Validation and reliability of the School-age Hearing Screening Questionnaire in adolescent users of compressed audio file players

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Abstract

Introduction: Frequent use of audio file players and volume intensity are risk factors for the development of hypoacusis. Objective: To validate the school-age hearing screening questionnaire (CUTAE, by its Spanish acronym) for hearing disorders detection in teenage users of compressed audio file players (CAFP). Methods: Adolescent CAFP users without hypoacusis or middle ear pathology were studied. The CUTAE was applied and audiometry was carried out. Reproducibility (intraclass correlation coefficient-ICC), internal consistency (Cronbach’s alpha), face validity (Delphi technique), CUTAE-audiometry concurrent validity (Pearson’s correlation) and predictive validity (multiple regression) of the questionnaire was assessed. Results: Fifty nine adolescents (118 ears), 66% females, average age of 13 years, were assessed. Ninety ears had normal parameters, 18 showed a threshold decrease < 20 dB, with morphology associated with acoustic trauma (AT) at 6 kHz and 10 with AT. The questionnaire had an ICC of 0.788, a Cronbach alpha-value of 0.807, Pearson’s correlation values of 0.290 to 0.368 (p < 0.05); the predictive variables were usage hours, difficulty hearing others (p < 0.05) and type of buzzing (p = 0.07). Conclusion: The CUTAE has adequate clinimetric properties to be considered as a screening test in the detection of hearing disorders in adolescent users of CAFP.


Introduction

Noise-induced hearing loss (NIHL) occurs when an individual is continuously exposed to dangerous sound levels. Compressed audio file players (CAFP) frequent use and high volume levels of are considered risk factors in adolescents for the development of hearing loss in adulthood.1

NIHL and noise-induced threshold shifts (NITS) are assessed with pure tone audiometry, which is considered the gold standard for the diagnosis hearing loss;2,3 with this diagnostic resource, noise exposure, habits and symptoms are assessed in order to identify hearing disturbances.4

Hearing screening questionnaires should include aspects related to NIHL such as hearing loss, tinnitus and noise exposure.5,6 There are only few instruments of this type for early diagnosis of harm due to noise exposure in adolescents.5,7,8 In Mexico, the School-age Hearing Screening Questionnaire (CUTAE – Cuestionario de Tamizaje Auditivo Escolar) was designed,4 which is able to detect disturbances in CAFP adolescent users; however, its clinimetric properties were not assessed. Our purpose was to validate CUTAE capability to detect hearing damage in adolescents exposed to noise and to the use of CAFP.

Method

The investigation was carried out at the Audiology Department of the National Institute of Rehabilitation in Mexico City, and the sample was obtained at two secondary schools. Adolescent CAFP users of between
and 16 years of age, of either gender, without a history of hearing loss secondary to hereditary or congenital factors or middle ear pathology were included.

The CUTAE measures exposure to CAFP, noisy environment, usage hours, sound volume and hearing loss in children and adolescents to identify hearing disturbances. It contains 26 questions with multiple answer options. It discriminates between CAFP users and non-users, and between subjects with and without hearing disturbances. The authors granted their consent for its validation.

A group of audiology, otoneurology, speech therapy and instrument validation experts with 7 to 10 years’ working experience was formed. Noise-exposure domains (attendance to concerts, high volume level, daily usage hours, type of earphones) and symptoms (hearing impairment, ear infection, buzzing, dizziness) were established. Instructions, language, comprehension and question-answer options coherence were reviewed. The modified questions are shown in table 1. With the final version, the CUTAE reproducibility was measured by applying it on two occasions, with 3 weeks distance between the first and the second.

Prior to the CUTAE application, informative talks and leaflets were provided to teachers and parents on the use of CAFPs and its relationship with hearing damage.

With parents’ written informed consent, the students were brought to the Audiology Department accompanied by one teacher. Two doctors delivered the CUTAE and took the children’s history, focusing on family or personal history of otic conditions or hearing loss, upper respiratory tract diseases and use of ototoxic agents, and carried out an otorhinolaryngologic examination.

Air tone audiometry and logoaudiometry (Madsen Orbi
ter 922® audiometer), as well as tympanometry (Madsen Zodiac 901® impedance tester) were carried out in a soundproof booth. Bone audiometry was performed in those in whom air conduction was observed to be lower than 20 dB.

