

## Preliminary results of the study on usage of portable music players and future plans for public policy in Slovenia

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### ABSTRACT

According to the information from the national database "Outpatient health care at primary level", doctor's visits due to tinnitus have increased among the population in Slovenia in the last ten years. With the collaboration of regional institutes of public health and the Slovenian network of schools for health in Europe, the National institute of public health has launched several activities to raise the awareness of noise and the importance of hearing protection, mainly among young people. In the school year 2011/12 a pilot study was conducted to assess teenagers' (15-17-years-old) habits of listening to music, using portable music players (PMP). In the pilot study, in which participated 420 students from twenty high schools, all members of the Slovenian Network of Schools for Health in Europe, the OHRKAN<sup>1</sup> questionnaire, developed in Germany, was used. Following the experience of the pilot study, the questionnaire was modified for online use. The main study ("How often do you listen to the music and what kind of music you prefer?") was performed in April 2013, involving 1,635 students 12 to 19 years old. The results of the study show that 12.4% of students might be at risk for permanent hearing damage if they persist in frequent and protracted listening of loud music using PMP. Our main goal for the future is to raise the awareness of harmful effects of noise, and try to reduce unnecessary exposure of young people to harmful sounds, thereby preventing hearing loss and tinnitus.

### INTRODUCTION

Adolescents use PMP and listen to loud music for diverse reasons. Among most frequent reasons indicated by Danish teenagers are that they feel better and enjoy the music that way, they can lose themselves in loud music, get energy from it, and also can relax better when the music is loud (Reiness et al. 2013). However, the scientific committee on emerging and newly identified health risks warns that approximately 5% to 10% of the PMP listeners are at risk of developing permanent hearing loss after five or more years of exposure (more than one hour a day) to loud music at high volume control setting (SCENIHR 2008). This theoretical safety assessment is based on the assumption that sound energy is crucial in causing hearing damage. The time and level of exposure summed over time can give an estimate of possible risk of hearing damage. Accordingly, exposure limit values were set in European Directive 2003/10/EC on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents, including noise. However, conclusions based on extrapolation of estimates from workers to adolescents exposed to non-industrial noise should be treated with caution (Fligor 2011). Furthermore, Fligor points out that the restrictions aiming to prevent all auditory injury should not be too strict lest they diminish the benefits and

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<sup>1</sup> The name "Ohrkan" was made-up for the study from the German word for ear "Ohr" as well as the German word for thunderstorm "Orkan".

motivation to moderate music-listening habits. Excessive exposure to loud music continues to be discussed in several studies and reviews as a possible cause of temporary or permanent hearing damage (Fligor 2011; Gilles et al. 2013; Keith et al. 2011; Muchnik et al. 2012; Twardella et al. 2013; Vogel et al. 2007, 2008, 2009, 2010, 2011).

The diversity of situations, including the use of different music players, earphones or headphones, the habits of listening to music in diverse sound environments that may involve noisy traffic streets or calm nature, and the preference for varying music genres, lead to difficulties in evaluating exposure to loud music. The purpose of our study was, therefore, focused on tinnitus, the symptom that may be an alarming sign of excess exposure to noise. The analysis of data from our national outpatient health care at primary level shows that the number of people with tinnitus looking for medical help has increased between 2000 to 2011 from 2,808 to 3,931 (Jeram & Butinar 2013). The number of visits increased more among older patients but the change was also observed in younger patients. Similar trends were also observed at the secondary health care level. But the collection method of our current medical statistics data does not allow assessing the incidence of people with tinnitus in Slovenia, a country with the population of two million inhabitants.

The need for raising among adolescents the awareness of possible hearing damage from excessive exposure to loud music was identified at the National Institute of Public Health. Due to the general concern about possible auditory injury and tinnitus, following protracted and frequent listening to loud music, our main focus was primarily on adolescents who could prevent potential hearing damage by modifying their music-listening habits. The actions for raising awareness were performed in collaboration with nine regional institutes of public health and the Slovenian network of schools for health in Europe. The pilot study involved twenty high schools and 420 students (age 15-17), in the school year 2010/2011. The results of our pilot study have shown that nearly 18 % of students have music-listening habits that might lead to excess exposure, and 17 students have experienced tinnitus already several times (Jeram & Breznikar 2012).

The aim of the online survey was to address a larger number of adolescents and collect more information on habits of teenagers, who listen to music using portable music devices and to raise among them awareness about the possibilities of hearing damage and protection from it. The survey was conducted in April 2013 as one of the activities celebrating the 18<sup>th</sup> International noise awareness day.

## **METHODS**

### **Questionnaire**

The survey was based on the OHRKAN questionnaire for students (Twardella 2010), translated from German to Slovenian, and slightly adjusted for our purpose. Its six sets of questions involved: general information on age and gender, habits of music-listening in the last twelve months, length and loudness level of listening to the music in the last seven days, exposure to sources of music or noise other than PMP, observations of any hearing damage symptoms, and self-reported hearing ability.

