the sociodemographic characteristics of the study population. Administration of the questionnaire at schools was conducted by specially trained researchers and public health promoters of the Municipal Public Health Service and/or a teacher. All data were gathered within and as part of existing research of preventive youth health care on health and lifestyle among senior-secondary vocational education. Students received information about the study; participation was voluntary and anonymous. Separate informed consent therefore was not requested. This study conformed to the principles embodied in the Declaration of Helsinki.<sup>19</sup>

The questionnaire included items on participants’ gender and age; whether the participant shared a household with at least 1 of his or her own parents (yes, no); and country of birth of participant and both parents. Ethnicity (Dutch, non-Dutch) was determined on the basis of mother’s and father’s country/countries of birth according to definitions of Statistics Netherlands.<sup>20</sup>

### Health-Risk Behaviors

Estimation of risky music-listening behaviors (MP3 player listening and discotheque and pop concert attendance)

**TABLE 1** Sociodemographic Characteristics of Study Population (*N* = 944)

	Frequency in Study Population (Unless Otherwise Specified)
Mean age, y	18 (SD 2; range, 15–25)
Gender	
Female	594 (62.9%)
Ethnicity	
Non-Dutch	626 (66.3%)
Home situation	
Living with parent(s)	746 (79.0%)

previously has been described in detail.<sup>8</sup> Within current European occupational safety standards,<sup>21</sup> music volume levels equal to or exceeding the equivalent of 80 dB (dB/dBA) for 40 hours per week are assumed to be potentially damaging. However, in the report of the Scientific Committee on Emerging and Newly Identified Health Risks, it is assumed that listening for 1 hour a day to a sound level of >89 dBA is potentially damaging. Because sound pressure levels are measured on a logarithmic scale, they cannot be added or averaged arithmetically; adding 2 sounds of equal pressure levels and durations results in a total pressure level with that same duration that is only 3 dB higher than each individual sound pressure level.<sup>22</sup> For example, if you add up an exposure of 80 dBA during 1 hour to another exposure of 80 dBA during 1 hour, the sum is equivalent to 80 dBA during 2 hours, but also equivalent to 83 dBA during 1 hour. As another example, by applying the principle that a doubling in level (+3 dB) can be offset by halving the permissible exposure duration,<sup>23,24</sup> it can be calculated that listening 7 hours per week to a music level of 89 dB is equal to listening for 56 hours per week to a music level of 80 dBA. Therefore, we chose to use a loosened 56-hours criterion instead of the more stringent safety standard of 40 hours; that is, 16 hours are added for the weekend days, because music listening is not restricted to working days.

To estimate a weekly music-listening dose based on reported exposure times and estimated decibel levels, we first calculated permissible exposure limits (PELs) for the estimated decibel levels of each participant per music source, by using the equation  $PEL_{(week)} = 56/2^{(L-80)/3}$ , where L stands for the estimated dBA level.<sup>23</sup> Second, each respondent's actual exposure time was divided by the PEL to compute his or her estimated weekly music-listening dose.<sup>23</sup> To evaluate risk behavior, responses were dichotomized into adolescents who were considered not to be exposed to risky music levels (dose <1; listening on average <1 hour per day to an equivalent music level of 89 dBA) and those who were considered to be exposed to risky music levels (dose ≥1; listening on average ≥1 hour per day to an equivalent music level of 89 dBA).

Traditional health-risk behaviors were categorized as follows: current daily cigarette smoking (yes/no); binge drinking, drank 5 or more alcoholic drinks in a row on 1 occasion at least once in the past 4 weeks (yes/no); cannabis use in the past 4 weeks (yes/no); hard drug use (Ecstasy, cocaine, amphetamines, and/or heroin) in the past 4 weeks (yes/no); and inconsistent use of condom during sexual intercourse (yes/no).

