

# Hearing habits of young adolescent students from public and private schools in the Brazilian Federal District

Valéria Gomes da Silva<sup>1</sup> Carlos Augusto Costa Pires de Oliveira<sup>2</sup> André Luiz Lopes Sampaio<sup>2</sup> Isabella Monteiro de Castro Silva<sup>2</sup> Camila de Castro Corrêa<sup>1</sup> Karen Maria de Paula<sup>1</sup> 

<sup>1</sup> Centro Universitário Planalto do Distrito Federal – UNIPLAN, Brasília, Distrito Federal, Brasil.

<sup>2</sup> Universidade de Brasília - UnB, Brasília, Distrito Federal, Brasil.

## ABSTRACT

**Purpose:** to analyze the hearing habits of a group of students between public and private schools and compare the degree of exposure to sound stimuli via earphones.

**Methods:** 1,085 public and private school students received a questionnaire on hearing habits and exposure to amplified music. Their answers to these questions were analyzed and compared between the groups of students. The chi-square test compared hearing habits between public and private schools, with the statistical significance level set at 5% ( $p < 0.05$ ).

**Result:** in general, most students (92%) reported hearing habits of exposure to amplified music. Questionnaire answers indicated a high prevalence of both earphone use (92%) and attendance at places with loud music (63.6%).

**Conclusion:** private school students use earphones more often than those from public schools.

**Keywords:** Adolescent; Music, Hearing Aids; Speech, Language and Hearing Sciences

A study conducted at Universidade de Brasília - UnB, Brasília, Federal District, Brazil.

**Financial support:** Nothing to declare.

**Conflict of interests:** Nonexistent.

### Corresponding author:

Valéria Gomes da Silva  
Avenida Pau Brasil, s/n,  
CEP: 71916-000 - Brasília, Distrito Federal,  
Brasil  
E-mail: valeriafga@gmail.com

**Received on:** March 22, 2023

**Accepted on:** August 3, 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

Hearing is an extremely important sensation to humans. Young people, particularly adolescents, are increasingly engaged in entertainment with loud music. Routinely attending parties, bars, and other places with a variety of loud sounds can irreversibly impair their hearing<sup>1,2</sup>.

Noisy contexts such as music concerts, events with automobile noises, and personal listening devices (e.g., MP3 players) can reach high-intensity levels, ranging from 100 to 150 dB<sup>3-5</sup>. The human hearing system can stand sounds up to 90 dB SPL (sound pressure level), but it suffers discomfort and pain when they exceed this limit. Sounds around 130 dB SPL can damage the hearing system. Such excessive exposure can cause noise-induced hearing loss, also known as sensorineural hypoacusis, which is considered an irreversible chronic disease that affects the hearing system and has other consequences<sup>3,6</sup>.

Using earphones for a brief time has already proved to cause temporary symptoms that indicate harmful effects on hearing. For instance, young people exposed to amplified music are at a 9.33 times greater risk of impairment in the auditory cells, more specifically in the outer hair cells, than non-exposed ones<sup>7</sup>. Many studies have addressed such impairments in young people's hearing and their associations with leisure hearing habits, especially among those above 18 years old<sup>8</sup>. However, the association of this impairment in younger ones must be further investigated, along with the damage to social aspects.

A study<sup>6</sup> has indicated the high prevalence of changes in outer hair cells in young people who use earphones, although it did not clarify the consequences according to the degree and time of exposure.

These circumstances point out the need for research to verify adolescents' hearing habits regarding exposure to loud music. Hence, this study aimed to analyze the hearing habits of a group of students and compare their degree of exposure to sound stimuli via earphones and musical settings between public and private schools.

## METHODS

This cross-sectional study was conducted in three high schools in the Brazilian Federal District between August 2013 and June 2016. It was approved by the Research Ethics Committee of the University of Brasília, Brazil, under protocol number 659.058 and CAAE

number 12659213.0.0000.5558. The three schools (one public and two private ones) were in different neighborhoods, about 10 km apart from each other, which the researchers selected by convenience, considering the principal's consent and the time available in the school schedule for the students' participation. Each student was approached only once to answer all questionnaire items. Administering it to all 1,088 students required about 18 visits to each school throughout the collection period. These previously scheduled visits occurred once a month (except for vacation and exam months), always in the morning. Since students could not be away from the classroom for long, few students were approached per visit, which prolonged the time of data collection for this study.

