Developing Safe Listening Features for Video Games: An International Online Survey on Beliefs, Attitudes, and Practices Among Gamers and Esports Participants

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Abstract

Background: The global increase in video gaming and esports popularity has brought attention to their potential impacts on health, including concerns about hearing loss due to loud sound exposure. Despite the entertainment value and emerging applications in healthcare, the auditory health risks associated with these activities and their correlates necessitate focused research, particularly as existing literature on hearing health in gaming and esports is scant.

Objective: This study aims to explore listening behaviors, attitudes, and awareness regarding hearing health risks among video gamers and esports participants. It seeks to inform the design and implementation of technological features to encourage safer listening practices, aligning with the WHO's Safe Listening initiative.

Methods: An online survey was conducted from September 2022 to January 2023, targeting video gamers and esports enthusiasts. Participants were recruited via WHO social media platforms and relevant stakeholders. The survey assessed gaming and esports behaviors, listening habits, awareness and knowledge about hearing health, beliefs, readiness to change listening behaviors, and communication preferences. Data analysis involved descriptive statistics and multinomial logistic regression.

Results: The survey garnered 488 responses, predominantly from male participants with a significant portion holding a college degree. Findings revealed high levels of engagement in video gaming and esports, with a notable fraction of participants preferring high or very high volume settings. Despite a general awareness of hearing risks and the benefits of preventive actions, significant barriers to safer listening practices were identified, including the belief that lower volumes would diminish the gaming experience. A considerable number of participants experienced symptoms indicative of hearing damage, yet protective behaviors like taking sound breaks were infrequently reported. The study identified a balanced distribution across readiness-to-change stages, with personalized beliefs and attitudes significantly influencing the likelihood of adopting safer listening habits. Communication preferences highlighted a demand for more information on hearing health, with a preference for trustworthy sources like healthcare professionals and governmental agencies.

Conclusions: The study underscores the urgent need for interventions to promote safe listening among video gamers and esports players, highlighting a gap between awareness and action. It supports the integration of safe listening features in video games and esports platforms and the development of targeted communication strategies to enhance auditory health awareness and practices. Future research should aim to evaluate the effectiveness of these interventions and expand upon the findings to ensure comprehensive auditory health protection in the digital entertainment sector.

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Conclusions: The study underscores the urgent need for interventions to promote safe listening among video gamers and esports players, highlighting a gap between awareness and action. It supports the integration of safe listening features in video games and esports platforms and the development of targeted communication strategies to enhance auditory health awareness and practices. Future research should aim to evaluate the effectiveness of these interventions and expand

upon the findings to ensure comprehensive auditory health protection in the digital entertainment sector.

Keywords: video gaming; esports; hearing health; safe listening; auditory risk; health behavior; intervention design

Introduction

Video gaming and esports have undergone an exponential rise in recent years, evolving into a major entertainment force that captivates individuals across different age groups [1]. With projections suggesting the global video game market will grow at an annual rate of 12.9% from 2022 to 2030, reaching an estimated $399.6 billion by 2028, and the global gamer population increasing from 2.7 billion in 2021 to an expected 3.04 billion by 2027, the influence of these digital platforms is significant [2,3]. Concurrently, esports has experienced a surge in popularity, with its global audience forecasted to reach 577 million by 2025, and the market anticipated to grow at a rate of 16.7% annually, resulting in a value of $4.28 billion by 2030 [4,5].
Beyond serving as engaging and entertaining mediums, video games and esports are increasingly acknowledged for their potential in healthcare, particularly through serious gaming applications aimed at education, rehabilitation, and therapy, thus highlighting their versatile utility beyond mere entertainment [6–8].

Despite these benefits, concerns about the potential health risks associated with video gaming and esports have emerged. The documented impacts on mental and physical health are compounded by the risks of hearing loss, tinnitus, and other auditory disorders resulting from exposure to loud and persistent sound effects inherent in these activities [9–11]. Echoing the World Health Organization's (WHO) warning, over 1 billion young people are at an elevated risk of hearing loss due to recreational exposure to loud sounds, including the use of personal audio devices and attendance at loud public events [12].

