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Attitudes towards hearing, hearing loss, and hearing protection in university students

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ABSTRACT

Objective: Young adults are at risk for hearing loss caused by exposure to loud music. Intervention at this stage provides opportunities to support lifelong hearing protection use. This study explores attitudes related to hearing, hearing loss, and hearing protection among university students.

Design: Qualitative interview design, supplemented by quantitative questionnaire data.

Study sample: 18 university students, aged 18-24 years.

Results: Students were uncertain about mechanisms of noise-induced hearing loss, did not feel vulnerable to permanent hearing damage from loud music, were unconvinced of hearing protection efficacy, and reported barriers to hearing protection use. Students emphasised the positive effects of loud music and reported an increased likelihood of using hearing protection were it used by peers. Music students appeared more aware of the negative effects of loud music exposure. Students reported conflicting attitudes regarding government regulation of hearing protection use.

Conclusion: Young adults require education about hearing protection from multiple, credible sources and need to understand the mechanisms behind noise-induced hearing loss in a way that makes it of high personal relevance.

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KEYWORDS

Noise-induced hearing loss; hearing protection; attitudes; young adults; tinnitus; leisure noise

Introduction

Leisure noise is easily accessible to young adults (Hunter 2018). High levels of noise and music can be found in pubs, nightclubs, bars, concerts, stadiums, gyms, cars and through the use of personal listening devices (PLDs). This ease of access has normalised loud music exposure.

Intervention during early adulthood provides opportunities to form lifelong protective habits. This period in life is categorised by transition, as one moves from the end of formal education towards their career (Stockings et al. 2016). Young adulthood provides opportunities for developing habits and skills that could benefit hearing health and therefore prevent the negative consequences of noise-induced hearing loss and/or tinnitus (NIHL/T). Furthermore, students are in an institutional environment which provides unique platforms for information-sharing and skill development (Stockings et al. 2016). Thus, critical timing of intervention programs could lead to the prevention of NIHL/T through promotion of hearing protection behaviour (HPBs) in the young adult population.

There is much research regarding noise exposure regulations in occupational settings (Health and Safety Executive [HSE] 2005; National Institute for Occupational Safety and Health [NIOSH] 1998). However, leisure activities lack similar mandatory regulations, with often only recommendations in place (HSE 2005; OSHA 2003). Although there is evidence that some young adults do engage in hearing protection use (Gjestland and Tronstad 2017), noise levels at concerts and other mass social events attended by

young adults often exceed these recommendations (Tittman et al. 2021). Current guidelines suggest limiting loud noise to a maximum average of 100 dB(A) over 15 minutes (Clark and Bohne 1999; Lutman, Davis, and Ferguson 2008; WHO 2022). Guidelines are an attempt to minimise the incidence of NIHL/T, the most common disorders of the auditory system caused by exposure to loud sounds. There is some evidence to suggest prevalence of such symptoms have been increasing (Henderson, Testa, and Hartnick 2011; Le Clercq et al. 2016; Shargorodsky et al. 2010). NIHL/T can impact significantly on an individual's life. Consequences may include social isolation, depression, and anxiety (Vogel et al. 2014).

One method of mitigating the risks of noise exposure during leisure activities is using hearing protection devices (HPDs) (Kraaijenga, Ramakers, and Grolman 2016). However, research shows use among young adults remains low (Alnuman and Ghnimat, 2019; Degeest et al. 2017; Reddy et al. 2021). Often people who use hearing protection do so because they have experienced temporary NIHL or tinnitus, which acts as a trigger, or cue to prevent further damage (Beach, Williams, and Gilliver 2012; Hunter 2018). Research indicates that young adults prioritise enjoyment of loud music over the hearing, and were concerned that hearing protection (particularly earplugs) would affect sound quality and enjoyment (Hunter 2018). Understanding the undesirable effects of hearing protection use will aid health professionals to improve the uptake of protection before the presentation of hearing symptoms.

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Keppler, Dhooge, and Vinck (2015), demonstrated that attitudes towards noise and hearing protection are directly linked to PLD use and hearing health status. Among their findings was the correlation between positive attitudes towards noise - meaning that noise was viewed as something positive and actively sought after - and low hearing protection use. Young adults who displayed a more positive attitude towards noise and a more negative attitude towards hearing protection had significantly worse hearing than other participants. In contrast, young adults do not consider the risk of hearing loss of high personal relevance (Vogel et al. 2008). Therefore, young adults are at high risk of NIHL due to PLD use coupled with their attendance at events associated with loud music. The risk is greater for young adults who are themselves musicians (Skoe and Tufts 2018). This suggests that young adults require interventions targeted towards them directly to address the dangers of loud music exposure.

Approaches determining how to design interventions to encourage HPD use may consider health behaviours within a health psychology framework to improve outcomes (Manchaiah 2012). However, a recent systematic review that included studies targeting young adults found a lack of health psychology theory applied, or at least described, within the development of recreational hearing protection interventions (Loughran et al. 2020). Various health behaviour frameworks have appeared in studies targeted towards promoting healthy hearing practices, including the health belief model (HBM), the protection motivation theory (PMT), and the theory of planned behaviour (TPB). In particular, the PMT framework proposed by Rogers (1983), and Rogers and Prentice-Dunn (1997), has been used to compare two different groups of adolescents in a study by Vogel et al (2008), which found that the PMT provided explanations accounting for health beliefs and behaviours in their respective groups.