Students were invited to participate in the research in their classrooms at school, and their parents/guardians were properly informed about it. The invitation included information on the profile of the target population of the study, according to its eligibility criteria.

The sample comprised randomly selected high school students of both sexes who attended school in the morning. The inclusion criteria were as follows: being 13 to 18 years old; being properly enrolled students in the schools selected for this research; being present in the classroom when questionnaire instructions were given; answering the questionnaire only once; and presenting the informed consent form signed by their parents/guardians, indicating they were aware of the procedures and agreed with them. Students that did not fill out the questionnaires completely, turned them in with unreadable corrections or checked more than one answer to the same question were excluded. Participants read and answered the questions in intervals between regular classes. The researcher was always present to answer any questions they might have.

The groups were compared regarding the hearing habits self-reported in the questionnaire. Since no validated instruments were found for this investigation, the authors chose to develop specific questions to survey the hearing habits of young people and adolescents concerning earphone use and exposure to amplified sound in musical settings. The questionnaire had eight objective questions (Appendix A) – questions 1 to 5 addressed the use, frequency, and sound intensity in the earphones, while questions 6 to 8 asked whether they attended places with amplified music, for how long, and how often. All answer options in the first column, which the authors indicated with the letter "A",

referred to exaggerated and more frequent exposure, thus considered a habit that posed a greater risk to hearing health. The options in the second column, indicated with the letter “B”, referred to less risk. There was no score, but the hearing habit analysis considered 50% or more answers checked in option “A” as indicative of risk – i.e., subjects who positively answered 50% or more options in letter “A” were classified as having habits that posed a risk to their hearing health. The other ones, whose answers amounted to less than 50%, were considered of lower or no risk.

The variables addressed in the statistical analysis were age, sex, and group (public and private school), verifying the differences between them regarding hearing habits. The analysis used the independent chi-square test to find the dispersion value of the school group and compare answers proportionately, as well as the independent chi-square test with Monte Carlo simulation. The statistical significance level was set at

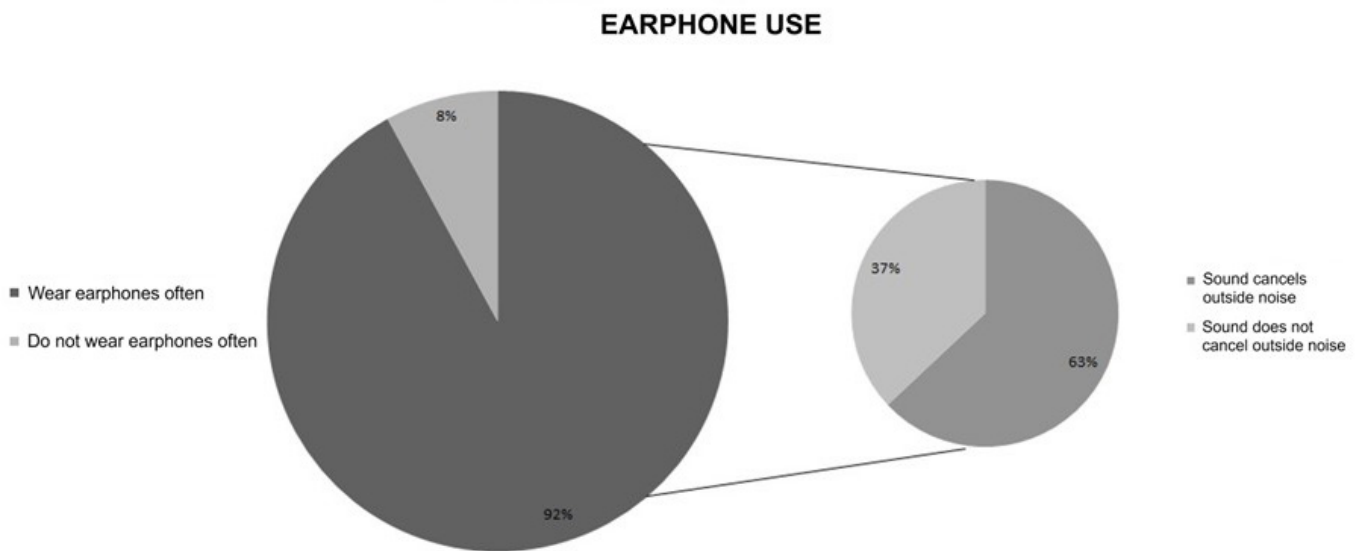
5% ( $p < 0.05$ ), and the RStudio software was used for data analysis.

