Noise Exposure in University Pep Band Members: Acoustic Measurements Versus Musicians’ Perceptions

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NOISE EXPOSURE IN UNIVERSITY PEP BAND MEMBERS:
ACOUSTIC MEASUREMENTS VERSUS MUSICIANS’ PERCEPTIONS

by

Jaime L. Roy

A Thesis Submitted in Partial Fulfillment
of the Requirements for a Degree with Honors
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ABSTRACT

While noise-induced hearing loss has been studied extensively, little research has focused on music-induced hearing loss, which is due to loud music exposure. Previous research has shown that loud music from an ensemble can produce harmful noise levels. In the current research, noise levels were measured during Pep Band performances at hockey games in Alfond Arena and basketball games at the Cross Insurance Center. It was hypothesized that noise levels may differ based on the sporting event. In a second study, UMaine Pep Band members’ perceptions of noise exposure and opinions of hearing protection and hearing health were surveyed. It was expected that Pep Band members would underestimate their noise exposure and have little knowledge about hearing health and hearing protection available to musicians. Noise levels were shown to be at a harmful level during performances. Survey results showed that Pep Band members underestimated their noise exposure and did not wear appropriate hearing protection. Taken together, these results indicate a strong need for hearing health education for student musicians with a focus on information about music-induced hearing loss and the importance of wearing hearing protection during band performances.
Acknowledgments

Many people have supported me this year, and there are certain individuals who I would like to thank.

During my four years at the University of Maine, the members of the Screamin’ Black Bears Pep Band and the Pride of Maine Marching Band have been my family. Thank you to all members, Mr. White, and the brothers and sisters of Kappa Kappa Psi and Tau Beta Sigma for not only making this thesis possible, but also for the memories, laughter, and fun over the past four years. I will truly miss you all.

Thank you, Dr. Grindrod and Amy Booth, for helping me with the project of my dreams. I came to you with an idea, and with your guidance, I now have a thesis that I am incredibly proud of. Thank you for the countless hours you have put into this project, and I am grateful that I had the opportunity to work with you.

I am fortunate that I had an incredible amount of support this year. Thank you to my wonderful boyfriend, my friends and family, the sisters of Tau Beta Sigma, and my SAA girls. I love you all. Thank you for your endless support!
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I. INTRODUCTION

Hearing plays an important role in communication, and even a small amount of hearing loss can have a negative effect on an individual’s quality of life. The leading cause of preventable hearing loss is excessive loud noise exposure (Hodgetts & Liu, 2006). Hearing loss results from exposure to loud sounds for an extended period of time (Auchter & Le Prell, 2014). This type of hearing loss is classified as noise-induced hearing loss (NIHL). NIHL is one of the most prevalent occupational diseases around the world (Gopal, Chesky, Beschoner, Nelson, & Stewart, 2013). Current research suggests that NIHL is of particular concern for teenagers (Shargarodsky et al., 2010). An estimated 12.5% of adolescents between the ages of 16-19, and 17% of adults between the ages of 20-69 have permanent hearing loss due to excessive noise exposure (”Noise-Induced Hearing Loss”, 2016). NIHL is typically caused by repeated exposure to high volume noise, but can also be caused by a single traumatic sound (Phillips, Henrich, & Mace, 2010). NIHL cannot be corrected through medical or surgical intervention. Habitual exposure to loud music can involve decreased hearing acuity; this phenomenon is referred to as a threshold shift (Opperman, Reifman, Schlauch, & Levine, 2006). Permanent threshold shifts can also be accompanied by symptoms such as tinnitus and distortion of certain frequencies.

There are guidelines in place to assess the danger of occupational noise. These standards exist to protect industry workers, such as individuals in manufacturing jobs. Research has shown that extended exposure to noise greater than 85 dB can result in permanent hearing loss (Balanay & Kearney, 2015). Figure 1 below, the National
Institute for Occupational Safety and Health (NIOSH) Noise Meter, is taken from the Occupational Safety and Health Administration’s (OSHA) website:

![Typical Sound Levels (dBA)](image)


This figure shows a decibel value associated an everyday sound equivalent. The values are measured in an A-weighted decibel scale, which is the most accurate prediction of the perception of loudness to the human ear. According to OSHA’s website (2013), the limit for a workplace sound is 90 dBA for eight hours for all workers. When noise is increased by three dB, it reduces the exposure time by half. NIOSH recommends that the limit should be 85 dBA for eight hours for workers, and when noise is increased by three dB, the exposure time should be cut in half. For example, NIOSH recommends less than 15 minutes a day for sounds at 100 dBA. If a workplace has workers exposed to sounds greater than 85 dBA for eight hours, there must a hearing conservation program. OSHA
monitors noise levels, provides hearing protection, and provides free hearing screenings for employees.

While noise-induced hearing loss has been studied extensively, very little research has focused on music-induced hearing loss (MIHL), which results from loud music exposure. Gopal et al. (2013) report that the number of young adults who expose themselves to loud music has increased in recent years and they often listen without realizing the risk of permanent hearing loss. Hearing health seems to be a low-priority health concern for the young population when compared to drug use and smoking. It has been reported that 18.8% of young adults between the ages of 18 and 25 are exposed to noise from leisure activities (Balanay & Kearney, 2015). Some of these environments are concerts, bars and clubs, and sporting events. There are no regulations about non-occupational noise, or leisure noise, especially in environments where young adults are frequently found. Hodgetts and Liu (2006) recorded data from three Stanley Cup playoff games, and the average noise exposure levels were 104.1, 100.7, and 103.1 dBA. The most common noise exposure reported from students was from sporting events, and participation in sporting events was found to have the highest percentage of students with a hearing related symptom such as ear pain, tinnitus, or noise sensitivity (Balanay & Kearney, 2015). Amplified music exposure from rock concerts and personal music players has also been associated with hearing problems in young adults (Balanay & Kearney, 2015). At concerts, the noise exposure is expected to be dangerous because of the lack of regulations and the pleasure associated with listening to loud music (Opperman et al., 2006). The average sound level at concerts is 95.3 dBA with peak levels at 122 dBA. Some genres of music have the stereotype of being loud, such as
heavy metal or distorted guitars, but it is unclear if other genres of music have the same risk of hearing damage. Noise exposure during the young adult years may accelerate NIHL even if there are only temporary hearing problems (Balanay & Kearney, 2015).