Understanding what motivates young adults to use hearing protection or not, is only half of the dilemma. The real goal of research in this area is to design practical strategies that will improve awareness and HPBs in young adult populations (Hunter 2018). However, audiologists and other health professionals need to first understand what hearing protection methods are appropriate for young adults, to bridge the gap between the methods that professionals expect to be easily executed, and the reality of which methods young adults are prepared to implement.

The aims of this qualitative research study include: (1) to explore the attitudes of young adult students with regards to hearing, hearing loss, and hearing protection; (2) to determine if there is a difference in attitudes towards hearing, hearing loss, and hearing health protection between music and non-music students; (3) to explore the behaviours of young adults with regards to hearing health; and, (4) to determine if there is a difference in behaviour regarding hearing protection between music and non-music students.

Methodology

Participants

Nineteen volunteers were interviewed. The sample size was chosen due to the potential for data saturation after consulting qualitative studies conducted within the subject area, such as Hunter (2018). Creswell (2002) also provides guidelines for qualitative research suggesting 15–20 individual interviews should be the standard. One participant was excluded due to a pre-existing audiological condition. Eighteen participants were included in the study (n = 18). Seven participants were male, and eleven

participants were female. Ages ranged from 18 to 24 years (mean age ≈ 22 years). 5 participants were studying for music degrees; the other 13 participants were studying various degrees (see Appendix 3). Of the students studying non-music-related degrees, 7 played musical instruments as a hobby. Participants were recruited from the University of Manchester, the University of Exeter, the Royal Northern College of Music, and Leeds College of Music. Participants were recruited through advertisements on departmental notice boards, volunteer databases, and word of mouth. Once a student expressed an interest to take part in the study, they were sent the participant information sheet by email, and given at least 24 hours to decide whether they wanted to participate in the study. Those that chose to participate contacted the primary researcher; appropriate times for interviews were arranged on a case-by-case basis. Written consent was obtained before the interview commenced. Ethical approval for this project was granted by the University Research Ethics Committee of the University of Manchester (reference number 2017-3183-4559).

Participants were included if they were undergraduate or postgraduate students, or recently-graduated (within 12 months) and were 18–24 years old. Volunteers were not included if they were hearing aid and/or cochlear implant users, or they had a hearingrelated condition that had been diagnosed by a medical doctor.

Procedure

Data collection sessions took around 45 min with each participant. Sessions involved a structured interview, conducted by the primary author, and then a questionnaire about listening habits and use of hearing protection.

Interview

The interview began with a series of open-set questions designed to prompt participants into sharing their own narratives and experiences with hearing, hearing loss, and hearing protection (Appendix 1). Many of the questions were adapted from a study by Vogel et al. (2008), which examined adolescents' perspectives towards hearing protection. These questions were categorised by headings, mostly taken from the PMT framework by Rogers (1983) and Rogers and Prentice-Dunn (1997), consisting of: intrinsic/extrinsic rewards; history of hearing damage; vulnerability/severity of consequences of hearing loss; response and selfefficacy; cost; responsibility and role models; social influences; and future involvement. The interview time ranged from 13 min to 41 min (average interview time ≈ 22 min). Interviews were audiorecorded, with consent, using a digital recorder (Olympus Digital Voice Recorder WS-560M).

Questionnaire

The participants were asked to complete an unvalidated questionnaire to determine more specific listening habits and HPBs. The questionnaire was made up of 15 questions generated by the authors, and can be viewed in Appendix 1.

Data analysis

Interviews were transcribed verbatim by the primary researcher. Participants were given the opportunity to read their transcripts and clarify/add to any points made during the interview. Qualitative data from the interview and questionnaire were collectively analysed using qualitative data software Nvivo version 12.1.0 (QSR International Pty Ltd). Data was independently analysed by two of the researchers: MM (primary analysis) and MTL (secondary analysis). Findings were then compared to assess the consistency of results. A combination of the thematic content analysis approach (Knudsen et al. 2012) and the framework analytic approach (Ritchie, Spencer, and O'Connor 2003) was used. A detailed description of the data was used to develop deductive codes using the PMT framework for reference (such as "extrinsic rewards", "intrinsic rewards") and inductive codes purely drawn from the data itself (such as "accessibility", "generational differences and effects"). The identified codes were then categorised under distinct themes for coherence, which are presented in the results below. In the results section, the authors have presented those codes mentioned primarily most frequently and secondly based on novelty compared to existing research. Conflicts were resolved through discussion and compromise, and where compromise could not be reached, the primary researcher's interpretation was upheld.

Results from the questionnaire were compiled quantitatively. However, because of the small sample size, this information was only used to supplement qualitative data. Comparisons between the participants were interpreted qualitatively.

Saturation

Saturation is used as an indicator of rigour in qualitative research (Morse 2015) and a barometer with which to judge the appropriateness of data collection and analysis (Saunders et al. 2018). To assess saturation, content from each participant interview was investigated in the context of the content gathered thus far. Following the first seven interviews, thirteen concrete categories had become apparent (87% of the total categories identified). After the eighth participant interview, two more categories were added (17% of the total categories). The 15 categories were then combined, refined and/or assigned to the themes presented below.

General attitudes and beliefs

Intrinsic and extrinsic rewards

Threat appraisal

Theme 1: History of hearing damage Theme 2: Vulnerability/severity of consequences of NIHL

Coping appraisal

Theme 3: Response and self-efficacy Theme 4: Cost Theme 5: Responsibility and role-models Theme 6: Social influences Theme 7: Future involvement

After the eighth interview, no further categories were added. It is likely that additional interviews would not have resulted in any new categories being identified.

