Attitudes Towards Music Levels at Orthodox Jewish Weddings

Evan Hirschhorn
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ATTITUDES TOWARDS MUSIC LEVELS AT ORTHODOX JEWISH WEDDINGS

By:

Evan Hirschhorn

A capstone research project submitted to the Graduate Faculty in Audiology in partial fulfillment of the requirements for the degree of Doctor of Audiology, The City University of New York

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This manuscript has been read and accepted for the Graduate Faculty in Audiology in satisfaction of the capstone research requirement for the degree of Au.D.

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ABSTRACT

ATTITUDES TOWARDS MUSIC LEVELS AT ORTHODOX JEWISH WEDDINGS

By:

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Noise induced hearing loss is a deficit in the sensorineural part of the hearing mechanism, produced by the damaging effects of overstimulation by high intensity sound levels, usually over a period of time. Much of the noise literature has focused on occupational noise; however, the noise levels measured at non occupational and recreational settings have been found to be notably high as well. Attitudes and behaviors may vary based on demographics as such hearing conservational practices may benefit by honing in on demographic information. In the Orthodox Jewish community, weddings have a central role in community life, attended by many in the community on a regular basis. Thus, our study investigated overall attitudes of 149 attendees regarding music levels at Orthodox Jewish weddings as well as assessing possible associations of attitudes with age and gender. A survey was developed and responses to items were analyzed using SPSS software. In addition, noise measurements were collected at three Orthodox Jewish weddings utilizing the Casella 35xdBadge and analyzed with the accompanying software package. Results indicated an overall awareness of loud levels, with 68% responding that the dancing section was too loud and 75% acknowledging that the noise reaches dangerous levels. Chi square analysis revealed significant associations between attitudes towards loud music and age, indicating older adults possess a healthier attitude towards loud music. There was no significant association found with gender. Dosimeter recordings demonstrated that music levels at such venues exceed recommended guidelines. Thus, many members of the community have frequent exposures to loud levels, including young children. Hearing conservation efforts should continue to raise awareness about the potential danger of loud sound exposure, especially among the young segments of the population.
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ATITUDES TOWARDS MUSIC LEVELS AT ORTHODOX JEWISH WEDDINGS

INTRODUCTION

Noise induced hearing loss is a deficit in the sensorineural part of the hearing mechanism, produced by the damaging effects of overstimulation by high intensity sound levels, usually over a period of time (Gelfand, 2009). Noise exposure can affect hearing sensitivity causing a temporary threshold shift, in which hearing is dulled for a short period of time, and subsequently improves over time, or a permanent threshold shift in audiometric thresholds can result. While the initial stages of the hearing loss may be unnoticeable, repeated exposure to noise can gradually develop over time to a more significant hearing loss. The decrease in hearing sensitivity often involves the higher frequencies, and is often characterized by a noise notch around 4000 Hz (Shargorodsky, Curhan, Curhan & Eavey, 2010). Noise exposure has also been associated with tinnitus and other disturbances to individuals which can impact various aspects of daily living, such as adverse perceived general and mental health (Vogel van de Looij-Jansen, Mieloo, Burdorf, & de Waart, 2014; as cited by Themann Suter, & Stephenson, 2013).

The risk of high exposure levels manifests itself in many different settings and venues. Much of the noise literature has focused on occupational noise; however, the noise levels measured at non occupational and recreational settings have been found to be notably high as well. At the higher end is the intensity of fireworks and gunshots at 140 dBA whereas lawnmowers and power tools reach an intensity level of 90dB (as seen in Gelfand, 2009). With the advent of more accessible and frequent leisure activities that involve higher music levels such as portable music listening, in addition to attending concerts and bars, many recent studies have shifted focus to these entertainment venues and exposure sources. Fligor and Cox (2004) reported output levels of various commercially available personal music device range from
approximately 80 dBA to 121 dBA. Keppler et al (2010) found the output of Ipod Nano ranges from 76.87 to 102.56 dBA for the earbuds and from 71.69 to 97.36 dBA for the supra-aural headphones (2010). Other studies have also found output measurements range between 70dBA and 99dBA (Levey, Levey & Fligor, 2011; Muchnik, Amir, Shabtai, & Kaplan-Neeman, 2012). With regard to entertainment venues, Clark (1991) found mean sound levels of 103.4dBA at discos and rock concerts. Serra et al (2005) evaluated discos in Argentina and found the range of noise level measured ranging from 104.3dB to 112.4 dB. The highest measurement noted were around 140dBA (Chung, Des Roches & Meunier 2005). There are numerous other studies that have substantiated the high intensity levels at concert (Clark, 1991; Zenner et al, 1999; Emmerich et al, 2002, Chung et al, 2005; Serra et al, 2005; Zocoli, Morata, Marques, & Corteletti, 2009).

