Revista CEFAC

eISSN 1982-0216

DOI: 10.1590/1982-0216/20232528922 | Rev. CEFAC. 2023;25(2):e8922

Original articles

Hearing health educational interventions for school students

Maria Thereza Raab Forastieri Piccino[1]
Bianca Caseiro Antonelli[1]
Lucas Ferreira Neri[1]
Jose Bassan Franco[1]
Ana Luiza Martins Apolônio[1]
Adriana Bender Moreira de Lacerda[2]
Dagma Venturini Marques Abramides[1]
Wanderleia Quinhoneiro Blasca[1]

[1] Universidade de São Paulo, Faculdade de Odontologia de Bauru - FOB/USP, Bauru, São Paulo, Brasil.

[2] Universidade Tuiuti do Paraná, Curitiba, Paraná, Brasil.

ABSTRACT

Purpose: to implement and assess hearing health interventions for school students, using Dangerous Decibels® Program activities in partnership with the Young Doctor Project, approaching noise-induced hearing loss prevention.

Methods: the study encompassed 41 students, aged 12 to 14 years, from two schools in inland São Paulo and a social institution for public school students. Activities were based on the Young Doctor Project and the Dangerous Decibels® Brazil Program. The students answered a questionnaire administered in three situations: before the intervention (pre), right after the intervention (post), and 4 months after the intervention. The ANOVA, Friedman ($p < 0.001$), and Tukey´s ($p < 0.05$) statistical tests were used.

Results: the 41 students who participated in the program were protagonists of knowledge, spreading the content they learned to another 954 students in the three schools through cultural workshops. The analysis of program effectiveness revealed improved results right after the intervention and 4 months afterward.

Conclusion: combining these two programs encouraged the protagonism of young people to increase their involvement with the community. Moreover, the students changed their attitude toward potentially dangerous sounds.

Descriptors: Health Education; Students; Hearing Loss; Noise

Study conducted at Universidade de São Paulo, Faculdade de Odontologia de Bauru - FOB/USP, Bauru, São Paulo, Brasil.

Financial support: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

Conflict of interests: Nonexistent.

Corresponding author:
Maria Thereza Raab Forastieri Piccino
Rua Dr. Antonio Xavier de Mendonça 2-66
CEP 17012-058 Bauru, São Paulo, Brasil
E-mail: mtrfp@hotmail.com

Received on: December 13, 2022
Accepted on: February 7, 2023

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Health promotion requires an in-depth look at health issues in the community, focused on individuals as a group and the environment in all its physical, social, political, economic, and cultural dimensions.

Hence, hearing health promotion programs have been developed to encompass elementary to high school students, as protagonists that disseminate knowledge through multiplicative actions to the community[1-5]. Such studies characterize the relevance of educational programs that address health prevention, approaching specific hearing health topics to young people exposed to high sound pressure levels[6].

These people are daily exposed to intense environmental or leisure noise, as they increasingly use personal sound devices (PSD) with earphones at high intensity[2,3,7,8]. Exposure to high sound intensity levels may trigger various auditory or non-auditory symptoms, such as intolerance to intense sounds, dizziness, otalgia, difficulties understanding or hearing words, tinnitus, hearing loss, sleep disorders, cardiovascular disorders, stress, fatigue, tension, irritability, inattention, tiredness, nervousness, headache, and arterial hypertension[9-11]. Hearing loss can have consequences on the quality of life, affecting social relationships[12]. Moreover, these symptoms can impair learning development as a whole, thus affecting reasoning, content comprehension, and sound perception.

Researchers report that noise-related injuries are the second main cause of hearing loss worldwide. However, they can be prevented by avoiding excessive noise exposure and especially wearing adequate protection[13-15]. Although research has demonstrated such results, the literature on young people's behavior toward hearing care demonstrated their lack of concern with the issue. This reveals that insufficient actions address hearing care prevention and concern, despite of their knowledge that excessive PSD use may cause hearing problems[2,3,16].

Thus, campaigns and programs have been carried out to raise the awareness of the world population of the risks of exposure to high sound pressure levels. Dangerous Decibels® is one such international program that stands out. Created in 1999, it aims to reduce the incidence of noise-induced hearing loss (NIHL) and tinnitus in children and adolescents. In 2015, the Brazilian Academy of Audiology partnered with the program, announcing its workshop and scientific papers, and making known information on intense sounds and their effects, especially NIHL and tinnitus (www.audiologiabrasil.org.br/ddbrasil)[17].

An approach worth noting in Brazil is the "*Projeto Jovem Doutor*" (Young Doctor Project), which has a training program for elementary to high school students on health issues. It uses interactive tele-education with educational objects, in-person workshops, and an interactive learning and cultural workshop platform to spread acquired knowledge to the community[18].

The school has been an important setting where health and education meet, promoting ample social action possibilities and health promotion and education activity strategies. Involving students in hearing health promotion initiatives help them reflect on their behaviors and change harmful habits[1-3,19].

Thus, this study aimed to implement and assess hearing health interventions for students using Dangerous Decibels® activities in partnership with the Young Doctor Project, approaching NIHL prevention.