Results

General attitudes and beliefs: intrinsic and extrinsic rewards

Participants discussed intrinsic and extrinsic rewards for listening to music. Intrinsic rewards refer to internal motivating factors, such as listening to music for one's own enjoyment, while extrinsic rewards refer to external motivating factors, such as social acceptance from peer groups. Music was an important part of the participant's lives, impacting on their mental health, stress/relaxation levels, and careers. Enjoyment from listening to music was apparent; the thought of losing the ability to listen to music being diminished or removed was seen as undesirable for all participants.

The rationale for listening to music loudly versus listening to music at more reduced volumes differed. Quieter levels were reported in situations where participants needed to concentrate (studying) or to provide an atmosphere (relaxation). Loud music was preferred for physical musical experiences (dancing); to improve mood; to motivate when doing physical exercise; to hear musicality (melodies); evoke positive personal experiences (memories); and to provide atmospheric and emotional states (freeing inhibitions/sense of euphoria):

... it has to consume me. (Participant 2)

... at a concert you do want to hear everything ... they might put it up a little bit too loud for your liking but you don't want to then block it out ... for your own safety it's a good thing to do but ... you want to hear it as it's intended ... to be heard. (Participant 10)

... you can immerse yourself in it [the music]. (Participant 18)

Participants mentioned that preferences for loud music changed throughout their lifespan; that they have been influenced by friends, family, peers, and found sharing music – in quiet or in loud circumstances – to be critical for forming or reinforcing social ties:

 \dots my dad \dots he's the one who like gave me the love of music \dots he is always finding me music \dots and I started making friends who liked more diverse types of music and together we'd find more music (Participant 2)

It is important to note that differences in vocation had an effect on the rewards of listening to music at different volume levels, as musicians had more specific preferences for listening to loud music (for example, increasing music volume to hear all the components in a musical piece).

Threat appraisal

Theme 1: history of hearing damage

All music students and 12 out of the 13 non-music students had experienced temporary NIHL/T, discomfort and/or pain in their ears when listening to loud music and reported negative attitudes towards the recurrence of symptoms. These participants found the threat of NIHL/T or pain to be "scary" and the threat of permanency of these symptoms as something that would lead them to feel "devastated", even more so for participants who were music students. Both music and non-music students reported that NIHL/T in particular would affect their ability to listen to music, to communicate, and to find employment. However, music students expressed fear and devastation to a higher degree than non-music students; spending up to five times longer expressing the effects hearing loss would have on their lives. Participants mentioned that at times, the loud level of music had immediate consequences, as it was distracting and made it difficult for them to communicate or focus on desired tasks.

Pain was a motivator for change, leading to earplug adoption, and technological changes (enforcing volume limits on PLDs). NIHL/T was a motivator for use of HPDs.

... last time I lost my hearing ... I can't really listen to anything so I know how it feels it's ... so quiet when people are talking to me I can see their lips are moving but I can't really get what they're saying ... (Participant 14)

 \dots when you come out of a club \dots anyone who's been in quiet knows that silence has a sound – a sort of eeee like a very \dots mild whistle but then when you've been in a club \dots that is just 200 times stronger \dots you can just hear the noise \dots it can be quite annoying \dots I've started wearing earplugs \dots (Participant 16)

Only one participant mentioned that they had not experienced temporary hearing loss, tinnitus, or pain in the ears following exposure to loud music, but that they knew of people (family members, friends, and teachers) who had permanent hearing loss and/or tinnitus. Although they had not experienced any form of hearing-related symptoms themselves, they reported that personal experience may be an avenue to engage with young adults about hearing loss.

Theme 2: vulnerability/severity of NIHL/T consequences

While participants viewed NIHL/T and ear discomfort/pain as negative outcomes, there was a degree of uncertainty as to whether they were personally at risk for these symptoms when listening to loud music:

I know it can't be very great but... it can't be that bad either (Participant 1) $% \left({{\left[{{{\rm{A}}_{\rm{T}}} \right]}_{\rm{T}}}} \right)$

There were participants that felt they did not personally run the risk of hearing loss from music exposure. Although 15 participants recognised listening to loud music had the potential to cause hearing damage, they were uncertain about the prevalence of such an effect in the general population:

How can one damage their ears – so, listening to music very loudly, I guess... is there a high instance of people damaging their ears by listening to music very high? (Participant 8)

The uncertainty extended to general knowledge about the effects of NIHL/Ton everyday life. Given the age group, there were participants who felt they were too young to be concerned with hearing protection as they felt the effects of loud music were temporary, their hearing would be restored within a few hours/days following exposure, and it was not an immediate threat. Many had not changed their listening habits in response to experiencing hearing-related symptoms. Participants reported that they were less aware of the risks of loud noise exposure compared to other causes of hearing loss (ageing), and were unaware of different methods/efficacy of hearing protection.

There was confusion around vulnerability to hearing loss, and legal requirements in relation to dangerous noise levels and hearing protection:

if you wear ... a hard hat for work ... it's a legal requirement, you have to ... I think it's the same for hearing (Participant 7)

Not all participants responded to the experience of hearingrelated symptoms in the same way. There were various reasons participants chose not to take part in HPBs, including: the perception of a lack of an immediate/permanent threat, enjoyment of loud music, and social stigma associated with the use of hearing protection. For the majority of participants, the risk of NIHL/T was not worth giving up their enjoyment of loud music, while for others, it was not regularly on their mind:

 \dots there is a little bit of a thing around it that if you wear earplugs it's a big like "aw \dots I can't quite deal with it [loud music]" (Participant 5)

I don't think it comes to me naturally to think to play quieter or listen quieter all the time I don't think I think about it enough (Participant 13)

A common subtheme that emerged was the idea that temporary NIHL/T or discomfort in the ears were considered to be a normal part of the musical event process and something that you get used to over time:

Once you go in you feel like it's super-duper loud... but then after ten minutes or so you're sort of used to it... actually it gets louder and louder but you don't even notice that (Participant 9)

There appears to be a clear link between perceptions of the severity of the threat and the vulnerability of participants to hearing-related symptoms, with those who have experienced temporary hearing-related symptoms generally more likely to view themselves as at-risk for experiencing more permanent symptoms.

