Section: Community Medicine

Original Research Article

HEARING IMPAIRMENT AND ITS ASSOCIATED FACTORS AMONG PRE UNIVERSITY COLLEGE STUDENTS USING PERSONAL LISTENING DEVICES IN KOLAR – A CROSS-SECTIONAL STUDY

Angayarkanni.P[1], Vishwas.S.[2], Ravi Shankar.S[3], Ujval.M[4]

[1]*Final year post graduate, Department of Community Medicine, Sri Devaraj URS Medical College, Kolar, Karnataka, India.*
[2]*Associate Professor, Department of Community Medicine, Sri Devaraj URS Medical College, Kolar, Karnataka, India.*
[3]*Assistant Professor in Biostatistiscs, Sri Devaraj URS Medical College, Kolar, Karnataka, India.*
[4]*Assistant Professor, Department of ENT, Sri Devaraj URS Medical College, Kolar, Karnataka, India.*

Received *: 16/02/2026*
Received in revised form *: 04/04/2026*
Accepted *: 22/04/2026*

Corresponding Author:
Dr. Angayarkanni.P,
Final year post graduate ,Department of Community Medicine, Sri Devaraj Urs Medical College, Kolar, Karnataka, India.
Email: kanipinki27@gmail.com

DOI: 10.70034/ijmedph.2026.2.157

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 922-927

ABSTRACT

Background: Hearing loss is a growing public health concern in adolescents and young adults in part due to unsafe listening practices associated with personal listening devices (PLDs). Recreational noise exposure because of extended and high-volume PLD use is a well-known preventable risk factor for noise-induced hearing loss. **Objectives:** To estimate the prevalence of likely hearing impairment using hearWHO app among PLD-using PU college students. To identify the factors associated with likely hearing impairment.

Materials and Methods: A cross-sectional analytical study was carried out among 360 Preuniversity college students aged 15-18 years who are regular users of PLDs. Students were selected from government and private colleges by the stratified random sampling. Information was gathered using a predesigned semi structured questionnaire validated questionnaire that included sociodemographic profile, pattern of use of PLD and awareness. Hearing screening was based on the hearWHO mobile app, with results as follows: hearing >75 (good hearing), 50–75 (follow-up needed), and <50 (suspected hearing impairment). Data was analyzed by SPSS 22.

Results: About 61% of participants were male and 53% were aged 17-18 years. PLD was mostly used for entertainment (50.7%), 60% had a daily PLD use of ≥4 h and 17.8% listened at high volumes. HearWHO screening found that 23.5% of the students likely had hearing impairment and 53.7% needed to be followed regularly. Associated factors of likely hearing impairment was male gender (OR=2.67), positive family history of hearing impairment (OR=5.94), daily use over 4 hours/day (OR=1.97), high-volume listening (OR=4.58) and the absence of listening breaks (OR=3,49).

Conclusion: Despite its high educational level, a large proportion of our PU students appeared to present with incipient hearing impairment related to modifiable listening habits. Mobile-based apps such as the hearWHO application can provide an inexpensive method for early screening. Prevention of future hearing impairment requires an inclusion of safe listening education and regular hearing screening in school health programmes.

Keywords: Audiometry, PLD, Noise, Hearing health.

INTRODUCTION

Hearing loss is a growing public health issue globally with profound consequences for communication, education, psychosocial development and personal quality of life. World Health Organization (WHO) latest data suggests that more than 430 million people have disabling hearing loss with the pace of increase set to accelerate due to an usage of PLD and sustained exposure to noise.[1,2]

Recreational exposure to noise from personal listening devices (PLDs), such as smartphones, earbuds and headphones, is an established preventable risk factor for permanent auditory damage mainly in older children, adolescents and young adults.[3,4] Global evidence shows that many young people engage in unsafe listening, with frequent exposure to sound levels sufficient to cause noise-induced hearing loss; prolonged personal listening device use is also linked to early cochlear changes on high-frequency audiometry, highlighting the need for greater awareness among regular users.[4-7]

