Epidemiologic Survey of College Student-Musicians Participating in Marching Band

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Abstract

Recently named the “Best Damn Band in the Land” by the Bleacher Report, the University of North Texas Green Brigade is one of the most celebrated collegiate marching bands in the country. In addition to performing at the home football games each Saturday, college student-musicians in the Green Brigade rehearsal over the summer and for 6 hours a week during the fall semester. For many, these demands are in addition to those associated with majoring in music. The purpose of this epidemiologic study is to characterize health related outcomes associated with participating in a collegiate marching band. A 70 item epidemiologic survey was designed to assess several areas of concern including musculoskeletal, dermatologic, hearing, and mental health. This paper will examine the musculoskeletal and mental health areas. Following IRB approved protocol, 82% of the Green Brigade Marching band (N=246/300) consented to participate in and successfully filled out the survey at the end of the 2011 fall season. Results reveal many interesting patterns and consequences associated with participating in a collegiate marching band. This paper will show demographic variables, patterns of physical and mental health problems, and responses to attitudinal questions regarding perceived value and impact associated with required levels of commitment. Recommendations for action will be offered.
Introduction

Performing artists experience injuries that can be devastating to their careers. As such, research has been conducted for several performing artist groups, such as dancers. This research shows both the types of injuries and areas of the body most commonly affected. It is through this type of research that recommendations for injury prevention can occur. This type of research, focused on injury prevention, also appears in the field of sports medicine. Perhaps more than any other field, the area of sports is rich in injury prevention research. However, there is not such a bank of information regarding marching band, or really musicians in general. Musicians are under-researched and therefore under-served through resources.

There is a small bank of related research in the field of concert musicians’ health. This research can be related somewhat to marching musicians, as the basics of playing an instrument remain the same. Concert ensembles often have extreme sound levels, which feature dangerously high decibels. In fact, one rehearsal in such a setting can produce as much sound as is approved for an entire day’s consumption. Marching bands feature volumes that make a concert ensemble forte seem tame. Marching bands must project over the crowd noise during half time at a football game and the general rule of thumb is “the louder the better”. The number of musicians in a typical concert ensemble is around 60 to 70, while a marching band can feature three to four times that number. When several hundred people make a unified attempt to play “as loud as possible,” the result can be quite literally deafening.

Although steps are being taken in the concert setting, there is little to no research being conducted on marching band participants. Marching band combines all of the physical demands of playing an instrument, as well as marching technique and even dance in some instances. A typical marching band rehearsal begins with a short physical warm up, usually running a lap around the practice field. After a brief stretching period, the rehearsal starts with a visual block to refine the fundamentals of marching technique. Punctuated by water breaks, often referred to as “chug ‘n go’s” the band rehearses the half time show. Students are expected to run back to each starting set, and attempt to be as accurate as possible during each “rep”. Talking must be kept to a minimum so that rehearsals can be taken at breakneck speeds. A marching band rehearsal keeps its participants in constant motion and is quite the physical activity. Trumpet players have been shown to have a higher heart rate during marching band rehearsals than their resting heart rate. In fact, marching band counts as the physical education requirement for Texas public schools. However, this intense physical activity comes at a price. In a study completed on a community band with older participants, there was an increase in musculoskeletal pain for those participating in marching band. These pain sites were most commonly concentrated in the upper extremities.

Besides the physical aspect to participating in marching, there is also an emotional and mental aspect associated with performance. Marching bands perform in football stadiums, during half time shows, and in marching band specific contests. These large venues lend themselves to large audiences, which create an exciting performance environment. For example, the Texas State Marching Band Contest is held in the Alamodome in San Antonio, with three levels of seating and several Jumbo-trons which zoom in on individual marchers. For eight to nine minutes, marching band participants devote themselves entirely to the physical and mental demands of performance, as even the slightest break in concentration can cause an error. Drill formations are so exact that being...
off your assigned coordinate by mere inches can result in the entire picture looking wrong to the audience and panel of judges. This results in a high level of individual responsibility for marching band participants. Marching band performances are most often associated with some level of competition, which can also lead to stress or performance anxiety. Interestingly enough, in a study done on those participating in drum and bugle corps, there was a lower rate of musical performance anxiety, or MPA. This could be attributed to the personalities of those performing in drum and bugle corps however, as those participants choose to join the activity for the summer. Drum and bugle corps are the equivalent of the NFL in football; they are the professional marching bands. Therefore, there is an even higher expectation and physical demand placed on the participants, as they compete at a world-class level. This makes for a very different model than the less competitive high school and collegiate level marching ensembles.