However, students still felt that they were more vulnerable to audiological symptoms when they were exposed to noise rather than music (motorsport events, shooting, factory work, traffic), and other risk factors (head injury, infections, medications, ageing, noisy jobs). Perhaps providing a rationale for hearing protection being reported for shooting but not music-related activities.

There is an expectation that music in clubs, bars, and other recreational venues would be significantly loud, and an acceptance of acclimatisation to these noise levels. However, there are those who feel that they do not attend clubs/concerts often enough to warrant vulnerability to hearing-related symptoms, and that attitudes changed as they became older/varied across generations.

Overall, participants were split in terms of their views on personal risk for NIHL/T. Participants mentioned differing reasons for their uncertainty: lack of information from credible sources, their youth, recovery from temporary threshold shifts and tinnitus, the perceived inevitability of hearing loss with ageing, acceptance of noise levels during music events, misconceptions about legality surrounding noise levels, and how loud is too loud to be considered harmful to hearing.

A lot of the time it's just either laziness or just thinking "oh it's only loud for a little bit, I'll just get over it" (Participant 5)

Coping appraisal

Theme 3: response and self-efficacy

Participants expressed awareness that effective protection against NIHL/T was possible. Methods perceived as effective included taking frequent breaks, monitoring and regulating volume level, standing away from speakers in clubs, regular hearing checks (online and in-person), and adopting noise-cancelling, around-ear headphones over insert earphones. Though students felt strongly that it was the responsibility of the individual to take these precautions, their opinions regarding the efficacy of hearing protection methods were heavily influenced by gate keepers¹. Participants mentioned prompts such as cell phone reminders when the volume became dangerously loud or the offer of free earplugs in clubs as forms of encouragement towards hearing protection use.

Use of hearing protection and observations of others using hearing protection was lacking. Those who wore hearing protection noted seeing teachers or peers as enablers, and discussed their personal experience with hearing protection as a means of enjoying loud music without experiencing negative consequences:

... it's like getting drunk without the hangover ... (Participant 16)

Students who played in orchestras also found the use of sound shields to be an effective method of hearing protection. Those who were musicians, or those who participated in other noisy activities (shooting and working in music venues) were more aware of alternative methods of hearing protection (taking breaks, volume control, and keeping distant from the sound source). Those who did not take part in such activities referred almost exclusively to earplugs as the only method of hearing protection.

There was a link between perceived response efficacy and self-efficacy: the more convinced a student was that a method of hearing protection was effective, the easier it was for them to put these methods into place. Therefore, participants who regularly used hearing protection reported strong beliefs that the methods they were using were effective. For example, those who used earplugs reported that they found them helpful and personally effective at minimising previously experienced negative symptoms, and therefore continued to use them.

Theme 4: cost

Many participants reported participation in risky listening habits. This was in part due to the intrinsic and extrinsic rewards explored previously, and due to costs associated with hearing protection use:

... it's embarrassing it's too hard why would you bother? (Participant 16)

Where hearing loss was perceived as an inevitable process of ageing, it was felt that hearing protection methods would be ineffective, would remove the fun of being young, and ruin the musical experience:

If someone told me I would lose my hearing when I got older and there was nothing I could do to stop it, I would keep listening to my music as loud as possible for as long as possible... just so that I could enjoy my music while I can (Participant 8)

... if you put in earplugs you still hear amazingly a high, large amount of the sound around you ... I wouldn't take those to a concert 'cause I don't think they'll be that effective (Participant 12)

If I put my earplugs in ... I can't hear the detail I normally would be able to hear and I can't always play in tune ... I find it quite frustrating (Participant 7)

Additional reasons for not participating in hearing protection included: affected communication, physical discomfort, poor selffeedback, lack of awareness, and not seeing others wearing hearing protection. Participants expressed that their listening habits was their decision alone, and there was agreement that they did not want to be forced into using hearing protection.

The HPB that required less time and effort cost was mentioned most often by participants as the easiest way to protect their hearing (keeping headphone/speaker volume low). Participants explained that the lower the time and effort cost, the more likely they were to adopt hearing protection practices:

 \dots depending on the \dots regimen – if it's like really intense well maybe I'll \dots do it once a week or something (Participant 8)

Theme 5: responsibility and role models

Participants felt personally responsible for protecting their hearing, however, almost all mentioned influences of gate keepers who could provide support in the form of credible knowledge about hearing, hearing loss, and hearing protection. Gate keepers included lecturers, the government, medical professionals, teachers, parents, peers, the media, members of the music industry, employers, music departments, and headphone manufacturers. Awareness, knowledge, encouragement, and even the provision of physical hearing protection (free earplugs) from these sources led to more adoption protective behaviour.

There has been a lack of information surrounding hearingrelated symptoms from persons considered reliable (lecturers, parents, and peers), including an example of poor professional support where symptoms were dismissed by an audiologist as not being worthy of concern.