There is evidence to suggest that increased exposure levels are leading to greater effects on hearing sensitivity. The National Institute on Deafness and Other Communication Disorders (NIDCD) estimated that approximately 15% of Americans between the ages of 20 and 69 have high frequency hearing loss due to noise exposure in both occupational and leisure settings. In a retrospective study in 2010, surveying audiometric data among adolescents aged 12-19 in the United States, researchers found that the prevalence of any hearing loss increased significantly from 14.9% in 1988-1994 to 19.5% in 2005-2006 (Shargorodsky et al 2010). Certainly, temporary decreases in hearing have been demonstrated through both survey data and audiometric testing due to loud noise exposure at entertainment venues to (Emmerich, Rudal & Richter 2008; Bogoch, House & Kulda, 2005; Opperman, Reifman, Schlauch & Levine, 2006 among others). Reviewing of the literature revealed that more studies focused on temporary threshold shifts as opposed to permanent threshold shifts, perhaps due to the difficulty
implementing an appropriate research design (Zhao Manchaiah, French & Price, 2000). Yassi, Pollock, Tran & Cheang (1993) followed 22 participants at a rock concert and noted that 81% of their participants showed a temporary threshold shift of at least 10dB from their pure tone averages in under 25 minutes of exposure, and 76% of these participants sustained the shift one hour later. Other studies have shown that regular use of portable music players may lead to a greater likelihood of developing hearing loss after long-term use, with elevated responses in high frequencies audiometry (16-20k Hz), and decreased amplitude in Transient Evoked Otoacoustic Emissions (Peng, Tao, & Huang 2007; Keppler et al 2010; Tarn et al 2013).

Similarly, tinnitus associated with recreational noise exposure has become more common (Vogel et al, 2014; Rawool & Colligon-Wayne, 2008; Olsen-Widen & Erlandsson, 2004). The prevalence of tinnitus varies among different studies. Some studies reported about 80% of participants in survey data reported tinnitus (Bogoch, et al, 2005), whereas others report around 58% (Rawool & Colligon-Wayne, 2008) and 21% (Lee, 1999). Researchers report that participants do not ascribe much significance to the sound, however, indicating the sensation will fade. Vogel et al (2014) noted that adverse perceived physical and mental health, adverse including depression and thoughts of suicide are related to permanent hearing loss symptoms in which tinnitus was listed.

In order to limit the risk of damage from noise, various guidelines were established for maximal noise levels. Criteria for occupational noise exposure were established by OSHA, (Occupational Safety and Health Administration) as well as NIOSH (National Institute for Occupational Safety and Health), which is part of The Centers for Disease Control and Prevention Department. OSHA regulates and enforces the standards, whereas NIOSH provides more stringent recommendations regarding the regulations based on research. OSHA limits
exposures of 90 dBA to an 8 hour day. For every increase of 5dB in noise level, the allowable exposure is reduced in half. NIOSH, however, recommends an exposure limit of 85dBA for 8 hours a day, and for every increase of 3dB, in the noise level the allowable exposure time is reduced in half. Thus, OSHA regulations allow for more exposure for longer periods of time. It is important to note these numbers relate to occupational standards and assume that noise levels are relatively quiet during the non-occupational noise exposure. Noise measurement studies attempt to quantify the noise levels by measuring the LAeq, noise dosage, and peak. LAeq is the average of the sound levels that exceed a certain threshold across a measurement period. Measurements include only sound levels that exceed a given threshold. Noise dosage refers to the amount of actual exposure relative to the amount of allowable exposure, and for which dosages above 100% are considered to be of sufficient risk of being hazardous (NIOSH, 1998). The maximum level reached by the sound pressure at any instant during a measurement period (recorded in dB) is called the Peak.

Many studies have reported leisure noise levels that exceed the recommended levels (Clark, 1991; Zenner et al, 1999; Emmerich et al, 2002, Chung et al, 2005; Serra et al, 2005; Zocoli et al, 2009). Similarly, survey responses to large-scale studies regarding recreational noise exposure, have revealed that adolescents tend to exceed recommended safety standards for noise when listening to music both using personal listening devices as well as at concerts (Muchnik, et al 2012; Henderson, Testa & Hartnick, 2011 ; Levey, Fligor, Ginocchi & Kagimbi, 2012 among others). On the other hand, Torre (2008) cited studies in which reported listening levels that did not exceed recommended values. Torre (2008) noted that the conclusion was based on self-reported listening levels in conjunction with duration of listening rather than objective measured levels.
To reduce the negative impact of high sound exposure, hearing conservation education and programs have been recommended and evaluated in the literature. Some concluded that education campaigns to adolescents yield low changes in behavior and question their efficacy (Weichbold & Sorowka 2003, Weichbold & Zorowka, 2007). Furthermore, Weichbold & Sorowka (2007) noted that many of the positive studies regarding the effectiveness of hearing education involve occupational noise, and thus do not necessarily generalize to recreational noise. Even when hearing conservation practices are put into effect, often they are not done correctly (Laitinen & Poulsen, 2008). Peoples' awareness of the risks of being affected by noise-related hearing problems, such as hearing loss, tinnitus and sound sensitivity, may be insufficient to make people use hearing protection when being exposed to leisure time noise (Bogoch et al, 2005; Goggin et al 2008; Folmer et al 2010; Johnson, Andrew, Walker, Morgan, & Aldren, 2014). Thus, some researchers concluded that hearing conservation programs may be only effective in changing attitudes and beliefs, but not sufficient to change behavior (Weichbold & Zorowka, 2007).