The public health realm has seen significant attention directed towards the issue of hearing loss from recreational sound exposure, leading to a wealth of research and the development of global standards aimed at mitigating this risk. The pervasive nature of this issue, covering activities ranging from personal listening device use to attendance at live events with high decibel levels, has been illuminated through extensive research. Such studies have consistently underscored the risk of hearing damage from prolonged exposure to loud music via earphones or headphones and attendance at entertainment venues where volumes exceed safe listening thresholds, potentially leading to noise-induced hearing loss [13–16].

In response, the WHO and the International Telecommunication Union (ITU) have collaborated to launch the "Make Listening Safe" initiative, which recommends standards for incorporating safe listening features into personal audio devices. This includes software that monitors volume levels and exposure time, aiming to regulate sound exposure in recreational settings and promote a balance between enjoyment and health [17,18]. These standards not only aim to raise awareness among the public and stakeholders about the risks associated with loud sound exposure but also to provide concrete guidelines for safe listening practices, such as sound level limits and user warnings about unsafe listening volumes.

Despite these initiatives, research focused on hearing health within the context of video gaming and esports remains virtually non-existent, particularly concerning factors that contribute to unsafe listening habits [19,20]. This gap in research underscores the urgent need to explore the listening behaviors, attitudes, and awareness of video gamers and esports participants regarding the risks associated with loud sound exposure. Our study seeks to address this gap by examining the relationship between listening habits and awareness of auditory health among these groups. In doing so, it aims to inform the design and development of technological features within video games and esports platforms that encourage safer listening practices. By supporting the WHO Safe Listening

initiative and contributing to the establishment of sound exposure standards tailored to the gaming and esports environments, this effort highlights the ongoing importance of auditory health considerations in the context of digital entertainment. It seeks to integrate health-conscious design principles into the rapidly evolving landscape of video gaming and esports, ensuring a holistic approach to hearing health across all recreational sound exposure settings.

Methods

Sample

From September 2022 to January 2023, an online survey was shared on WHO's social media platforms. The survey link was also distributed to key stakeholders in the fields of ear and hearing health, as well as gaming and esports worldwide, who were requested to share it within their local communities. To participate in the survey, individuals had to have a good command of English, Spanish, French, or Chinese and be either video game players or involved in esports. To ensure that participants responded to the survey with adequate attention, response time was evaluated, and individuals who completed the survey in under five minutes were excluded. A total of 488 individuals successfully completed the survey.

Instrument and measures

To develop the online questionnaire, a combination of established theories and empirical studies was used. Specifically, the Health Belief Model [21], the Transtheoretical Model of Change [22], and previous research on music- and noise-induced hearing loss were drawn upon [23]. The HBM suggests that individuals are more likely to adopt preventive measures if they perceive themselves to be at risk of developing a severe health condition (perceived susceptibility and severity), believe that taking action can prevent it (perceived benefits), and have the confidence to perform the necessary actions (self-efficacy). The TMC suggests that individuals can be categorized into different groups based on their readiness to adopt preventive behaviors.

The questionnaire consisted of seven main sections designed to assess various aspects of participants' listening habits when gaming or engaging in esports. These sections included questions on (i) their gaming or esports behaviors and related listening habits, (ii) the consequences of their listening behavior, (iii) their knowledge and awareness of hearing loss, (iv) their beliefs about hearing loss and safe listening, (v) their readiness to change their listening behavior, (vi) their desire for information on hearing loss and safe listening, their preferred sources of information, and (vii) their socio-demographic information.

Gaming and esports behaviors and related listening habits

To assess the frequency of video game or esports viewing/playing and volume level preferences, a series of single-item indicators were used. Participants were asked to rate the frequency of their gaming or esports activities, as well as the volume level they typically set on their devices, using a scale ranging from 1 (minimum volume) to 10 (maximum volume). These questions were adapted from measures utilized in prior research on the topic, such as the Listening Habits Questionnaire (LHQ) [23].

Preventive behaviors and consequences of listening

Participants were asked to indicate whether they take a break from sound every hour and whether they check the sound dose. The frequency of experiencing a ringing or fuzziness in the ears after playing video games or engaging in esports was measured on scales ranging from 1 (never) to 5 (always). Participants were asked to rate how often they experienced these symptoms using questions from the LHQ [23].