Theme 6: social influences

Although few participants reported using hearing protection regularly, participants felt they would be more likely to use hearing protection if it were more widely used by their peers, and all participants reported that they felt capable of taking precautions.

It was felt that increased awareness would lead to increased adoption of hearing protection. Participants who discusses family members' hearing loss and/or tinnitus, who were themselves musicians, and who had experienced temporary NIHL/T were more aware of the consequences of hearing loss, and therefore more aware of the benefits of hearing protection use.

No participants mentioned avoiding hearing protection use due to purely aesthetic reasons. This was separated from social stigma, which was more about how they felt people would prejudge them if they were seen wearing hearing protection:

it is still kind of embarrassing to see people wearing earplugs (Participant 16)

Theme 7: future involvement

Participants expressed a need for greater awareness about hearing, hearing loss, and hearing protection. Critical sources of education around these issues were mentioned: schools, governments, awareness campaigns, and the medical community. Additional sources of information were noted as members of the music industry and university music departments. Participants feltthe governmentcould promote hearing protection by providing stricter enforcement of noise level legislations for clubs, bars, pubs, event organisers, and PLDs. Music venues were seen as having a responsibility to provide ear protection to their patrons, and to provide prompts and reminders for hearing protection use.

General education about hearing and hearing loss was seen as fundamental to personal health, but participants requested more in-depth information about NIHL, in particular: what physical and physiological mechanisms are involved, what causes these symptoms, and what levels are considered dangerous. There was the feeling that education needed to be age-appropriate, thorough, and come from a credible source.

A multidisciplinary approach to promoting knowledge about hearing, hearing loss, and hearing protection was recommended. Participants felt the information would be more effective coming from multiple sources, utilising different gate keepers at different life stages and enhancing education and protection behaviours. Provision of information from different sources would lead to increased opportunity for knowledge-sharing and repetition, to the point where the majority of hearing protection discussion acts as a reminder:

... the ideal situation would be there's a cacophony of people telling each other this is what you should do and then your voice just adds on top of that (Participant 16)

Participants emphasised the need to educate children and teenagers about the dangers of loud music exposure during their formative years. They discussed parents and family being critical gate keepers. Some participants expressed that young adulthood would be the best time to learn about NIHL/T risk, while others expressed that they would prefer to learn about this at an earlier age. However, participants also noted that education should be directed at all age groups, including older generations who were denied the knowledge of the effects of loud music exposure during their own more formative years.

Additional suggestions for increasing hearing protection use: informing people about NIHL and hearing protection following experience of tinnitus or temporary hearing loss designing more comfortable and accessible hearing protection, building healthy listening habits, using social media to promote hearing protection, as well as discussing personal experiences with NIHL/T:

... if you just tell them about ways to protect and the severity (of hearing loss) it doesn't really hit them as hard as if somebody actually went up to share about their experiences (Participant 6)

The question that received the most disparate results was that regarding whether hearing protection use should be regulated by law. As seen in Appendix 2, seven out of eighteen participants indicated that hearing protection use should be regulated by law, while six participants preferred a "no" response, and five out of eighteen participants remained unsure.

Discussion

Results from this study suggest that there are individual differences in student attitudes towards hearing health behaviour. Young adults should be educated about hearing protection methods that are applicable to their needs; this study suggests that different intervention types may be more effective for different students.

Key findings

Hearing protection use among students remains low (Gilles and Paul 2014; Gupta et al. 2014). Lack of awareness coupled with barriers to hearing protection use may provide reasons for this. There was superficial awareness among participants that exposure to loud music may be dangerous, while many students remained unaware of the deeper mechanisms and consequences of NIHL. Therefore, students were uncertain about the necessity and efficacy of using hearing protection methods. This corresponds to findings from Vogel et al. (2008), and Zhao et al. (2012), that young people remain unconvinced of their vulnerability to hearing damage, possibly because the effects of loud music are not immediately detectable, they felt they were too young to be affected by NIHL, or lack of awareness regarding the physiology behind NIHL. It was difficult for most students to conceptualise losing their hearing. Those who had previously experienced temporary NIHL/T were more likely to be aware of the consequences. Young adults were responsive to the idea that noise was more likely to cause damage than music. This follows results from studies such as Widén et al. (2009), which showed that young adults were more likely to wear hearing protection during shooting, lawn mowing, and noisy tool use compared to music events. In contrast, hearing damage was considered to be eventually inevitable for a number of students. These findings pose a challenge. If young adults feel that hearing protection use is futile, they are less likely to feel that HPBs are effective. It is critical to educate young adults about the need for protecting their ears against loud music and provide them with evidence regarding the efficacy of these techniques. It is clear from this study that students were more likely to engage in HBPs if they believed the measures would assist them in preserving their hearing.

Although music students showed greater awareness of the consequences of NIHL/T on quality of life, they described greater barriers to hearing protection use than non-music students. For all students, earplug use has social and personal implications. For music students in particular, earplug use has additional occupational implications. Earplugs caused amplification of internal noise and alterations in sound quality, making practice and performance challenging. These findings echo the results of previous studies investigating musicians' use of earplugs (O'Brien et al. 2014). However, this study provides valuable insights into music and non-music students' preferred methods of hearing protection, such as the use of sound shields/protective screens, changes in positioning, taking frequent breaks, and regulating sound levels, which do not incur the same challenges as earplug use.

