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Hearing Conservation Attitudes and Behaviors at Orthodox Jewish Weddings

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By

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ABSTRACT

Hearing Conservation Attitudes and Behaviors at Orthodox Jewish Weddings

By

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Previous research has shown that prolonged exposure to noise can cause permanent hearing loss. Noise levels at Orthodox Jewish weddings can reach extremely high and damaging levels, yet the hearing conservation attitudes and behaviors of the attendees are unknown. The objective of this study is to identify the attitudes and behaviors of Orthodox Jewish wedding attendees toward hearing conservation. The major questions are: 1. What are the sound exposure levels at Orthodox Jewish weddings? 2. Do attendees hold positive attitudes toward the need for hearing conservation at Orthodox Jewish weddings? 3. What hearing conservation is being practiced at weddings among Orthodox Jewish attendees? 4. Is there an association between hearing conservation practice and age? 5. Is there an association between hearing conservation practice and gender?

Noise measurements were conducted using the Casella CEL-35X dBadge dosimeter at three Orthodox Jewish weddings in the New York-New Jersey area. The data was analyzed using supplied software with the National Institute of Occupational Safety and Health (NIOSH) protocols and definitions. The results revealed that the noise dose at each wedding exceeded NIOSH recommendations, suggesting hazardous levels of noise exposure.

A survey was developed and administered at five Orthodox Jewish weddings in the New York-New Jersey area and in Toronto, Canada. Participants were asked to respond to a series of items addressing hearing conservation attitudes and behaviors. The results showed that the majority of participants believe hearing protection is necessary at weddings. However, the survey responses revealed limited practice of hearing conservation at weddings. In fact, only a small percentage of participants reported protecting their hearing with earplugs at weddings.

The associations between age, as well as gender, and hearing conservation attitudes and behaviors were investigated. Chi square analysis revealed a significant effect for age on hearing conservation attitudes and behaviors; however, the practical differences in reported behavior between 18-30 year olds and 30+ year olds appear to be minor. No significant gender effect was revealed. Future efforts to promote hearing conservation at Orthodox Jewish weddings should focus on increasing earplug usage, as this is one of the most effective healthy hearing conservation behaviors, yet according to our study, the least practiced.

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INTRODUCTION

Noise-induced hearing loss (NIHL) is a common sensorineural form of hearing loss that typically develops gradually, over years of exposure to loud sound levels. Noise exposure is defined as the total sound energy, a combination of sound intensity and duration, that reaches the inner ear (Fausti et al., 2005). The classical presentation of NIHL is a bilateral hearing loss, initially affecting the higher frequencies of the speech frequency range at 3kHz, 4kHz, and 6 kHZ (Dobie, 1992). Overexposure to intense sound can cause temporary or permanent hearing loss. Following overexposure, thresholds will either fully recover ("temporary" threshold shift) or remain at an elevated level ("permanent" threshold shift). In permanent threshold shifts, destruction of, or damage to, cochlear hair cells occurs. Hair cell damage can be visible immediately after overexposure, and hair cell death can continue for days (Wang, Hirose, & Liberman, 2002). In contrast, temporary threshold shifts are not associated with hair cell death or damage.

Yet, despite the absence of hair cell death or damage, and even with the recovery of thresholds, more recent research has brought to light the dramatic consequences of temporary NIHL as well. Kujawa and Liberman (2009) studied the effects of noise exposure on male mice, and found that temporary NIHL may result in acute loss of afferent nerve terminals and delayed degeneration of the cochlear nerve. This does not contradict the observed recovery of thresholds, given that behavioral thresholds have been shown to be unaffected by diffuse neuronal loss, as demonstrated in a study by Schuknecht and Woellner (1953) involving trained cats before and after partial section of the cochlear nerve. Thus, it appears that overexposure to noise may have far more extensive and progressive consequences than what can be seen from conventional threshold testing.

NIHL is especially dangerous because of the abundant opportunities for overexposure, both in the workplace (occupational noise exposure) and in leisure (recreational noise exposure). Occupational noise exposure is associated with many industries, particularly agriculture, mining, manufacturing, construction, and transportation, as heavy machinery and power tools that produce high sound levels must be used for many hours on a daily basis. In the United States, more than 30 million workers are exposed to hazardous noise (Concha-Barrientos, Campbell-Lendrum, & Steeland, 2004). Recreational activities are also sources of excessive noise exposure. Shooting or hunting is one of the loudest recreational noise sources, with a single gunshot yielding an equivalent amount of acoustic energy as 40 hours of continuous exposure at 90 dB (Clark & Bohne, 1999).