Hearing loss is a critical and ignored burden for all ages in India. Community prevalence of hearing loss varies between 6-26.9% and of disabling hearing loss is within the range 4.5-18.3% across studies in India.8 National reports also emphasize the continued failure to uptake, with early identification and management of hearing loss in the younger age group more specifically.[9] Use of mobile and wireless PLDs is widespread among Indian adolescents and young adults,[10] yet few have correlated usage patterns with hearing status.[8,9]

A major recent work from South India highlighted that 26.1% of medical students using PLDs were identified as potential candidates for having hearing loss and almost 50% indicated that they should be screened regularly.[7] Though significant, the above findings pertain to medical students and not generalizable to adolescents and college going students as a whole indicating a clear knowledge gap. Knowledge of hearing loss and its correlates among PU students might be relevant because they use heavy amount of digital media for study as well as entertainment. Young individuals typically exceed safe listening guidelines and their at-risk behaviors could highlight the importance of preventive counseling and broader public health interventions about NIHL.

Findings from this study will help in the development of effective health education interventions that integrate safe listening into school and college health services and support the World Health Organization (WHO) Make Listening Safe campaign to prevent future hearing-related disability across socioeconomic status.[3,4,7] Therefore, this study planned to estimate the prevalence of likely hearing impairment based on hear WHO app scores and identify their determinants among students studying in pre university colleges of kolar who were PLDs.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted among Pre-University (PU) college students aged 15–18 years who used personal listening devices (PLDs) such as earphones or headphones for academic or personal purposes. The study was carried out in government and private PU colleges in Kolar district, Karnataka. Students aged 15–18 years who reported regular use of PLDs and were willing to participate with informed consent were included in the study. Students with present or recent ear discharge, those undergoing treatment for ear infections, those with previously diagnosed congenital hearing abnormalities, and those absent on the day of data collection were excluded from the study.

The sample size was calculated based on a prevalence of 26.1% reported by Ritikaa S et al. among PLD users, using the formula $N = Z^2PQ / L^2$ with 95% confidence level and 5% absolute precision, resulting in a minimum sample size of 360 participants, including a 20% allowance for non-response. Stratified random sampling was employed, where PU colleges in Kolar district were stratified according to management type (government and private). Four colleges were selected using computer-generated random sampling, and from each college 90 eligible students aged 15–18 years were selected through simple random sampling, resulting in a total sample of 360 students.

Data were collected using a pre-tested semi-structured questionnaire that assessed sociodemographic characteristics, patterns of PLD use, awareness regarding hearing health, and hearing screening scores using the hearWHO mobile application developed by the World Health Organization. The hearWHO application is a validated screening tool with 82% sensitivity and 95% specificity, generates scores ranging from 0 to 100, reflecting signal-to-noise ratio thresholds. Hearing screening was conducted in a quiet environment, and scores were categorized as >75 (good hearing), 50–75 (requiring follow-up), and <50 (likely hearing impairment). Prior to screening, otoscopy and tuning fork examinations were performed. The questionnaire underwent content validation, pilot testing, and reliability testing, yielding a Cronbach's alpha of 0.84. Data were entered in Microsoft Excel and analyzed using SPSS version 22. Descriptive statistics such as frequencies and percentages were used for categorical variables, while mean and standard deviation were calculated for continuous variables. Chi-square test was applied to assess associations, with $p < 0.05$ considered statistically significant.

RESULTS

Among 360 PU college students more than half (53%) were those aged 17–18 years and 61% were male. Most of the students were from upper middle/lower middle socioeconomic class (67%) and above half of them lived in urban areas (54.6%). Nearly 12% reported a family history hearing problems and recent ear infection was rare (3%). [Table 1]

Entertainment was reported as the most frequent PLD use (50.7 per cent) followed by academic combined with entertainment use (28.1 per cent). PLDs users

had been using PLDs for a mean of 3.5 years (SD = 2.6) and Bluetooth headphones were the most used device (63.7%). Nearly 60% reported daily use of a PLD ≥4 hours, and 17.8% listened to loud volume levels (>75%). Active noise cancelling enabled devices were used by over half of the subjects (53.7%). Ironically, 56.3% of the respondents did not interrupt long time listening sessions and 17.2% slept with PLDs on. [Table 2]

Among the 360 PU College students nearly 23.5% students were found to likely have hearing impairment (Score < 50) by hearWHO app screening followed by 53.7% requiring regular follow up screening (Score 50-75) as depicted in Figure 1.