Evident in this study as in previous research, societal influences play a significant role in whether individuals make use of hearing protection (Landälv, Malmström, and Widén 2013). Listening to loud music was considered a social norm, while the use of hearing protection was not. While students insisted that most people know there is some risk when listening to loud music, they conceded that it is something that is not often discussed among their social groups. However, many students mentioned that they would be more likely to protect their own hearing if they knew these methods were endorsed by those around them. Indeed, this is reflected by studies examining the effects of culture on HPB. For example, Widén et al. (2009) study comparing attitudes towards hearing protection use between American and Swedish young adults. It found young adults in Sweden were more likely to use hearing protection because it was considered a social norm. Notably, most students in this study who wore hearing protection remarked that they had teachers or peers who also wore hearing protection. Two participants were music students who attended specialist music colleges where earplug use was actively promoted. Therefore, encouraging more widespread use of hearing protection will itself lead to further uptake of HBP. An important finding was that the information needs to come from multiple, credible sources.

Another vital factor in loud music exposure was that of enjoyment and the effects of loud music on mood. Students in this study indicated that loud music was preferred for relaxation, motivation to move, and general good feeling. Many students acknowledged that the louder music heightened their experience of enjoyment, which perpetuated their listening habits.

There were conflicting opinions among students regarding whether hearing protection should be regulated by law. Most adolescents in the Vogel et al. (2008) study, expressed a desire to regulate their own listening levels. However, there seems to be no clear indication whether university students would prefer to set their own listening limits, or if they would be willing to let government bodies limit loudness levels of PLDs or venue officials control loudness levels at music events. Examples such as Gjestland and Tronstad (2017), show that concert hall and music festival performers and producers were able to adhere to a 100dBA limit when asked, with no evident impact on quality of enjoyment of audiences. However, it is unclear how young adults would respond to the knowledge that these hearing health decisions are being made on their behalf. This is an area that warrants further investigation.

Future implications

Gilles and Paul (2014), suggested that educational campaigns can have significant impact on hearing protection use, although the long-term effects of such campaigns have yet to be explored.

Platforms such as the UK's "Don't lose the music" programme could be a valuable resource for concert attendees (British Association for Performing Arts Medicine 2020). Students who had received lectures on hearing protection displayed more positive attitudes towards hearing protection use. As found in previous studies, students that had experienced temporary NIHL/ Twere more likely to adopt hearing protection techniques (Vogel et al. 2008; Widén et al. 2009). This provides more support for educational programs, such as the University College London (UCL) "HearLoss" and the NIOSH "What does a hearing loss sound like?" applications that allow people to experience something akin to hearing loss personally, providing a higher personal relevance (Centers for Disease Control and Prevention [CDC] 2012; UCL Psychology and Language Sciences Faculty of Brain Sciences 2019). Perhaps future educational programs could incorporate options for tinnitus. However, we must consider that 'education' is only one out of a possible nine intervention categories/functions (Michie, van Stralen, and West 2011; Michie, Atkins, and West 2014). It is valuable to consider applying other functions (environmental restructuring, earplugs, prompts/cues) alongside education (Craig et al. 2008) to improve outcomes for young adults (Couth et al. 2022; Loughran et al. 2020).

Hearing protection programs must generate methods to ensure safe PLD use. Students proposed methods such as inhome hearing tests and applications that would allow them to monitor their own listening levels (such as in Kaplan-Neeman, Muchnik, and Amir 2017 study). Online tools could be an effective way to reach young adults, for both educational and practical purposes. Another suggestion was to compile a hearing protection "regimen" for young adults to follow. There are many checklists available for occupational hearing protection guidelines, such as the "Noise: Don't lose your hearing" checklist compiled by the (HSE 2012). Conceivably, a recreational noise exposure checklist could be compiled.

There is an opportunity in this period of transition, following worldwide lockdowns because of the COVID-19 pandemic, for audiologists and other health professionals to put effective infrastructure into place. As life returns to a semblance of normality, and young adults can participate in activities involving listening to loud music in social situations once again, there is a chance for them to be met with clear guidance to support their hearing health.

Limitations

The small sample size holds implications for generalising these results to other populations of students. Small sample size may cause researchers to miss different perspectives that may have enriched the results and conclusions.

Further, themes deemed less important by the authors in this study may be valuable for hearing conservationists, therefore these have been added as a supplementary file for reference purposes.

Note

1. A term which used here refers to a person known to the young adult who controls access to credible information regarding hearing, hearing loss, and hearing protection