Awareness and knowledge

Participants were presented with three statements related to hearing loss in the context of gaming and esports, which were collaboratively developed with a team of international experts in the field of hearing. The statements included: “Listening to sounds above 85 Decibel (dB) over a period of time can cause permanent damage to your hearing”, “The amount of time you listen to a sound affects how much damage it will cause”, and “Listening to video games/esports sounds at loud listening levels may damage hearing”. Participants were asked to indicate whether they believed each statement to be true or false and were scored accordingly. A knowledge score was then computed by summing the scores for all three statements, resulting in a range of 0 to 3. The average knowledge score was 2.77, with a standard deviation of 0.61 and an alpha coefficient of .690.

Beliefs

An adapted version of a section of the LHQ [23] was used to assess the constructs of the HBM. The adaptation involved removing the distinction between quiet and loud environments after internal pretesting. Participants were then asked to rate their agreement on a 7-point scale (with higher scores indicating greater agreement) on a total of 22 statements about hearing loss susceptibility related to gaming and esports. These statements covered perceived susceptibility to hearing loss (4 items, α = .776), perceived severity of hearing loss (6 items, α = .865), benefits of preventing hearing loss (5 items, α = .830), barriers to preventing hearing loss (3 items, α = .638), and self-efficacy for taking preventative action (4 items, α = .845). The scores for each construct were obtained by averaging the individual scores on items within each subscale.

Readiness to change

To assess readiness to change listening behaviors, a set of 12 statements was adapted from Rollnick and colleagues' survey for excessive drinkers [24] and from a previous study on safe listening in the context of personal listening devices [13]. Each statement represented one aspect of the three stages of the TMC (pre-contemplation, contemplation, and action). Respondents answered each statement on a 5-point scale (ranging from 2 = "Strongly disagree" to +2 = "Strongly agree"), as per the authors' instructions. The subscales showed acceptable to good internal consistency (Precontemplation α = .626; Contemplation α = .740; Action α = .784). Scores for items related to the same stage were added, resulting in a stage score ranging from - 8 to + 8. The respondent's stage of change was determined by the stage with the highest score. If two stages had equally high scores, the stage furthest along the change process was chosen (e.g., if pre-contemplation and contemplation had the highest scores, contemplation was designated as the stage of change).

Communication needs and preferences

Participants were asked if they desired more information about hearing loss and safe listening, with response options of yes or no. Those who answered affirmatively were then asked to indicate their preferred channels for receiving this information on a 7-point scale, ranging from "Definitely no" to "Definitely yes," which included options such as public health campaigns, gaming device interfaces, and social media. Additionally, all participants were asked to rate how much they trust in different sources of information about hearing loss and safe listening, such as healthcare professionals, governmental and international agencies, and family and friends, using a 7-point scale ranging from "Not at all" to "Completely."

Socio-demographics

Participants were requested to provide information about their gender, age, the highest level of education completed, and country of residence.

Data analysis

The data were analyzed using IBM SPSS Statistics version 21.0. Basic frequencies were used to describe the sample as regards all variables of interest. Separate multinomial logistic regression analyses for video gamers and esports players were performed to assess the impact of the individual predictors of interest (knowledge and beliefs) on the outcome variable (i.e., readiness to change), while keeping all other variables constant.

Ethical considerations

In accordance with the Swiss Federal Act on Research involving Human Beings (Human Research Act, HRA, of September 30th, 2011), the present study did not necessitate formal approval from an ethical review board given that it did not pertain to diseases, nor to the structure or functioning of the human body. The research was conducted in strict adherence to the principles outlined in the Declaration of Helsinki. Comprehensive informed consent was obtained from each participant. Prior to their inclusion, participants were thoroughly apprised of the study's purpose and procedures and were made aware of their right to withdraw their consent at any point during the study.

Results

Of the survey participants, the majority were male (67.7%, n = 355), with an average age of 28.4 years (SD = 10.8). The highest level of education attained by most respondents was a four-year college degree (21.9%, n = 107) or a high school diploma/GED (20.7%, n = 101). Although respondents hailed from 92 different countries, the largest number of respondents came from the USA (14.3%, n = 70), followed by the UK (10.5%, n = 51) and India (8.2%, n = 40). More details about the participants are shown in Table 1.

Table 1. Sample characteristics

All respondents: N = 488	n (%)
Gender	
Male	328 (67.2%)
Female	144 (29.5%)
No answer	16 (3.3%)
Age	
16–35	386 (79.1%)
35+	102 (20.9%)
Education	
Low education (less than college)	196 (40.2%)
Middle education (college)	133 (27.3%)
High education (more than college)	142 (29.1%)
No answer	17 (3.5%)
Country of origin (Top 5)	
USA	70 (14.3%)
United Kingdom	51 (10.5%)
India	40 (8.2%)
Belgium	34 (7.0%)
Australia	21 (4.3%)

Gaming and esports behaviors and related listening habits

Details of the overall gaming and esports behaviors and the related listening habits are shown in

Table 2.