On bivariate analysis the variables significantly associated with likely hearing impairment were Male gender (OR = 2.67, p = 0.0003), positive family history of hearing impairment (OR = 5.94, p <.0001), daily PLD use ≥4 hours (OR = 1.97, p = 0.012), regular high-volume listening (OR = 4.58, p <0.0001) and absence of breaks in-between long listening hours (OR=3.49, p<0.0001). [Table 3]

Table 1: Baseline characteristics among the study participants

S No	Characteristics	Frequency (N = 360)	Percentage (%)
1.	**Age (in Years)**		
	15 – 16	169	47%
	17 - 18	191	53%
2.	**Gender**		
	Male	220	61%
	Female	140	39%
3.	**Socioeconomic status**		
	Upper Class	49	13.6%
	Upper middle /Lower middle	241	67%
	Upper Lower / Lower	70	19.4%
4.	**Type of residence**		
	Urban	197	54.6%
	Rural	163	45.4%
5.	**Family history of hearing problems**		
	Yes	43	12%
	No	317	88%
6.	**History of ear infection in the past 1 Year**		
	Yes	349	97%
	No	11	3%

Table 2: Personal listening device usage related characteristics (N – 650)

Characteristics	Government PU College n (%)	Private PU College n (%)	Overall n (%)
Purpose for which Personal listening device is used*			
Education	29 (16%)	47 (26.3%)	76 (21.2%)
Entertainment	108 (60%)	75 (41.4%)	183 (50.7%)
Both	43 (24%)	58 (32.3%)	101 (28.1%)
Years of using PLD			
< 3 Years	94 (52%)	56 (31.3%)	150 (41.6%)
3 – 5 Years	66 (37%)	74 (41%)	140 (39%)
6 - 10 Years	20 (11%)	50 (27.7%)	70 (19.4%)
Type of PLD used*			
Earphone Wired	42 (23.5%)	59 (33%)	101 (28.2%)
Earphone Bluetooth	110 (61%)	120 (66.5%)	229 (63.7%)
Headphone Wired	13 (7%)	21 (11.5%)	33 (9.3%)
Headphone Bluetooth	43 (24%)	49 (27%)	92 (25.5%)
All of these	5 (3%)	12 (6.5%)	17 (4.7%)
Daily hours of PLD usage			
< 4 Hours a day	75 (41.5%)	69 (38%)	144 (40%)
≥ 4 Hours a day	105 (58.5%)	31 (62%)	216 (60%)
Maximum volume regularly used			
< 50%	11 (6.4%)	20 (11%)	31 (8.7%)
50 - 75%	130 (72%)	135 (75%)	265 (73.5%)
> 75%	39 (21.6%)	25 (14%)	64 (17.8%)
Presence of active noise cancellation feature in PLD			
Yes	76 (42%)	120 (65.5%)	193 (53.7%)
No	104 (58%)	60 (34.5%)	167 (46.3%)
Take breaks in between long listening hours			
Yes	81 (45%)	69 (38.5%)	157 (43.7%)
No	99 (55%)	111 (61.5%)	203 (56.3%)
Sleep with PLD devices on			
Yes	20 (11%)	42 (23.5%)	62 (17.2%)
No	160 (89%)	138 (76.5%)	298 (82.8%)
Faced herring related to hearing due to PLD Use			
Yes	26 (14.6%)	38 (21%)	64 (17.8%)
No	154 (85.4%)	142 (79%)	294 (82.2%)

Table 3: Association between hearing impairment and selected variables among the study participants