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## Respondents

The basis for the sampling frame was the framework of the Ministry of education, science and sports. The sampling frame was all students of elementary (7<sup>th</sup> and 9<sup>th</sup>) grades and all students of 2<sup>nd</sup> and 4<sup>th</sup> grades of high schools. The sampling unit consisted of a class or section. From the target population of 72,218 students we randomly selected a sample size by systematic sampling. The sample consisted of 4,667 students: 2,331 students from 109 elementary schools and 2,336 students from 79 high schools. The mode of interview was online survey (CAWI). The survey was conducted with the help of the 1KA ([www.1ka.si](http://www.1ka.si)) online surveying application. Students answered the questions via internet in the classrooms under supervision of teachers, who had received instructions for conducting the survey. Participation was anonymous and in agreement with the parents of elementary school students and the National medical ethics committee.

## Statistical analysis

The response rate was 35.0%. The cause for a low response rate was mainly due to electronic invitation distribution being the only way of our communication with schools. Therefore, the interpretation of our results should be addressed with caution. All returned questionnaires (1753) were checked and 118 were excluded due to mistakes observed in the procedure of answering the questions. SPSS software was used for data analysis. Results were mainly presented in tables and graphs. Statistically significant differences between shares were established using the Chi-Square test. The value of statistical significance of  $p \leq 0.05$  was set for the significance level.

## Definition of participants at risk

The potential risk of excess exposure to loud music was evaluated according to SCENIHR criteria for time and level of exposure (SCENIHR 2008) and information relating the self-reported volume settings on the PMP to expected listening levels of sound (Portnuff et al. 2011).

## RESULTS

### Respondents

There were 1,635 respondents, 48.8% boys and 51.2% girls, representing all nine regions of Slovenia. The four age groups contained 520, 423, 433 and 259 students of average ages of 12, 14, 16 and 18 years, respectively. The group of the oldest students was smaller than others and also represented the lowest proportion of all students of the same age at the national level. Elementary school population was represented by more girls in both grades (ratio to boys was 1.1), whereas the high school by more boys in the second grade (ratio to girls was 1.1). In the fourth grade of high school, the number of boys and girls was almost identical, respectively, 129 and 130.

### Music-listening habits in last 12 month

The question on frequency of music-listening in the last 12 months was answered by 1,618 students: 9.5% of them never listened to music using PMP and 22.7% listened only a few times per month. However, 67.8% of students listened weekly or daily. Among more frequent PMP users we have not identified significant differences either between girls and boys or between elementary and high schools. Looking into more details we observed that the most frequent listeners were the ninth graders (75.5%),

followed by second and fourth grade students of high school (71.1% and 65.6%). The lowest proportion of frequent PMP users was found among the youngest students (60.0%).

### **Typical duration of music-listening**

The question "How long did the listening to the music usually lasted on a day of your typical listening habits?" was answered by 1,417 students: 50.8% listened to the music less than one hour, and 29.4% up to two hours; 9.7% listened from two to three hours; 4.0% three to four hours and 6.1% more than four hours. Boys (22.1%) reported longer listening times than girls (17.6%). Comparing the age groups, the largest proportion of longer listening times was reported by ninth graders (22.5%), followed by 16-years-old students in high school (22.0%). These proportions were lower in the oldest and youngest groups of students, 17.0% and 16.9%, respectively.

### **Volume setting on PMP at a typical listening event in the last 7 days**

The question "In the last seven days, have you listened to the music via headphones using PMP?" was answered by 1,590 students, of which 1,084 (68.2%), among them 71.3% of the girls and 64.9% of the boys, said that they used the PMP in the last seven days. A smaller number of students (1,057) answered the question on volume level setting. Among them 43.8% set the volume level below 70% and 56.2% above 70% of the maximum level on their own PMP. A larger proportion of boys (57.7%) than girls (54.9%) listen to music louder. This proportion is larger for high school students (60.3%) than for elementary school students (53.4%). The volume set to the maximum level was reported by 17.2% of students (182). To a slightly different question, 144 students (13.6%) answered that they always set the music to the highest level. Among them, the proportion was the greatest in older boys (18.8%), followed by younger boys (15.3%) and younger girls (12.6%), followed by older girls (8.1%).

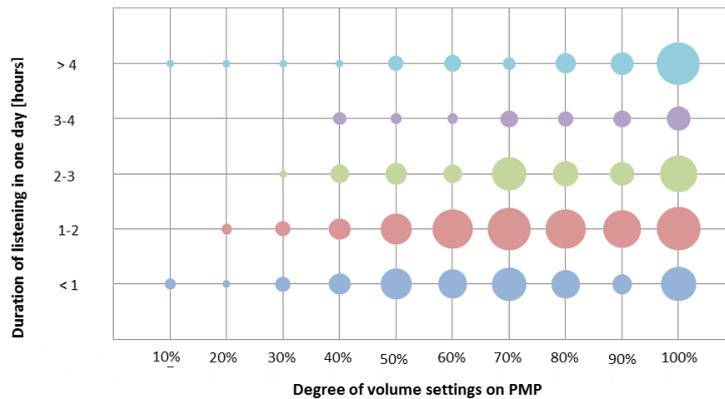
### **Participants at risk**

The answers to the questions on the frequency of listening to music using PMP in the last 12 months, on the duration of listening at a typical event and on the usual volume setting on PMP were the base for identifying a group of students that might be at risk of possible hearing damage, if their declared music-listening habits were to persist for several years. These students (360; 22.0%) reported listening to the music daily or weekly, setting the volume level at 70% or more and listening to the music more than one hour per event. In this group, we have further identified three subgroups. For the purpose of this evaluation, we assumed that weekly listening to the music means three days a week. We also assumed that students had one listening event per day. The first subgroup of 54 students (15%) have a very low risk, second subgroup of 103 students (28.6%) may be at risk, and the third subgroup of 203 students (56.4%) will probably be at risk if they don't change their music-listening habits. The ratio between girls and boys in the latter group was 1.05.