Another important recreational source of noise is music, either through the use of personal listening devices or in public settings such as entertainment venues. It has been estimated that over 20 years, since the early 1980s to 2000, the number of young people with social noise exposure has tripled (from 6.7% to 18.8%), though occupational noise exposure has decreased (from 8.9% to 3.5%) and gunfire noise exposure has remained rather constant (3.1% to 2.9%) within this age group (Smith et al., 2010). During the last 10-20 years use of personal listening devices (PLDs) has become very much more prevalent, and sound levels in public nightclubs and discotheques are reported to have increased. Goggin et al. (2008) revealed that people in entertainment venues were exposed to high average sound levels of 95dBA. At 95dBA, the occupational exposure standard would be exceeded after 48 minutes. However, the average time spent by people in the entertainment venues was close to five hours (Goggin et al., 2008). A meta-analysis reviewing the noise exposure at rock music concerts found that the average noise level was 103.4 dBA (Clark, 1991). Similarly, Gunderson et al. (1997) found that

individuals attending performances at live music clubs were exposed to sound levels that ranged from 94.9 to 106.7 dBA.

In fact, many PLD users enjoy listening to their music at levels that exceed the recommended exposure limits adopted by the National Institute for Occupational Safety and Health (NIOSH), and consequently, are at risk for developing NIHL. Adding to the danger, exposures that damage hearing are not necessarily painful, or even bothersome (Kujawa & Liberman, 2009). In a study of 160 adults in New York City, it was found that the average listening level for PLDs was 94.1 dBA, with 61.9% exceeding the recommended daily exposure limit and 57.5% exceeding the recommended weekly exposure limit (Fligor, Levey, & Levey, 2014). A recent cross-sectional study of children with slight to mild hearing loss in Australia found that reported use of personal stereo devices was associated with a 70% increased risk of hearing loss (Cone et al., 2010).

It may seem unsurprising then that the number of individuals with hearing loss is on the rise. Using the Third National Health and Nutrition Examination Survey (NHANES III), 1988-1994, and NHANES 2005-2006, Shargorodsky et al. (2010) found that the prevalence of any hearing loss increased significantly from 14.9% in 1988-1994 to 19.5% in 2005-2006. However, no change was found in the prevalence of noise-induced threshold shift, a purported marker of noise exposure. Additionally, no difference in estimated noise exposure between the two time periods, and no significant association between self-reported noise exposure and hearing loss in 2005-2006, was revealed. Nevertheless, the authors noted that adolescents and young adults typically underestimate symptoms of loud sound, tinnitus, and temporary hearing impairment during music exposure and underreport concern for these conditions. They suggested that,

perhaps, the finding of a significant rise in high frequency hearing loss between the 1988-1994 and 2005-2006 time periods might indicate an increase in NIHL.

Due to the permanent nature of NIHL, prevention is essential to lessen its prevalence, and in the workplace, occupational standards were established in order to regulate the amount of noise to which workers may be exposed. The Occupational Safety and Health Administration (OSHA) has established damage risk criteria and defines maximum exposure time for unprotected ears as 85 dB over a time-averaged, 8-hour workday. For each 5 dB increase in sound intensity, the criteria established that the exposure time should be cut in half to maintain a similar risk. To illustrate, maximum exposure time should be 4 hours for a 90 dB sound and 7.5 minutes for a 120 dB sound (Fausti et al., 2005). OSHA requires employers to provide hearing protection equipment to employees who work in areas that exceed acceptable noise levels. Furthermore, workers exposed to loud sounds, above 85 dB(A), are enrolled in a mandatory hearing conservation program, which in addition to providing hearing protection devices, provides audiologic monitoring, noise control, noise surveys, education, and motivation (Chen, Huang, & Wei, 2008). In contrast, for recreational environments, no safety guidelines to protect hearing exist. For example, at an entertainment venue, although regulations are in place for staff under OSHA, no similar protection safeguards patrons (Goggin et al., 2008). As such, when it comes to leisure activities, individuals must practice hearing conservation independently.