Variable	Likely Hearing Impairment		P value	Odds Ratio (95% CI)
	Present (85)	Absent (275)		
Age (in years)				
17 - 18	38	153	0.078	0.64 (0.38 – 1.05)
15 - 16	47	122	ref	
Gender				
Male	62	138	**0.0003***	2.67 (1.55 – 4.56)
Female	23	137	ref	
Socioeconomic status				
Upper class	10	39	0.576	0.80 (0.38 – 1.69)
Middle / Lower class	75	236	ref	
Family history of hearing problems				
Yes	30	13	**< 0.0001***	5.94 (3.05 – 11.60)
No	55	262	ref	
Type of PU College				
Private	40	140	0.535	0.85 (0.52 – 1.39)
government	45	135	ref	
Years of PLD usage				
> 5 Years	15	55	0.632	0.85 (0.45 – 1.61)
≤ 5 Years	70	220	ref	
Daily hours spent using PLD				
≥ 4 Hours	61	155	**0.012***	1.97 (1.16 – 3.33)
< 4 Hours	24	120	ref	
Presence of active noise cancellation feature in PLD				
No	33	134	0.110	0.66 (0.40– 1.09)
Yes	52	141	ref	
Regular usage of PLD at high volume (≥ 75% of the maximum volume)				
Yes	32	32	**< 0.0001***	4.58 (2.58 – 8.13)
No	53	243	ref	
Take breaks in between long listening periods				
No	66	137	**< 0.0001***	3.49 (2.00 – 6.14)
Yes	19	138	ref	
Sleeping with PLD on play				
Yes	11	51	0.234	0.65 (0.32 – 1.32)
No	74	224	ref	
Facing ear related complications due to PLD usage				
Yes	15	49	0.971	0.98 (0.52 – 1.86)
No	70	226	ref	
***p value < 0.05 is statistically significant**				

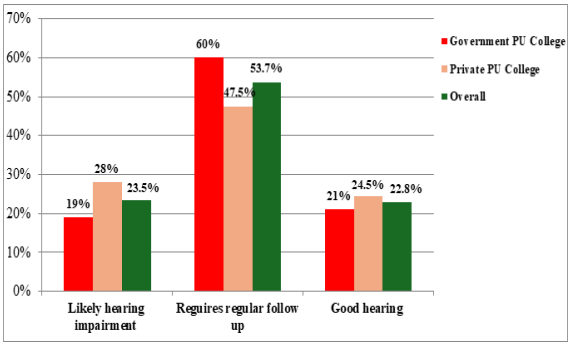

Figure 1: Hear WHO app based hearing assessment score

DISCUSSION

This study reveals a substantial early burden of hearing loss among PU college students with respect to user PLDs. Majority belonged to 17–18 years age group and were male (61%), as was also observed in studies by Mogan KA et al,[9] Floria C et al,[13] Gilliver M et al,[14] and Mokhatrish MM et al,[15] while some Indian studies reported a female preponderance.[11,16-18] This variability most likely stems from disparities in institutional context, student populations and sex-related listening habits. Positive family history of hearing problems was nearly 12% and this proportion is similar to Mogan KA et al,[9] Ritikaa S et al,[7] while a little less in comparison to Kirubasankar M et al.[11]

The most predominant reason for PLD use was entertainment (50.7%) at par with Kirubasankar M et al,[11] Srihari A et al,[19] You S et al,[20] but academic use was reported higher than in this study by Ramya MR et al,[16] Mogan KA et al,[9] and Ritikaa S et al,[7] especially among medical students. The high prevalence of the use of Bluetooth earphones (63.7%) is consistent with findings from Ritikaa S et al,[7] which might be due to better access and availability to such wireless devices that allow longer duration of listening.

Nearly 60% used PLDs ≥4 h on a daily basis; 17.8% listened at high levels (>75%). This trend is consistent with the findings published by Kirubasankar M et al,[11] Ritikaa S et al,[7] Mogan KA et al,[9] and Srihari A et al,[19] which highlighted the existence of cumulative noise exposure between younger users. Potentially hazardous practice such as lack of listening break periods (56.3%) and sleeping with PLDs on (17.2%) were similar to Ritikaa S et al,[7] study.