Table 2. Gaming and esports behaviors and related listening habits

All respondents, n = 488	n (%) or Mean (SD)
Involved in… (more than one answer possible)	
Video games	443 (90.8.0%)
Esports viewing	268 (54.9%)
Esports participation	62 (12.7%)
Video game players, n = 443	
Time spent playing	
0–1 hours per week	29 (6.5%)
1–2 hours per week	30 (6.8%)
3–4 hours per week	50 (11.3%)
4–6 hours per week	49 (11.1%)
6–10 hours per week	73 (16.5%)
10–15 hours per week	74 (16.7%)
15–30 hours per week	82 (18.5%)
30+ hours per week	56 (12.6%)
Volume setting	
Mean (SD), scale 1–100	47.6 (21.3)
Very low (0–20%)	49 (11.1%)
Low (20–40%)	134 (30.2%)
Medium (40–60%)	150 (33.9%)
High (60–80%)	85 (19.2%)
Very high (80–100%)	25 (5.6%)
Importance of sounds	
Not at all important	14 (3.2%)
Not so important	25 (5.6%)
Somewhat important	87 (19.6%)
Very important	151 (34.1%)
Extremely important	166 (37.5%)
Sound break every hour	
Yes	152 (34.3%)
Checks usage stats	
Yes	45 (10.2%)
Experience ringing in ears	
Never	253 (57.1%)
Rarely	125 (28,.2%)
Sometimes	51 (11.5%)
Often	6 (1.4%)
Always	8 (1.8%)
Experience fuzziness in ears	
Never	206 (46.5%)
Rarely	148 (33.4%)
Sometimes	71 (16.0%)
Often	11 (2.5%)
Always	7 (1.6%)
Esports viewers, n = 287	

Frequency of viewing	
Daily	14 (5.2%)
Weekly	75 (28.0%)
Monthly	79 (29.5%)
Yearly	68 (25.4%)
Less than yearly	32 (11.9%)
Volume setting	
Mean (SD), scale 1–100	45.6 (20.4)
Very low (0–20%)	34 (12.7%)
Low (20–40%)	80 (29.9%)
Medium (40–60%)	105 (39.2%)
High (60–80%)	36 (13.4%)
Very high (80–100%)	13 (4.9%)
Experience ringing in ears	
Never	186 (69.4%)
Rarely	46 (17.2%)
Sometimes	29 (10.8%)
Often	2 (0.7%)
Always	5 (1.9%)
Experience fuzziness in ears	
Never	187 (69.8%)
Rarely	49 (18.3%)
Sometimes	23 (8.6%)
Often	4 (1.5%)
Always	5 (1.9%)
Esports players, n = 62	
Frequency of playing	
Daily	15 (24.2%)
Weekly	23 (37.1%)
Monthly	11 (17.7%)
Yearly	6 (9.7%)
Less than yearly	7 (11.3%)
Volume setting	
Mean (SD), scale 1–100	55.7 (22.5)
Very low (0–20%)	5 (8.1%)
Low (20–40%)	10 (16.1%)
Medium (40–60%)	24 (38.7%)
High (60–80%)	14 (22.6%)
Very high (80–100%)	9 (14.5%)
Experience ringing in ears	
Never	36 (53.7%)
Rarely	20 (29.9%)
Sometimes	6 (9.0%)
Often	0 (0.0%)
Always	5 (7.5%)
Experience fuzziness in ears	
Never	33 (49.3%)
Rarely	18 (26.9%)

Sometimes	8 (11.9%)
Often	3 (4.5%)
Always	5 (7.5%)
Esports viewers and players, n = 281	
Importance of sounds	
Not at all important	10 (3.6%)
Not so important	36 (12.8%)
Somewhat important	82 (29.2%)
Very important	85 (30.2%)
Extremely important	68 (24.2%)
Break from sound every hour	
Yes	106 (37.7%)
Checks usage stats	
Yes	43 (15.3%)