Music-induced hearing loss is of particular concern for music students and performers. The potential for prolonged loud noise exposure could be especially high for these groups. There is evidence that professional musicians can have severe hearing loss (Washnik, Phillips, & Teglas 2016). Many professional musicians, including Sting and Roger Daltrey, have hearing loss attributed to loud music exposure (Mittnacht, 2014). There has been a growing concern for musicians, music students, and people in the music industry because they are dependent on their hearing for their career. Musicians are aware of potential hearing damage, but many are unsure of how to handle this problem (O’Brien, Driscoll, & Ackermann, 2012). The amount of people who are at risk is extremely large. It is estimated that there are 21,000 people in Sweden who interact with music for a living, with 7000 of those people being music teachers (Kähäri, Zachau, Eklöf, Sandsjö & Möller, 2003). Gopal et al. (2013) report that hearing loss in musicians may be as high as 50%. Some musicians exceed their daily noise level exposure, and if in a workplace, would be required to wear hearing protection provided by employers (Fulford, Ginsborg, & Goldbart, 2011).

The danger of noise exposure has been difficult to measure in musicians because it is difficult to quantify music exposure, unlike industrial noise, which is at a more constant level. Determining a musician’s noise exposure is difficult due to the dynamic nature of music. Music performances often consist of long periods of high volume music and short periods of rest between songs. The risk of hearing loss due to excessive loud
music exposure is hard to quantify because music is difficult to isolate from other sounds (Fulford et. al, 2011). Recent studies have shown that musicians playing certain instruments, such as percussion, trumpets, and horns, are at the greatest risk of noise exposure (O’Brien et al., 2008). The instruments mentioned above are not the only ones to put musicians at risk for hearing damage. According to Etymotic Research, Inc., nearly all instruments can create sounds over 100 dB. The instruments with the lowest dB values are the tympani and the oboe both at 74 dB; however, each of these instruments can generate noise as loud as 94 and 102 dB, respectively (Etymotic - Hear for a Lifetime, n.d.). The loudest instrument is the bass drum, which can generate noise levels of 122 dB, which without earplugs, reaches the daily exposure limit in seven seconds.

Every instrument can generate sounds that are above the 85 dB safe limit. People who play the violin and viola are of particular concern, because these instruments create a high level of sound right next to the musician’s ear (Royster et al., 1991). In a study of the Chicago Symphony Orchestra, it was shown that the majority of musicians had notched audiograms, which could indicate MIHL (Royster et al., 1991). Notched audiograms (characterized by a notch centered around 4000 Hz) are consistent with noise-induced hearing damage. This same study reported that music majors had a higher prevalence rate of MIHL than non-music majors (Royster et al., 1991). In Laitinen and Poulsen’s (2008) study, it was reported that 80% of the musicians surveyed from three Danish symphonies thought that the orchestra played uncomfortably loud. In sharp contrast, only 10-12% of these same musicians reported that they were very or quite worried about their hearing. This data is concerning because although the musicians
recognized the symphony as being loud, most were not worried about their hearing health.

Another factor that makes musicians more at risk for NIHL is their lack of hearing protection. Musicians who do not use hearing protection have a high risk of developing hearing loss (Santoni & Fiorini, 2010). Most musicians do not use hearing protection on a regular basis. Few musicians report always wearing hearing protection, with more saying they wear them occasionally, and those who do wear hearing protection only wear it during loud passages of music (Laitinen & Poulsen, 2008). Musicians also report removing their hearing protection when the conductor is speaking or during more difficult parts of the music. Musicians who have hearing symptoms associated with hearing loss are more likely to use hearing protection than musicians who do not (Laitinen, 2005). Many musicians do not wear hearing protection because of the negativity surrounding their use, including dampened voice and ear pressure (Santoni & Fiorini, 2010). Musicians who wear hearing protection regularly are those who already have hearing complaints and hearing-loss related symptoms. Other negative issues about hearing protection that musicians report are itching, infection in the ear canal, hearing their own breathing, difficulty with hearing other musicians which negatively impacts their own playing, discomfort, and difficulty with insertion (Laitinen & Poulsen, 2008). Additionally, musicians criticized disposable earplugs because they are too visible. Some musicians only wear hearing protection in one ear with the ear depending on the location of the loudest sound. Studies have shown that musicians have poorer hearing thresholds in their left ear than their right (Kähäri et al., 2003). This may be because many instruments are held closer to the left ear when played.
Musicians’ negative perceptions of the use of hearing protection prevents them from becoming accustomed to using hearing protection, and companies need to continue to improve products to address some of the negative opinions mentioned above. Musicians need time to adjust to hearing protection; only 10% of musicians adjusted to hearing protection right away, and others require more time (Laitinen & Poulsen, 2008). One third of the musicians in Laitinen and Poulsen’s (2008) study gave up or stopped using hearing protection because they were not used to wearing it. Most musicians reported that it took several weeks to adjust to hearing protection. Educational programs could change musicians’ views about hearing protection. The sound levels within an orchestra are not extremely high, so hearing protection with a limited attenuation would work well for these musicians. This information could possibly be applied to musical groups other than orchestras. Santoni and Fiorini (2010) suggest that there is more of an acceptance of hearing protection in rehearsals, and it is becoming more frequent in performances. They also suggest that hearing protection met the needs and expectations of the individuals in their survey, which could indicate a positive trend toward musicians’ acceptance of hearing protection. There needs to be a change in the music industry about this issue. Noise-induced hearing loss will continue to be a problem for musicians unless policies are made to resolve this problem (see Schink, Kreutz, Busch, Pigeot, & Ahrens, 2014).

II. CURRENT RESEARCH

While previous studies have investigated noise exposure and hearing health in orchestral musicians, very little research has focused on these issues in student musicians,
especially during performances at sporting events. The current research is unique because it compares actual noise level measurements during Pep Band performances to members’ general perceptions of noise levels. Through this comparison, this research aimed to shed light on the relationship between physical noise levels and Pep Band members’ perceptions of these levels.