A number of hearing conservation programs have been designed to encourage hearing protection use and raise awareness regarding noise induced hearing loss, particularly among youth and adolescents. Neufeld (2010) studied the efficacy of Sound Sense, created by The Hearing Foundation of Canada, and found significant short- and long-term efficacy in changing the hearing loss prevention behaviors in elementary school children. In particular, improved

earplug use practices were revealed at six months post intervention. Another program, Dangerous Decibels, a public-private partnership launched in Oregon, was evaluated by Griest, Folmer, & Martin (2007) to determine the effectiveness of a single 35-minute hearing loss prevention program in increasing fourth-grade and seventh-grade students' knowledge and positively changing their attitudes and intended behaviors related to hearing and hearing loss prevention. They found that fourth-grade students who participated in the Dangerous Decibels presentation demonstrated significant long-term improvements in knowledge and attitudes regarding sources of dangerous sounds, consequences of dangerous sound exposure, and ways to protect oneself from dangerous sounds. Seventh grade students also experienced long-term improvements in their knowledge base. However, while attitudes and intended behaviors in seventh graders showed initial evidence of improvement immediately after the classroom program, attitudes and intended behaviors related to hearing loss prevention returned to baseline levels 3 months after the presentation.

On the other hand, Chermak and Peters-McCarthy (1991) found that only 5.5% of the elementary school students reported the use of hearing protection while engaged in noisy activities. Similarly, Griest, Folmer, & Martin (2007) found that prior to hearing the Dangerous Decibels classroom presentation, less than 3% of the fourth- and seventh-grade students in their study routinely used hearing protection devices (HPDs) when they were exposed to hazardous sounds. The authors stressed the importance of adult influence, noting that students learning hearing loss prevention skills will be more likely to apply the learning if they find that their parents, teachers, and/or other important adults regard this issue as important.

Unfortunately, studies examining the hearing conservation behaviors in adult populations reveal low HPD usage. Nondahl et al. (2006) assessed the use of HPDs in adults aged 48 to 92

years at baseline, during noisy recreational activities such as hunting, target shooting, woodwork/carpentry, metalworking, driving loud recreational vehicles, and performing yard work using either power tools or a chain saw. The findings revealed low usage of HPDs for most activities at baseline, as well as at the five- and ten-year follow-up examinations. For each activity, with the exception of target shooting, less than 40% of participants reported using hearing protection devices, with the lowest rates reported for driving loud recreational vehicles (4.4% to 6.4%), hunting (4.6% to 10.6%), and performing yard work using power tools (4.3% to 13.5%).

Crandell, Mills, and Gauthier (2004) investigated the knowledge, behaviors, and attitudes of a young adult population (18 to 29 years of age) in the United States regarding the factors that contribute to NIHL and the use of hearing protection. They also assessed the racial/ethnic differences in knowledge of hearing loss and the use of HPDs among African-American and Caucasian young adults. They found that both ethnic/racial groups demonstrated substantial knowledge about the effects of noise on hearing. For example, 85% of young adults knew that there is no cure for hearing loss, and 95% knew that noise causes damage to hearing at any age. However, despite this knowledge regarding the harmful effects of noise and the permanent nature of NIHL, and although 70% of subjects correctly identified using earplugs and earmuffs as the best way to protect hearing, 72% reported that they do not utilize hearing protection. The authors of the study suggested this seeming contradiction may be due to cultural pressures to "fit in" with a certain youthful image of attractiveness and health, and that young adults may associate hearing protection with "old age."

An interesting finding of the Crandell et al. (2004) study is the association between ethnicity and hearing loss preventative behavior. Caucasians showed greater participation in

high-risk noisy activities and were less likely to wear hearing protection than African Americans. However, African Americans answered less questions correctly regarding knowledge of hearing loss than Caucasians. The authors reasoned that additional differences likely occur in other racial/ethnic groups, and that such differences should be taken into account in order for hearing conservation programs to be successful. A study by Fligor et al. (2014) also reported ethnicity as a factor in listening levels and daily/weekly duration of PLD use, and encouraged hearing conservation efforts to be sensitive to cultural differences.

Presently, there is an absence of research related to noise exposure and hearing conservation among the Orthodox Jewish community who frequently attend weddings. Noise levels at Orthodox Jewish weddings may reach extremely high and damaging levels, yet the attitudes and behaviors of this population regarding hearing conservation at such events remain unknown. Analysis of the attitudes and behaviors of this population can help guide future hearing conservation education. Furthermore, research has proposed that such educational programs are more beneficial when developed for specific age and/or ethnic/racial groups (Crandell et al, 2004).

The objective of this study is to identify the attitudes and behavior of Orthodox Jewish wedding attendees toward hearing conservation. The major questions are: 1. What are the sound exposure levels at Orthodox Jewish weddings? 2. Do attendees hold positive attitudes toward the need for hearing conservation at Orthodox Jewish weddings? 3. What hearing conservation is being practiced at weddings among Orthodox Jewish attendees? 4. Is there an association between hearing conservation practice and age? 5. Is there an association between hearing conservation practice and gender?