METHODS

The study was carried out in three school settings: two schools in inland São Paulo – a private (School 1) and a municipal public school (School 2) – and a social institution for public school adolescents – Intermunicipal Consortium for Social Promotion (ICSP). It was approved by the Human Research Ethics Committee of the Dental School of Bauru at the *Universidade de São Paulo* (FOB/USP), Brazil, under evaluation report no. 77171117.0.0000.5417, CAAE 56186221.6.0000.5417. The parents/guardians of participating minors signed an informed consent form, while the participants filled out an assent form. The study was conducted in partnership encompassing the Department of Speech-Language-Hearing Sciences at FOB/USP, the Municipal Department of Education, the Dangerous Decibels® Group at the Oregon Health & Science University (OHSU), and the Dangerous Decibels® Group of Brazil.

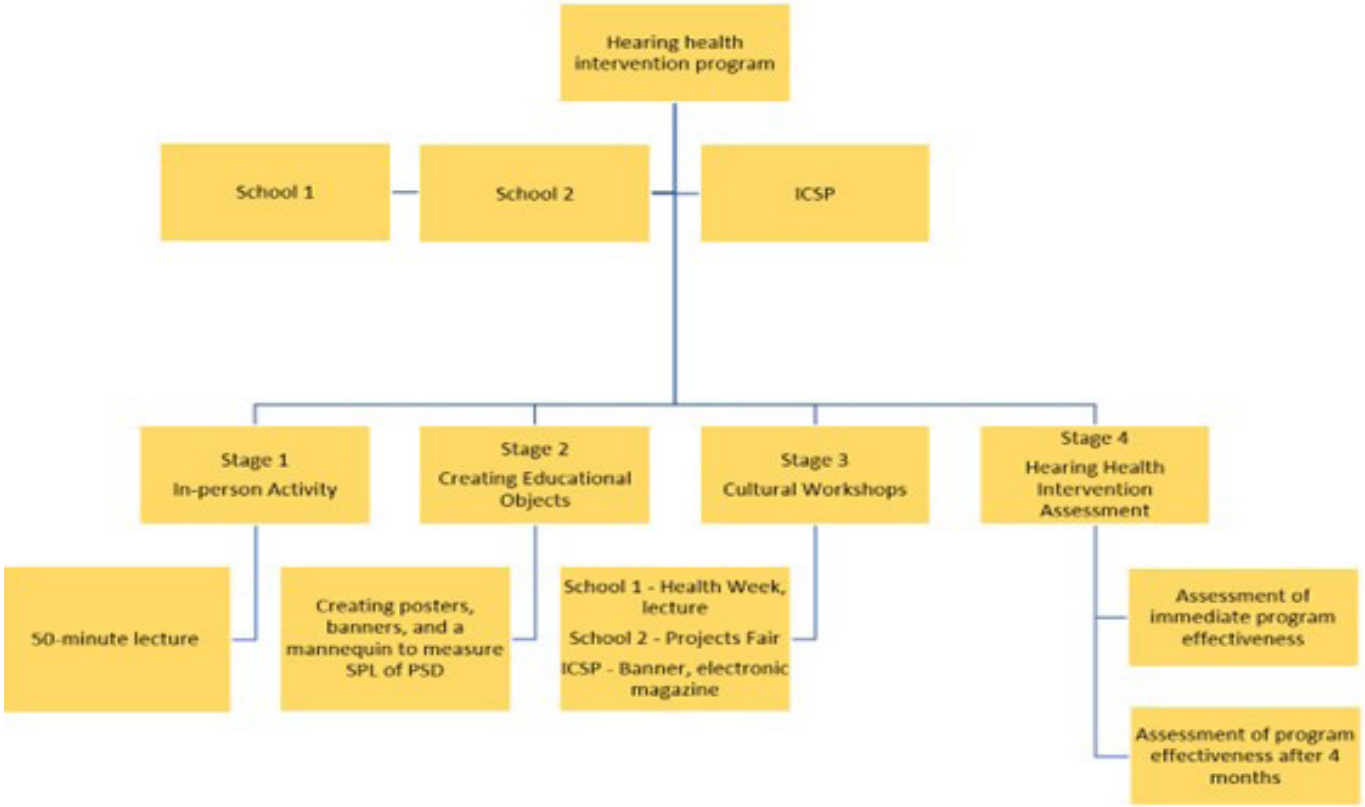
Sample

Altogether, 133 eighth graders of both sexes, aged 12 to 14 years, were invited to participate in the program and selected based on their interest and availability to participate in the program. Of the 133 students

invited, 46 began the study. Those who did not sign the informed consent and assent forms and did not answer all assessment questionnaires were excluded – five students were excluded for not answering all questionnaires, leaving a total sample of 41.

Interventions

The interventions were based on the Young Doctor Project[18] and classroom activities proposed by the Dangerous Decibels® Brazil Program[17] and divided into four stages, as shown in Figure 1.



Captions: ICSP = Intermunicipal Consortium for Social Promotion, SPL = sound pressure level, PSD = personal sound device.

Figure 1. Flowchart of the project

Stage 1 – In-Person Activity

Students participated in an in-person activity at their schools, using educational classroom material from the Dangerous Decibels® program. The activity was based on information encompassing:

- The paths of hearing.
- The dangerous sounds.
- The effects of dangerous sound exposure.
- How to protect oneself from such sounds.

The researcher participated in the educator training program – Dangerous Decibels® international and Dangerous Decibels® Brazil.