This thesis aimed to answer two research questions. Study One addressed how much noise Pep Band members are exposed to in a performance environment. This study used quantitative data about physical sound levels during Pep Band performances at hockey and basketball games at the University of Maine. Study Two addressed Pep Band members’ perceptions of noise exposure and opinions about the use of hearing protection. This study examined these issues using an online survey.

Study One was expected to show results similar to other studies about noise levels at sporting events and other entertainment venues (Hodgetts & Liu, 2006). It was predicted that noise levels would exceed the NIOSH recommended levels. It was also expected that hockey games would be louder than basketball games because the latter environment has less crowd intensity and a wider band arrangement. Study Two was expected to show that Pep Band members would not have a good understanding of hearing health. Specifically, they would underestimate the amount of loud noise in the performance environment. Moreover, it was expected that few Pep Band members would report wearing hearing protection on a regular basis based on the literature and personal observation.

III. STUDY ONE
**Introduction**

This study examined the noise levels at Pep Band performances at men’s hockey games in Alfond Arena, and men’s and women’s basketball games at the Cross Insurance Center. The goal of this study was to learn about how much actual noise Pep Band members were exposed to during performances at different sporting events.

**Participants**

“The Screamin’ Black Bears Pep Band” plays in the balcony, commonly referred to as the student section, in Alfond Arena. The band section in the balcony cannot hold more than 50 members, which reduces the band’s size at games. At the December 9, 2016 hockey game, there were 35 musicians in addition to a few extra musicians who were not registered on the attendance sheet. There were at least four alto saxophones, four clarinets, one mellophone, six percussion, five tenor saxophones, three trombones, six trumpets, and three sousaphones. This instrument distribution is typical of most Pep Band performances. At the January 28, 2017 hockey game, there were 47 Pep Band members. There were 45 members at the February 1, 2017 women’s basketball game, and 47 members at the February 6, 2017 men’s basketball game. The average age of participants was 19.5 ± 1.2 years. 36.8% of members were freshman, 35.1% were sophomores, 12.3% were juniors, and 15.8% were seniors. A large variety of majors and types of instruments were represented.
Location

Harold Alfond Sports Arena has been the main location of men’s hockey games since 1977. The seating capacity for a hockey game is 5641. The student section is in the upper balcony of Alfond Arena, which is the location of the University of Maine Pep Band. The band section is HH, and the maximum capacity for the band is 50 members.

The Cross Insurance Center is the home venue for University of Maine basketball games. The seating capacity is 8000. The Pep Band is seated on bleachers at the end of the court. While the arrangement of the band is similar, there is a slight difference because of the bleacher setup when compared to Alfond Arena. At the Cross Insurance Center, the metal bleachers are located on the floor next to the basketball court. The band size and instrument distribution is the same as for hockey game performances.

Procedure

Sound levels were collected using an iPhone app called Decibel 10 (formally Decibel 10th). Decibel 10 was developed by Skypaw Co. LTD. It is available on mobile Apple devices with iOS 8 or later. The app is free to download and use, but the pro version must be purchased to use the A-, B-, and C-weighted scales. The A-weighted scale was used for the measurements taken in this study. The A-weighted decibel scale is the most accurate prediction of the perception of loudness to the human ear. The app has two different recording speeds: slow (500 milliseconds) and fast (200 milliseconds). The slow speed was used to collect data for this study. Measurements were taken using an iPod touch (6th generation) secured to a shoulder loop on a harness for a tenor saxophone. This loop held the iPod touch close to the ear.
Decibel 10 has been shown to be reliable in measuring sound levels in previously published research. One article mentions its positive features such as relating the noise level to common examples and having the ability to export collected data (Adrian, 2013). It has also been used to measure noise levels at McGill University’s library (Lange, Miller-Nesbitt & Severson, 2016) and to quantify classroom noise (Radley, Dart, & O’Handley, 2016). This app was used because of its ease of use, export features, positive reviews, and reliability based on the above-mentioned studies.

To ensure reliability, another piece of equipment was used called Jolene. Jolene was created by the University of Northern Colorado with the goal of measuring personal stereo systems. It is a manikin torso with a flesh-like ear on the side of its head. This ear has a microphone in it, and Jolene has a decibel meter on her side. This design is supposed to mimic how a human ear would experience noise exposure. It was originally designed to measure how loud personal music players are by putting an earbud in its flesh-like ear. For this study, Jolene was used in an unconventional way to record sound levels during hockey and basketball games. The manikin was tied to the top of a milk crate and then tied to the bleacher to make her a similar height to a Pep Band member. The values from her decibel meter were recorded on video by a palmcorder. Data collected using Jolene were compared to the Decibel 10 recordings, and they were highly similar. Because similar values were obtained from Jolene and the Decibel 10 app, only the measurements from Decibel 10 are reported in the results below.

Noise levels were recorded during the short version of the Stein Song. This version of the song includes only the first chorus. It is played when the teams come out and when UMaine scores. Typically, it is played many times during a single game. This
song was chosen because it is a standard in the band and it is played at roughly the same speed and volume every time across settings. The short version of The Stein Song is approximately one minute long.

Noise levels were measured at Alfond Arena for hockey games and at the Cross Insurance Center for basketball games. Four measurements were taken: two hockey games and two basketball games. The hockey games measured were December 9, 2016 versus American International College, and January 28, 2017 versus The University of Massachusetts. The two basketball games were on February 1, 2017 (women’s basketball versus The University of Vermont), and February 6, 2017 (men’s basketball versus The University of Hartford).

Results

Recorded values were exported from the Decibel 10 app to Microsoft Excel. Due to technical issues with exporting the data, some of the values were exported as 0s. These values, representing less than 1% of the data, were removed before the results reported below were analyzed. Because these 0 values represent very little of the total data, they should not have any effect on the results. The maximum, minimum, and average values were calculated for each Stein Song performance at different games. The start and end times of the recording were gathered and determined by the Decibel 10 app, and the middle point was determined to be the halfway point.