METHODS

Instrumentation and Survey

A survey was developed, consisting of thirteen questions. A number of versions of the survey were refined using volunteers who were not part of the study pool. They assisted in evaluating earlier drafts of the survey to ensure that the final items were both clear and relevant. A subset of these volunteers responded to the survey aloud while one researcher monitored their deliberations to identify any potential misunderstanding in the intent of the question. In addition, volunteers made recommendations for modifications or additions to the survey. Following that initial stage, volunteers were asked to respond in the same manner as the study respondents. They also confirmed that the final version did not take much more than five minutes to complete. Originally, 18 questions were drafted, but 13 questions were ultimately adopted. The survey included items regarding (1) age and gender, (2) number of weddings attended in the past month and year, (3) perception of the music level during different portions of the wedding and overall trend, (4) attitude toward the music level, (5) attitude toward hearing protection at weddings, (6) hearing conservation behavior at weddings, and (7) experience of any negative auditory effects after weddings. Items addressing attitudes and behaviors related to hearing conservation are the subject of the present investigation whereas attitudes towards noise/music level is addressed in another, concurrent investigation. A copy of the survey can be found in Appendix A, and the subset of questions for the current study appears in Appendix B. The survey used a 4-degree Likert scale in which the direction of progressively negative to positive versus positive to negative responses toward hearing conservation varied. For the purpose of analysis, a higher score on the scale indicated a more positive attitude toward hearing protection. Originally, some questions had used a 5-degree Likert scale. However, prior to the analysis phase, the categories

of ‘never’ and ‘rarely’ were combined and the category of ‘no opinion’ was omitted, achieving a 4-degree scale for all of the survey questions reported in the present study. For the few cases in which a participant had responded no opinion, it was treated as missing data.

Noise Dosimeter

Noise measurements were conducted at three Orthodox Jewish weddings in the New York-New Jersey area. Sound level readings were taken with the Casella CEL-35X dBadge dosimeter, calibrated using a CEL-110 Acoustic Calibrator. Data were analyzed using supplied software with National Institute of Occupational Safety and Health (NIOSH) protocols and definitions.

Participants

The Brooklyn College Institutional Review Board (IRB) gave approval for this study. The study sample consisted of 149 guests at Orthodox Jewish weddings, all 18 years old and above, who volunteered to participate in this study by responding to the study survey. The majority of participants were in the 18-30 year old age group. The next largest age group was the 51-60 year old group (see Table 1). Due to this age distribution, all participants over the age of 30 were combined into one age group (31+ year old) for the age group comparisons. The gender distribution of the sample was 71 males (53%) and 62 females (47%). Of the total number of participants, 16 (11%) did not complete the gender question. The average number of weddings attended in the last year was 9 weddings, and the average number of weddings attended in the last month was 2 weddings. Four weddings in the New York-New Jersey area and one wedding in Toronto, Canada were targeted. All venues featured a live band.

Table 1. Participant Age Information

	No (n=149)	%
Age 18-30 years	88	59
Age 31-40 years	3	2
Age 41-50 years	13	9
Age 51-60 years	36	24
Age 61-70 years	7	5
Age 70+	2	1

Procedure

In the first phase of the study, sound levels were measured at three weddings. The Casella CEL-35X dBadge dosimeters were worn by the principal investigator or co-investigator, either attached to a purse or a jacket pocket. The investigator behaved as a typical wedding attendee, and situated his/herself as he/she would normally at such an event. The recording began at the bedeken (the ceremony in which the groom veils the bride), continued through the chuppah (the wedding ceremony) and the meal, and ceased at the end of the first dance. In the second phase of the study, guests at five different weddings were approached at random near the entrance of the venue and asked to participate in a study related to noise levels and hearing protection at weddings. The participants who agreed to participate were each given a survey to complete. They were informed that the estimated time involved in participation would be less than five minutes and were assured of the anonymity of their responses. Informed consent was obtained orally. The participants placed their completed surveys into a large manila envelope.

Data Analyses

Descriptive data and responses to questions were managed and analyzed using SPSS IBM 22 statistical software. Cronbach's alpha was determined in order to establish the internal consistency among the items and allow for a single statistical analysis. Pearson chi square testing was performed to determine differences between groups on demographic measures of age and gender.

RESULTS

Noise Level Exposure

Noise level analysis was conducted in order to better understand the exposure risk of a typical attendee at an Orthodox Jewish wedding. Table 2 presents the noise level data compiled. The data was derived using the Casella Insight Management Software (2008) and NIOSH parameters.