Conversely, other studies note a benefit to hearing conservation programs. They suggested that hearing conservation education can help raise awareness and modify behaviors and attitudes towards noise levels (Knobloch & Broste, 1998; Folmer et al 2002). Overall education generates a better sense of awareness. Opperman et al (2006) found that 4 of 14 participants (64%) who did not wear hearing protection demonstrated significant threshold shifts, whereas only 4 of 15 participants (27%) showed similar significant threshold shifts. Auchter, & Le Prell (2014) found an increase in hearing conservation practices amongst marching band members following a short hearing protection training program. Researchers introduced hearing protection training, including ear plug use to two high school marching band members, Hearing
conservation such as ear plug usage increased from 23% before the training to 62%, at least for occasional use. Additionally, 94% of participants reported that they intend to use hearing protection in the future. Thus, the short training not only increased an awareness of hearing conservation, but increased hearing conservation behavior as well. Thus, creating an awareness of the potential damages to hearing caused by recreational noise may lead to change in behavior at least in the short term. Thus, it is crucial to continue education and develop more effective tools in aiding hearing conservation. Other studies also support the effectiveness of hearing educational programs to increase in awareness, motivation to protect their hearing, and overall hearing knowledge (Chermak et al, 1996; Lukes & Johnson, 1998; Bennett & English, 1999; Folmer et al, 2002).

Attitudes and behaviors may vary based on demographics; thus, development of hearing conservation programs may benefit by honing in on demographic information. There is evidence of a difference in terms of hearing conservation behaviors and attitudes towards music as a function of age (Vogel, 2007; Bogoch et al 2005; Chung et al 2005; Wuest & Getty, 1992; Rawool & Colligon-Wayne). Similarly, gender differences have been reported in degree of noise induced hearing loss (Royster et al, 1980). However, that difference may be explained by the occupational experiences of gender. In addition, there is evidence to suggest that attitudes and behaviors may vary by culture (Filgor et al 2014; Torre 2008; Levey et al 2013; Crandell et al, 2004; Zogby, 2006). A targeted study of specific cultures and ethnicities may yield better assessment of noise levels and attitudes towards noise. In doing so, a more effective hearing conservation program can be established.

In the Orthodox Jewish community, weddings have a central role in community life, attended by many in the community on a regular basis. Music levels at such venues may exceed
recommended guidelines. Thus, many members of the community may have frequent exposures to loud levels, including young children. Analysis of the attitudes of this population will determine the need for and guide hearing conservation education as well as assist in more effectively targeting this population. Thus, our goal in this study is to assess the attitudes of wedding noise levels among Orthodox Jewish wedding participants in correlation to the noise levels measured at such venues. The following research questions are addressed: 1. What are the noise levels at various periods at Orthodox Jewish weddings? 2. What are the attitudes of attendees regarding music levels at Orthodox Jewish weddings? 3. Is there a difference in the attitudes regarding music levels of attendees as a function of age? 4. Is there a difference in the attitudes regarding music levels of attendees as a function of gender?

METHODS

Survey Development

A survey was developed by the researchers consisting of 13 Items using a Likert Scale to assess wedding attendee’s attitudes towards wedding music, as well as hearing conservation behavior. 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 each item. 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 items were drafted, but 13 items were ultimately adopted. Items consisted of hearing conservation behaviors at weddings as well as
attitudes towards music levels at weddings. The survey also consisted of basic demographic data, including gender, age, and frequency of wedding attendance. A copy of the survey can be found in Appendix A. Items addressing attitudes towards hearing conservation is the subject of a future investigation and will not be addressed in the current study.

*Noise Dosimeter*

Sound level measurements were collected at three Orthodox Jewish weddings. The researchers used a calibrated personal noise dosimeter with a data logging feature to collect the measurements. The dosimeter used was Casella CEL-35x dBadge. The CEL-35x dBadge meets the standards for IEC 61252: 2002, BS EN 61252: 1997, ANSI S1.25 - 1992 for dosimeters and sound exposure meters (Casella CEL-35X dBadge Users Handbook) Calibration for the dBadge was completed prior to measurement recordings. Calibration checks were performed with a with a handheld Casella calibrator (Model CEL-120/2 Class 2 Acoustic Calibrator). The device measures the A-weighted sound pressure level and tracks the time information for further analysis.

*Procedures*

A sealed box was present to place the surveys to ensure anonymity. Attendees who appeared to be 18 years of age or older were approached outside three Orthodox Jewish wedding venues in the Greater New York City region/Northern New Jersey over the course of a four month period between May to August 2014. Individuals were approached randomly and the nature of the survey was described. Informed consent was obtained according to the approved Brooklyn College IRB protocol. Participants were informed the survey would take less than five minutes to complete and they were provided the option to decline participation. Surveys were
distributed in a public space near the entrance of the venue. Data were analyzed using SPSS statistical software.

Noise level measurements were obtained at 3 weddings using the CEL-35x dBBadge at different halls from May 2014 until the August 2014 (in the Greater New York City area/Northern New Jersey. Permission was obtained prior to recordings from a member of the wedding party. The dosimeters were mounted via clips in the appropriate manner with the researcher’s discretion to the researcher; so as to be as unobtrusive as possible during measurements (mounted on suit jacket pocket or on pocket book strap on the shoulder bag). The researchers moved in the hall as a typical wedding attendee. The researcher did not alter his/her behavior during the wedding to accommodate the recording. The primary purpose in obtaining noise measurements was in order to better inform the researchers about the nature of the noise levels at these venues, and place the survey findings within the context of these measures.