Results of the recording at the 12/9/16 hockey game are presented in Figure 2 below (stars indicate the minimum and maximum time points). This figure shows how variable noise levels were during the short version of the Stein Song. It also demonstrates the dynamic nature of music and that noise levels are not constant. The minimum value
for this recording was 87.8 dBA. The maximum value was 111.7 dBA. The average noise level for approximately one minute was 106.4 dBA.

![Figure 2](image.png)

Figure 2. Noise levels recorded during the 12/9/16 hockey game (in decibels) over time (in minutes).

Results of the recording at the 1/28/17 hockey game are presented in Figure 3 (stars indicate the minimum and maximum time points). The minimum value was 79.7 dBA, and the maximum value was 111.1 dBA. The average noise level for the recording was approximately 105.4 dBA.
Figure 3. Noise levels recorded during the 1/28/17 hockey game (in decibels) over time (in minutes).

The results of the recording at the 2/1/17 women’s basketball game are shown in Figure 4 (stars indicate the minimum and maximum time points). The minimum value was 78.7 dBA, and the maximum value was 111 dBA. The average noise level for the recording was approximately 101.8 dBA.

Figure 4. Noise levels recorded during the 2/1/17 women’s basketball game (in decibels) over time (in minutes).

The results of the recording at the 2/6/17 men’s basketball are shown in Figure 5 (stars indicate the minimum and maximum time points). The minimum value was 60.1
dBA, and the maximum value was 109.7 dBA. The average value for the recording was 98.8 dBA.

![Figure 5. Noise levels recorded during the 2/6/17 men’s basketball game (in decibels) over time (in minutes).](image)

Table 1 below compares noise levels measured during the Stein Song after the first University of Maine goals of the 12/9/16 and 1/28/17 hockey games. The values for the first goal of the 12/9/16 game were an average of 106.4 dBA, a minimum of 87.7 dBA, and a maximum of 111.7 dBA. The values for the first goal of the 1/28/17 game were an average of 105.4 dBA, a minimum of 79.7 dBA, and a maximum of 111.1 dBA.

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/9/16</td>
<td>106.4</td>
<td>87.7</td>
<td>111.7</td>
</tr>
<tr>
<td>1/28/17</td>
<td>105.4</td>
<td>79.7</td>
<td>111.1</td>
</tr>
</tbody>
</table>

Table 2 below compares the noise levels of the Pep Band after University of Maine goals at the 12/9/16 hockey game. Values are listed for the first, third, fourth, and fifth goals of the game. The first goal’s average noise level was approximately 106.4
dB. The minimum value was 87.7 dBA and the maximum value was 111.7 dBA. The third goal’s average noise level was approximately 106.3 dBA. The minimum value was 82.3 dBA and the maximum value was 111.6 dBA. The fourth goal’s average noise level was approximately 106.9 dBA. The minimum value was 77 dBA and the maximum value was 111.4 dBA. The fifth goal’s average noise level was approximately 105.5 dBA. The minimum value was 74.9 dBA and the maximum value was 111.5 dBA.

Table 2. Comparison of noise levels (in decibels) during the Stein Song after goals at the 12/9/16 hockey game.

<table>
<thead>
<tr>
<th></th>
<th>1st Goal</th>
<th>3rd Goal</th>
<th>4th Goal</th>
<th>5th Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>106.4</td>
<td>106.3</td>
<td>106.9</td>
<td>105.5</td>
</tr>
<tr>
<td><strong>Min</strong></td>
<td>87.7</td>
<td>82.3</td>
<td>77.0</td>
<td>74.9</td>
</tr>
<tr>
<td><strong>Max</strong></td>
<td>111.7</td>
<td>111.6</td>
<td>111.4</td>
<td>111.5</td>
</tr>
</tbody>
</table>

Table 3 compares the noise levels of the Pep Band after the second court entrance of the 2/1/17 women’s basketball game and the 2/6/17 men’s basketball game. The 2/1/17 recording had an average value of approximately 101.8 dBA. The minimum and maximum values were 78.7 dBA and 111 dBA, respectively. The 2/6/17 recording had an average value of approximately 98.8 dBA. The minimum value was 60.1 dBA and the maximum value was 109.7 dBA.

Table 3. Comparison of noise levels (in decibels) during the Stein Song after basketball game second entrance.

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2/1/17 Women</strong></td>
<td>101.8</td>
<td>78.7</td>
<td>111.0</td>
</tr>
<tr>
<td><strong>2/6/17 Men</strong></td>
<td>98.8</td>
<td>60.1</td>
<td>109.7</td>
</tr>
</tbody>
</table>

In comparing noise levels recorded during hockey and basketball games, as expected, the Stein Song was louder at hockey than basketball games. The two hockey
game recordings were comparable, as are the two basketball games. The hockey game recordings also have less variability than the basketball game recordings. The recording with the most variability was the 2/6/7 men’s basketball game.

**Discussion**

There could be many reasons why noise exposure was greater at hockey games than basketball games. The hockey game environment is a louder environment than is basketball. For example, more students attend hockey games than basketball games, and students create a loud and exciting environment. Another factor that could contribute to the higher noise levels is the Pep Band’s space and arrangement at hockey games. The Pep Band is located within the student section at hockey games, which is not the case at basketball games. Attendance is higher at hockey games than basketball games, and crowd noise could be a factor contributing to the higher noise levels. Because there is a larger crowd cheering for the hockey team, that could contribute to higher noise levels. Alfond Arena is a much smaller environment compared to the Cross Insurance Center. At the Cross Insurance Center, the band stands on two large metal bleachers on the floor of a large building. Alfond Arena is much smaller, and the band is closer to the roof of the building. This compact space could increase the noise levels produced and experienced by the Pep Band.

In comparison to previous research, Study One’s results were similar to Hodgetts and Liu (2016). Their average noise level for entire Stanley Cup games were 104.1 dB, 100.7 dB, and 103.1 dBA. These values are comparable to the measurements recorded in the current study. Hodgetts and Liu (2016) state that in Game Three of their study, it
would only take six minutes to reach the daily noise exposure limit. Because both studies have similar results, it is reasonable to apply this same finding to hockey games at Alfond Arena.