### Statistical Analysis

Statistical analyses were performed by using SPSS (version 15; SPSS Inc, Chicago, IL). Frequency tables were used to explore the health-risk behaviors of the total study population (*N* = 944), and females (*n* = 594) and males (*n* = 350); frequency differences of the health-risk behaviors were examined through  $\chi^2$  statistics. To explore interrelations between health-risk behaviors, multiple logistic regression analyses were performed in which 1 behavior was the dependent variable and the other behavior was the independent variable

(adjusted for age, gender, ethnicity, and home situation). The resulting odds ratios indicate the risk for a behavior to be reported present under the condition that the other behavior was reported also to be present. Multivariate odds ratios and their 95% confidence intervals were calculated with multiple logistic regression analyses to explore for both music-listening behaviors the association with more traditional health-risk behaviors (adjusted for age, gender, ethnicity, and home situation). In the latter analyses, only traditional health-risk behaviors were included that were found significantly related to music-listening behaviors in the former analyses. Any *P* values of <.05 were considered to be statistically significant.

### RESULTS

We estimated that 30.4% of the study population exceeded the revised safety threshold for MP3-player use; with regard to music from discotheques and pop concerts, 48.1% exceeded the threshold. Regarding substance use, frequencies ranged between 5.5% (hard drugs during the past 4 weeks) and 33.2% (binge drinking in the past 4 weeks), and 37.5% reported inconsistent use of condoms during sexual intercourse (Table 2). Except for MP3-player use, cigarette smoking, and inconsistent use of condoms during sexual intercourse, in comparison with females, males reported more often unhealthy-lifestyle behaviors. Table 3 shows that, except for hard-drug use during the past 4 weeks with risky music-listening behaviors, all health-risk behaviors were significantly correlated with each other.

Table 4 presents results of the multiple regression analyses. Risky MP3-player listeners more often used cannabis during the past 4 weeks. Students exposed to risky sound levels during discotheque and pop concert attendance

**TABLE 2** Unhealthy Lifestyle Behaviors of Study Population (*N* = 944)

Unhealthy Lifestyle Behaviors	Total <i>N</i> = 944	Females <i>n</i> = 594	Males <i>n</i> = 350	<i>P</i> <sup>a</sup>
Music exposure <sup>b</sup>				
MP3 players (past month)	30.4	31.3	28.8	
Discotheque and pop concert visits (past year)	48.1	44.1	54.8	**
Substance use				
Cigarette smoking (current)	33.1	33.3	32.9	
Binge drinking <sup>c</sup> (past 4 wk)	33.2	29.6	39.5	**
Cannabis (past 4 wk)	13.3	10.3	18.7	**
Hard drugs (past 4 wk)	5.5	3.4	9.2	***
Sexual behavior				
Inconsistent use of condoms <sup>d</sup>	37.5	37.5	37.8	

Values reported are percentages.

<sup>a</sup> Females compared with males. \*\**P* < .01, \*\*\**P* < .001.

<sup>b</sup> Average exposure equivalent to sound levels of 89 dBA during ≥1 h per day.

<sup>c</sup> Drank 5 or more alcoholic drinks in a row on 1 occasion at least once.

<sup>d</sup> Reported to “not always” use condoms during sexual intercourse.

less often used cannabis during the past 4 weeks, were more often binge drinkers, and reported inconsistent condom use during sexual intercourse. No gender differences were present in these associations.

## DISCUSSION

This study highlights the need to regard high-volume music listening as a risk factor for risk-taking behavior. Risky music-listening behaviors were highly correlated, and it is well known that combined exposures to high-volume music increases the risk of hearing loss. In addition, both risky music-listening behaviors were associated with more traditional health-risk behaviors such as the use of substances and unsafe sexual intercourse.

Although the risky music-listening behaviors were highly correlated, it seems that 2 distinct groups can be distinguished when looking at coexistence with other health-risk behaviors.

First, risky MP3-player listeners were often also cannabis users. The combination of cannabis use and risky MP3-player listening could be related to the existential period in life that constitutes adolescence and emerging adulthood, not only because of the positive feeling to be alive and the experience of existential meaning, but also as something that can fill existential emptiness.<sup>25</sup> Previously, the experience of intrinsic rewards was found to be an important correlate of adolescents' risky-MP3 player listening, implying that the need for music is important for