The in-person activity took place in the classrooms during science classes. At ICSP, a partnership was made with a doctoral researcher, whose objective was to produce a documentary on earphone use. The said activity was included in the paper entitled "Education and health: Production of a transmedia documentary on adolescent hearing health". The researcher and the science teacher conducted together the interactive actions proposed by the Dangerous Decibels® Brazil Program (Chart 1).

Chart 1. Interactive actions in modules of the hearing health intervention program

IA 1 *What is sound?*	The purpose of this activity was to teach students that: • Sound results from vibrations. • Sound vibrations are also called sound waves. • There is no sound without vibration. • Sound energy can be harmful and damage the ears.	**Materials used:** a tuning fork and a ping-pong ball tied to a string.
IA 2 *How do we hear?*	The purpose of this activity was to teach students ear anatomy and physiology.	**Materials used:** an image of the ear anatomy.
IA 3 *What are the hair cells?*	The purpose of this activity was to help students understand how intense sounds can permanently damage cochlear hair cells.	**Materials used:** pipe cleaners, an image of a lit candle, and an image of hair cells before and after loud sound exposure.
IA 4 *How intense is the sound?*	In this activity, students began associating different sounds with different decibel levels.	**Materials used:** flashcards.
IA 5 *Measuring SPL with a sound level meter*	The purpose of this activity was to measure sound intensity with a sound level meter.	**Materials used:** a sound level meter and a hairdryer.
IA 6 *How to wear earplugs*	In this activity, students learned how to put earplugs on their ears.	**Materials used:** earplugs made of different materials.
IA 7 *Time to act*	The purpose of this activity was to demonstrate to students how peers pressure them regarding dangerous sounds and that they must make their own decisions in terms of individual behavior.	**Materials used:** flashcards and cards with the three ways to protect themselves from dangerous sounds.

Captions: IA = interactive actions, SPL = sound pressure level

Stage 2 – Creating Educational Objects

After Stage 1, schools spent 2 weeks developing educational material to spread the acquired knowledge to the school community.

Students in school 1 made posters, helped by the arts education teacher, showing the content they learned as a means of researching and making auditory behaviors known. At another moment, a robotics student made a mannequin using the Dangerous Decibels® Program cookbook, which measures PSD sound pressure levels. The mannequin, named "Jefferson" by the students, was among the educational objects proposed by the Dangerous Decibels® Program and was used in various campaigns and projects at schools, the university, and the community. This activity aimed to measure the sound pressure levels of the young participants' PSDs.

Students in School 2 and their science teacher developed a guide to present the program in Stage 3, while those at ICSP developed an electronic magazine and printed material, such as posters and banners, based on the content they learned in the in-person activity.

Stage 3 – Cultural Workshops

In this stage, students spread the acquired knowledge to all other students and the community through cultural hearing health workshops, organized by the students 1 month after the in-person activity, thus creating a collaborative learning network.

Stage 4 – Intervention Program Assessment

To assess the intervention, students answered a questionnaire developed by the Dangerous Decibels® Program, translated and adapted by Knobel and Lima[20] (ANNEX 1). The questionnaire was administered in three situations: before (pre-intervention), right after (post-intervention), and 4 months after the intervention[21].

The questionnaires were measured on a Likert scale, with five possible scores: Never (1), Rarely (2), Sometimes (3), Often (4), and Always (5). The scores in questions 1, 6, 10, 11, 14, 16, 18, and 20 are inverted – i.e., Never (5), Rarely (4), Sometimes (3), Often (2), and Always (1).

Intervention effectiveness was determined by comparing the total questionnaire scores in the three situations (pre, post, and 4 months after the

intervention). Immediate effectiveness was assessed by comparing the total questionnaire scores pre- and post-intervention, while long-term intervention effectiveness was assessed by comparing the total questionnaire scores pre and 4 months after the intervention, as well as the scores post and 4 months after the intervention. The questionnaire scores of each school were also compared in the three situations.

The questions were grouped into four domains: Auditory Perception, Knowledge, Behavior, and Barrier – Perception is addressed in questions 1, 6, and 11; Knowledge, in questions 2, 3, 4, 8, 9, 10, 12, and 13; Behavior, in questions 5, 7, 14, 15, 17, and 19; and Barrier, in questions 16, 18, and 20. The scores were also compared between the domains in the three situations: pre, post, and after 4 months.

Result analysis

Data were analyzed with normality and homogeneity tests to verify the normal distribution. The repeated measures analysis of variance (ANOVA) was conducted in the cases that met the principles, whereas the Friedman nonparametric test was used in those that did not meet the principles. Schools were compared with the Tukey´s test. The significance level was set at $p < 0.05$.

RESULTS

After the student training program had finished and the educational objects had been developed, each participating school carried out cultural workshops. They aimed to spread the knowledge acquired by students to their peers, teachers, school employees, and the community through interactive and participative actions planned by them and the school coordinator, supervised by the researcher. During the workshops, participating students conducted activities involving the other students at school.

School 1 students participated in "Health Week", throughout which the posters they had developed were on display. They also conducted an interactive activity for elementary and middle school students, in which "Jefferson" helped measure their PSD sound pressure levels. Thus, 390 students were involved in these actions.

School 2 had a "Projects Fair" involving the community. Students instructed visitors on "How to protect themselves from dangerous sounds", based on texts they had produced. This activity involved 221 middle school students.