The dosimeter was turned on during the “Bedekin”\(^1\) ceremony towards the beginning of the wedding, and recording continued through the wedding ceremony (“Chupah”) \(^2\) and remained activated and in the same position on the individual until the end of the first dance. The time period of the Bedekin was recorded, as well as those of the Chupah, the first dance and the meal. The recordings lasted about 2 hours 30 minutes for most of the recordings. The measurements were stored and analyzed using the Casella Insight Software Measurement parameters used were LAeq, equivalent continuous A-weighted noise level in decibels, an average level of noise over the entire period, Peak Values of Sound Level Pressure, as well as Noise Dosage calculated

\(^1\) Bedekin: The men escort the groom to his bride in song and dance prior to the Chuppah Ceremony. Often trumpets and other instruments are employed during this event, accompanied by song and dance.

\(^2\) Chuppah: Main Wedding Ceremony. This is often accompanied by periods of music, and concluded with loud music as well as song and dance
according to OSHA/ISO standards. Manually, we inputted NIOSH criteria of a lower threshold level of 75dB (in which levels below were not considered damaging and thus not included in the recordings) and a upper limit of 85dB (maximum exposure limit for an 8 hour day). Exclusion zones were also implemented to analyze the above variables in relation to the meal compared to the first dance.

All data were summarized and analyzed using SPSS IBM 22 software.

RESULTS

Respondents

A total of 149 surveys were collected. Guests present ranged from infants to elderly adults, however, no data were obtained from individuals younger than 18 years of age. Tables 1 and 2 summarizes the distribution of gender and age. The majority of the respondents were in the 18 to 30 range group. Gender was equally represented, although an additional 16 participants did not respond to that item. The average yearly wedding attendance amongst respondents was 9.10 weddings per year and the average number of weddings attended in the past month was 2.18 weddings. It should be noted that some respondents may attend multiple weddings during a certain period for various reasons including clerical/rabbinical duties. Additionally some participants may not be present for the entire duration of the wedding.

Table 1: Participants-Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>71</td>
<td>48%</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>42%</td>
</tr>
<tr>
<td>Unknown</td>
<td>16</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>149</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 2: Participants-Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-30</td>
<td>88</td>
<td>59%</td>
</tr>
<tr>
<td>31-40</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>41-50</td>
<td>13</td>
<td>9%</td>
</tr>
<tr>
<td>61-70</td>
<td>36</td>
<td>24%</td>
</tr>
<tr>
<td>70+</td>
<td>9</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>100%</td>
</tr>
</tbody>
</table>

Attitudes towards music and perceived impact

Attitudes towards noise levels at weddings were scored and inputted into SPSS. As noted earlier, of the 13 items only 7 items relevant to attitudes towards the perceived impact of music levels were assessed in the current study. Figure 1 summarizes the responses to Item 2 regarding perceived loudness during the dancing portion of the wedding. Of 149 respondents, 68% reported that the music levels during the dancing were too loud, and 27% felt the levels were acceptable. For comparison, Item 1 assessed perceived loudness during the meal portion of the wedding. These results, summarized in Figure 2, revealed that 36% reported that the music during the meal was too loud whereas 62% of respondents reported the music levels were acceptable. Furthermore, when asked whether they believed that the music at weddings reaches damaging levels (Item 4), 75% of responded affirmatively. It is interesting to note that 55% of responded that louder music does not enhance their enjoyment of the wedding (Item 3), whereas 37% responded affirmatively. Regarding perceived impact of the loudness of music levels, one item addressed the experiencing of tinnitus/ringing (Item 11); 60% responded having rarely or never had such symptoms, and only 30% noted ringing on occasion. Similarly when asked regarding the sensation of a decrease in hearing sensitivity, “dullness in hearing” (Item 12), 62% responded rarely or never having noticed any change in hearing sensitivity. Only 35% responded noting dullness in their hearing sometimes or often. Item 13 probed whether participants noticed a trend in the music levels at weddings. Almost half of the respondents
(48%) noted an increase. Nevertheless, 42% noticed no trend in the levels of music, and 5% noted an overall decrease in music levels.

Figure 1: Pie Chart showing overall attitudes towards music levels at Orthodox Jewish Weddings: Meal Section

Figure 2: Pie Chart showing overall attitudes towards music levels at Orthodox Jewish Weddings: Dancing Section

Relationship between attitudes towards music levels and age

To examine a possible relationship between age of respondent and attitudes regarding music levels at weddings, two Pearson chi-square tests were performed, using the data from Items 2 and 4. We found a significant association, $X^2 (15, N = 149) = 42.3670, p < .01$. Between age and attitudes regarding music levels, in which older adults reported finding the
music levels during the dancing too loud compared to younger adults (see Figure 2). We also found a significant relationship in which younger adults were more likely to agree that louder music makes the wedding more fun, $X^2 (20, N = 149) = 42.925, p < .01$. (See Figure 3).