Of the participants surveyed, 90.8% (n = 443) reported engaging in video games. Around one-third of gamers (35.7%, n = 158) reported playing for up to 6 hours per week, followed by a second group (33.2%, n = 147), who played between 6 and 15 hours per week, and a third group (31.1%, n = 138) who played more than 15 hours per week. Younger respondents (P = .005) and males (P < .001) reported significantly more time spent on video gaming, while those with a higher educational level spent significantly less time than the other two groups (P < .004). The average volume setting reported by participants was just below 50% (M = 47.6, SD = 21.3), with almost one in four respondents listening at a high or very high volume (24.8%, n = 110) No significant differences were found across genders, ages, or educational levels. However, we observed that those playing videogames between 6 and 15 hours per week listened on average to a higher volume compared to those playing for less than 6 hours (P = .008). Finally, most respondents indicated that sounds are either extremely (37.5%, n = 166) or very (34.1%, n = 151) important when playing video games. Male respondents, on average, placed greater importance on video game sounds than female respondents (P = .005).

More than half of the study participants (57.6%, n = 281) reported engaging in esports, with most of them only viewing (75.8%, n = 213) and approximately one-fifth (19.6%, n = 55) both viewing and participating. A small percentage (4.6%, n = 13) reported only participation. Among viewers (n = 268), the majority viewed on a monthly basis (29.5%, n = 79). Males were found to watch esports events more often (P = .002). The average volume setting reported was slightly below 50% (M = 45.6, SD = 20.4), with almost one in five respondents listening at a high or very high volume (18.3%, n = 49). Participants with lower educational levels reported significantly higher volume settings (P = .045), while no significant differences were observed across gender or age groups. Those watching daily, weekly, or monthly reported, on average, significantly higher volume settings compared to those who only watch once per year or less (P = .002). Among participants (n = 68), the majority took part in esports events on a weekly basis (37.1%, n = 23). No significant differences were observed regarding gender, age, or education. The average volume setting for esports participation was higher than for viewing at 55.7 (SD = 22.5), with more than one in five respondents listening at a high or very high volume (21.0%, n = 23). No significant differences were observed across genders, ages, educational levels, or frequency of participation.
Overall, esports viewers and players consider sounds in esports either somewhat (29.2%, n = 82), very (30.2%, n = 85), or extremely (24.2%, n = 68) important. On average, sounds were perceived as more important by younger respondents (P = .041) and by those with lower education (P = .003)

Protective behavior and consequences of listening

Only about one-third of video game players (34.3%, n = 152) reported taking a break from sound every hour. Just one in ten (10.2%, n = 45) reported checking the sound dosage information provided by the gaming device. A similar picture emerged for esports players and participants. Over one-third of them (37.7%, n = 106) reported taking an hourly break, and only a few reported checking the sound dosage (15.3%, n = 43).

Regarding the consequences of listening, almost half of the video games players reported having experienced at least once a ringing in their ears after playing (42.9%, n = 190), and more than half have experienced fullness or fuzziness in their ears (53.5%, n = 237). Female video gamers reported experiencing fullness or fuzziness more often than men ($P < .001$). Regarding esports, we observed two different pictures for viewers and players. Among esports viewers, less than one-third reported having experienced a ringing in their ears (30.6%, n = 82) or a feeling of fullness or fuzziness (30.2%, n = 81) after watching esports. Among esports players, however, this percentage increased to 46.3% (n = 31) for the ringing in their ears and to 50.7% (n = 34) for the feeling of fullness or fuzziness. Participants' characteristics, frequency of playing, watching, or participating and volume levels were not associated with the frequency of experiencing consequences.

Awareness and knowledge

Overall, the respondents were very knowledgeable about the risks for hearing related to exposure to video games, scoring on average 2.78 (SD = .62) on a three-point scale. No significant differences among groups were observed.

Beliefs

The majority of participants rated the perceived severity of hearing loss as high (M = 5.84, SD = 1.31), while their perceived susceptibility to it was relatively low (M = 3.70, SD = 1.54). Participants recognized the benefits of preventing hearing loss (M = 5.84, SD = 1.22), but also faced significant barriers to doing so (M = 4.53, SD = 1.56), such as the belief that turning down the volume would limit their enjoyment of video games and esports. Despite this, respondents demonstrated high confidence in their ability to modify their listening behavior (Mean = 5.24, SD = 1.57). We observed few group differences in beliefs, except for lower self-efficacy among female respondents ($P = .043$) and lower perceived susceptibility among younger respondents ($P < .001$). Also, less educated respondents reported perceiving fewer benefits of prevention ($P = .015$). Only among video gamers, higher reported listening volume was shown to be significantly associated with perceiving more barriers ($P < .001$).