Based on the knowledge they had acquired, ICSP students produced a web banner and an electronic magazine, which are available from https://seiusar-fonedeouvido.wordpress.com/. They also measured the PSD sound pressure levels. The activities reached 343 students.

The 41 students who participated in the intervention program were protagonists of knowledge – through cultural workshops, they spread what they had learned, involving a total of 954 students in the three schools.

Auditory Health Intervention Assessment

Intervention effectiveness was determined by comparing the total questionnaire scores in the three situations (pre, post, and 4 months after intervention) in each school. A statistically significant difference in the mean scores between the groups was found in School 1 (Table 1).

The assessment of the immediate intervention effectiveness in each school revealed a statistically significant difference between pre- and post-intervention questionnaire scores in School 2, with increased results between them (Table 1).

Long-term effectiveness was assessed by comparing the questionnaire scores post and 4 months after the intervention, as well as pre and 4 months after the intervention, in each school. The results demonstrate a statistically significant difference between questionnaire scores post and 4 months after the intervention in School 2. As for ICSP, there was a statistically significant difference between the questionnaires pre and 4 months after the intervention, as shown in Table 1. Questionnaire results significantly increased 4 months after the intervention.

Table 1. Comparative analysis of the questionnaires between the three situations in each school

Schools	N	Situations	Mean	SD	p-value
1	20	pre[a]	67.2	7.5	< 0.001[ab]
		post[b]	77.3	8.4	< 0.001[ac]
		after 4 months[c]	71.8	7.2	< 0.001[bc]
2	14	pre[a]	63.7	6.5	< 0.001[ab]
		post[b]	74.7	6.3	< 0.001[bc]
		after 4 months[c]	67.0	6.7	
CIPS	7	pre[a]	57.2	8.7	
		post[b]	69.7	10.7	< 0.001[ac]
		after 4 months[c]	74.8	7.3	

Captions: ICSP: Intermunicipal Consortium for Social Promotion; ANOVA statistical test; p < 0.001 (statistically significant); N = subjects; SD = standard deviation; values superscript with letters a, b, and c represent the results of groups with a statistically significant difference; pre = before the intervention; post = right after the intervention

The comparison between questionnaire results pre, post, and 4 months after the intervention involving all students revealed a statistically significant difference in the mean scores between the groups (Table 2).

Table 2. Comparative analysis between questionnaire results pre, post, and 4 months after the intervention

Situations	N	Median	Q_1	Q_3	p-value
Pre	41	64.0	57.0	71.0	
Post	41	75.0	70.0	79.0	<0.001*
After 4 months	41	71.0	65.5	76.0	

Captions: * Friedman statistical test; p < 0.001 (statistically significant); N = subjects; Q_1=first quartile; Q_3=third quartile; pre = before the intervention; post = right after the intervention.

The questions were classified per domain (Knowledge, Auditory Perception, Behavior, and Barrier). Table 3 presents a descriptive analysis of the domains in the three situations (pre, post, and 4 months after the intervention) involving all students. There was a statistically significant difference in the mean scores of Knowledge, Behavior, and Barrier between the three situations.

Table 3. Descriptive analysis of the domains pre. post. and 4 months after the intervention

Domain	N	Situation	Results	p-value
Knowledge	41	Pre	28.3 (5.2) [1]	<0.001*
		Post	33.5 (4.7) [1]	
		After 4 months	31.2 (4.2) [1]	
Auditory Perception	41	Pre	12 (11/14) [2]	0.941**
		Post	12 (10.5/14) [2]	
		After 4 months	12 (11/14) [2]	
Behavior	41	Pre	14 (13/17.5) [2]	<0.001**
		Post	19 (15/22) [2]	
		After 4 months	17 (14.5/19) [2]	
Barrier	41	Pre	9 (7/11) [2]	<0.001**
		Post	11 (9/12) [2]	
		After 4 months	10 (8.5/13) [2]	