According to the hearWHO app screening, 23.5% of the students had likely hearing impairment and 53.7% needed regular follow-up screening. These results were very close to Ritikaa S et al,[7] and Kirubasankar M et al,[11] who also reported similar levels of hearing loss, further evaluation as well as monitoring needed with the same screening technique. Higher prevalence reported by Masthi NRR et al,[18] and Gilliver M et al,[14] and lower estimates from Mogan KA et al,[9] Floria C et al,[13] and Mokhatrish MM et al,[15] are indicative of variation across age groups, degree of exposure and assessment settings.

In the current study, being male, family history of hearing impairment, daily use of PLDs for ≥4 hours per day and regular listening to loud music at high volumes along with absence of breaks in between long listening hours showed significant association with likely hearing impairment. These relationships are in agreement with those reported by Ritikaa S et al,[7] and Kirubasankar M et al,[11] whereas prolonged high-volume exposure is also the main determinants identified by Aishamrani R et al,[21] and Mokhatrish MM et al.[15] Taken together, these data support a role for modifiable listening behaviors in early auditory injury.

CONCLUSION

This study indicates a huge load of early hearing impairment among the PU college students who use PLDs. The major risk factors were prolonged daily PLD use, excessive volume and absence of listening breaks, male sex and family history of hearing loss. These data reinforce the evidence that risky listening behaviours are common in young people and may be associated with measurable auditory change. Also mobile-based screening solutions such as the hearWHO app are applicable instruments for early detection due to their usability and feasibility in school settings.

Information on safe listening should be included in school and college health education programmes, which promote safe durations, moderation in volume and regular breaks. Regular, systematic hearing screening, especially of high-risk PLD users, should be conducted through readily accessible methods such as the hearWHO app. Schools need to inculcate digital well-being norms for safe audio usage in online learning. By raising the awareness of school students, their families and teachers hearing related disability can be averte.

REFERENCES

1. World Health Organization. World report on hearing. Geneva: World Health Organization; 2021. Available from: https://www.who.int/publications/i/item/world-report-on-hearing
2. Vos T, Lim SS, Abbafati C, Abbas KM, Abbasi M, Abbasifard M, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204-1222. doi:10.1016/S0140-6736(20)30925-9.
3. World Health Organization. Make listening safe. Geneva: World Health Organization; 2015. Available from: https://iris.who.int/handle/10665/177884
4. Dillard LK, Shubham S, Meier AR, McKinnon BJ. Prevalence and global estimates of unsafe listening practices in adolescents and young adults: a systematic review and meta-analysis. BMJ Global Health. 2022;7(11):e010501. doi:10.1136/bmjgh-2022-010501.
5. Basner M, Babisch W, Davis A, Brink M, Clark C, Janssen S, et al. Auditory and non-auditory effects of noise on health. Lancet. 2014;383(9925):1325-1332. doi:10.1016/S0140-6736(13)61613-X.
6. Le Clercq CMP, van Ingen G, Ruytjens L, van der Schroeff MP. Music-induced hearing loss in children, adolescents, and young adults: a systematic review and meta-analysis. Otolaryngology–Head and Neck Surgery. 2016;154(5):789-798. doi:10.1177/0194599816630360.
7. Ritikaa S, Vijayakarthikeyan M, Eldho S, Sangeetha S. Smart screening: using the hearWHO app to assess hearing health in South Indian medical students using personal listening devices (PLDs). Natl J Community Med. 2026;17(1):19-25. Available from: https://www.njcmindia.com/index.php/file/article/view/6051
8. National Programme for Prevention and Control of Deafness (NPPCD). Operational guidelines for prevention and control of deafness. Ministry of Health and Family Welfare, Government of India; 2018. Available from: https://www.mohfw.gov.in/sites/default/files/51892751619025258383.pdf
9. Mogan KA, Shrivastava SR, Shrivastava PS. Assessment of hearing impairment among young adults using smartphone-based audiometry: a cross-sectional study. Indian Journal of Community Medicine. 2023;48(2):281-284. doi:10.4103/ijcm.ijcm_679_22.
10. Sulaiman AH, Seluakumaran K, Husain R. Hearing risk associated with the usage of personal listening devices among urban high-school students in Malaysia. Public Health. 2013;127(8):710-715. doi:10.1016/j.puhe.2013.04.007.
11. Kirubasankar M, Sri K, Devi S, Pandian S, Grace AG. An Application-Based Hearing Assessment Among Medical Students Using Personal Listening Devices in a Private Medical College in South Chennai. Indian Journal of Community Medicine:10-4103. DOI: 10.4103/ijcm.ijcm_494_24
12. Swords C, Twumasi E, Fitzgerald M, Fitzsimons- West E, Luo M, Dunne H, Lim KH, Jones O, Law S, Myuran T, Smith