Our study focused on three noise measurements. The first is the A-weighted equivalent continuous sound level, known as LAeq. LAeq is defined as the steady noise level, which over a given period of time has the same total energy as the actual fluctuating noise (Casella CEL-35X dBadge Users Handbook, 2011). The LAeq at the three weddings ranged from 91.4 dB to 94.9 dB. The Zpeak, defined as the linear, or un-weighted, measurement of peak sound, ranged from 125.9 dB to 134.4 dB. The noise dose is the amount of actual exposure relative to the amount of allowable exposure, for which 100% and above represents exposures that are hazardous (NIOSH, 1998). The noise dose at each of the three weddings exceeded the NIOSH recommendation, with doses that ranged from 148.10% to 310.30%.

Table 2. Noise exposure levels using NIOSH standards

Wedding	LAeq	Zpeak	Noise Dose
1	94.9 dB	125.9 dB	310.30%
2	92.4 dB	129.6 dB	148.10%
3	91.4 dB	134.4 dB	194.80%

Hearing Conservation Attitudes and Behaviors

As noted earlier, results from this investigation were based on six questions addressing the issue of hearing conservation attitudes and behaviors. Participants were first asked about their general attitude toward hearing conservation. Regarding the statement "Protecting my hearing is necessary at weddings", 67% of participants agreed or strongly agreed with the statement (Item 6). Participants were then asked a series of questions addressing different hearing conservation behaviors and their inclination toward them. The majority of participants (87%) reported avoiding standing near the speakers at weddings (Item 9). And more than half (60%) of the participants reported that they leave the room to take a break from loud music (Item 8). A smaller number (13%) responded that they leave a wedding early due to loud music (Item 10). However, and perhaps for the most critical issue of earplug use, only 12% of participants responded that they wear earplugs at weddings (Item 5). The responses to Item 10 regarding use of earplugs at weddings are summarized in Figure 1.

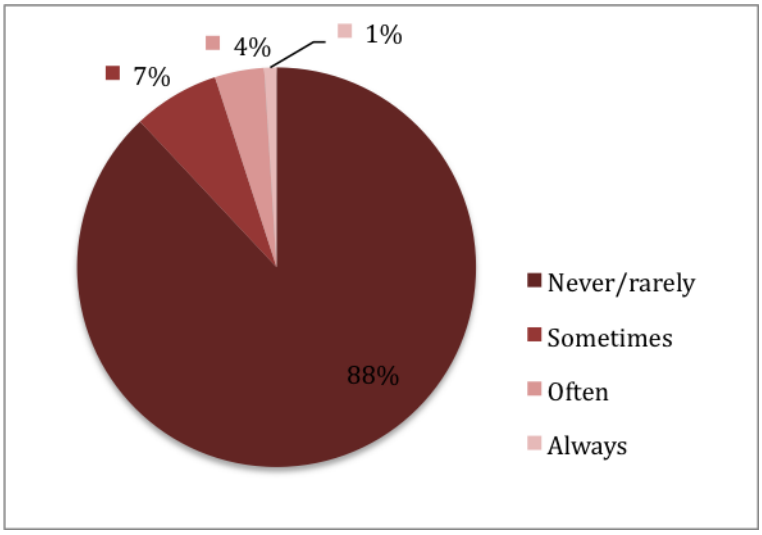

Figure 1: *Pie chart showing percentage of participants who wear earplugs at weddings.*

In order to assess whether this is merely due to convenience, Item 7 probed whether participants would wear earplugs more often if the wedding host provided them. A larger

percentage of participants (38%) responded that they would probably or definitely use earplugs more often in that scenario. The data are summarized in Figure 2.

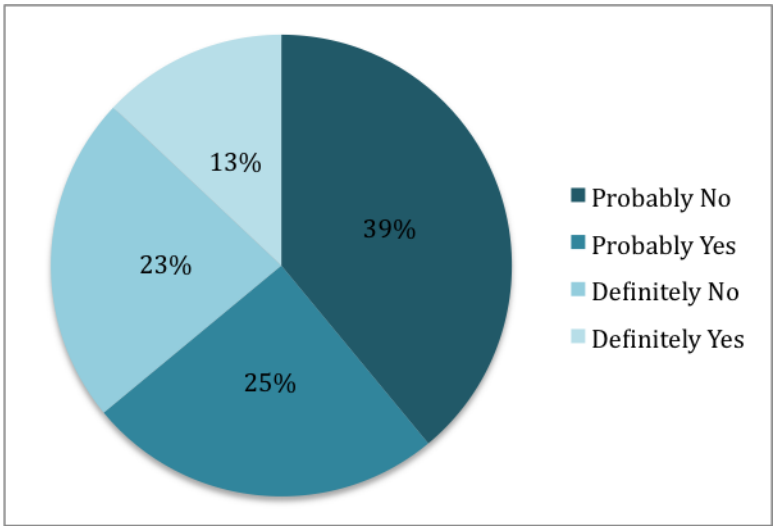

Figure 2: *Pie chart showing percentage of participants who would wear earplugs if the wedding host provided them.*