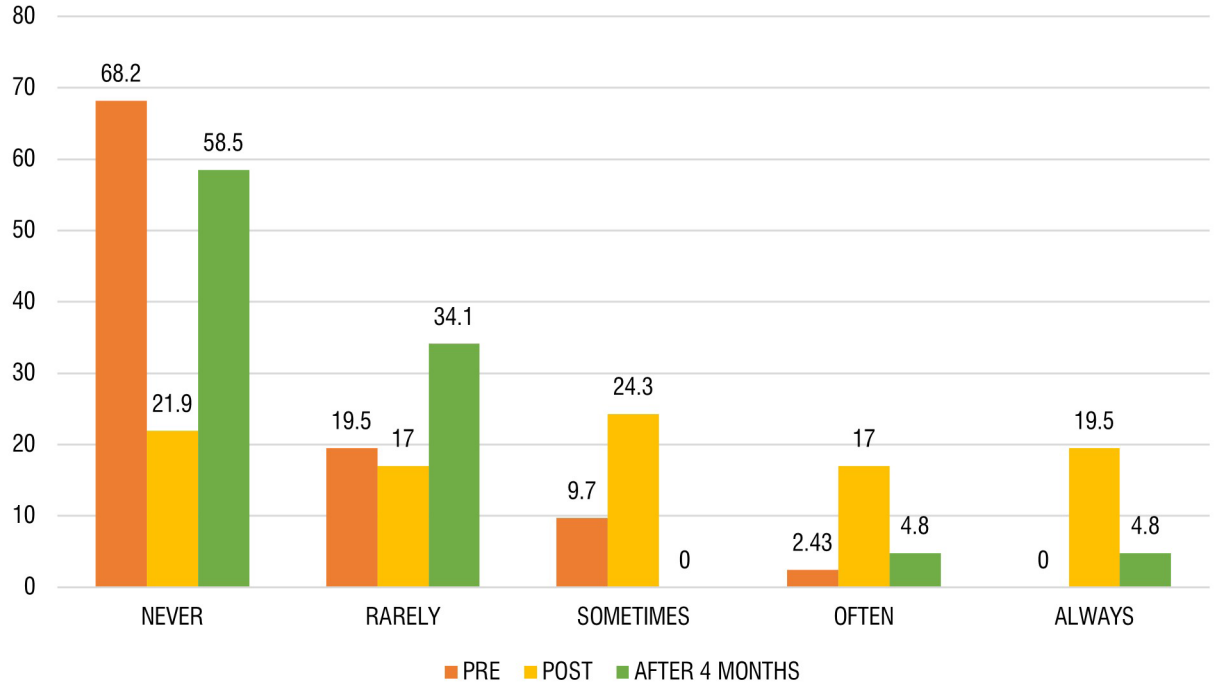
Captions: [1]result presented in mean values (SD= standard deviation); [2]result presented in median values (Q_1=first quartile/ Q_3=third quartile); *ANOVA statistical test; **Friedman statistical test; N = subject; pre = before the intervention; post = right after the intervention.

Table 4. Comparative analysis between the domains in the three situations

Domain	pre x post	pre x after 4 months	post x after 4 months
Knowledge	< 0.05*	< 0.05*	< 0.05*
Behavior	< 0.05*	< 0.05*	> 0.05
Barrier	< 0.05*	< 0.05*	> 0.05

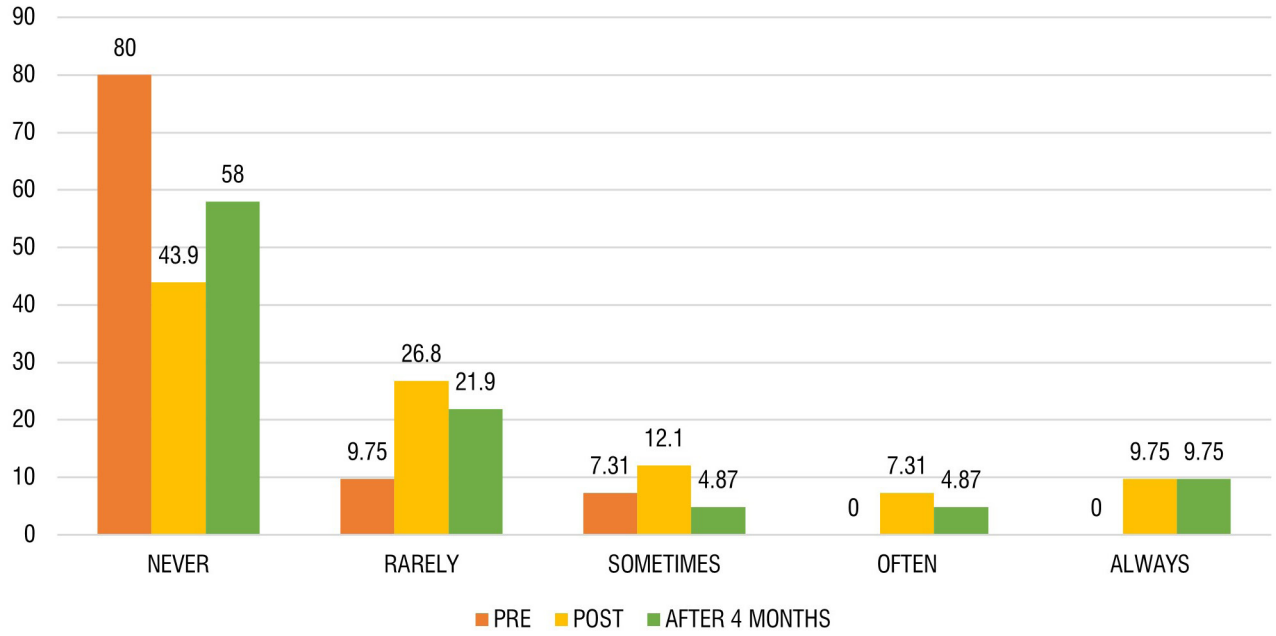
Captions: Tukey´s statistical test; p < 0.05* (statistically significant); pre = before the intervention; post = right after the intervention.

A percentage analysis of questions 15 and 17 (which address earplug use) was performed regarding the three situations. The percentage had increased from pre- to post-intervention and was maintained 4 months after it (Figures 2, 3).



Caption: Y-axis: comparative percentage of answers in situations; pre = before the intervention; post = right after the intervention; after 4 months = 4 months after the intervention.

Figure 2. "If you went to a music concert with very loud music or a party with your friends, would you wear earplugs?" Analysis of the total percentage between the situations (pre, post, and after 4 months)



Caption: Y-axis: comparative percentage of answers in situations; pre = before the intervention; post = right after the intervention; after 4 months = 4 months after the intervention.