Readiness to change

We observed a balanced distribution of participants into the three readiness-to-change groups. Most of them (35.3%, n = 173) could be categorized as belonging to the "contemplation" stage, followed by the "action" stage (34.2%, n = 167), and the "pre-contemplation" stage (30.3%, n = 148). Crosstabulations showed that those with lower education were less likely to be in the action group compared to the others, while those with higher education were more likely to be in the action stage and less likely to be in the pre-contemplation stage ($P = .009$). Only for video games players, those in the action group reported on average significantly lower listening volume ($P = .025$) compared to those in the other groups. Table 3 shows the multinomial logistic regression results for factors associated with being in one of the three readiness-to-change stages. Those who were in the contemplation stage were the reference category.

Table 3. Associations of knowledge and beliefs with readiness to change: Odd ratios (OR) and 95% confidence intervals (CI)

All respondents, N = 488	Readiness to change			
	Precontemplation		Action	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Knowledge	1.293 (.769–.174)	.333	.998 (.628–1.584)	.992
Perceived susceptibility	.557 (.452–.687)	<.001	1.031 (.851–1.249)	.758
Perceived severity	1.344 (1.056–1.712)	.016	1.082 (.868–1.349)	.484
Benefits of preventive action	.611 (.461–.809)	.001	.968 (.732–1.281)	.822
Barriers to preventive action	.985 (.818–1.186)	.539	.808 (.680–.959)	.015
Self-efficacy in prevention	1.518 (1.237–1.863)	<.001	1.431 (1.196–1.711)	<.001
Notes: Multinomial logistic regression analysis with contemplation as the reference category. The model is adjusted for gender, age, and education. Pseudo R-Square: Cox and Snell = .274; Nagelkerke = .308.				

Multivariate results: Contemplation vs pre-contemplation stage

The second column of the table shows the odds ratio for being in the pre-contemplation stage versus being in the contemplation stage for each variable listed. The odds of being in the pre-contemplation versus the contemplation group decrease the more one perceives to be susceptible to hearing loss (OR: .557; 95% CI: .452–.687), and the more one perceives the benefits of preventive actions (OR: .611; 95% CI: .461–.809). On the other hand, the odds of being in the pre-contemplation group increase the more one perceives hearing loss as severe (OR: 1.344; 95% CI: 1.056–1.712), and the more one has self-efficacy in the prevention of hearing loss (OR: 1.518; 95% CI: 1.237–1.863).

Multivariate results: Contemplation vs action stage

The third column of the table shows the odds ratio for being in the action stage versus being in the contemplation stage for each variable listed. The odds of being in the action versus the contemplation group decrease the more barriers to preventive action for hearing loss one perceives (OR: .808; 95% CI: .680–.959) and increase the more one has self-efficacy in the prevention of hearing loss (OR: 1.431; 95% CI: 1.196–1.711).

Communication needs and preferences

More than half of the participants (n = 249; 51.0%) expressed an interest in expanding their knowledge on the topics of hearing loss and safe listening in the context of video gaming and esports. While investigating the preferred channels for obtaining such information, it was found that no single mode was unequivocally favored. Nonetheless, noteworthy options included instruction manuals for gaming devices, dedicated websites, and user interfaces integrated into gaming devices. No significant differences were observed in preferences for gender, age, or education. Regarding trusted sources of information, respondents showed a clear preference for healthcare professionals and governmental or international agencies (e.g., WHO), while traditional media and religious leaders were among the least trusted sources. Female respondents showed significantly more trust in governmental or international agencies ($P = .003$). Younger respondents showed more trust in healthcare professionals ($P < .001$), governmental or international agencies ($P = .026$), and producers of gaming devices ($P < .001$). Those with low education had significantly less trust in newspapers and magazines ($P = .019$), while those with a high education showed less trust in producers of gaming devices ($p < .008$). More details about communication needs and preferences can be found in Table 4.