Association Between Demographics and Hearing Conservation Attitudes and Behaviors

Prior to assessing the association between demographic data and hearing conservation attitudes and behaviors, a Cronbach's alpha was determined in order to establish the internal consistency among the items. The results of Cronbach's alpha in this study (a=.761), established good internal consistency, allowing for all of the items to be analyzed in a single statistical analysis. A Pearson Chi square analysis was subsequently performed to investigate relationships between age, as well as gender, and hearing conservation attitudes and behaviors. The association between gender and hearing conservation attitudes and behaviors was found to be insignificant [χ^2 (15, N = 149) = .614, p <.05]. However, a significant association between age and hearing conservation attitudes and behaviors was revealed [χ^2 (75, N = 149) = .012, p <.05].

Due to the significant association between age and hearing conservation attitudes and behaviors, questionnaire responses were further assessed according to age groups. Of those in the 18-30 year old group, 60% responded that they believe hearing protection is necessary, compared to 80% of 31+ year olds. Not surprisingly, this difference in attitude was reflected, for the most part, in the degree to which the groups practice healthy hearing conservation behaviors. For most of the hearing conservation behaviors asked about in the survey, a larger percentage of the older participants (31+ year olds) compared to the younger participants (18-30 year olds), practiced healthy hearing conservation, although the differences tended to be relatively small. For example, 15% of 31+ year olds responded that they wear earplugs, compared to 10% of 18-30 year olds. Forty five percent of 31+year olds responded that they would wear earplugs more often if the host provided them, compared to 33% of 18-30 year olds. Additionally, 62% of 31+ year olds responded that they leave the room to take a break from loud music, compared to 59% of 18-30 year olds. For only one item, a larger percentage of the younger participants (18-30 year olds) practiced healthy hearing conservation, compared to older participants (30+year olds). When asked if they have ever left a wedding early due to loud music, 16% of 18-30 year olds responded that they had, compared to 8% of 30+ year olds.

DISCUSSION

The objective of our study was to identify the attitudes and behaviors of Orthodox Jewish wedding attendees toward hearing conservation. Hearing conservation attitudes and behaviors were identified based on responses to a survey developed by the authors. The majority of participants (67%) responded that they agree or strongly agree that hearing protection is necessary at weddings. This suggests that most of the participants possess a healthy attitude toward hearing conservation. Despite that finding, the majority of participants (88%) reported that they do not use earplugs, and 62% of participants reported that they would be unlikely to do so even if the wedding host provided the earplugs for them. Furthermore, most participants (87%) responded that they do not leave a wedding early due to loud music. Although the majority of participants reported avoiding standing near speakers (87%) and taking a break from loud music (60%), the results suggest that hearing conservation practice among Orthodox Jewish wedding attendees is limited.

In our study, age was found to have a significant effect on hearing conservation attitudes and behaviors. This corresponds to other findings from adults exposed to recreational noise (Nondahl et al., 2006; Goggin et al., 2008). However, whether increased age is related to greater hearing protection usage or less usage varies based on the literature. According to Goggin et al., (2008), those aged over 25 years were significantly more likely to either wear earplugs or accept them if offered by the venue at no cost. In the Nondahl et al. (2006) study, a comparison by age revealed that those under the age of 65 were twice as likely to use hearing protection devices during noisy activities than those who were 65 years old or above. Nondahl et al. (2006) reasoned that this age related difference might be due to improved awareness among individuals under the age of 65 years regarding the risks of noise exposure and the hearing protection options

available. Additionally, the younger age group may be more willing to wear hearing protection devices because they believe it is not too late to prevent or minimize hearing loss.

Perhaps the findings of Goggin et al. (2008) and Nondahl et al. (2006) are not in contradiction. Rather, instead of hearing protection usage steadily increasing as age increases, it may be lower in individuals under the age of 25 years, reach a maximum between the ages of 25 years to 65 years, and then decline. While our study did not analyze the relationship between these specific age groups and hearing protection usage, a future study may wish to investigate this matter further.