IV. STUDY TWO

Introduction

The purpose of Study Two is to learn about perceptions of hearing health and noise exposure of Pep Band members, many of whom participated in the performances recorded at the hockey and basketball games described above.

Participants

A total of 57 out of 126 students completed the survey, which represents a 45% response rate. Informed consent was obtained in a manner approved by the Institutional Review Board of the University of Maine. The participants were recruited from MUO 113, which is the class identification for Pep Band. The sample included students from both the Fall 2016 and Spring 2017 semesters. 60% of respondents were female. The average age of participants was 19.5 ± 1.2 years. 36.8% of participants were freshman, 35.1% were sophomores, 12.3% were juniors, and 15.8% were seniors. A wide variety of majors and types of instruments were represented. 50.9% of participants had only been enrolled in MUO 113 for one or two semesters. 28.1% had been enrolled for three to five semesters, and 21.1% had been enrolled for six to eight semesters.
Survey

The survey consisted of questions pertaining to the band background (e.g., how long have you been involved with the Pep Band? and what instrument do you play?). Other questions pertained to hearing protection use (e.g., how often do you wear hearing protection?, what type of hearing protection?, and in what environment?). Lastly, there were questions about band members’ perceptions of noise exposure (e.g., Do you think your instrument is loud enough to cause hearing loss?, do you experience a ringing sensation in your ears after Pep Band performances?). The full survey is provided in Appendix A.

Procedure

A link to the survey website was distributed through an email by the Director of Bands to Pep Band members from both the Fall 2016 and Spring 2017 semesters. This link directed participants to the consent form. After the consent form was read, participants indicated if they agreed to take the survey or not. The first set of questions were demographic questions. Participants then indicated if they wore hearing protection in Pep Band performances. Their answer to this question determined how the rest of the survey was completed. If they answered “Yes” (I wear hearing protection), questions about hearing protection use were asked. Some questions included which type, how often hearing protection was used, and if the participants noticed less negative effects from noise. If participants answered “No” (I do not wear hearing protection), they were directed to a question asking why hearing protection was not used. After the hearing protection section, participants answered questions about their perceptions of noise
exposure. Questions such as, how often are you exposed to loud music?, do you experience symptoms like ringing in your ears?, and have you been taught about noise exposure damage?, were included. In total, the survey took 5-10 minutes to complete.

Results

Only nine out of 57 survey participants (16%) reported wearing hearing protection during Pep Band performances. This finding was not related to the amount of time members were involved in Pep Band. For this group, the majority reported wearing earplugs, with the next highest response being musician’s plugs. In response to the question about how long students had been wearing hearing protection, the majority of students responded for 1-3 months (44.4%), with the next highest response being 4-6 months (33.3%). When asked about the frequency of wearing hearing protection, most Pep Band members selected “often”, with “sometimes” being the next highest answer. The majority overwhelmingly responded that they wore hearing protection in both ears. When asked in which Pep Band environment hearing protection was worn, most participants selected both hockey and basketball games (66.7%). When asked about the benefits of wearing hearing protection, most participants (7/9 participants) responded that they experienced less buzzing and ringing in their ears after performances and fewer headaches. Some participants also responded that they had less fatigue after performances because of wearing hearing protection. Responses from hearing protection wearers are reported in Table 4.
Table 4. Hearing protection wearers’ (n = 9) responses to questions about hearing protection.

<table>
<thead>
<tr>
<th>Type of Hearing Protection Worn</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Earplugs</td>
<td>55.6%</td>
<td>Musician’s Plugs</td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Custom</td>
<td>11.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length of Use of Hearing Protection</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than a month</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>1 to 3 months</td>
<td>44.4%</td>
<td></td>
</tr>
<tr>
<td>4 to 6 months</td>
<td>33.3%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of Use of Hearing Protection</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sometimes</td>
<td>33.3%</td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td>44.4%</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>22.2%</td>
<td></td>
</tr>
</tbody>
</table>

| Ear in Which Hearing Protection is Worn |          |
|                                        | Right ear | Left ear | Both       |
|                                        | 11.1%     | 0%       | 88.9%      |

| Environment Where Hearing Protection is Used |          |          |
|                                             | Hockey games | Basketball games | Both hockey and basketball games |
|                                             | 33.3%        | 0%            | 66.7%            |

| Benefits of Wearing Hearing Protection |          |          |          |
|                                        | Less buzzing or ringing in ears | Fewer Headaches | Less Fatigue |
|                                        | 7 responses                | 6 responses     | 4 responses   |

For the 48 participants who did not wear hearing protection, the majority reported that they did not wear hearing protection because they did not own any. The next group of answers were all related to not hearing the environment, such as not being able to hear the director, their peers’ instruments, or their own instrument. Responses from non-hearing protection wearers are reported in Table 5.

Table 5. Non-hearing protection wearers’ (n = 48) responses about why they do not use hearing protection.

<table>
<thead>
<tr>
<th>Do not own any</th>
<th>Cannot hear director</th>
<th>Cannot hear own instrument</th>
<th>Cannot hear other instruments</th>
<th>Too uncomfortable</th>
<th>Fit poorly</th>
<th>Lost them</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 responses</td>
<td>19 responses</td>
<td>14 responses</td>
<td>14 responses</td>
<td>5 responses</td>
<td>5 responses</td>
<td>4 responses</td>
</tr>
</tbody>
</table>
With respect to questions about noise exposure, when asked if Pep Band members believed noise exposure could cause permanent hearing loss, every participant selected “yes”. Furthermore, the majority of participants selected “yes” when asked if they thought they were at risk for developing hearing loss. In response to the question asking participants if they thought their own instrument could cause hearing loss, the slight majority (61.4%) said “yes”. Interestingly, when looking at responses to this question based on specific instruments played by survey respondents, all trumpet and percussion players believed that their (louder) instrument could cause permanent hearing loss, whereas all clarinet players believed that their (quieter) instrument could not cause permanent hearing loss. Most survey respondents reported that Pep Band performances were not uncomfortably loud. When asked if hearing protection changes the way people play their instrument, the majority said “yes”. About half of the respondents selected “yes” when asked if they knew about high-fidelity hearing protection for musicians. When asked if they would get their hearing checked, the overwhelming majority of participants selected “yes”. Responses to noise exposure questions are reported in Table 6.
Table 6. Pep Band members’ (n = 57) responses to questions about noise exposure.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can noise exposure cause permanent hearing loss?</td>
<td>Yes 100.0</td>
<td>No 0.0</td>
</tr>
<tr>
<td>Are you at-risk for developing permanent hearing loss?</td>
<td>Yes 75.4</td>
<td>No 24.6</td>
</tr>
<tr>
<td>Is instrument loud enough to cause severe hearing loss?</td>
<td>Yes 61.4</td>
<td>No 38.6</td>
</tr>
<tr>
<td>Are Pep Band performances uncomfortably loud?</td>
<td>Yes 22.8</td>
<td>No 77.2</td>
</tr>
<tr>
<td>Does wearing hearing protection change how instrument is played?</td>
<td>Yes 66.7</td>
<td>No 33.3</td>
</tr>
<tr>
<td>Are you aware of high-fidelity hearing protection for musicians?</td>
<td>Yes 52.6</td>
<td>No 47.4</td>
</tr>
<tr>
<td>Would you have your hearing tested?</td>
<td>Yes 98.2</td>
<td>No 1.8</td>
</tr>
</tbody>
</table>