Figure 3. "How often do you wear earplugs in noisy places?"
Analysis of the total percentage between the situations (pre, post, and after 4 months)

DISCUSSION

The students' effective participation with questions and comments was essential to their motivation and interaction with the researcher. Other studies point out that such a contact increases the students' interest, contributing to better intervention results[22]. These data agree with studies conducted by researchers who used Dangerous Decibels® program activities[20,21] and verified that interpersonal educative interventions like the classroom program are more effective and have a greater long-term impact than self-learning experiences.

Following the Young Doctor Project approach, 41 participating students produced educational objects to promote hearing health, creating strategies to spread the acquired knowledge to the community, and involving 954 students in the three schools. Other papers likewise conducted such workshops on various topics, stimulating the protagonism of young people through active methodologies to encourage health behavior changes. These studies reached more than 10,000 people, including parents, teachers, students, and the community, who received knowledge through the actions they carried out[2,20,22-29].

Even though the study was conducted in schools with different teaching methodologies, comparing separate school results demonstrates that Schools 1 and 2 had quite similar scores. The same was true for the total result analysis regarding the three situations in all schools. As for ICSP, the questionnaire score increased 4 months after the intervention, as shown in Table 1. Despite not being assessed, this school had a different approach to the in-person activity, in which students developed a transmedia documentary. These data may have resulted from their involvement in producing the documentary. The comparison of results pre and 4 months after intervention between schools revealed a significant difference between School 1 and ICSP. Such results were not found in other studies conducted by researchers who used the Dangerous Decibels® Program approach. Immediately increased results, maintained 4 months after the intervention, were reported in international studies and the Brazilian version of the Dangerous Decibels® Program[20,21,30-32].

The analysis of the separate domains showed a statistically significant difference in Knowledge, which agrees with the findings of the creators of the Dangerous Decibels® Program[21]. The immediate results in Behavior and Barrier also increased and were maintained 4 months after the intervention. These findings were likewise reported in related studies, whose participating students increased their questionnaire results from pre

to immediately after the intervention, maintaining them 4 months afterward[20,21,30-32]. On the other hand, there was no difference in Auditory Perception between the three situations, as shown in Table 3.

Concerning the students' behavior, 0% of them wore earplugs at concerts or parties with loud music before the intervention; this result increased immediately after it (19.5%) and decreased again 4 months afterward (4.8%). The same happened in the question on wearing earplugs in noisy situations, although the result remained 4 months after the intervention (9.75%), as seen in Figures 2 and 3. These findings corroborate studies that used the Dangerous Decibels® Program approach. Those conducted by Brazilian researchers[20] verified that students did not know what earplugs are and few used them only in noisy situations – e.g., when they visited their parents at work.

The results of this study agree with other ones that used the educational classroom strategies of the Dangerous Decibels® Program, in which hearing health education included in the activities of elementary and middle school students can effectively increase the knowledge, attitudes, and behaviors toward dangerous sound exposure and hearing protection strategies[20,21,30,31].

Despite the low adherence of students to the educational interventions due to the parents' lack of understanding of the informed consent and assent forms, the results made clear that the 41 participants involved in the actions changed their attitudes toward potentially dangerous sounds.

Hearing health intervention programs for students must be carried out by audiologists or other professionals of related areas, involving the schools and families. Auditory risks are present in young people's routine situations, including environmental noise, leisure activities with music, PSD use, and so forth. The students' active participation as protagonists helps raise their awareness and thus change inadequate habits[1-3,8,20,21,26,27,31,33-35].

Nevertheless, habits are known to change gradually. Therefore, the researchers point out the importance of conducting continuous educational actions to address young people's auditory behavior[1,2,35-40].

CONCLUSION

The combination of the Young Doctor Project approach and the educational objects of the Dangerous Decibels® Program was important to the effectiveness of hearing health educational interventions for young people. Joining these two programs encouraged the students' protagonism through interactive actions and cultural workshops, aiming at the greater involvement of the university with the community. The results show that students got involved in the actions and changed their attitudes toward potentially dangerous sounds.