## RESULTS

### Description of the sample

The study encompassed 1,088 students, of whom three were excluded due to unreadable corrections and invalid answers. Hence, the study considered 1,085 students – 35.9% of them from public schools and 67.1% from private ones. The participants’ mean age was 15 years, which was also that of 29.6% of the sample. The sexes were evenly distributed, as 51.2% were males, and 48.8% were females.

Most respondents (92%) reported they used earphones often at an important intensity, as they answered that the sound canceled the outside noise (Figure 1).



**Figure 1.** Representative percentage of the frequency of earphone use and its usual volume

Most students (79.8%) had been using earphones to listen to music for more than 1 year, and 73% reported using them every day. Also, 56.4% of the study individuals used earphones for more than 2 hours a day.

Places with amplified music were habitually attended by 63.6% of participants, whereas the other 36.4% reported not doing so. Of those who had such a habit, 59.5% reported they had been attending these places for more than 1 year, and 49% attended places with loud music more than once a month.

A comparison analyzed the answers that indicated a risk habit, considering those who answered that they “used earphones often, whose sound canceled the outside noise, and used them every day for more than 1 year, for more than 2 hours a day” and “attended places with loud music for more than 1 year, more

than once a month” (Table 1). A statistically significant difference was found in that private school students used earphones more often than public school ones. There was a difference in the number of positive answers between public school (n = 358) and private school students (n = 611), demonstrating that private school students have this risk habit more often. The comparison of the time of earphone use showed that private school students had used them for more than 1 year and more than 2 hours a day. Hence, there were significant differences in these variables between the groups (Table 1). The number of participants varied depending on the answer, as the analysis considered only those that indicated a risk, and the groups had an uneven number of participants. Therefore, the analysis used the independent chi-square test to balance the groups proportionally.

**Table 1.** Comparison of answers regarding habits that pose a risk to hearing among public and private school students

Risk habits among students	Frequency of risk habits per school		p-value
Wear earphones often	Public	358	0.02*
	Private	611	
Sound cancels outside noise	Public	241	0.5
	Private	418	
For more than 1 year	Public	276	<0.001*
	Private	528	
Wear every day	Public	274	0.86
	Private	462	
More than 2 hours/day	Public	226	0.03*
	Private	341	
Attend places with loud noise	Public	224	0.05*
	Private	425	
For more than 1 year	Public	165	<0.001*
	Private	363	
More than once a month	Public	153	0.85
	Private	280	

Statistical test: Independent chi-square, (\*) considering  $p < 0.05$ .

The analysis also showed that most students from both schools reported listening to music at volumes that canceled the outside noise, though with no statistically significant difference ( $p = 0.45$ ). A similar result was found in the analysis of the question on how often they listened to music on earphones. Most students from both public and private schools used earphones every day, and the difference between the groups was not statistically significant (Table 1).

Likewise, there was no statistically significant difference in the monthly frequency with which they attended places with loud music. All public and private school students in this study reported attending them once a month on average.

## DISCUSSION

Previous research<sup>6</sup> found that most of the sample (94%) used earphones, and a considerable number of them (79%) had abnormal results in the examinations that assessed cochlear cell functioning. However, the authors deemed it necessary to conduct a study in further detail to investigate these young people's hearing habits concerning the frequency and time of device use and attendance at places with amplified music. Since the investigation involved public and private school students, it was decided to compare these two groups to verify whether they had any differences.

Such habits were investigated with a questionnaire developed to this end because there were no validated instruments to specify the frequency of earphone use or this population's presence in musical settings – which were the main focus of the authors' investigation. Even though the Youth Attitude to Noise Scale (YANS)<sup>9</sup> is available in the literature, it measures young people's attitude to noise in different circumstances, which differs from the approach in this study. There is a need for studies to validate instruments that speech-language-hearing therapists specialized in audiology could use to assess such exposure in adolescents.