**Figure 3: Attitudes During Dancing Section Across Age Group**

![Attitudes During Dancing Across Age](image)

**Figure 4: Loud Music and Enjoyment Across Age Group**

![Loud Music and Enjoyment Across Ages](image)
Relationship between attitudes towards music levels and gender

Similarly, two Pearson chi square tests were performed to examine the relationship between gender and attitudes towards music levels at weddings. We did not find a similar association with gender and attitudes towards music levels for either ,“Perceived Loudness During Dancing” (Item 1 ) $X^2 (3, N = 133) = .416$, “Perceived Loudness During Meal” (Item 2), $X^2 (3, N = 133) = .527$ or “Loudness and Enjoyment” (Item 3) $X^2 (4, N = 133) = .899$, or “Wedding Levels Reach Damaging Levels” (Item 4) , $X^2 (4, N = 133) = .837$.

Noise Levels: Overall

Noise level recordings were obtained using the Casella 35-xDBadge. All of the measurement analysis was conducted using the Casella Insight Data Management Software (2008). The measurements were all streamed from the Casella 35-xDBadge to the software in which were subsequently calculated. Whereas all measurements and parameters in the software are in accordance with OSHA or ISO guidelines in the Casella Software, parameters were altered to align with NIOSH’s guidelines. The recordings lasted between 2 and 3.5 hours. The average maximum sound level (peak) across the three weddings was 129.97 dBA, with a peak of 125.9dBA, 129.6dBA and 134.4dBA at each wedding. The average sound level exposure (LEQ) at each of the weddings were 94.9dBA, 92.4dBA and 91.4dBA. Leq is the average of the sound levels that exceed a certain threshold (85dBA) in a given measurement time period. Therefore, only sounds that exceed the threshold used are included in the calculation. The recordings demonstrated that all three weddings attended exceeded recommended noise levels according to NIOSH.
Additionally the dosimeter software also calculated noise dosage. Noise dosage is the percentage of maximum noise exposure level over a period of time. Exposure to the maximum level in a certain time period, (such as 85dBA in an 8 hour day) would be 100% noise dose for that day. For shorter time periods the exposure limit would be less. The noise exposure dosages for the 2 hour to 3 hour weddings were 310.30%, 148.10% and 194.80% respectively (See Table 4).

*Noise Levels: First Dance and Meal portions*

Noise level recording were also divided into sections. The researchers carefully recorded the start and end time of each section, that would be analyzed separately. There were two main sections measured in this analysis the meal portion, and the first main dance. The meal section, lasted approximately 40 minutes, and the first dance section ranged from 30 minutes to 46 minutes. It should be noted it was difficult to correlate exact timing of the sections due to a discrepancy in the software’s calculation of timing and our own timing parameters. Therefore all timing is approximate. The LAeq was for the meal sections were 91.8 dBA, 82.6dBA and 84.9dBA. The LAeq for the dancing sections were, 99.3dBA, 97.6dBA and 96.9 dBA. It should be noted that for the meal section the average LAeq was 86.43 dBA which falls within the recommended limits. However, the LAeq for the dancing sections was 97.93dBA, with each individual recording exceeding the recommended limits. For a list of the values see Table 3.

For each of the weddings we calculated the noise dose manually used by NIOSH (NIOSH, 1998). However, we only provided an estimate value of noise dosage with our calculations using the LAeq of the total time of each section. A true calculation requires the sum of each dB

---

3 Using Formula: \[D = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_n}{T_n}\] \(H \times 100\). C refers to time of exposure. T refers to the maximum exposure duration at which the noise is considered dangerous at a certain level.
level according to time of exposure. Therefore we provided the range of the LAeq levels during each section to help provide an sense of the noise levels (See Appendix B, C and D) For the meal sections the noise dose ranged from 5.41% to 29% of the daily noise dose. For the dancing section we found the range of 125% to 250.50% of the daily noise dose See Table 4 for a detailed breakdown of each wedding by section according to duration, LAeq, exposure recommendation and noise dose.

Table 3. Section Dosimeter Recording Measurements

<table>
<thead>
<tr>
<th>Type</th>
<th>Meal_1</th>
<th>Dance_2</th>
<th>Meal_2</th>
<th>Dance_2</th>
<th>Meal_3</th>
<th>Dance_3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (Minutes)</td>
<td>40</td>
<td>46</td>
<td>39</td>
<td>30</td>
<td>41</td>
<td>44</td>
</tr>
<tr>
<td>LAeq (dB)</td>
<td>91.8</td>
<td>99.3</td>
<td>82.6</td>
<td>97.6</td>
<td>84.6</td>
<td>96.9</td>
</tr>
<tr>
<td>Peak(dB)</td>
<td>120.1</td>
<td>123.5</td>
<td>113.2</td>
<td>129.6</td>
<td>118.7</td>
<td>134.4</td>
</tr>
</tbody>
</table>

Table 4. Noise Dose Per Sections At Each Weddings

<table>
<thead>
<tr>
<th>Section</th>
<th>Duration(Minutes)</th>
<th>LAeq (dBA)</th>
<th>Recommended Exposure Time(Min)</th>
<th>Noise Dose(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meal1</td>
<td>40</td>
<td>91.8*</td>
<td>95</td>
<td>29%</td>
</tr>
<tr>
<td>Dancing1</td>
<td>46</td>
<td>99.3**</td>
<td>18</td>
<td>255.50%</td>
</tr>
<tr>
<td>Meal2</td>
<td>39</td>
<td>82.6***</td>
<td>12hrs</td>
<td>5.41%</td>
</tr>
<tr>
<td>Dancing2</td>
<td>30</td>
<td>97.6****</td>
<td>24</td>
<td>125%</td>
</tr>
<tr>
<td>Meal3</td>
<td>41</td>
<td>84.6******</td>
<td>8hrs</td>
<td>8.50%</td>
</tr>
<tr>
<td>Dancing3</td>
<td>44</td>
<td>96.9******</td>
<td>30</td>
<td>146.60%</td>
</tr>
</tbody>
</table>

