

Personal audio devices use patterns associated with risks of hearing loss and compromised road safety among medical students in Delhi

Saurav Basu¹, Suneela Garg, M Meghachandra Singh, Charu Kohli

¹ Maulana Azad Medical College, New Delhi, India (corresponding author)

Corresponding author's e-mail address: saurav.basu1983@gmail.com

ABSTRACT

Background

Over 1 billion young people globally are at risk of hearing loss and road traffic accidents due to unsafe listening practices while using personal audio devices (music players, smartphones).

Objective

Our objective was to ascertain the knowledge of risks and patterns of usage of personal audio devices (PADs) among medical undergraduates at a medical college in Delhi, India. Participants aged ≥ 18 years were selected through simple random sampling and those willing were enrolled after written informed consent. Data was collected using a pretested self-administered questionnaire during December' 2016 – Jan' 2017. Ethical approval was granted by the Institutional Ethics Committee, Maulana Azad Medical College, New Delhi.

Results

We conducted a cross sectional study and enrolled 154 male and 96 women students ($n = 250$). The practice of listening to music using PADs at loud volume for ≥ 2 hours/day and ≥ 4 days per week was reported by 48 (19.2%) participants. Unsafe pedestrian or riding practices during PAD use was reported by 67 (26.8%) participants.

Discussion

Unsafe listening practices using PADs is potentially compromising the health and safety of young people in India.

INTRODUCTION

Recreational noise induced hearing loss is emerging as a major public health challenge globally since the advent and rapid universalization of Personal audio devices (PADs) [1]. Studies have shown that the output of most PADs often exceed safe levels (80 dB) and are a health hazard since prolonged hearing for over an hour daily can cause noise induced hearing loss among their users [2-3]. The World Health Organization estimates that 1.1 billion young people worldwide including almost half of all teenagers and young adults below 35 years could be at risk of hearing loss due to unsafe listening practices while using PADs [1]. Personal audio devices permit

listening to music privately without disturbing nearby people and their use has grown exponentially in the past two decades especially in developing nations like India. According to the Pew Global Research, only 15% of Indians used smartphones as of 2016 although the proportion was much higher in urban demographics with higher socioeconomic status [4]. The ubiquity of mobile phone especially smartphone possession has universalized PAD use [1]. Moreover, studies have suggested that adolescents and young adults are at greater risk due to higher likelihood of not taking necessary precautions while using PADs which is important for protect their hearing and safety [5-8].

Furthermore, the use of PADs while walking, driving, cycling is also associated with subversion of road safety and risk of accidents by compromising the necessary auditory attention and responses required during all such activities [9-11]. Lichenstein et al found 116 cases of deaths or injury of pedestrians wearing headphones through a retrospective study involving US National Electronic Injury Surveillance System between 2004 and 2011 [12]. India has one of the highest road traffic accident burden in the world with pedestrians constituting a substantial mortality burden [13].

There is hence a need for generation of critical evidence for enactment of an evidence based policy which protects the health of PAD users. Similarly, understanding the practices of PAD users while on the road need to be better understood in order to help policy makers frame appropriate legislation upholding road safety for all. There is paucity of literature from India regarding the knowledge of risks of PADs and their associated usage patterns in young at risk populations including medical students.

We thereby conducted this study with the objective of ascertaining the risks associated with the use of PADs among medical students in Delhi by understanding their patterns of PAD usage.

MATERIALS AND METHODS

We conducted a cross sectional study among medical undergraduate students at the Maulana Azad Medical College, New Delhi, India between Dec' 2016 to Jan' 2017. The inclusion criteria was any undergraduate medical student currently studying at the Maulana Azad Medical College and aged ≥ 18 years. Students were explained reasons for conducting the study, written informed consent was taken from all the study participants and no personally identifiable information was collected during the course of the study. Ethical approval for conducting the study was granted by the Institutional Ethics Committee, Maulana Azad Medical College, New Delhi.

We selected the study participants through simple random sampling from 1st, 2nd and 3rd year students and distributed questionnaires to 270 subjects, of which 20 were returned incomplete and were excluded from the final analysis.

We used a pretested self-administered questionnaire which collected data from the study participants on their Personal Audio Device preferences, knowledge of risks associated with PADs, patterns of usage and health risks. The items in the questionnaire were prepared based on an exhaustive review of the literature and consultation with experts. To assess the typical preferred listening volume of the subjects while using PADs, the subjects were asked "On most days, what kind of loudness levels do you prefer while listening to music on your Personal Audio device?" with 5 options on a 5 item Likert type scale with options as 1 (Very Loud), 2 (Somewhat loud), 3 (Loud), 4 (Medium) and 5 (Low Volume). We eliminated the mid-point in our rating scales to limit the socially desirable bias observed during pretesting of the questionnaire.