Non-occupational noise exposure has been increasingly approached. A study indicates that non-occupational noise poses less risk of lesions, but a substantial number of young people expose themselves to this type of noise, especially in earphones<sup>5</sup>. The said study was corroborated by the present one, as the habit of using the earphone was greater than the attendance to places with amplified music. Mobile phone use may also be associated, considering that they have easy access to this device, which contributes to greater

earphone use. The authors did not aim to describe the earphone model most used by participants. Hence, it cannot be stated whether there is a difference between them, which makes it relevant to conduct further studies addressing this variable.

It has already been verified that individuals with a history of earphone use in noisy circumstances or greater exposure have higher hearing thresholds than participants without such history or exposure<sup>10,11</sup>. Even if they do not have hearing loss, the differences in thresholds prognosis their susceptibility to developing hearing changes.

It is also important to approach the issue of human communication, which the subject forfeits when they spend hours on this type of entertainment. Communication is essential to social living among humans<sup>12</sup>. Therefore, when young people give priority to spending most of their leisure time listening to music in earphones, they consequently set aside social communication and interaction. This study found a high prevalence of young people who used earphones often, and a considerable number of them listened to music at an intensity that cancels outside noise – i.e., they cannot hear anything that is happening around them. Psychology interprets this behavior, in certain circumstances, as if the person did not want to talk to anyone, not even if someone talked to them<sup>13</sup>. Adolescents who spend hours listening to something in their earphones may sometimes miss opportunities to acquire social skills with other people.

This research surveyed adolescents' exposure to amplified music, suggesting that the present-day culture among young people involves not worrying about the harmful effects of loud music. Most of them answered they had the habit of using earphones and attending places with amplified music, which characterized them as a risk group. However, they showed no concern with prolonged exposure or excessive sound volume, as observed in the high prevalence of answers reporting that the sound in the earphones cancels outside noise. These behaviors expose them to early irreversible cochlear lesions<sup>7</sup>. In other countries, such as the Netherlands, 70% of the young people reported attending nightclubs, and 24.6% were at risk of hearing loss due to the estimated exposure to 100 dBA for more than 1 hour a week without wearing hearing protection<sup>14</sup>.

The authors pondered that, since these are younger teenagers (Mean = 15 years), they do not attend places such as nightclubs, concerts, and the like as often as

young adults. Consequently, they use earphones more often for entertainment, whereas such settings are mostly attended by older young people.

Music is a pleasurable entertainment for humans, although it has the potential to be an aggressive noise. Sounds related to pleasure, such as music, despite being less harmful, are nonetheless a current risk factor for hearing loss, also damaging other aspects of social life. There is a concern with young people who attend places like parties, nightclubs, concerts, movies, and outdoor events, as they get exposed to high-intensity sound levels (100 dB) that may cause hearing problems<sup>5</sup>. This study asked about their habits regarding earphone use, attendance at places with amplified music, and the time and frequency of these habits.

It was found that the students from private schools were more likely to attend places with amplified music and do so for longer than those from public schools. No studies were found relating these aspects, but it was hypothesized that this factor is related to socioeconomic issues. This study had more participants from private than public schools. However, this difference did not influence the results because the analysis used the independent chi-square test with Monte Carlo simulation, which assesses categories according to their dimensions.

Other studies approaching other types of hearing habits among young people pointed out that listening to music in earphones is the most frequent one<sup>1,4-8,11</sup>. These data corroborate the findings in the present study and possibly reflect the lack of awareness among young people of the problem posed by this type of noise and its effects.

As for being constantly in musical settings in general, the many leisure opportunities available to urban populations are believed to emphasize the close relationship with the attendance to entertainment settings with loud music.

Noise-induced hearing loss is an invisible problem that young people may overlook when it comes to loud music – which could be minimized with the support from schools and educative programs. Besides observable minimum cochlear changes<sup>7</sup>, other impairments may affect this population's hearing, such as tinnitus, which in turn causes a series of other problems (like stress, irritability, and mood changes) and is a quite frequent complaint in the general population<sup>15-20</sup>. Moreover, psychosocial aspects could be further investigated in cooperation with psychology researchers<sup>13,15,17,20</sup>.