Looking at the entire group of students included in the study, there are 12.4% (203) students whose music-listening habits could lead to hearing damage if their behaviour persists over a longer period. An additional 6.3% of students might be at risk as well but the probability is lower. However, 42.8% students use PMP safely, 25.2% do not use PMP at all and 13.3% did not answer the corresponding questions.

The number of students whose listening habits are cause for concern increases with their age: from 23.6% for the 12-years-old and 28.6% for 14-years-old elementary

school students to 33.0% for the 16-years-old high school students, but drops considerably to 14.8% for the 18-years-old high school students.

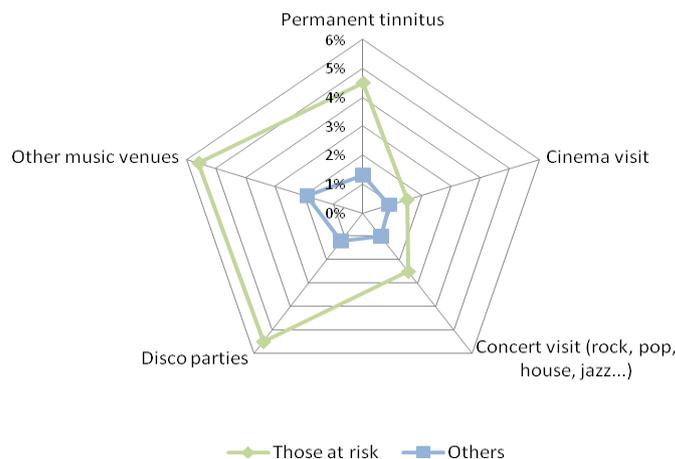


**Figure 1:** The number of participants that used PMP every day and listened to the music at different volume settings and for different duration is represented by the size of the circles (n=466). Source: NIJZ, Anketa Glasba 2013

Figure 1 shows that the majority of students that use PMP every day tend to listen to the music up to two hours per day and set the volume from 60% to 100%. Only 32 students estimated their listening of music at the highest level lasting for more than 4 hours and stand out in the graph. It may be that those students exaggerated their reported behaviour and, therefore, their results should be looked at with caution. The same graphs for students listening to the music less frequently (weekly or monthly) would show that they also tend to listen to the music for shorter durations (up to two hours) and at a lower volume settings (from 50% to 70% of volume maximum).

### Hearing ability and tinnitus

Most students (89.1%; 1,563 participants) assessed their hearing abilities as very good or good; 8.7% as moderate, and 1.9% believe their hearing is bad or very bad.



**Figure 2:** The group of students at greater risk (n=203) compared to the rest of participants in our study (n=1432), considering the proportion of students with permanent tinnitus, students often visiting a party in disco, visiting a party in other places with music, visiting a concert (rock, pop, house, jazz...) and visiting a cinema (p <0.05). Source: NIJZ, Anketa Glasba 2013

Five students (0.3%) confirmed the use of a hearing aid. A third of students (34.0%) reported that they never experienced ringing in the ears (tinnitus). Almost the same percentage (34.4%) experienced tinnitus more than once while 27.2% only once. Permanent tinnitus was reported by 27 students (1.7%).

Data in Figure 2 show a statistically significant difference in habits between the students at potential risk for hearing damage due to excess exposure to loud music compared to the rest of students in the study.

## CONCLUSIONS

The results of the study show that nearly 12.4% of students of age 12 to 19, might be at risk for permanent hearing damage if they persist in their frequent and long lasting listening of loud music, using PMP. The risk is increasing with students' age up to second grade of high school and decreases for the group of the oldest students. This trend could be an optimistic sign, showing that adolescents up to 16 years of age might be exaggerating their listening to loud music but this should be confirmed by further studies. Statistically significant difference was observed in incidence of tinnitus between the students at risk and the rest of the participants. Therefore, we conclude that education and raising awareness among younger students, their parents and teachers could play an important role in public health action plans. However, we need to be cautious in interpretations of our results due to low response rate, especially in the case of fourth graders where the response was the lowest. In the future we plan to establish collaboration with the National Education Institute and improve our system of communication with schools.

We also plan to establish a stronger collaboration with medical organisations performing systematic screening of hearing in preschool children and elementary and high school students. Furthermore, education of preschool teachers with focus on noise awareness, development of listening skills in children and improving sound environment in kindergartens and schools is also one of the near future priorities.

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