The output scale of the questionnaire was additive and a score was assigned to each answer option, with their weight and order being considered: 1, no hearing damage and 5, highest damage; lowest score was 26 and highest 128; it was used for all questions except for number 23, where a visual scale with values ranging from 1 to 10 was viable.

Face validity was assessed with Delphi technique, internal consistency with Cronbach’s alpha, test-test reproducibility with intraclass correlation coefficient (ICC) and concurrent validity (CUTAE-audiometry) with Pearson’s correlation.

Table 1. Changes to the School-age Hearing Screening Questionnaire questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Original version</th>
<th>Modified version</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Under what circumstances have you been exposed to noise? Attending parties, bars or clubs</td>
<td>Parties, family entertainment center (videogames)</td>
</tr>
<tr>
<td>3</td>
<td>In the past 3 months, how many times have you attended a concert, bar or club, loud parties, movie theater or theater or places with fireworks?</td>
<td>“Bar or club” was eliminated</td>
</tr>
<tr>
<td>7</td>
<td>Type of earphones: -On-ear -Earbuds -In-ear</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Mark the volume you use most commonly in your Mp3 player</td>
<td></td>
</tr>
<tr>
<td>13 and 14</td>
<td>Have you ever experienced any type of hearing problems such as buzzing, pain or hearing difficulty? What problems have you experienced?</td>
<td>Which of the following discomforts have you experienced?</td>
</tr>
</tbody>
</table>
In 49% of adolescents who attended concerts and parties once or twice within the previous 3 months, normal audiometry was observed in comparison with 17% of those who did it more than 15 times in the same period (p < 0.05); 74% of those who used the CAFP between 1 and 2 hours per day had a normal audiometry in comparison with those who used it for more than 8 hours per day (p < 0.05); 5% of adolescents who used the player at home had AT (p < 0.05). Volume level > 50 to 100% of the player capacity was associated with hearing disturbance (p < 0.05) and AT (p < 0.012); 33% showed difficulty listening to teachers in class and listening on the telephone (p < 0.05).

The presence of tinnitus was associated with hearing disturbances in 33% of cases (p < 0.05). In addition, the type of buzzing is associated with hearing problems: adolescents who perceived a buzzing similar to motor noise had hearing problems in comparison with those who perceived a buzzing similar to the sound of an insect (p < 0.001). Table 3 shows the predictors for noise-induced hearing damage.

## Discussion

The CUTAE is reproducible, reliable and valid. It measures noise exposure and symptoms with similar results to those published in other investigations where hearing loss due to recreational or social noise was assessed. Internal consistency of the instrument was similar to that reported by Bohlin and Gullone (Cronbach’s alpha of 0.80 versus 0.88); there was adequate homogeneity between questions, so that it turned out to be a reliable screening test for the detection of hearing disturbances in CAFP adolescent users, among whom acoustic trauma was identified in 24% of ears, in contrast with 12.5% reported by Niskar in children and adolescents with hearing loss induced by noise and 14% of hearing loss reported by Olunsanya. The high prevalence might be explained by the low awareness of adolescents about the damage caused by the use of CAFP and high volume levels in comparison with older young persons.

Of the adolescents exposed to intense noise on more than 15 occasions within a 3-month period, 17% had hearing disturbances, which is lower than the 30% rate observed by Jofre in young individuals exposed to sound intensities higher than those considered as occupational risk in activities such as attending clubs or concerts or playing in a rock band.

CAFP daily use was considered to be a risk factor for acoustic trauma: 25% of the sample had injuries.
in both ears. Adolescents exceeded the noise daily dose recommended time by using the player for more than 8 hours; in the occupational setting this exposure is regarded as risky and is regulated by the Mexican Official Standard22 (noise daily dose of 90 dB in an 8-hour period).

With regard to sound intensity, an important variation was identified according to the context in which music is listened to: it was higher when practicing sports and when using public transport.13 In the analyzed adolescents, 44 % listened to the player at home and, of this proportion, 5 % had acoustic trauma.

The main symptom was tinnitus in 17 % of the sample; it has been identified in 23 to 66 % after noise exposure and, of this proportion, 5 % had acoustic trauma.

NIHL predictors were CAFP daily usage hours, difficulty listening on the telephone (p < 0.05) and, to a lesser extent, buzzing type and onset (p = 0.07), consistent with Ising observations,26 who reported that continuous noise exposure for 5 years causes hearing loss induced by noise louder than 10 dB at the end of this period. We conclude that CUTAE is a reliable screening test for the detection of hearing disturbances in CAFP adolescent users.

### References