Young people and their parents should be informed increasingly earlier of the risks of being exposed to loud music<sup>17,18,20,21</sup> in either earphones or leisure activities.

Some attitudes can minimize such poor habits. Examples include surveilling intensity levels in musical settings; approaching behavioral issues and healthy hearing habits in school curricula since early grades; having pediatricians, adolescent health specialists, and otorhinolaryngologists routinely request yearly audiological examinations to monitor adolescents' hearing and prevent further damage. These highlight the relevance of raising awareness of the damages this type of exposure can cause.

## CONCLUSION

The study showed that most adolescent students have habits that pose a risk to their hearing health. The comparison of the habitual degree of exposure between public and private school students demonstrated that those from private ones generally use earphones more often, have been using them for longer, and attend places with amplified music in a greater proportion than public school students in this study.

## REFERENCES

1. Paping DE, Vroegop JL, El Marroun H, Baatenburg de Jong RJ, van der Schroeff MP. The association of sociodemographic factors and risk behavior with unsafe use of personal listening devices in adolescents. *Int J Environ Health Res.* 2023;33(7):700-9. <https://doi.org/10.1080/09603123.2022.2047901>. PMID: 35262403.
2. Dirks KN, Le Roux L, Shepherd D, McBride D, Welch D. The contribution of personal audio system use and commuting by bus on daily noise dose. *Noise Health.* 2021;23(110):87-93. [https://doi.org/10.4103/nah.NAH\\_81\\_20](https://doi.org/10.4103/nah.NAH_81_20). PMID: 34599112.
3. Dehankar SS, Gaurkar SS. Impact on hearing due to prolonged use of audio devices: a literature review. *Cureus.* 2022;14(11):e31425. <https://doi.org/10.7759/cureus.31425>. PMID: 36523704.
4. Bhatt IS, Washnik N, Torkamani A. Suprathreshold auditory measures for detecting early-stage noise-induced hearing loss in young adults. *J Am Acad Audiol.* 2022;33(4):185-95. <https://doi.org/10.1055/s-0041-1740362>. PMID: 36195294.
5. Byeon H. Associations between adolescents' earphone usage in noisy environments, hearing loss, and self-reported hearing problems in a nationally representative sample of South Korean middle and high school students. *Medicine (Baltimore).* 2021;100(3):e24056. <https://doi.org/10.1097/MD.00000000000024056>. PMID: 33546006.
6. Silva VG, Sampaio ALL, Oliveira CACP, Tauil PL, Jansen GMB. Hair cell alteration prevalence rates in students of a school in Distrito Federal. *Braz J Otorhinolaryngol.* 2012;78(4):91-7. <https://doi.org/10.1590/S1808-86942012000400017>. PMID: 22936143.