It is important for research to be done in this area to discover what effect the balancing act of musical, mental, and physical demands has on the body. Many questions exist as to what effect participating in marching band has on the body. It is also interesting to note that it is unknown what effect marching band has on the health of someone who is active in music in other forums, such as a concert ensemble. Does marching band have a greater impact on the health of someone who plays more often, such as a collegiate music major, as opposed to non-music majors? Will there be differences amongst not only the groups of various instrument types, but the specific instruments (such as clarinet or trumpet)? Certain instruments are pre-disposed to experiencing specific health issues, such as right hand pain in clarinet players. Do these issues become exacerbated by participation in marching band? Through the process of searching for the answers to these questions it will become more clear what effect participation in marching band has on health. From this point, additional resources can be made available to those students participating in marching band, to assist the prevention of future injuries. The purpose of this study is to investigate health-related problems associated with collegiate marching band. Specific aims include: 1) describing the demographic make up of the study group, 2) characterizing self-reported rehearsal protocols, and 3) characterizing the frequency and intensity of musculoskeletal and mental health problems associated with marching band.

Methodology

Participants
A total of 246 college student-musicians participated in this study. Participants came from the University of North Texas Green Brigade Marching Band. This sample included both undergraduate and graduate students enrolled in a music laboratory class related to the marching band. The IRB approved this study, and from there data was collected. Basic demographic information was collected along with measures of musculoskeletal, audiological, dermatological, and mental health areas. Mean age was 19.08 (SD=1.102) years. Out of the surveyed group 42% was female (N=103) and 58% was male (N=140). Music majors made up 61% (N=150) of this group.

Procedures
Research data was collected through the use of a 70 question epidemiologic questionnaire that was administered on two separate test dates. The first test date was during a colorguard sectional while the second was during an instrumental recording session; these two test dates allowed both the instrumental and guard members of the marching band to participate in the study. The questionnaire
was given out at the start of the colorguard sectional and at the end of the instrumental recording session. Students were instructed to fill out the questionnaire in regards to the current semester in the marching band. The questionnaire given to participants included questions regarding basic demographics, musculoskeletal, audiological, dermatological, and mental health.

**Assessment Tool**
Data was collected through a 70 question epidemiologic survey that was designed specifically for this study, which can be seen in Appendix A. This survey consisted of basic demographic questions as well as questions regarding each of the four areas of health covered in the study. These areas were musculoskeletal, audiological, dermatological, and mental health. The mental health section also included questions regarding attitude towards marching band. Several questions featured the 10 cm visual analogue scale (VAS) as a way to measure perceptions; such as how often one feels a certain way. These scales were then hand measured and the length to the tick mark was recorded to the second decimal place. There was also a section in the survey where participants designated where they experienced pain. For each pain site, the participant also noted what type of pain was experienced and how intense this pain was.

**Data analyses**
Responses to the surveys were entered into a database using SPSS 19 (SPSS Inc. 2010). Descriptive statistics were derived for the total and sub-groups. Appropriate parametric and non-parametric statistical procedures were used to detect any significant differences across groups of interest. The participants were analyzed in relation to two groups. The large pool of participants was either split by music and non-music major, or by instrument groups (woodwind, brass, percussion, and colorguard). The demographics of the study group were described in terms of the full group, and split by major. Rehearsal protocols across the sub-groups of major and instrument group were examined in an effort to spot any differences in preventative measures. The frequency and intensity of musculoskeletal and mental health was analyzed in respect of major and instrument groups. Also analyzed were the various sub-groups of health (again, musculoskeletal, audiological, dermatological, and mental). Variables connected to these various sub-groups were analyzed in regards to various pain levels. For example, actions that could affect the extremities, such as the incidence of stretching, were compared to musculoskeletal pain.