Table 4. Communication needs and preferences

All respondents, N = 488	n (%) or Mean (SD)

Interest in receiving more information	
Yes	249 (51.0%)
Preferred channels[a]	
Instructions of gaming device	5.91 (1.58)
User interface of gaming device	5.84 (1.79)
Dedicated website	5.82 (1.65)
Social media	5.70 (1.78)
Mass media	5.43 (1.89)
Public health campaign	5.29 (1.95)
Written information	4.90 (2.14)
Interpersonal communication	4.86 (2.11)
Public events	4.20 (2.31)
Trust in sources of information[b]	
Healthcare professionals	6.22 (1.32)
Governmental or international agencies	6.01 (1.46)
Charitable organizations	4.65 (1.76)
Producers of gaming devices	4.48 (1.90)
Family or friends	4.21 (1.66)
Internet	4.19 (1.65)
Radio	3.87 (1.80)
Newspapers or magazines	3.85 (1.80)
Television	3.78 (1.75)
Religious organizations or leaders	2.74 (1.98)

[a] Scores ranging from 1 to 7, with higher scores indicating higher willingness to receive information from the source; [b] Scores ranging from 1 to 7, with higher scores indicating higher trust in the source.

Discussion

In this study, we aimed to explore the gaming and esports behaviors, related listening habits, and awareness about hearing health risks among gamers and esports participants. This investigation was motivated by the increasing concerns over potential hearing damage due to prolonged exposure to high sound levels in video gaming environments and the need for designing and implementing features that make video games safer.

Principal Results

Our results suggest that an important part of players set the volume at high or very high levels, with younger participants reporting significantly higher volume settings than older respondents. Furthermore, we observed that most viewers and players consider sounds in esports to be important, and the volume level for esports participation was higher than for viewing. Although most respondents were aware of the risks of loud sound exposure and recognized the benefits of prevention, they still engaged in risky listening behaviors. For instance, only about one-third of video game and esports players reported taking a break from sound every hour, and only a few reported checking the sound dosage. This lack of protective behavior is particularly concerning given that almost half of the video game players reported having experienced at least once a ringing in their ears after playing, and more than half have experienced fullness or fuzziness in their ears. Among esports players, this percentage increased to 45.9% for the ringing in their ears and 50% for the feeling of fullness or fuzziness. These findings suggest that many video gamers and esports players are experiencing symptoms of hearing damage, yet are not taking the necessary steps to protect their hearing.

Despite recognizing the risks associated with loud sound exposure, participants faced significant barriers to modifying their listening behavior, in line with what is suggested by current theories of behavior change and evidence in the field of safe listening in other contexts [13,15,21]. For instance, many believed that turning down the volume would limit their enjoyment of video games and esports. Our findings suggest that participants rated the perceived severity of hearing loss as high while their perceived susceptibility to it was relatively low. This finding highlights the need for education programs specifically designed to show how prevention does not necessarily limit enjoyment (e.g., through testimonials [25]) and to increase the perceived susceptibility (see, e.g., [26]) to hearing loss among video gamers and esports players.

We observed a balanced distribution of participants into the three readiness-to-change groups, as defined by the Transtheoretical Model [22], with most of them belonging to the “contemplation” stage, followed by the “action” stage, and the “pre-contemplation” stage. While many video gamers and esports players are aware of the risks of loud sound exposure and are considering taking action, they may need additional support to move from contemplation to action. The multivariate analysis revealed several factors that were associated with participants' readiness to change their listening behavior in the context of video gaming and esports. Participants who perceived themselves as more susceptible to hearing loss and recognized the benefits of preventive actions were less likely to be in the pre-contemplation stage and more likely to be in the contemplation stage. On the other hand, participants who perceived hearing loss as severe and had more self-efficacy in preventing hearing loss were more likely to be in the pre-contemplation stage. Participants who had more self-efficacy in preventing hearing loss were more likely to be in the action stage than in the contemplation stage. Finally, participants who perceived more barriers to preventive actions were less likely to be in the action stage. These findings suggest that interventions aimed at promoting safe listening habits among video gamers and esports viewers and players should be tailored to participants' beliefs and attitudes about hearing loss and preventive actions [27]. In particular, our findings suggest that interventions aimed at increasing self-efficacy [28] may be effective in promoting safe listening habits among video gamers and esports players independent of the stage they are in. At the same time, interventions for those in the pre-contemplation stage should focus on increasing the perceived susceptibility and on showing the benefits of prevention, while those targeted at those in the contemplation stage should include information aimed at reducing barriers, for instance, by showing how listening to lower volumes does not reduce enjoyment.