When asked about how often Pep Band members are exposed to loud music, the majority of students responded with either “sometimes” or “often”. The majority of participants selected “rarely” or “sometimes” when asked about how often they experienced ringing in their ears after Pep Band performances. Lastly, in response to the question about how often they wear hearing protection at sporting events, Pep Band members had a relatively even distribution of responses between “never”, “rarely”, “sometimes” and “often”. Responses to the final three questions are reported in Table 7.
Table 7. Pep Band members’ (n = 57) responses to questions about frequency of noise exposure, ringing sensations, and hearing protection use.

<table>
<thead>
<tr>
<th>Frequency of loud music exposure</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>0%</td>
<td>5.3%</td>
<td>42.1%</td>
<td>45.6%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Ringing sensation in ear(s) after Pep Band performances</td>
<td>Never</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
<td>Always</td>
</tr>
<tr>
<td>Never</td>
<td>17.5%</td>
<td>38.6%</td>
<td>31.6%</td>
<td>8.8%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of hearing protection use at sporting events</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>26.8%</td>
<td>17.9%</td>
<td>26.8%</td>
<td>17.9%</td>
<td>10.7%</td>
</tr>
</tbody>
</table>

Discussion

The number of Pep Band members who did not wear hearing protection was consistent with the original hypothesis of this study. Previous research have shown that only a small number of musicians wear hearing protection in large music ensembles (Santoni & Fiorini, 2010), which is also true for the UMaine Pep Band. For the small number of musicians who wear hearing protection, it is encouraging that they reported fewer symptoms associated with loud music exposure, such as fewer headaches, less ringing and buzzing in their ears, and less fatigue. Not only does hearing protection potentially protect these musicians from harmful noise exposure, but it also alleviates discomfort during Pep Band performances. Reasons why UMaine Pep Band members said they did not wear hearing protection are like those reported by Laitinen and Poulsen (2008) and Jin et al. (2013). Musicians have concerns about not hearing their surroundings, which can impact how they play their instrument. Not owning any hearing protection was the most common reason for not wearing hearing protection at performances. This could indicate a lack of availability of hearing protection or a lack of
awareness of the benefits of wearing hearing protection. While hearing protection is easy to purchase through many sources, more effort is needed to make hearing protection readily available for student musicians.

Many Pep Band members recognize that noise exposure can cause permanent hearing loss and acknowledge that they are at risk for developing permanent hearing loss. This finding shows that there is some awareness about high noise exposure and music-induced hearing loss. Although a large majority of students believe that they are at risk for noise-induced hearing loss, only a slight majority believe that their instrument can cause hearing loss. This finding suggests that there could be a lack of understanding about the noise level differences of personal instruments versus the entire Pep Band. Overall, these student musicians seem to underestimate their own instrument’s potential to create harmful noise levels. Moreover, while Pep Band members can identify the need for wearing hearing protection at sporting events, many do not recognize the need to wear hearing protection during Pep Band performances.

Interestingly, Jin et al. (2013) reported a higher percentage (45%) of band members who used hearing protection some of the time. It is, however, important to note that their results were taken as part of a three-year study. The band members in their study were also given counseling, hearing protection, and had their hearing tested. The present study showed that only 16% of participants used hearing protection at performances, but they were not provided with the resources listed above. Laitinen and Poulsen (2008) also reported a higher percentage of musicians (52%) who used hearing protection to varying degrees in performances. Like Jin et al.’s (2013) study, this ensemble also had hearing education before the survey was conducted. Findings of these
two studies suggest that hearing education programs may increase hearing protection use in musical groups.

V. GENERAL DISCUSSION

In Study One, Stein Song performances were found to be louder at hockey games than at basketball games by an average of about 5 dBA, which is significant in terms of noise levels. In Study Two, Pep Band members were found to have some awareness of how loud sounds can cause permanent hearing problems, but they did not apply this knowledge to Pep Band performances. Only a fraction of Pep Band members reported wearing hearing protection, and almost half of them believed that their instrument was not capable of producing harmful noise levels. Overall, Pep Band members seem to underestimate their risk of potential hearing loss due to loud music exposure, and do not recognize the need for wearing hearing protection.

There is a disconnect between Pep Band members’ perceptions of noise exposure during performances, as indicated by their survey responses, and actual noise levels measured during performances at two different sporting events. Pep Band members may not have the ability to gauge noise levels during performances or determine the intensity of noise levels. Many Pep Band members reported in the survey that the band’s noise levels were not uncomfortably loud, yet the current study shows that the Stein Song reached noise levels comparable to construction sites and nightclubs. While band members acknowledge that the performance environment can produce high noise levels, they underestimate the actual noise levels that the band can produce.