young people and perhaps for their psychological well-being.<sup>18</sup> It is also known that cannabis users have a need for internal sensations (internally generated feelings)<sup>26–28</sup> and that cannabis generates feelings of happiness and relaxation.<sup>29</sup> Furthermore, it enhances activities, that is, music sounds better with cannabis use. It could be that this subgroup of listeners want to experience a feeling of “getting lost” in the music and to cut oneself off from one's surroundings,<sup>18,30</sup> which may be intensified by using cannabis while listening to high-volume music on an MP3 player. Therefore, interventions aimed at reducing cannabis use should also take into account risky MP3-player use and vice versa, while facilitating the experience of internal rewards and sensations in a safe way. For example, manufacturers of MP3 players and earphones should be encouraged to create a safer listening environment by producing players and phones that enable people to experience intrinsic rewards and sensations while listening at lower music levels and without using cannabis.

Second, frequent visitors of discotheques and pop concerts reported less often the use of cannabis, but more often binge drinking and sexual intercourse without using a condom. The use of alcohol is thought to impair cognitive processes, including the ability to make

**TABLE 3** Associations Between Unhealthy Lifestyles

	MP3 Player <sup>a</sup>	Music Venues <sup>b</sup>	Smoking <sup>c</sup>	Binge Drinking <sup>d</sup>	Cannabis Use <sup>e</sup>	Hard Drug Use <sup>e</sup>
MP3 player <sup>a</sup>						
Music venues <sup>b</sup>	2.22 (1.64–3.01)					
Smoking <sup>c</sup>	1.64 (1.21–2.22)	1.70 (1.26–2.28)				
Binge drinking <sup>d</sup>	1.70 (1.25–2.31)	6.22 (4.47–8.65)	3.06 (2.24–4.18)			
Cannabis use <sup>e</sup>	2.28 (1.53–3.41)	1.66 (1.10–2.51)	9.71 (6.07–15.54)	5.29 (3.42–8.17)		
Hard drug use <sup>e</sup>	1.22 (0.66–2.25)	1.76 (0.95–3.24)	2.96 (1.60–5.48)	3.47 (1.86–6.49)	9.53 (5.04–18.01)	
Inconsistent condom use <sup>f</sup>	1.44 (1.05–1.97)	2.85 (2.08–3.91)	2.06 (1.51–2.80)	2.91 (2.11–4.00)	2.72 (1.78–4.18)	1.72 (0.91–3.23)

Values reported are odds ratios (95% confidence interval). Odds ratios are adjusted for age, gender, ethnicity, and home situation

<sup>a</sup> Risky MP3-player music listening; listening on average ≥1 hour per day to an equivalent music level of 89 dBA.

<sup>b</sup> Risky music listening during discotheque and pop concert attendance; listening on average ≥1 hour per day to an equivalent music level of 89 dBA.

<sup>c</sup> Daily cigarette smoking.

<sup>d</sup> Drank 5 or more alcoholic drinks in a row on 1 occasion at least once in the past 4 wk.

<sup>e</sup> Use in the past 4 wk.

<sup>f</sup> Reported to “not always” use condoms during sexual intercourse.



**TABLE 4** Multivariate Odds Ratios and 95% Confidence Intervals From Multiple Logistic Regression Analyses With Risky Music-Listening Behaviors as Dependent Variables and Other, More Traditional, Unhealthy Lifestyle Behaviors as Independent Variables

Unhealthy Lifestyle Behaviors	MP3 Player Use	Music Venues <sup>a</sup>
Unsafe MP3 player use		2.07 (1.46–2.94)
Unsafe exposure in music venues <sup>a</sup>	2.06 (1.46–2.90)	
Cigarette smoking (current/daily)	1.19 (0.84–1.68)	1.12 (0.77–1.63)
Binge drinking <sup>b</sup> (past 4 wk)	1.01 (0.70–1.45)	5.94 (4.09–8.61)
Cannabis use (past 4 wk)	1.99 (1.26–3.16)	0.57 (0.34–0.97)
Inconsistent condom use <sup>c</sup>	1.10 (0.78–1.55)	2.03 (1.41–2.91)

Values reported are odds ratios (95% confidence interval). Odds ratios are adjusted for age, gender, ethnicity, and home situation. Risky music listening means listening at an equivalent sound level of  $\geq 89$  dBA for 1 hour per day or 7 hours per week.