*used estimate of 92dBA
** used estimate of 99dBA
*** used estimate of 83dBA
**** used estimate of 98dBA
*****used estimate of 85dBA
****** used estimate of 97dBA
DISCUSSION

Whereas other studies have assessed attitudes towards noise levels among a variety of populations, our study is unique in focusing on the Orthodox Jewish community. As noted earlier, attitudes and behaviors towards noise levels may have cultural and ethnic differences, especially regarding recreational noise levels. Filgor et al (2014) found the highest output for personal listening devices amongst African American (99.8 dBA) and Caribbean listeners (95.1 dBA). The lowest levels were found amongst White (90.5dBA) and Asian listeners (92.6dBA).

Torre (2008) surveyed various ethnicities regarding Personal Listening device usage including African American, Hispanic, Latino, American Indian, Alaskan; Hawaiian/Pacific Islander and White participants. They noted African American respondents were significantly more likely to report longer durations of exposure. Numerous other studies have focused on ethnic differences regarding noise levels as well (Crandell et al, 2004; Zogby, 2006). Levey et al (2013) noted potential cultural reasons for differences regarding listening habits of various ethnicities, including type of music, in terms of historical, style and music genres, as well as primary location of listening (such as the background environmental noise which can affect volume control of the listeners). As noted earlier, in the Orthodox Jewish community, a prominent venue for recreational noise exposure is at weddings. Many in the community attend weddings, ranging from young children to elderly adults. Thus, the noise environment affects the community at large. An analysis of the attitudes of this population can help guide hearing conservation education.

Dosimetry recordings

As part of our study, we collected noise measurements using a dosimeter. Although the data are based on a sample size of three, these recordings can provide an estimate of the noise
environment at these weddings. The noise recording results revealed that participants were
exposed on average to high levels of sound during a 2 to 3 hour period. The average level during
the three weddings ranged from 91.4dBA to 94.9dBA. These values are consistent with other
recreational noise values in the literature obtained at sporting events, concerts, discos in which
average levels exceeded recommended limits, with a high noise dosage (Clark, 1991; Zenner et
al, 1999; Emmerich et al, 2002, Chung et al, 2005; Serra et al, 2005; Zoccoli et al, 2009; England,
& Larsen). According to NIOSH, safe exposure to sound at the intensity levels measured would
range from 1 hour 35 minutes to 1 hour. In terms of noise dosage the entire measurement for the
entire wedding recording all exceeded the 100% noise dose limit recommended by NIOSH
(310.30%, 148.10% and 194.80%). Thus, in a two to three hour period, wedding attendees were
exposed to up to 1.5 times to about three times the recommended exposure limit. When we
further analyzed the noise dosage for the meal and dancing sections we found the noise dose is
much greater during the dancing. The noise dose during the meal ranged from 5.41% to 29% of
the daily noise dose. However, during the dancing section we found the range of 125% to
250.50% of the daily noise dose. Therefore, the majority of the noise dose stems from the
dancing sections. It should be recalled, however, that guests may often come for only part of the
wedding, in which case they would have lower exposure levels, whereas others may stay for the
entire wedding, which would include a second set of dancing/music exposure, resulting in a
much higher noise dose.

It is crucial to note that the measurement criteria for recommended levels of noise exposure
are based on NIOSH’s standards for occupational noise. These standards were established for
occupational noise exposure, for an average level of noise over an 8-hour day, forty hour week.
There have not been accepted standards for recommended noise levels for recreational noise
levels, and thus we only were able to compare our recordings to those accepted standards. Future research should include dosimeter measures that include others parts of the day. More data are required to make conclusive statements regarding noise levels at Orthodox Jewish weddings, which should also include accounting for the different physical and acoustical properties of the various weddings venues. Our goal was primarily to introduce pilot data information regarding the need to further explore the noise effects at such weddings. Researchers from National Acoustics Laboratory (NAL) (Carter et al 2014) conducted a review of leisure noise exposure studies, and noted a wide gap in conclusions from various studies regarding leisure noise exposure, ranging from a minimal effect to significant changes in hearing sensitivity. They noted many potential limitations of such designs. Whereas Carter et al (2014) reported that many of the studies relied more on speculation than evidence to base conclusions regarding the noise exposure and the actual effects of the noise levels, they concluded that there is adequate data to support the notion that some leisure activities can yield potentially dangerous noise levels.

It is important to report that for the dosimeter recordings, the researchers acted as a regular wedding attendee. The researchers were vigilant about not altering behavior during the wedding to accommodate the recording, however we acknowledge potential recorder bias inherent in the design. Furthermore, our goal in obtaining recordings was to serve as preliminary information to complement the survey data, as well as to provide pilot data.