To further ascertain the effect of PAD listening on compliance with expected road safety norms, the subjects were asked "In which of the following situations and how frequently do you listen to

music on your Personal Audio device?" with the situations including driving, walking on the road, crossing the street, cycling and riding a motorbike and the options being 1 (Very likely), 2 (Quite Likely), 3 (Somewhat likely), 4 (Unlikely) and 5 (No).

The assessment of the perceived risks like hearing loss, ringing in ears, irritability, insomnia, inability to concentrate and hypertension associated with PAD usage was made through questions using 5 item Likert type scale with options being 1 (Very Likely), 2 (Quite Likely), 3 (Somewhat likely), 4 (Likely) and 5 (Unlikely).

We checked data forms prior to entry and corrections were made as required. We entered the data in MS EXCEL which was cleaned and then subject to statistical analysis using SPSS Version 17. Chi square test was used to find association between the categorical variables with $P \leq 0.05$ accepted as statistically significant.

RESULTS

The mean age of the study participants was 19.89 ± 1.648 years (mean \pm s.d). We enrolled 154 males and 96 women students. The principle personal audio device (PAD) for music listening was the mobile phone which was preferred by 95.6% (239) with smartphones being used by 93.2% (233) of the study participants. With regards to the type of earphones, headphones were being used by 51.6% (129) and earbuds by 33.6% (84) participants. Among the 250 participants, duration of PAD usage was > 5 years in 42% (105), 2-5 years in 33.6% (84) and < 2 years in 24% (60). Frequency of PAD usage in a typical week was 4.6 ± 2.3 days. Male students were found with greater PAD usage frequency in a typical week compared to women students with the difference being statistically significant. However, on a typical day of the week, PAD usage was restricted to ≤ 1 hour among 70% (175) participants. (Table 1).

Table 1. Personal Audio Device use characteristics in the study population, Delhi, 2016

Variable	Males (N = 154)	Women (N = 96)	P value	Total n (%)
Duration of PAD usage				
< 2 years	42 (27.2%)	19 (19.8%)	P = 0.281	61 (24.4%)
2-5 years	54 (35%)	30 (31.2%)		84 (33.6%)
> 5 years	58 (37.66%)	47 (49%)		105 (42%)
Number of days of PAD usage/week				
0-3 days	47 (30.5%)	51 (53.1%)	P < 0.01	98 (39.2%)
$\geq 4-7$ days	107 (69.5%)	45 (46.9%)		152 (60.8%)
Number of hours of total PAD use/day				
≤ 1 hour	112 (72.7%)	63 (65.7%)	P = 0.23	175 (70%)
≥ 2 hours	42 (27.3%)	33 (34.3%)		75 (30%)

Number of hours of continuous PAD use/day				
≤ 1 hour	121 (78.5%)	73 (76.1%)	P = 0.59	192 (76.6%)
> 1 hour	33 (21.5%)	23 (23.9%)		56 (22.4%)

Music at medium and low volumes was preferred by 59.2% (148) participants. However, male students compared to women students were significantly at higher risk of reporting PAD use for ≥ 4 days in a week with ≥ 2 hours/day at either loud, somewhat loud and very loud volumes ($p \leq 0.01$).

Table 2. Personal audio device volume preferences in the study population, Delhi 2016

PAD Volume	PAD use ≥ 4 days/ week and ≥ 2 hours/day		Total (N = 250)
	Males (n = 154)	Women (n = 96)	
Very Loud	18 (11.68%)	5 (5.2%)	23 (9.2%)
Somewhat Loud	5 (3.2%)	3 (3.1%)	8 (3.2%)
Loud	15 (9.7%)	3 (3.1%)	18 (7.2%)
Total at higher risk	38 (24.6%)	11 (11.4%)	49 (19.6%)

The probable association between long term PAD usage and the risks of hearing loss and ringing in ears was considered not significant by 24% (60) and 24.8% (62) of the participants with male students showing higher likelihood of not believing in any such association. The safe duration for listening using PADs was reported as not known by 49.6% (124) participants while 41.6% (104) considered just ≤ 1 hour to be the optimum safe duration (Table 3).