Finally, the study explored communication needs and preferences among the participants. Approximately half of the participants expressed a keen interest in expanding their knowledge on hearing loss and safe listening in the context of video gaming and esports. Regarding trusted sources of information, respondents showed a clear preference for healthcare professionals and governmental or international agencies. Females showed significantly more trust in governmental or international agencies, while younger respondents showed more trust in healthcare professionals, governmental or international agencies, and producers of gaming devices. This information is important as it can inform future communication efforts especially tailored to video gamers and esports players.

Practice implications

Overall, our findings support the need for the design and implementation of safe listening features in video games. First, the substantial engagement in video gaming and the pronounced importance of sound for an immersive gaming experience highlight the necessity for interventions that do not compromise sound quality. Features enabling the tracking of the sound dose, such as dosimetry [29] or dynamic range compression [30], have emerged as crucial innovations, which would ensure that gamers can remain engaged and fully immersed without risking their hearing health.

Second, the observation of gamers frequently listening at high volumes and not engaging in protective practices, such as regular sound breaks, motivates the introduction of features enabling an automatic reduction of volume [31] and in-game notifications [32] related to measured sound exposure. These interventions would directly encourage gamers to adjust their volume settings and take necessary breaks, promoting safer listening habits organically within the gaming environment.
Third, the reported adverse effects, including ringing in the ears and feelings of fullness, highlight the need for features allowing users to remove particularly harmful sounds [33] and, considering the detrimental impact of tinnitus in terms of psychological or emotional effects, sleep disturbance, auditory issues, and overall health [34], support the introduction of general safe listening warnings in video games. These features aim to provide a more comfortable gaming experience for individuals experiencing tinnitus, reduce the experiences of tinnitus, and raise awareness about the potential adverse effects of unsafe listening practices.
Fourth, despite participants being somewhat knowledgeable about the risks of hearing damage, the application of this knowledge was limited, indicating a gap between awareness and protective action. This gap underscores the importance of user guides, detailing what can be done at different levels, and adaptive headphone safety modes [35,36] that automatically optimize listening settings for safety when switching from a loudspeaker to headphones, directly addressing the need to bridge knowledge with actionable safe listening practices.
Fifth, the significant interest among gamers in expanding their knowledge about hearing health and safe listening practices supports the creation of a safer listening mode. Besides directly contributing to protecting users' hearing, the very existence of such a mode could educate them on safer listening practices, addressing the community's desire for information and tools to protect their hearing health.
Lastly, the preference for personalization and control over the listening environment among gamers calls for developing features allowing for a customized audio experience that respects individual preferences and hearing thresholds while ensuring overall sound levels remain within safe limits. These include, for instance, sound category controls [37,38] and dynamic range tests [39].

Limitations

This study has several limitations that should be considered when interpreting the results. First, the study relied on self-reported data, which may be subject to bias and may not reflect actual behaviors. Second, the study was cross-sectional, which precludes causal inferences. Third, the study sample was predominantly male and may not be representative of the entire video gaming and esports community. Fourth, the study did not assess the use of noise-canceling headphones, which may reduce the risk of hearing damage. Finally, we acknowledge that our sample cannot be considered representative. Our focus on identifying associations allows us to draw meaningful conclusions regardless. Additionally, the consistency of our results with previous studies on related topics [13,14] gives us confidence in their validity. Future research should address these limitations and investigate the effectiveness of educational interventions in promoting safe listening habits among video gamers and esports players.

Conclusions

This study underscores the urgency of developing interventions to foster safe listening habits in video gamers and esports enthusiasts, pointing out their general lack of awareness and preventive actions against hearing damage. Besides stressing the need for effective communication strategies tailored to this group's specific preferences, the findings support creating targeted interventions to encourage safe listening and minimize hearing loss risk among these audiences. Incorporating safe listening features directly into video games offers a strategic method to address prolonged exposure to high sound levels without detracting from the gaming experience. These personalized, gamer-friendly solutions could significantly boost auditory health awareness and practices. The insights into

gamer behavior and preferences provided by this study not only enrich discussions on digital health interventions but also pave the way for enhancing hearing health in the digital entertainment sector, contributing to the broader goal of leveraging technology to improve health outcomes.

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Conflicts of Interest

None declared

Abbreviations
WHO: World Health Organization

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