REFERENCES

1. Lacerda ABM, Soares VMN, Gonçalves CGO, Lopes F, Testoni R. Educational workshops as a strategy to promote hearing heath of adolescents: an exploratory study. Audiol., Commun. Res. 2013;18(2):85-92.
2. Piccino MTRF. Modelo Educacional Interativo para adolescentes usuários de fones de ouvido [Dissertation]. Bauru (SP): Universidade de São Paulo. Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2015.
3. Santana BA, Alvarenga KF, Cruz PC, Quadros IAD, Jacob-Corteletti LCB. Prevention in a school environment of hearing loss due to leisure noise. Audiol., Commun. Res. 2016;21:e1641. https://doi.org/10.1590/2317-6431-2015-1641.
4. Blasca WQ, Oliveira JRM, Falsetti APM, Piccino MTRF, Corrêa CC. Analysis of the social and motivational attitudes of students after training in hearing health. Audiol Commun Res.. 2017;22:e1750. https://doi.org/10.1590/2317-6431-2016-1750.
5. Gondim LMA, Marques JM, Lüders D, Meinke D, Martin WH, Lacerda ABM. Public health programs strategies for acoustic education and hearing health promotion to students in southern Brazil. 26º Congresso Internacional de Som e Vibração, ICSV 2019. Jul, 7-11 Canadian Acoustical Association, Montreal, 2019.
6. Khan KM, Bielko SL, McCullagh MC. Efficacy of hearing conservation education programs for youth and young adults: a systematic review. BMC Public Health. 2018;18(1):1-12. https://doi.org/10.1186/s12889-018-6198-7. PMID: 30466413. PMCID:PMC6249850.
7. Feder K, McNamee J, Marro L, Portnuff C. Personal listening device usage among Canadians and audiometric outcomes among 6-29 year olds. Intern J Audiol. 2021;60(10):773-88. https://doi.org/10.1080/14992027.2021.1878398. PMID: 33586578.
8. Reddy BA, Thenmozhi MS. Excessive usage of headphones among college students and their effects. Drug Invent Today. 2018;10(11):2296-9.
9. Gonçalves CL, Dias FAM. Audiological findings in young users of headphones. Rev. CEFAC. 2014;16(4):1097-108. https://doi.org/10.1590/1982-0216201422412.
10. Basner M, Babisch W, Davis A, Brink M, Clark C, Janssen S et al. Auditory and non-auditory effects of noise on health. The Lancet. 2014;383(9925):1325-32. https://doi.org/10.1016/S0140-6736(13)61613-X. PMID: 24183105. PMCID:PMC3988259.
11. Santana PDF, Mascarenhas WN, Borges LL, Camarano MRH. Hábitos de jovens usuários de dispositivos eletrônicos individuais e sintomas advindos da exposição à música em forte intensidade. Revista Estudos - Vida e Saúde. 2015;42(3):315-25.
12. Viana LS. Consequências da perda auditiva e, ou, zumbido na qualidade de vida, no trabalho e nas relações sociais [Dissertation]. Viçosa (MG): Universidade Federal de Viçosa; 2016.
13. Nunes ADS, Silva CRL, Balen SA, Souza DLB, Barbosa IR. Prevalence of hearing impairment and associated factors in school-aged children and adolescents: a systematic review. Braz J Otorhinolaryngol. 2019;85(2):244-53. https://doi.org/10.1016/j.bjorl.2018.10.009. PMID: 30555026. PMCID: PMC9452222.

14. Rabinowitz PM. Hearing loss and personal music players. Reducing exposure is prudent (editorial). BMJ. 2010;340:57-8. https://doi.org/10.1136/bmj.c1261. PMID: 20406864.

15. Twardella D, Raab U, Perez-Alvarez C, Steffens T, Bolte G, Fromme H. Usage of personal music players in adolescents and its association with noise-induced hearing loss: a cross-sectional analysis of Ohrkan cohort study data. InJAudiol. 2017;56(1):38-45. https://doi.org/10.1080/14992027.2016.1211762. PMID: 27686245.

16. Bruijn GJ, Spaans P, Jansen B, van't Riet J. Testing the effects of a message framing intervention on intentions towards hearing loss prevention in adolescents. Health Educ Res. 2016;31(2):161-70. https://doi.org/10.1093/her/cyw006. PMID: 26956040.

17. Dangerous Decibels Brasil. Available at: https://www.audiologiabrasil.org.br/jdr/. Accessed 2019 set 25.

18. Wen CL. Dinâmica do Jovem Doutor. [updated: 2011]. Available at: http://www.jovemdoutor.org.br/jdr/. Accessed 2016 out 10.

19. Silva MAI, Mello DF, Carlos DM. O adolescente enquanto protagonista em atividades de educação em saúde no espaço escolar. Rev Eletr Enf. 2010;12(2):287-93. https://doi.org/10.5216/ree.v12i2.5301.

20. Knobel KAB, Lima MCPM. Effectiveness of the Brazilian version of the Dangerous Decibels® educational program. Int J Audiol. 2014;53(2):35-42. https://doi.org/10.3109/14992027.2013.857794. PMID: 24564691.

21. Martin W, Griest SE, Sobel JL, Howarth LC. Randomized trial of four noise-induced hearing loss and tinnitus prevention interventions for children. Int J Audiol. 2013;52(1):41-9. https://doi.org/10.3109/14992027.2012.743048. PMID: 23373742.

22. Picolini MM. Teleducação interativa na capacitação de estudantes do ensino fundamental em síndromes genéticas [Dissertation]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2011.

23. Carvalho JLB. Promoção da saúde em ensino fundamental: ações de teleducação em Fonoaudiologia na inclusão escolar [Dissertation]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2012.

24. Oliveira VV. Jovem Doutor: promoção da saúde auditiva e inclusão do deficiente auditivo com malformação de orelha externa e/ou média [Thesis]. Bauru (SP): Universidade de São Paulo, Hospital de Reabilitação de Anomalias Craniofaciais; 2012.

25. Maximino LP. Telessaúde e fonoaudiologia: análise de um programa de capacitação em síndromes genéticas em dois estados do Brasil [Thesis]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2012.

26. Falsetti APM. Rede de aprendizagem colaborativa de educação em saúde auditiva [Dissertation]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2013.

27. Corrêa CC. Projeto Jovem Doutor: ações de educação em saúde voltadas à Síndrome da Apnéia e Hipopnéia Obstrutiva do Sono [Dissertation]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2014.