Table 3. Perceptions regarding Personal audio devices and risks in the study population, 2016

Association with PAD use	Males (n = 154)	Women (n = 96)	Total (N = 250)
Hearing loss			
Very likely	27 (17.5%)	18 (18.7%)	45 (18%)
Quite/Somewhat/Likely	80 (52%)	65 (67.7%)	145 (58%)
Unlikely	47 (30.5%)	13 (13.6%)	60 (24%)
Irritability			
Very likely	17 (11%)	13 (13.5%)	30 (12%)
Quite/Somewhat/Likely	86 (55.8%)	64 (66.6%)	150 (60%)

Unlikely	51 (34%)	19 (19.7%)	70 (38%)
Insomnia			
Very likely	16 (10.3%)	10 (10.4%)	26 (10.4%)
Quite/Somewhat/Likely	77 (50%)	64 (66.6%)	141 (56.4%)
Unlikely	61 (39.7%)	22 (23%)	83 (33.2%)
Headache			
Very likely	26 (16.8%)	24 (25%)	50 (20%)
Quite/Somewhat/Likely	85 (55.1%)	62 (64.5%)	147 (58.8%)
Unlikely	43 (17.2%)	10 (10.5%)	53 (21.2%)
Hypertension			
Very likely	8 (5.1%)	8 (8.4%)	16 (6.4%)
Quiet/Somewhat/Likely	57 (37.1%)	44 (45.8%)	101 (40.4%)
Unlikely	89 (47.8%)	44 (45.8%)	133 (53.2%)
Ringing in ears			
Very likely	24 (15.6%)	28 (29.2%)	52 (20.8%)
Quiet/Somewhat/Likely	82 (53.2%)	54 (56.2%)	136 (54.4%)
Unlikely	48 (31.2%)	14 (14.6%)	62 (24.8%)
Safe limit for PAD use at normal (not loud) volumes			
≤ 1 hour	64 (41.5%)	40 (41.6%)	104 (41.6%)
2-3 hours	42 (27.2%)	31 (32.3%)	73 (29.2%)
4-5 hours	7 (4.5%)	4 (4.1%)	11 (4.4%)
No specific limit	10 (6.4%)	3 (3)	13 (5.2%)
Don't know	31 (20.1%)	18 (19%)	49 (19.6%)
Safe limit for PAD use when used continuously			
≤ 1 hour	51 (33.1%)	43 (44.8%)	94 (37.6%)
2-3 hours	42 (27.3%)	16 (16.7%)	58 (23.2%)
4-5 hours	6 (3.9%)	4 (4.2%)	10 (4%)
No specific limit	13 (8.4%)	1 (1%)	14 (5.6%)
Don't know	42 (27.2%)	32 (33.3%)	74 (29.6%)

Self-reported hearing loss and ringing in ears (tinnitus) which persisted for at least 3 days within the previous 6 months was reported by 9.6% (24) and 5.6% (14) participants respectively. Music at loud or higher volumes was preferred by 53% (18) participants who reported any or both the symptoms (n = 34). However, only 26% (65) of the study participants reported having undergone a hearing examination within the previous 5 years.

The use of PAD while driving, walking on the road, cycling, crossing the streets and riding a motorbike were reported as either 'Likely' or 'Quite Likely' by 26.8% (67), 17.6% (44), 24.4% (61), 8% (20) and 7.2% (18) of the study participants.

DISCUSSION

The safe use of PADs is essential for protecting the health of young people and road safety especially in the developing world. We conducted a cross sectional study among medical students in Delhi to evaluate their patterns of usage of PADs and risks associated with their use. We found music at loud volumes was the preferred mode of listening for one fifth of the study participants. Male students were more likely to listen to music using PADs with greater frequency in a typical week and also less likely to be concerned with potentially adverse effects on hearing due to long term PAD usage compared to women students.

Almost one fourth of our study participants reported undesirable pattern of PAD usage which potentially compromised road safety. Almost one in ten participants reported crossing the streets while still using their PADs. The finding is similar to that reported in the study by Thompson et al in Washington USA who observed crossing behaviour of 1102 pedestrians and found 11.2% subjects listening to music while crossing the road [14].

In our study, majority (70%) of the participants were using PADs for ≤ 1 hour per day while the rest were using PADs for ≥ 2 hours. The students perceived susceptibility regarding hearing loss and PAD use was known to three fourth of the participants. In contrast, the study by Rekha et al in a medical college in Mangalore, India reported PAD usage of ≥ 1 hour in majority (77.7%) of the students while less than one fifth (18.8%) reported awareness of adverse health effects on prolonged PAD usage [15]. Similarly, Ansari et al conducted a cross sectional study among Iranian adolescent students and found almost half (49.6%) of them listening to somewhat loud or very loud music, while one-third of the students listened to music > 2 hours a day [16].

In our study, the history of hearing loss and tinnitus was reported by only a few students although almost three fourth of the participants had not undergone hearing examination in the previous 5 years which could have led to missing out on existing cases of mild hearing loss. Our findings are similar to those of Hoover et al in a study who among US college students in California reported hearing loss and tinnitus in 11.2% and 15.9% of the subjects respectively [17].