<sup>a</sup> Risky music exposure during discotheque and pop concert attendance.

<sup>b</sup> Drank 5 or more alcoholic drinks in a row on 1 occasion at least once.

<sup>c</sup> Reported to “not always” use condoms during sexual intercourse.

clear judgments, which can make people “loosen up” and feel more socially confident and comfortable initiating or engaging in sex, and reducing the likelihood that condoms would be used during sexual intercourse.<sup>31</sup> Furthermore, alcohol has a greater impact on attitudes and intentions toward unprotected sex when individuals are sexually aroused.<sup>32</sup> High-volume music in music venues provides its visitors with an opportunity to congregate without having to communicate; this is referred to as the “social noise phenomenon.”<sup>33</sup> Because loud music prevents communication at distances of  $<1$  m, it enables people to move inside the personal space of members of the opposite sex to communicate with them, however limited the mode of communication may be.<sup>33</sup> Therefore, it may well be possible that people meet and explore each other at music venues before they have unsafe sex. Thus, interventions to reduce the occurrence of unprotected sex, for example, might best be implemented in contexts where people will be making

the decision to have unprotected sex, such as in discotheques or at pop concerts. A discotheque or pop concert could not only be a place where hearing protection is provided, but also where condoms are provided. In addition, inhibiting cues could be provided by posters with warnings against alcohol abuse and unsafe sex at discotheque entrances or by printing messages on admission tickets.

This study has several limitations, 1 of which was the use of a convenience sample of students attending senior-secondary vocational education; however, most of the characteristics of the study group reflected those of this subgroup of Dutch inner-city adolescents and emerging adults. Although the proportion of females attending inner-city senior-secondary vocational education is somewhat greater than the proportion of males, the proportion of females was relatively greater in our sample.<sup>20</sup> Also, we have no information about the behaviors of nonparticipants

in the study. With regard to selective nonresponse, our nonparticipation rate was 22.1%; this may have affected the results. The data used in our study were cross-sectional and self-reported. Dichotomization of variables reduces statistical power to detect a relation and leads to a loss of effect size.<sup>34,35</sup> However, we chose to dichotomize the behaviors into people who did or did not perform unhealthy behavior. This may have resulted in a loss of information about individual differences. It could be possible that there are small differences between the individuals that score close to the cut-off value. However, because our primary interest was in comparing people who do not perform unhealthy behaviors and people who do perform unhealthy behaviors, even if it is only 1 time, we chose to dichotomize into people who did or did not perform unhealthy behavior.

## CONCLUSIONS

The high prevalence of risky music-listening behavior among youth attending lower education and its coexistence with other health-risk behaviors has important implications for both research on understanding the behaviors and planning interventions. The results provide evidence in support of the integration of risky music-listening behaviors within research on and programs aimed at reducing more traditional health-risk behaviors such as substance abuse and unsafe sexual intercourse.

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**APPENDIX** Survey Items

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- 1 Sociodemographic characteristics
- Are you a boy or a girl?
  - What is your age in years?
  - What is your country of birth?
  - What is your father's country of birth?
  - What is your mother's country of birth?
  - With whom do you share a household?
- 2 Music-listening behavior
- MP3 player*
- Do you ever listen to music through earphones on a portable music player (MP3 player)?
  - On average, over the past month, on how many days per week did you listen to music on an MP3 player?
  - How long do you normally use your MP3 player per day?
  - At what volume-control level do you normally listen?
- Discotheque and pop concerts*
- Have you been to a discotheque in the past year?
  - On average, over the past year, how many times per month did you go to a discotheque?
  - During the past year, how often did you go to a pop concert?
- 3 Traditional health-risk behaviors
- On average, how many cigarettes do you smoke per day?
  - During the past 4 wk, on how many days did you have 5 or more drinks of alcohol in a row?
  - On average, over the past 4 wk, how often did you use cannabis?
  - On average, over the past 4 wk, how often did you use Ecstasy?
  - On average, over the past 4 wk, how often did you use cocaine?
  - On average, over the past 4 wk, how often did you use amphetamines?
  - On average, over the past 4 wk, how often did you use heroin?
  - During sexual intercourse, how often do you use condoms?
-

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