Another potential limitation with the methodology involved the recording of the different sections of the wedding with the dosimeter. We elected to run the dosimeter from the beginning of the wedding (bedekin) until the end of the first dance continuously. Therefore, the software analyzed the data on the entire sample. Thus, in order to obtain data for each section, the researchers rigorously recorded time of each section. However, when translating that to the
software, the timing was off, and at best the researchers were able to estimate the timing of each section. Therefore, the statements regarding the sections are estimated values. The software enabled a feature of isolating different sections of the recording to obtain the various values, such as $L_{Aeq}$, and the Peak levels, but does not calculate the noise dosage. Therefore, the researcher manually calculated those values. However, we believe these limitations have at most a minor impact on the findings.

Survey Data

The goal of the survey was to assess wedding participant’s attitudes towards music levels at weddings. Interestingly, our findings revealed that a majority of the respondents, in fact, were critical of some volume levels at weddings. For example, 68% responded that the music levels during the dancing were too loud (Item 1), and 75% responded that music levels reach damaging levels (item 4). Furthermore, there was a difference in perception of the loudness levels during the meal and dancing sections in concert with the intensity levels measured. However, there seems to be some disconnect between the awareness of the potential damaging levels and levels of enjoyment, as only 55% responded that the loud levels do not enhance their enjoyment. This disconnect has been recorded in the literature as well. Bogoch et al (2005) reported a similar finding in which about 73% of respondents felt that the levels at concerts they attended were damaging to their hearing, nonetheless 48% noted a preference being close to the loudest location. Goggin et al (2008) found that 48% of 303 survey participants considered noise levels dangerous at various entertainment featured (including venues with live bands, or recorded music) a yet only 24% reported a willingness to wear hearing protection.

These responses indicate some awareness of the loud levels and recognition of potential hazards of loud noise levels. Regarding Item 4 (Damaging Levels), however, the word
“damaging” was not operationally defined and can have different connotations in terms of severity and impact. While respondents may acknowledge a degree of the damaging effect of loud noise they may minimize the effect in general or to themselves. They may not feel the levels are actually dangerous to their hearing health. Furthermore, unless hearing sensitivity is measured it is difficult to demonstrate a shift in hearing. Only about a third of participants noted noticing some degree of symptoms such as tinnitus, or decrease in hearing sensitivity after weddings. The majority of participants did not note any presentation of these symptoms. Thus, despite the loud levels measured at such events, many respondents did not note any subjective symptoms. These results suggest there is a reasonable recognition amongst the Orthodox Jewish community to the dangers of high music levels. This does not preclude the necessity for the continuation creation and development of hearing conservation education and programming. However, there may be a greater need to focus on conservation as other studies noted a difficulty of translating knowledge into actions (Weichbold & Sorowka 2003, Weichbold, V., & Zorowka, P. 2007; Goggin et al 2008; Folmer et al 2010; Johnson, Andrew, Walker, Morgan, & Aldren, 2014). Furthermore, hearing conservation should be targeted to all with an emphasis to the younger members of the community in particular. This is highlighted in a recent study in which Johnson et al (2014) found that 73.2 % of students noted that the risk of hearing damage would not affect their recreational habits of attending nightclubs. Nonetheless, 70.2 % preferred that the noise levels be reduced to safer noise levels. The findings from our present study indicated a significant association between age and attitudes towards noise at weddings which correlated with the literature regarding noise levels and young adults (Giles et al 2012; Giles et al 2013; Quintanilla-et al; 2009; Widen, 2006; Olsen Widen, & Erlandsson, S. I. 2004b). Vogel et al (2007) noted that a primary feature in the barriers to young adolescent’s healthy hearing behavior
was in their attitudes towards noise and hearing protection/conservation. Among the primary issues noted were physical appearance (Bogoch et al 2005; Chung et al 2005), social pressure (Wuest & Getty, 1992) or level of enjoyment (Chung, 2005) as well as the perception of the quality of the music and higher level of background noise. Rawool and Coligon-Wayne (2008) related the perception that many adolescents do not believe their hearing will be affected by noise until much later in life.

Many of these aforementioned concerns may be present with adolescents and difficult to change, however, some suggest a targeted campaign to society at large as well as targeting younger children (Griest, et al 2007) and parents (Sekhar Clark, Davis, Singer,& Paul, 2014) can help promote a healthier noise environment during leisure activities. There is research that demonstrated that creating awareness and a negative perception of noise can also increase hearing conservation, even amongst young adults (Widen, 2006). For example Olsen-Widen and Erlandsson (2004b) investigated the relationship between attitudes towards noise and hearing protection use various music venues. They found about half of the young adults who viewed loud noise negatively used hearing protection, whereas less than one quarter of those who viewed loud noise as neutral or positive used hearing protection. While these numbers are not staggering, we see that by creating an awareness of the negative effects of loud noise we may be able to at least begin to slowly generate greater hearing conservation practices.

While our study did not focus on the reasons behind the difference in attitudes with age, one explanation may relate to the differences in noise floor (Gross, 2006). At weddings there is dancing and singing and a high level of noise. Thus, the music to be heard must be played above that noise floor. The higher the noise floor the higher level the music is to be played. He notes that younger adults, tend to be more centered in the middle of the dance floor, where the
background noise level is higher and needs a higher level for the music (stimulus) to overcome the noise floor (Gross, 2006). As a result they may perceive the need for the music to be louder just to be enjoyable. Whereas older adults who experience a lower of a noise floor, they may perceive the music as louder, and this affects their attitudes towards the music.