One way to bridge the disconnect between Pep Band members’ perceptions of noise levels compared to actual noise levels is by introducing a hearing education
program for student musicians. Previous studies have shown that nearly half of some ensembles report using hearing protection to varying degrees (Jin et al., 2013; Laitinen & Poulsen, 2008). With a hearing education program, perhaps the UMaine Pep Band could significantly increase hearing protection use. One of the popular hearing education programs is Etymotic’s Adopt-A-Band program. Their mission is to help musicians enjoy music without the risk of tinnitus. Programs like Adopt-A-Band can educate musicians about products that can protect their hearing. Significant benefits of this program have already been documented. For example, Auchter and Le Prell (2014) found that after implementing a hearing loss prevention program, 96% of participants reported that they had a better understanding of hearing loss. They also found that members were surprised by some of the information. For example, some members did not know that hearing loss was permanent and could not be cured. This education could potentially have similar benefits for the UMaine Pep Band. With education, musicians can acknowledge the risk of the noise levels they are exposed to, and learn how to better protect their hearing.

The Pep Band members who use hearing protection at performances generally have positive views. Most hearing protection users reported less buzzing or ringing in their ears, fewer headaches or less fatigue. Santoni and Fiorini’s (2010) study reported that musicians who wore hearing protection had positive opinions about their hearing protection, which is supported by the current study. These positive views from musicians about their hearing protection could encourage more band members to purchase hearing protection and continue to use it. Hearing protection should be worn by musicians to protect themselves from excessive noise exposure, but it is important that musicians like their hearing protection.
One of the biggest concerns regarding the use of hearing protection is not being able to hear others in the environment, including fellow members and the director. A possible solution could be wearing high-fidelity hearing protection made for musicians. This type of hearing protection allows the user to hear their environment better in musical ensembles while still protecting the user’s hearing. In the current study, half of the survey participants were not aware of this type of hearing protection. If student band members could try this type of hearing protection in a performance setting, their negative opinions about wearing hearing protection could change. High-fidelity plugs could provide Pep Band members with the benefits of hearing protection while still being able to hear their surroundings, thus potentially increasing their use.

While the current study provides important data regarding hearing health and noise exposure in Pep Band members, a few limitations should be mentioned. This study measured noise levels of the Stein Song after University of Maine hockey goals and basketball team entrances, a relatively small portion of these sporting events. To provide a more accurate representation of the Pep Band’s noise exposure, the entire game could be recorded. In future studies, a larger number of games could be analyzed. Ideally, the Decibel 10 app could be used to record sound levels from multiple points within the band, whereas the current recordings were made at one constant location. This study provides a starting point for analyzing noise exposure in Pep Band members, but more research is needed to assess noise exposure levels of student musicians.

There is also a need for future research to learn more about noise exposure in college student musicians. Other University of Maine musical groups (e.g., Pride of Maine Marching Band, UMaine Symphonic Band, UMaine Jazz Ensemble) could be
compared to the UMaine Pep Band. It is also recommended to study band rehearsals as well as performances. Musicians spend a large amount of time in rehearsals in preparation for performances, which would be valuable to compare to noise levels during actual performances. For any future surveys, more questions could be included about Pep Band member’s perceptions of the band’s sound levels. It would be interesting to see how Pep Band members would compare their perception of band noise levels relative to other sounds listed on the NIOSH meter.

VI. CONCLUSION

In the current study, noise levels during Pep Band performances at two sporting events were measured and survey data on hearing protection use and perceptions of noise exposure of student musicians were also collected. Results showed how performances of the Stein Song after hockey goals and during basketball games produced potentially harmful noise levels. In line with the original hypothesis, the noise levels at hockey games were louder than basketball games. In fact, the noise levels recorded were comparable to those of a construction zone or night club. Results of the survey were also consistent with the hypothesis that Pep Band members would underestimate their noise exposure and lack knowledge about hearing health and hearing protection available to musicians. Only half of survey participants responded that they were aware of high-fidelity hearing protection for musicians, and only 60% reported that their instrument could cause permanent hearing loss. Taken together, the current studies highlight the need for education about noise exposure levels and hearing health for student musicians. This training should primarily focus on music-induced hearing loss, and the importance of wearing hearing protection during Pep Band performances.
REFERENCES

Adrian, A. (2013). Get smart about noise: These apps can turn your smartphone into a sound-level meter. *ASHA Leader, 18*, 30.


APPENDIX A: SURVEY

Demographic Questions

- Date
- Age
- Gender
- Major
- Year
- # of Semesters in Pep Band
- What instrument do you play?

Hearing Health Questions

- Do you wear hearing protection (such as earplugs) during Pep Band performances?
  - Yes/No
- What type of hearing protection do you wear?
  - ear plugs/ear muffs/musician’s plugs/custom
- How long have you been wearing hearing protection?
  - Less than a month, 1-3 months, 4-6 months, 7-12 months, >1 year
- How often do wear hearing protection?
  - Never/Rarely/Sometimes/Often/Always
- In what ear(s) do you wear hearing protection?
  - left/right/both
- In what Pep Band environment do you wear hearing protection?
  - hockey game/basketball game
- Do you like wearing hearing protection in Pep Band?
  - Yes/No
- When I use hearing protection, I notice that (select all that apply):
  - My ears don’t buzz or ring as much after music exposure
  - I don’t get headaches as much after music exposure
  - I am less fatigued and can play longer
  - There is no difference compared to not using hearing protection
- I don’t use hearing protection because (select all that apply)
  - I don’t own any
  - I lost them
  - They are uncomfortable
  - They fit poorly
  - I can’t hear my own instrument very well
  - I can’t hear the other instruments around me
  - I can’t hear the director
Noise Exposure Questions

- How often are you exposed to loud music?
  - Never/Rarely/Sometimes/Often/Always
- Do you believe noise exposure can cause permanent hearing loss?
  - Yes/No
- Given the sounds you are exposed to, do you think you are at-risk for developing a permanent hearing loss?
  - Yes/No
- Do you experience a ringing sensation after Pep Band performances?
  - Never/Rarely/Sometimes/Often/Always
- Do you think your instrument can generate sounds loud enough to cause a severe hearing loss?
  - Yes/No
- Do you think Pep Band performances are uncomfortably loud?
  - Yes/No
- Which sporting event do you think is louder?
  - hockey/basketball
- I would wear hearing protection at sporting events.
  - Never/Rarely/Sometimes/Often/Always
- Do you think that wearing hearing protection changes the way people play their instrument?
  - Yes/No
- Are you aware of high-fidelity hearing protection available for musicians?
  - Yes/No
- If I had the opportunity, I would have my hearing tested to see if it is OK.
  - Yes/No
- Have you been taught about the potential damage of noise exposure?
  - Yes/No
APPENDIX B: IRB APPROVAL LETTER

Application #: 2017-01-12
Application Title: Survey of Hearing Health and Noise Exposure of UMaine Pep Band Members
PE: Jaime Roy
Approval Start Date: 2/21/2017

Dear Jaime,

The above referenced project was approved by the University of Maine’s Institutional Review Board for the Protection of Human Subjects (IRB). The study was deemed exempt from further review under category 2 of the regulations. A study in this category requires no further communication with the IRB, unless you need a modification.