7. da Silva VG, de Oliveira CA, Tauil PL, de Castro Silva IM, Sampaio AL. Amplified music exposure carries risks to hearing. *Int J Pediatr Otorhinolaryngol.* 2017;93:117-22. <https://doi.org/10.1016/j.ijporl.2016.12.023>. PMID: 28109481.
8. 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>.
9. Olsen-Widén SE, Erlandsson SI. Self-reported tinnitus and noise sensitivity among adolescents in Sweden. *Noise Health.* 2004;7(25):29-40. PMID: 15703147.
10. Acentales QL, Flórez LJH, Gutiérrez JCC, Castañeda VAR, Forero CR, Palacios KM. The auditory and neuropsychological effects of school children's exposure to environmental noise in a locality in Bogotá, 2010. *Rev salud pública.* 2013;15(1):116-28. PMID: 24892576.
11. 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>.
12. Benetti S, Ferrari A, Pavani F. Multimodal processing in face-to-face interactions: a bridging link between psycholinguistics and sensory neuroscience. *Front Hum Neurosci.* 2023;17:1108354. <https://doi.org/10.3389/fnhum.2023.1108354>. PMID: 36816496.
13. MacDonald R, Burke R, De Nora T, Sappho Donohue M, Birrell R. Our virtual tribe: sustaining and enhancing community via online music improvisation. *Front Psychol.* 2021;11:623640. <https://doi.org/10.3389/fpsyg.2020.623640>. PMID: 33708151.
14. Ansari H, Mohammadpoorasl HAA, Rostami F, Ahdieh Maleki A, Sahebihagh MH, Naieni KH. Pattern of use of earphone and music player devices among Iranian adolescents. *Int J Prev Med.* 2014;5(6):776-81. <http://www.ncbi.nlm.nih.gov/pmc/articles/pmc4085931/>. PMID: 25013698.
15. Park JI, Lee IH, Lee SJ, Kwon RW, Choo EA, Nam HW et al. Effects of music therapy as an alternative treatment on depression in children and adolescents with ADHD by activating serotonin and improving stress coping ability. *BMC Complement Med Ther.* 2023;23(1):73. <https://doi.org/10.1186/s12906-022-03832-6>. PMID: 36879223.
16. Liang X, Tang X, Liu M, Liang X, Chen L, Chen X et al. Associations of self-reported residential noise exposure with obesity and hypertension in children and adolescents. *Front Pediatr.* 2022;10:902868. <https://doi.org/10.3389/fped.2022.902868>. PMID: 36034553.
17. Knoerl R, Mazzola E, Woods H, Buchbinder E, Frazier L, LaCasce A et al. Exploring the feasibility of a mindfulness-music therapy intervention to improve anxiety and stress in adolescents and young adults with cancer. *J Pain Symptom Manage.* 2022;63(4):e357-e363. <https://doi.org/10.1016/j.jpainsymman.2021.11.013>. PMID: 34896280.
18. Degeest S, Keppler H, Vinck B. Leisure noise exposure and associated health-risk behavior in adolescents: an explanatory study among two different educational programs in Flanders. *Int J Environ Res Public Health.* 2021;18(15):8033. <https://doi.org/10.3390/ijerph18158033>. PMID: 34360342.
19. Rhee J, Lee D, Suh MW, Lee JH, Hong YC, Oh SH et al. Prevalence, associated factors, and comorbidities of tinnitus in adolescents. *PLoS One.* 2020;15(7):e0236723. <https://doi.org/10.1371/journal.pone.0236723>. PMID: 32735626.
20. Chęć M, Ligocka M, Janik I, Samochowiec J, Samochowiec A. Intermediary role of mood in the way music affects emotional reception of visual stimuli in adolescents. *Psychiatr Pol.* 2019;53(2):341-57. <https://doi.org/10.12740/PP/82028>. PMID: 31317962.
21. Piccino MTRF, Corrêa CC, Pardo-Fanton CS, Blasca WQ. Social-educational hearing health activities based on blended learning. *Disturb. Comunic.* 2023;35(1):e57003. <https://doi.org/10.23925/2176-2724.2023v35i1e57003>.

#### Author's contributions:

VGS, KMP: study conceptualization and design, data collection and analysis, and article writing and review;

CCC, IMCS: data analysis and article writing and review;

CACPO, ALLS: study conceptualization and design, project development, supervision of data collection and analysis, and article writing and review.

## APPENDIX A. QUESTIONNAIRE

Survey of youth and adolescents' hearing habits concerning the use of earphones and exposure to amplified music

Name: \_\_\_\_\_

Grade/Class: \_\_\_\_\_ Age: \_\_\_\_\_

Sex: ( )M ( )F

Please, answer:

1- Do you frequently wear earphones to listen to music?

A-( ) yes B-( ) no

2- Does the sound in the earphones you use cancel outside noise?

A-( ) yes B-( ) no

3- How long have you had the habit of listening to music on your earphones?

A-( ) For more than 1 year B-( ) For less than 1 year

4- How often do you usually listen to music using earphones?

A-( ) Every day B-( ) Less than 3 days a week

5- How much time on average do you usually listen to music per day?

A-( ) more than 2 hours a day B-( ) Less than 1 hour a day

6 – Do you often attend places with very loud sounds, such as shows, concerts, nightclubs, parties, gyms, and so on?

A-( ) yes B-( ) no

7- How long have you been attending such places?

A-( ) For more than 1 year B-( ) For less than 1 year

8- How often do you go to these places?

A-( ) More than once a month B-( ) Once a month