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References

- Alnuman, N., and T. Ghnimat. 2019. "Awareness of Noise-Induced Hearing Loss and Use of Hearing Protection Among Young Adults in Jordan." *International Journal of Environmental Research and Public Health* 16 (16): 2961. https://doi.org/10.3390/ijerph16162961
- Beach, E. F., W. Williams, and M. Gilliver. 2012. "A Qualitative Study of Earplug Use as a Health Behavior: The Role of Noise Injury Symptoms, Self-Efficacy and an Affinity for Music." *Journal of Health Psychology* 17 (2): 237–246. https://doi.org/10.1177/1359105311412839
- British Association for Performing Arts Medicine. 2020. Don't Lose The Music! Hearing loss and tinnitus. p. 1–3. https://www.bapam.org.uk/wp-content/ uploads/2020/10/DontLosetheMusic_BAPAMfactsheet_Hearing.pdf.
- CDC. 2012. What Does a Hearing Loss Sound Like? Accessed May 4, 2021. https://www.cdc.gov/niosh/mining/content/hlsoundslike.html
- Clark, W. W., and B. A. Bohne. 1999. "Effects of Noise on Hearing." JAMA 281 (17): 1658–1659. https://doi.org/10.1001/jama.281.17.1658
- Le Clercq, C. M. P., G. Van Ingen, L. Ruytjens, and M. P. Van Der Schroeff. 2016. "Music-Induced Hearing Loss in Children, Adolescents, and Young Adults: A Systematic Review and Meta-Analysis." *Otology & Neurotology* 37 (9): 1208–1216. https://doi.org/10.1097/MAO.000000000001163
- Couth, S., M. T. Loughran, C. J. Plack, D. R. Moore, K. J. Munro, J. Ginsborg, P. Dawes, and C. J. Armitage. 2022. "Identifying Barriers and Facilitators of Hearing Protection Use in Early-Career Musicians: A Basis for Designing Interventions to Promote Uptake and Sustained Use." *International Journal of Audiology* 61 (6): 463–472. https://doi.org/10. 1080/14992027.2021.1951852
- Craig, P., P. Dieppe, S. Macintyre, S. Michie, I. Nazareth, and M. Petticrew. 2008. "Developing and Evaluating Complex Interventions: The New Medical Research Council Guidance." *BMJ* 337 (7676): a1655.
- Creswell, J. W. 2002. Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research. Upper Saddle River, NJ: Pearson Education.
- Degeest, S., E. Clays, P. Corthals, and H. Keppler. 2017. "Epidemiology and Risk Factors for Leisure Noise-Induced Hearing Damage in Flemish Young Adults." *Noise & Health* 19 (86): 10–19. https://doi.org/10.4103/1463-1741.199241
- Gilles, A., and V. H. Paul. 2014. "Effectiveness of a preventive campaign for noiseinduced hearing damage in adolescents." *International Journal of Pediatric Otorhinolaryngology* 78 (4): 604–609. https://doi.org/10.1016/j.ijporl.2014.01.009
- Gjestland, T., and T. V. Tronstad. 2017. "The Efficacy of Sound Regulations on the Listening Levels of Pop Concerts." Journal of Occupational and Environmental Hygiene 14 (1): 17–22. https://doi.org/10.1080/15459624. 2016.1207779
- Gupta, N., A. Sharma, P. P. Singh, A. Goyal, and R. Sao. 2014. "Assessment of Knowledge of Harmful Effects and Exposure to Recreational Music in College Students of Delhi: A Cross Sectional Exploratory Study." *Indian Journal of Otolaryngology and Head and Neck Surgery* 66 (3): 254–259. https://doi.org/10.1007/s12070-013-0671-5
- HSE. 2005. Controlling Noise at Work: The Control of Noise at Work Regulations 2005. Sudbury: HSE Books.
- HSE. 2012. Noise: Don't lose your hearing!, 1-4. Accessed May 4, 2021. https://www.hse.gov.uk/pubns/indg363.pdf
- Henderson, E., M. A. Testa, and C. Hartnick. 2011. "Prevalence of Noise-Induced Hearing-Threshold Shifts and Hearing Loss Among US Youths." *Pediatrics* 127 (1):e39–e46. https://doi.org/10.1542/peds.2010-0926
- Hunter, A. 2018. "There are More Important Things to Worry About": Attitudes and Behaviours Towards Leisure Noise and Use of Hearing Protection in Young Adults." *International Journal of Audiology* 57 (6): 449-456. https://doi.org/10.1080/14992027.2018.1430383
- Kaplan-Neeman, R., C. Muchnik, and N. Amir. 2017. "Listening to Music with Personal Listening Devices: Monitoring the Noise Dose using a Smartphone Application." *International Journal of Audiology* 56 (6): 400– 407. https://doi.org/10.1080/14992027.2017.1297541
- Keppler, H., I. Dhooge, and B. Vinck. 2015. "Hearing in Young Adults. Part I: The Effects of Attitudes and Beliefs Toward Noise, Hearing Loss, and Hearing Protector Devices." *Noise & Health* 17 (78): 237–244. https://doi. org/10.4103/1463-1741.165024
- Knudsen, L. V., A. Laplante-Lévesque, L. Jones, J. E. Preminger, C. Nielsen, T. Lunner, L. Hickson, G. Naylor, and S. E. Kramer. 2012. "Conducting Qualitative Research in Audiology: A Tutorial." *International Journal of Audiology* 51 (2): 83–92. https://doi.org/10.3109/14992027.2011.606283
- Kraaijenga, V. J. C., G. G. J. Ramakers, and W. Grolman. 2016. "The Effect of Earplugs in Preventing Hearing Loss from Recreational Noise Exposure: A Systematic Review." JAMA Otolaryngology – Head & Neck Surgery 142 (4): 389–394. https://doi.org/10.1001/jamaoto.2015.3667