G. A multicenter validity study of four smartphone hearing test apps in optimized and home environments. The Laryngoscope. 2024 Jun;134(6):2864-70. https://doi.org/10.1002/lary.31256
13. Floria C, Velayutham P, Davis P. Prolonged Use of Portable Listening Devices Among Medical Students in a Healthcare Institution in Puducherry: A Clinico-Audiological Study. Cureus. 2025 Feb 13;17(2). DOI: 10.7759/cureus.78929
14. Gilliver M, Nguyen J, Beach EF, Barr C. Personal listening devices in Australia: Patterns of use and levels of risk. InSeminars in hearing. Thieme Medical Publishers.2017 Nov 38(04):282-297. https://doi.org/10.1055/s-0037-1606324.
15. Mokhatrish MM, Dighriri RM, Otaif AA, Otaif AA, Jahlan RA, Daghreeri AA, Hakami HT, Mobarki AM, Daghriri BF, Hakami FM, Dighriri OM. Awareness of and the relationship between noise-induced hearing loss and the use of personal listening devices in Jazan region, Saudi Arabia. Frontiers in Public Health. 2025 Feb 21;13:1505442. https://doi.org/10.3389/fpubh.2025.1505442
16. Ramya M R, Geetha M. Headphone/Earphone Usage Practices and its Health Effects among College going Students: A Cross- Sectional Study from South India. Healthline. 2022;13(3):261-265. DOI: 10.51957/Healthline_394_2022
17. Kaur H, Singhal P, Arora R, Kumar S, Thakur JS, Verma RK. Prevalence of Hearing Impairment and Associated Factors among Adults Residing in Rural Area of Chandigarh, India. Asian Journal of Nursing Education and Research. 2025;15(1):53-7. DOI:10.52711/2349-2996.2025.00012
18. Masthi, N.R.R., Srivatsav, R.P., Aryan, R., Nagesh, P., Chikgouda, S.A., Vyshak, B.N., Thammaiah, R.R., Shashank, N. and Lavanya, R., 2025. A cross-sectional study on the burden of visual and hearing impairment using WHO eyes and hear WHOpro applications among professional degree college students, Bengaluru Urban. Journal of Family Medicine and Primary Care, 14(2), pp.785-789. DOI: 10.4103/jfmpc.jfmpc_1088_2
19. Srihari A, Shanmukananda P, Kumar LS, John S. Analysis of potential risk of hearing loss among students using personal audio devices. National Journal of Physiology, Pharmacy and Pharmacology. 2021 May 1;11(5):462. .http://dx.doi.org/10.5455/njppp.2021.11.1130120202712202 0
20. You S, Kwak C, Han W. Use of personal listening devices and knowledge/attitude for greater hearing conservation in college students: Data analysis and regression model based on 1009 respondents. International journal of environmental research and public health. 2020 Apr;17(8):2934. https://doi.org/10.3390/ijerph17082934
21. Alshamrani R, Altheeb F, Almasaoud H, Alghamdi A, Latif R, Rafique N, Sulaiman AA. The effect of various patterns of personal listening devices on hearing among university students in saudi arabia. Acta Informatica Medica. 2022 Sep;30(3):225. https://doi.org/10.5455/aim.2022.30.225-229.