In conclusion, most medical students in Delhi were found to frequent PAD users for listening to music at variable volumes often possessing inadequate knowledge of health effects of prolonged PAD use especially on their hearing while also reporting undesirable and unsafe use of PADs which compromise road safety.

There are certain limitations with the study. We conducted the study among medical students who may be expected to possess better knowledge of adverse effects on prolonged PAD usage and hence the results cannot be easily generalized to other demographics. We also could not use an objective method for assessment of the volume level of the PADs used by the participants. There is also possibility of self-desirability bias leading to underreporting of undesirable PAD usage especially regarding those actions which are usually known to undermine road safety.

Future studies especially in the developing world including India should evaluate PAD usage in other demographics of at risk populations like school going adolescents and non-medical college students to ascertain the extent of the problem. IEC activities discouraging PAD use behaviour which threaten road safety should also be adopted by governing agencies and traffic authorities.

Acknowledgments

We would like to thank all the students who consented to participate in the study.

REFERENCES

- [1]. Hearing loss due to recreational exposure to loud sounds: A review. Geneva: World Health Organization; 2015.
- [2]. Fligor BJ, Cox LC. Output levels of commercially available Personal compact disc players and the potential risk to hearing. *Ear Hear.* 2004;25:513-27.
- [3]. Williams W. Noise exposure levels from Personal stereo use. *Int J Audiol.* 2005;44:231-6.
- [4]. Pew Global. [Internet]. Accessed 1.4.2017
<http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/>
- [5]. Vogel I, Brug J, van der Ploeg CP, Raat H. Strategies for the prevention of MP3-induced hearing loss among adolescents: expert opinions from a Delphi study. *American Academy of Pediatrics*; 2009. Sep 3];123(5):1257–62. doi: 10.1542/peds.2008-2291.
- [6]. Vogel I, van de Looij-Jansen PM, Mieloo CL, Burdorf A, de Waart F. Risky music- listening behaviors and associated health-risk behaviors. *Pediatrics* 2012;129(6):1097-103. doi: 10.1542/peds.2011-1948.
- [7]. Portnuff CD, Fligor BJ, Arehart KH. Teenage use of Portable listening devices: a hazard to hearing? *J Am Acad Audiol.* 2011;22(10):663-77. doi: 10.3766/jaaa.22.10.5.
- [8]. Vogel I, Brug J, Van der Ploeg CP, Raat H (2011) Adolescents risky MP3-player listening and its psychosocial correlates. *Health Educ Res* 26(2):254–64.
- [9]. Young KL, Salmon PM. Examining the relationship between driver distraction and driving errors: a discussion of theory, studies and methods. *Safety Sci.* 2012;50(2):165-74.
- [10]. Horie Y, Toriizuka T. A study on the influence of headphones in auditory perceptual function. *Work.* 2012;41(Suppl. 1):5417-8. doi: 10.3233/WOR-2012-0839-5417.
- [11]. Schwebel DC, Stavrinou D, Byington KW, Davis T, O'Neal EE, de Jong D. Distraction and pedestrian safety: how talking on the phone, texting, and listening to music impact crossing the street. *Accid Anal Preven.* 2012;45: 266–71. doi: 10.1016/j.aap.2011.07.011
- [12]. Lichtenstein R, Smith DC, Ambrose JL, et al Headphone use and pedestrian injury and death in the United States: 2004–2011 *Injury Prevention* 2012;18:287-290.
- [13]. Hsiao M, Malhotra A, Thakur JS, et al Road traffic injury mortality and its mechanisms in India: nationally representative mortality survey of 1.1 million homes *BMJ Open* 2013;3:e002621. doi: 10.1136/bmjopen-2013-002621

- [14]. Thompson LL, Rivara FP, Ayyagari RC, Ebel BE. Impact of social and technological distraction on pedestrian crossing behaviour: an observational study. *Injury Prevention*. 2013;19(4):232-237. doi:10.1136/injuryprev-2012-040601.
- [15]. Rekha T, Mithra P, Bukelo M, Unnikrishnan B, Kumar N, Ballala K. Perceptions and practices regarding use of personal listening devices among medical students in coastal South India. *Noise Heal*. 2011 Sep-Oct;13(54):329-32. doi: 10.4103/1463-1741.85500.
- [16]. Ansari H, Mohammadpoorasl A, Rostami F, Maleki A, Sahebihagh MH, Naieni KH. Pattern of Use of Earphone and Music Player Devices among Iranian Adolescents. *International Journal of Preventive Medicine*. 2014;5(6):776-781.
- [17]. Hoover A, Krishnamurti S. Survey of college students' MP3 listening: Habits, safety issues, attitudes, and education. *Am J Audiol* 2010;19:73-83.