28. Silva DR, Abreu LR, Cara LM, Wen CL. Projeto Jovem Doutor: o aprendizado prático de estudantes de medicina por meio de atividade socioeducativa. Rev Med. 2017;96(2):73-80. https://doi.org/10.11606/issn.1679-9836.v96i2p73-80.

29. Rossi-Landro IC. A Teleducação Interativa como estratégia de multiplicação do conhecimento dos benefícios da amamentação [Thesis]. Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2018.

30. Griest SE, Folmer RL, Martin WH. Effectiveness of "Dangerous Decibels," a School-Based Hearing Loss Prevention Program. Am J Audiol. 2007;16(4):165-81. https://doi.org/10.1044/1059-0889(2007/021).

31. Griest SE. Evaluation of a hearing-loss prevention program. Semin Hearing. 2008;29(1):122-36. https://doi.org/10.1055/s-2008-1035676.

32. Welch D, Reddy R, Hand J, Devine IM. Educating teenagers about hearing health by training them to educate children. Int J Audiol. 2016;55(9):499-506. https://doi.org/10.1080/14992027.2016.1178859. PMID: 27196113.

33. Bahillo-Neves CS. Estéreos pessoais e perda auditiva: percepção pelos adolescentes da exposição sonora e dos cuidados auditivos [Thesis]. Belo Horizonte (MG): Faculdade de Medicina da Universidade Federal de Minas Gerais; 2014.

34. Lacerda ABM. Saúde auditiva no contexto da educação: práticas voltadas a promoção e prevenção. In: Boéchat EM et al., editors. Tratado de Audiologia. 2ª.ed. - Rio de Janeiro: Guanabara Koogan; 2015. p.414-24.

35. Lacerda ABM, Gondim LMA. Hearing health programs for schoolchildren. J Otolaryngol & Rhinol. 2019;1(4):1-3. https://doi.org/10.33552/OJOR.2019.01.000512.

36. Lacerda ABM, Gonçalves CGO, Zocoli AMF, Diaz C, Paula K. Hábitos auditivos e comportamento de adolescentes diante das atividades de lazer ruidosas. Rev. CEFAC. 2011;13(2):322-9. https://doi.org/10.1590/S1516-18462010005000129.

37. Sant'ana NC. Criação de uma ferramenta hipermídia para a promoção da saúde auditiva em jovens usuários de dispositivos sonoros portáteis individuais [Dissertation] Bauru (SP): Universidade de São Paulo, Faculdade de Odontologia de Bauru, Departamento de Fonoaudiologia; 2012.

38. Blasca WQ, Picolini MM, Silva ASC, Campos K, Pinto GFR, Brasolotto AG et al. Young Doctor Bauru Project: training of high school students in hearing health. Rev. CEFAC. 2013;15(6):1407-17. https://doi.org/10.1590/S1516-18462013005000035.

39. Portnuff CDF. Reducing the risk of music-induced hearing loss from overuse of portable listening devices: understanding the problems and establishing strategies for improving awareness in adolescents. Adoles Health Med Ther. 2016;7:27-35. https://doi.org/10.2147/AHMT.S74103. PMID: 26929674. PMCID: PMC4754097.

40. Herrera S, de Lacerda ABM, Lurdes D, Alcaras PA, Ribeiro LH. Amplified music with headphones and its implications on hearing health in teens. Int. Tinnitus J. 2016;20(1):42-7. https://doi.org/10.2147/AHMT.S74103. PMID: 26929674. PMCID: PMC4754097.

Author contributions:

MTRFP: study design, data collection, writing original draft;

BCA, LFN, JBF: data analysis;

ALMA: critical review;

ABML: project guidance and monitoring as national coordinator of the Dangerous Decibels® Brazil program;

DVMA: writing review;

WQB: study design, collection guidelines and writing review.

ANNEX 1 – QUESTIONNAIRE ADMINISTERED BEFORE, AFTER, AND 4 MONTHS AFTER THE INTERVENTION

QUESTIONNAIRE

Name: _____ Age:_____ Grade:_____ Date: _____

1. In the last month, were you near loud sounds that made your ears ring?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

2. Can earphones with loud music damage your ears?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

3. Can traffic noise damage your ears?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

4. Can music concerts damage your ears?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

5. Do you usually protect your ears from loud sounds?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

6. Do you hear ringing or buzzing sounds in your ears or head?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

7. Do you think your friends consider it important to protect their hearing?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

8. Listening to extremely loud sounds even once can cause hearing loss.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

9. Very loud sounds can damage small hair cells in the inner ears.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

10. Being near loud sounds for a long time gets your ears used to them and protects your hearing.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

11. My ears can stand loud music more than other people's ears.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

12. If it's going to cause me hearing problems, it's not so good to listen to music.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

13. If I have hearing problems, it will be difficult to understand what people say.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

14. I don't usually turn the music volume down, even when I know it's too loud.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

15. If you went to a music concert with very loud music or a party with your friends, would you wear earplugs?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

16. I'd look weird if I wore earplugs in noisy environments.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

17. How often do you wear earplugs in noisy places?
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

18. My friends would tease me if I wore earplugs.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

19. I can put on earplugs on my own, without any help.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

20. It's difficult to put on earplugs.
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always