Furthermore, although our study did reveal a statistically significant age effect, the actual differences between the two age groups (18-30 year olds versus 31+ year olds) regarding their hearing protection behaviors at Orthodox Jewish weddings were not dramatic. For one item (#8), only a 3% difference was found between the age groups when they were asked if they leave the room to take a break from loud music. In fact, the largest difference noted between the two groups was a mere 15%, which was found for item #7, regarding whether they would wear earplugs more often if the host provided them. Practically then, there may not be a need to approach hearing conservation education differently for different ages in this population.

Additionally, our study found that gender did not have a statistically significant effect on hearing conservation attitudes and behaviors. This is consistent with the findings of Lusk, Ronis, and Baer (1997), in which similar hearing protection usage between male and female blue-collar workers was revealed. In contrast, several recent studies found that females were less likely to use hearing protection devices than their male counterparts (Goggin et al., 2008; McCullagh, Ronis, and Lusk, 2010; Nondahl et al., 2006; Tak et al., 2009). It has been suggested this might be because women tend to have significantly better hearing than men, and perhaps

they are less concerned with hearing loss, and therefore, hearing protection, than men. According to Abel et al. (1990), this may be due to a difference in comfort, as females reported greater discomfort with earplugs than males, perhaps due to the smaller size of female ear canals. As our study is the first to investigate this matter in the Orthodox Jewish population, future research should be done to confirm our findings and further examine possible gender differences for this issue.

Our findings revealed that the majority of participants (88%) never/rarely wear earplugs, and most (63%) reported that they would probably not/definitely not wear earplugs even if the host provided them. This lack of acceptance of earplugs, provided at no cost, corresponds to the findings of Goggin et al. (2008). Since most participants strongly agreed with the necessity of hearing protection at weddings, and are already taking some precautions against noise exposure (namely, avoiding speakers), perhaps education regarding the difference in the protection provided by earplugs compared to merely avoiding speakers would be beneficial. However, it should be noted that our survey did not address the reason why an individual might avoid the speakers at a wedding. As such, it cannot be determined whether this behavior is motivated by a desire to protect hearing, or a different reason (such as annoyance or discomfort).

The disconnect between acknowledging the need for hearing protection, yet not practicing hearing conservation behaviors such as wearing earplugs, may be related to any number of barriers. Future research can apply the Pender Health Promotion Model (HPM) to explore the factors affecting hearing protection usage (McCullagh, Lusk, & Ronis, 2002). The HPM model is based on social-cognitive, nursing, and public health theory, and uses a variety of individual characteristics and experiences, behavior-specific cognitions, and affects to predict

and explain health-promoting behavior. It has demonstrated usefulness in diverse populations of age, gender, and ethnicity.

Our findings revealed that a greater number of people would wear earplugs if the host provided them. If one of the barriers to earplug usage at weddings is the perception that it is not fashionable/stylish or "not cool," it is reasonable to assume that if wedding attendees saw more people donning earplugs at weddings, perhaps it would serve as motivation for them to re-consider their own practices and wear them as well. If that were the case, then raising awareness among wedding hosts regarding the need for and benefits of providing earplugs to their guests would be an important step in promoting healthy hearing conservation behavior.

While raising awareness and improving education to promote hearing conservation is one strategy to limit the hazardous levels of noise exposure at Orthodox Jewish weddings, an alternative is for venues to adopt maximum sound level limits. Goggin et al. (2008) made such a recommendation for entertainment venues, describing it as the most effective strategy, yet the most difficult to implement and sustain. Regulating noise levels at commonly used venues would limit the risk to all attendees, even those who do not practice healthy hearing conversation behaviors.

Our study also measured sound exposure levels at three Orthodox Jewish weddings in order to better understand the risk of dangerous levels of exposure. While our small sample limits the ability of our findings to be generalized, it is still alarming to note that for all three of the weddings the noise dose was well above the recommended daily limit. Even more worrisome, we do not know what the levels of the wedding attendees' noise exposure were for the rest of the day. In our study, the noise dose is based only on the noise exposure over the duration of the dosimeter recording (from the bedeken until the end of the First Dance,

approximately two to three hours). It is possible though, that attendees may have stayed for shorter or longer durations of the wedding, which would alter their noise dose. These noise dosage standards, however, are based on occupational and not recreational data, and thus, must be interpreted cautiously.