We keep applications in this category for five years and then destroy them, but we will confirm with you that the study is complete prior to destroying.

I have attached the completed cover page for your records. Good luck with the study. Gayle

There is one minor change needed in the consent. My email address is incorrect (I didn’t notice the first time). It is gayle.jones@umit.maine.edu. I fixed my copy, so just fix yours -- no need to send me anything!

Thanks!

Gayle M. Jones
Assistant Director, Research Integrity and Compliance
Office of Research and Sponsored Programs
University of Maine
5717 Corbett Hall, Room 400
Orono, ME 04469-5717
Phone: 207/581-1498 Fax: 207/581-1479
APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

PRINCIPAL INVESTIGATOR: Jaime Roy EMAIL: jaime.roy@maine.edu
CO-INVESTIGATOR: EMAIL:
CO-INVESTIGATOR: EMAIL:
FACULTY SPONSOR: Christopher Grindrod EMAIL: christopher.grindrod@maine.edu

TITLE OF PROJECT: A survey of hearing health and noise exposure of University of Maine pep band members
START DATE: 2/20/2017 2/21/2017 PI DEPARTMENT: Communication Sciences & Disorders
FUNDING AGENCY (if any): n/a

STATUS OF PI: UNDERGRADUATE

1. If PI is a student, is this research to be performed:
   X for an honors thesis/senior thesis/capstone?
   □ for a master's thesis?
   □ for a doctoral dissertation?
   □ for a course project?
   □ other (specify)

2. Does this application modify a previously approved project? No. If yes, please assign assigned number (if known) of previously approved project:

3. Is an expedited review requested? Yes

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

*******************************************************************************
FOR IRB USE ONLY Application # 2017-01-12 Review (F/E): E Expedited Category:
ACTION TAKEN:
   X Judged Exempt; category 2 Modifications required? Y Accepted (date) 2/21/2017
   □ Approved as submitted. Date of next review: by Degree of Risk:
   □ Approved pending modifications. Date of next review: by Degree of Risk:
   □ Modifications accepted (date):
   □ Not approved (see attached statement)
   □ Judged not research with human subjects

FINAL APPROVAL TO BEGIN 2/21/2017
Date 01/2017

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APPENDIX C: INFORMED CONSENT

PURPOSE
You are being asked to participate in a research project conducted by Jaime Roy, an undergraduate student in Communication Sciences and Disorders, and faculty sponsor, Dr. Christopher Grindrod, an Assistant Professor in Communication Sciences and Disorders at the University of Maine. This research will gather information on the hearing health of University of Maine Pep Band members. Previous research on noise exposure and hearing protection among band members has been conducted. The current research aims to add to this knowledge and promote further awareness of noise exposure and hearing health among student Pep Band members. You must be at least 18 years of age to participate.

WHAT WILL YOU BE ASKED TO DO?
If you choose to participate, you will be asked to answer questions about your background, use of hearing protection and noise exposure in Pep Band. The survey will take approximately 5 to 10 minutes to complete. The survey will not ask for your name, so any information you provide will remain anonymous.

RISKS
Minor risks are your time and inconvenience. You may skip any questions that make you feel uncomfortable.

BENEFITS
There are no direct benefits to you. With respect to the overall potential benefit of the research, the results obtained will provide new information about hearing protection usage and the hearing health of student Pep Band members.

CONFIDENTIALITY
This survey is anonymous. All data will be stored on the principal investigator’s and the faculty advisor’s password-protected computers. All data related to the study will be destroyed by June 1st, 2017.

VOLUNTARY
Your participation is completely voluntary. If you choose to complete the survey, you can stop at any time. You may skip any questions that you do not want to answer.

CONTACT INFORMATION
If you have questions about this study, you may contact Jaime Roy (207-745-6184; jaime.l.roy@maine.edu) or Dr. Christopher Grindrod (207-581-2014; christopher.grindrod@maine.edu). If you have questions about your rights as a research
participant, you may contact Gayle Jones, Assistant to the University of Maine’s Protection of Human Subjects Review Board (207-581-1498; gayle.jones@umit.maine.edu).

**STATEMENT OF CONSENT**

By selecting “agree” below, you are indicating that:
1) you have read the above information,
2) you voluntarily agree to participate, and
3) you are at least 18 years of age.
If you do not wish to participate, please decline participation by selecting “disagree”.

Agree          Disagree
Author’s Biography

Jaime Roy is from Orrington, Maine, and graduated from John Bapst Memorial High School in Bangor, Maine. At the University of Maine, she majored in Communication Sciences and Disorders with minors in Music and Disability Studies. She participated in the Screamin’ Black Bears Pep Band and the Pride of Maine Marching Band playing tenor saxophone. Jaime is a sister of Tau Beta Sigma, National Honorary Band Sorority, and served as Vice President of Membership. She also participated in the National Student Speech Hearing Language Association as historian, and helped establish the Student Academy of Audiology chapter at UMaine. In August 2016, Jaime participated in a Global Volunteers trip and taught English to children on the Island of Crete, Greece, thanks to the generous Dennis Rezendes ’57 and Jacqueline Beau Rezendes Global Service Scholarship and the Honors College.

After graduating, Jaime will attend the University of Connecticut to begin her Doctor of Audiology degree and further her dream of becoming an audiologist. She hopes that she can integrate her love of music into her future profession.