- Landälv, D., L. Malmström, and S. E. Widén. 2013. "Adolescents' Reported Hearing Symptoms and Attitudes Toward Loud Music." Noise & Health 15 (66): 347–354. https://doi.org/10.4103/1463-1741.116584
- Loughran, M. T., S. Lyons, C. J. Plack, and C. J. Armitage. 2020. "Which Interventions Increase Hearing Protection Behaviors during Noisy Recreational Activities? A Systematic Review." *BMC Public Health* 20 (1): 1376. https://doi.org/10.1186/s12889-020-09414-w
- Lutman, M. E., A. C. Davis, and M. A. Ferguson. 2008. Epidemiological Evidence for the Effectiveness of the Noise at Work Regulations, RR669 (Research Report, RR669), Sudbury, UK: Health and Safety Executive.
- Manchaiah, V. K. C. 2012. "Health Behavior Change in Hearing Healthcare: A Discussion Paper." *Audiol Res* 2 (1): 12–16.
- Michie, S., L. Atkins, and R. West. 2014. The Behaviour Change Wheel: A Guide to Designing Interventions. 1st ed. London: Silverback Publishing.
- Michie, S., M. M. van Stralen, and R. West. 2011. "The behaviour change wheel: A new method for characterising and designing behaviour change interventions." *Implementation Science* 6 (1): 42. https://doi.org/10.1186/1748-5908-6-42
- Morse, J. M. 2015. "Data were saturated." *Qualitative Health Research* 25 (5): 587-588. p. https://doi.org/10.1177/1049732315576699
- NIOSH. 1998. National Occupational Research Agenda. Cincinnati: CDC.
- O'Brien, I., T. Driscoll, W. Williams, and B. Ackermann. 2014. "A clinical trial of active hearing protection for orchestral musicians." *Journal of Occupational and Environmental Hygiene* 11 (7): 450–459. https://doi.org/ 10.1080/15459624.2013.875187

OSHA. 2003. Directive 89/656/EEC – use of personal protective equipment – Safety and health at work – EU.

- Reddy, R., V. Nosa, I. Mafi, and D. Welch. 2021. "Attitudes to noise and behaviour towards hearing protection among Pasifika university students in New Zealand." *Kotuitui* 16 (2): 1–11.
- Ritchie, J., L. Spencer, and W. O'Connor. 2003. "Carrying out Qualitative Analysis." In *Qualitative Research Practice: A Guide for Social Science Students* and Researchers, edited by J. Ritchie & J. Lewis. London: Sage, 219–262.
- Rogers, R. W. 1983. "Cognitive and Physiological Processes in Fear Appeals and Attitude Change: A Revised Theory of Protection Motivation." In *Social Psychophysiology: A Sourcebook*, edited by J. T. Cacioppo & R. Petty, 153–177. New York: Guilford.
- Rogers, R. W., and S. Prentice-Dunn. 1997. Handbook of Health Behavior Research I: Personal and Social Determinants. Edited by D. S. Gochman, 113-132. New York: Springer US.

- Saunders, B., J. Sim, T. Kingstone, S. Baker, J. Waterfield, B. Bartlam, H. Burroughs, and C. Jinks. 2018. "Saturation in Qualitative Research: Exploring Its Conceptualization and Operationalization." *Quality & Quantity* 52 (4): 1893–1907. https://doi.org/10.1007/s11135-017-0574-8
- Shargorodsky, J., S. G. Curhan, G. C. Curhan, and R. Eavey. 2010. "Change in Prevalence of Hearing Loss in US Adolescents." JAMA 304 (7): 772–778. https://doi.org/10.1001/jama.2010.1124
- Skoe, E., and J. Tufts. 2018. "Evidence of Noise-Induced Subclinical Hearing Loss Using Auditory Brainstem Responses and Objective Measures of Noise Exposure in Humans." *Hearing Research* 361: 80–91. https://doi.org/ 10.1016/j.heares.2018.01.005
- Stockings, É., W. D. Hall, M. Lynskey, K. I. Morley, N. Reavley, J. Strang, G. Patton, and L. Degenhardt. 2016. "Prevention, Early Intervention, Harm Reduction, and Treatment of Substance Use in Young People." *The Lancet. Psychiatry* 3 (3): 280–296. https://doi.org/10.1016/S2215-0366(16)00002-X
- Tittman, S. M., R. J. Yawn, N. Manzoor, M. M. Dedmon, D. S. Haynes, and A. Rivas. 2021. "No Shortage of Decibels in Music City: Evaluation of Noise Exposure in Urban Music Venues." *The Laryngoscope* 131 (1): 25– 27. https://doi.org/10.1002/lary.28556
- UCL Psychology and Language Sciences Faculty of Brain Sciences. 2019. HearLoss – Hearing Loss Demonstrator. Accessed May 4, 2021. https:// www.phon.ucl.ac.uk/resource/hearloss/
- Vogel, I., J. Brug, E. Hosli, C. van der Ploeg, and H. Raat. 2008. "MP3 Players and Hearing Loss: Adolescents' Perceptions of Loud Music and Hearing Conservation." *The Journal of Pediatrics* 152 (3): 400–404. https:// doi.org/10.1016/j.jpeds.2007.07.009
- WHO. 2022. "Environmental noise." In Compendium of WHO and other UN guidance on health and environment, Geneva: World Health Organisation.
- Vogel, I., P. M. Van De Looij-Jansen, C. L. Mieloo, A. Burdorf, and F. De Waart. 2014. "Risky Music Listening, Permanent Tinnitus and Depression, Anxiety, Thoughts About Suicide and Adverse General Health." PLOS One 9 (6): e98912. https://doi.org/10.1371/journal.pone.0098912
- Widén, S. E., A. E. Holmes, T. Johnson, M. Bohlin, and S. I. Erlandsson. 2009. "Hearing, Use of Hearing Protection, and Attitudes Towards Noise Among Young American Adults." *International Journal of Audiology* 48 (8): 537–545. https://doi.org/10.1080/14992020902894541
- Zhao, F., D. French, V. K. Manchaiah, M. Liang, and S. M. Price. 2012. "Music Exposure and Hearing Health Education: A Review of Knowledge, Attitude, and Behaviour in Adolescents and Young Adults." *Health Education Journal* 71 (6): 709–724. https://doi.org/10.1177/0017896911422780