Furthermore, it is very possible that the wedding attendees were exposed to a significant amount of noise during a different part of their day, which would lead to a greater noise dose. Perhaps some had already reached their recommended limit before they even arrived at the wedding! Grounds for such an assumption exists based on Fligor et al. (2014), who found that more than half of 160 participants listened to music using PLD's at levels and for durations that exceeded both daily and weekly NIOSH recommended exposure limits. Future research, using a larger sample size, should be conducted to expand on these findings. A survey item that addresses noise exposure earlier in the day, prior to arriving at the wedding, may be helpful.

One limitation of our study was that 11% of the participants did not complete the gender question. However, since all of the participants did complete the age question, which may be considered to be of a more sensitive or personal nature, we assume that any participants who left out the gender question did so as an oversight, rather than intentionally skipping it. Perhaps a future study should re-format the survey to make the gender question more apparent.

A future study may also consider employing a different setting for data collection. While the authors viewed a wedding as a fitting setting given the nature of this study, it is possible that the wedding environment resulted in participants being unable to devote sufficient time and/or focus to the questionnaire, which may have affected the accuracy of their responses.

CONCLUSION

1. Noise measurements at the three Orthodox Jewish weddings sampled revealed hazardous levels of noise exposure, as the noise dose at each wedding exceeded NIOSH recommendations.

2. The majority of Orthodox Jewish wedding attendees believe that hearing protection is necessary at weddings.

3. Limited hearing conservation is being practiced at Orthodox Jewish weddings among attendees, with only a small percentage of attendees reporting earplug usage.

4. Age has a significant statistical effect on hearing conservation attitudes and behaviors, however, practically, the differences in reported behavior between 18-30 year olds and 30+ year olds appear to be minor.

5. There is no significant gender effect on hearing conservation attitudes and behaviors.

6. Future research measuring noise levels at Orthodox Jewish weddings should use a larger sample size to allow for greater generalizability of the findings. Additionally, including a survey item regarding noise exposure earlier in the day, prior to arriving at the wedding, should be considered.

7. Future efforts toward hearing conservation at Orthodox Jewish weddings should focus on increasing earplug usage, as this is one of most effective healthy hearing conservation behaviors, yet according to our study, the least practiced. One possibility to both raise awareness and increase earplug usage is to promote the provision of earplugs by the wedding host.

APPENDIX A

Orthodox Jewish Wedding Music Survey

Age: 18-30 31-40 41-50 51-60 61-70 70+
Gender: Male Female
Where do you live? _____ (town or borough) _____(State)
Number of weddings you attended in the last year:___, in the last month:___

Regarding the following portions at weddings, the music level is generally:
1. **Dancing**: Too soft Acceptable Too loud No opinion
2. **Meal**: Too soft Acceptable Too loud No opinion

3. Louder music tends to make the wedding more fun:
Strongly agree Agree Disagree Strongly disagree No opinion

4. The music at weddings reaches levels that can damage my hearing:
Strongly agree Agree Disagree Strongly disagree No opinion

5. I wear earplugs at weddings:
Never Rarely Sometimes Often Always

6. Protecting my hearing is necessary at weddings:
Strongly agree Agree Disagree Strongly disagree No opinion

7. I would use earplugs more often if the wedding host provided them:
Definitely yes Probably yes Probably no Definitely no

8. I leave the room to take a break from loud music at weddings:
Never Rarely Sometimes Often Always

9. I avoid standing near the speakers at weddings:
Never Rarely Sometimes Often Always

10. I have left a wedding early due to loud music:
Never Rarely Sometimes Often Always

I experience the following after coming out from a wedding:
11. Ringing in the ear(s): Never Rarely Sometimes Often
12. Dullness in my hearing: Never Rarely Sometimes Often

13. Which is true?
__ I notice a trend towards a reduction in overall music levels at weddings
__ I notice a trend towards an increase in overall music levels at weddings
__ Overall music levels at weddings do not seem to have changed over time

APPENDIX B

Age: 18-30 31-40 41-50 51-60 61-70 70+
Gender: Male Female
Where do you live? _____ (town or borough) _____(State)
Number of weddings you attended in the last year:___, in the last month:___

5. I wear earplugs at weddings:
Never Rarely Sometimes Often Always

6. Protecting my hearing is necessary at weddings:
Strongly agree Agree Disagree Strongly disagree No opinion

7. I would use earplugs more often if the wedding host provided them:
Definitely yes Probably yes Probably no Definitely no

8. I leave the room to take a break from loud music at weddings:
Never Rarely Sometimes Often Always

9. I avoid standing near the speakers at weddings:
Never Rarely Sometimes Often Always

10. I have left a wedding early due to loud music:
Never Rarely Sometimes Often Always

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