In addition, loud music as experienced at weddings, for example, may be considered as noise to some, and enjoyable as the signal to others. The categorization of recreational noise as noise creates an interesting dilemma, regardless of established noise limit standards, what is constituted as noise is subjective. Noise is by definition an unwanted stimulus. Thus, many people may not consider loud recreational music as noise. Establishing perceptions about music is important because a desired stimulus may be less likely to be perceived as dangerous and thus, changing behaviors toward it may be more difficult to accomplish. In fact individuals who may be inclined to wear hearing protective devices may opt against doing so where music is concerned (Chung et al 2005). Researchers found that younger adults tend to attend to the music in the background whereas older listeners attempt to ignore the background music (Russo and Pichora-Fuller, 2008). The researchers of that study connected their findings to age differences to listening to speech in noise, highlighting the preference of older adults to focus on speech, whereas the younger adults preferred both listening to speech and music. This preference may shed light in the age differences regarding recreational noise levels. In conjunction with numerous studies have noted the increased listening effort and cognitive load may impact older adults in more complex listening environments (Pichora-Fuller, 2003; Pichora-Fuller, Schneider & Daneman, 1995; among numerous other studies). This increased load may also contribute to age differences in attitudes and behaviors towards noise. Additionally a recent study
demonstrated small, but significant correlation between age and listening levels; as age increases average listening levels decrease (Fligor et al 2014).

Of great concern was the response to trends in volume over time. Almost half of respondents (48%) noticed a trend towards an increase in overall music levels at weddings, compared to about 8% noting a reduction in overall music levels at such venues. Forty-two percent did not notice a trend at all, but one must consider the age range of our participants as well. Younger adults, aged 18-30 which comprised 59% of respondents, and may not have had the capability to assess as well any trend in music levels, as the older adults. Despite the process of item evaluation that occurred prior to the final construction of the survey, Item 13’s wording may have lent itself to misinterpretation, as a result of which participants chose multiple responses for that item. Thus, we did not include Item 13 in our analysis but rather just reported the number of responses. Thus, these results suggest that there is already some awareness of the issues of volume levels at weddings, although more education is needed. These results are important to disseminate in the event that anecdotal reports suggesting that musicians may be reluctant to lower the volume because they believe the majority prefer it at such high volume. It would be interesting in a future study to assess the attitudes of musicians at these venues to determine in fact if this is the case.

We hypothesized that in cultures where gender roles and separation are encouraged, there may be a greater likelihood of differences between the sexes in attitudes towards noise levels, however; we did not find statistically significant gender differences in our survey responses. Though studies have documented gender differences in Otoacoustic Emissions, Auditory Brainstem Responses (ABR), and middle latency measures (as cited in Rogers, Harkrider, Burchfield, & Nabelek 2003). Perhaps perceptions of sound may cause a difference in attitudinal
relation to noise. Rodgers et al, (2003) noted there are some measures of perceptual differences of speech and background noise for males than females, such as higher comfortable listening levels and accepted higher levels of background noise. Perhaps these perceptual differences may contribute to a differential attitude towards noise levels. Conversely, the high levels measured at concerts and similar venues may not yield any noticeable measureable perceptual differences. Furthermore, the measures of MCL and BCL relate to speech, whereas at concerts and other venues the goal is to listen to the music and not necessarily focus on optimizing communication. However, by not noting any significant differences between genders, perhaps a hearing conservation education program be created to suit both genders with only slight cultural modifications.

The survey developed by the researchers consisted of 13 items a Likert Scale to assess wedding attendee’s attitudes towards wedding music, as well as hearing conservation behavior. A number of versions of the survey were refined using volunteers who were not part of the study pool. The volunteers made recommendations for modifications or additions to the survey. Originally, 18 items were drafted, but 13 items were ultimately adopted. However, we noted a couple of limitations with the survey, including missing or misinterpretation of the items. For example, we noticed 16 participants (10.7%) failed to identify their gender. Given that the anonymity of the survey and that a smaller percentage did not identify an age group, indicates that perhaps based on the layout of the survey the item was missed. Future studies should make appropriate adjustments in the survey. In developing our study we made a few assumptions. We presume the majority of the attendees are part of the Orthodox Jewish Community, and the survey respondents would be from the Orthodox Jewish community. Whereas we did not ask
regarding their religious affiliation, it is assumed that most were indeed part of the Orthodox Jewish community.

Conclusions

1. Music levels reach potentially dangerous levels during weddings based on dosimeter recordings, with almost half of respondents reporting a trend toward increases in volume over time.

2. A majority of respondents perceived the volume of the music to be too loud and that it can reach damaging levels.

3. There is a significant association between attitudes towards loud music with age, with older respondents reporting healthier attitudes. The association with gender was not significant.

4. Hearing conservation efforts should continue to raise awareness about the potential danger of loud sound exposure, especially among the young segments of the population.

5. Whether the healthy attitudes found here are complemented by use of hearing conservation strategies is the subject of a companion study.
Appendix A

Orthodox Jewish Wedding Music Survey

A. Gender: Male Female

B. Age: 18-30 31-40 41-50 51-60 61-70 70+

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

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: *Casella Software Dosimeter Recording of Wedding 1.*

Appendix C: *Casella Software Dosimeter Recording of Wedding 2.*

Appendix D: *Casella Software Dosimeter Recording of Wedding 3*
References


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