**Results**
The group surveyed for this research study was comprised of members of the Green Brigade Marching Band at the University of North Texas. There were 246 college students who completed the questionnaire as part of this study. Within this group were 103 females and 140 males. Three students chose not to specify in terms of this question. The mean age for the group was 19.08 years. Out of this group, 204 had some sort of health insurance, while 39 had no form of health insurance. There were 19 African American students, 7 Asian students, 145 Caucasian students, 61 Hispanic students, 1 Pacific Islander student, and 61 students who specified being of mixed racial backgrounds. There were 98 woodwind instrumentalists, 110 brass and 14 percussionists. The colorguard section was made up of 21 students. There was one vocalist and 2 pianists. However, these last three submissions (vocal and piano students) were deemed as incorrect submissions and were not taken into consideration during further analysis. The mean amount of sleep for those who participated in the survey was 6.44 hours per day. On average, there was 41.12 ounces of water
drunk per day. To put this in perspective, it is recommended that people drink at least 8 cups of water per day, or 64 ounces. This group exercised an average of 3.14 hours per week.

There were a few significant differences in the demographics of the group surveyed, as shown in Table 1 below. Although all the students who participated came from the same music laboratory class, there were more music majors than non-music majors. As previously stated, music majors made up 61% (N=150) of the group surveyed. Within the music major sub-group, the mean age was 19.22 years. This was significantly different from the non-music major group, where the mean age was 18.86 years. The music major group was made up of 45 females and 105 males. Within the music majors, only 30% of students were female. The other 70% of music majors surveyed were male. The non-music major group included 58 females and 35 males. In this case, there were more females surveyed than males. Females made up 62% of the non-music major group. There was also a significant difference in the ethnic diversity of each sub-group. In the music major group there were 7 African Americans, 7 Asians, 97 Caucasians, 35 Hispanics, 1 Pacific Islander, and 5 Mixed Race individuals. Within the non-music group there were 12 African Americans, 48 Caucasians, 26 Hispanics, and 6 Mixed Race individuals. There were no Asian or Pacific Islander students within the non-music major group.

The music major group includes 65 woodwinds, 72 brass, 11 percussionists, and 1 colorguard member. The non-music major group included 33 woodwinds, 38 brass, 3 percussionists, and 20 colorguard members. Within both groups there were 2 piano majors and 1 voice major. Since these two majors are not included within the sections of a marching band, they will not be included in the rest of the analysis. These answers will be considered as incorrect submissions. Amongst the music and non-music major groups there was a significant difference in the exercise habits. Music majors exercise 2.66 hours each week on average, while non-music majors exercise 3.92 hours. This exercise does not include any activity during marching band rehearsal. In all other areas of the demographic analysis of the test subjects, the two groups did not differ significantly.

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Music Major</th>
<th>Non-Music Major</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Mean (SD)</td>
<td>19.08 (1.102)</td>
<td>19.22 (1.029)</td>
<td>18.86 (1.185)</td>
<td>t</td>
<td>.014*</td>
</tr>
<tr>
<td>Gender Freq. (%)</td>
<td></td>
<td></td>
<td></td>
<td>x²</td>
<td>.000**</td>
</tr>
<tr>
<td>Female</td>
<td>103 (42.4%)</td>
<td>45 (43.7%)</td>
<td>58 (56.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>140 (57.6%)</td>
<td>105 (75%)</td>
<td>35 (25%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health Insurance</td>
<td></td>
<td></td>
<td></td>
<td>x²</td>
<td>NS</td>
</tr>
<tr>
<td>Yes</td>
<td>204 (83.6%)</td>
<td>130 (63.7%)</td>
<td>74 (36.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>39 (16%)</td>
<td>21 (53.8%)</td>
<td>18 (46.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity Freq. (%)</td>
<td></td>
<td></td>
<td></td>
<td>x²</td>
<td>.020*</td>
</tr>
<tr>
<td>African American</td>
<td>19 (7.8%)</td>
<td>7 (36.8%)</td>
<td>12 (63.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>7 (2.9%)</td>
<td>7 (100%)</td>
<td>0 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>145 (59.4%)</td>
<td>97 (66.9%)</td>
<td>48 (33.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>61 (25%)</td>
<td>35 (57.4%)</td>
<td>26 (42.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>11 (4.5%)</td>
<td>5 (3.3%)</td>
<td>6 (6.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>1 (0.4%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Instrument Freq. (%)</td>
<td></td>
<td></td>
<td></td>
<td>x²</td>
<td>.000**</td>
</tr>
<tr>
<td>Woodwind</td>
<td>98 (39.8%)</td>
<td>65 (66.3%)</td>
<td>33 (33.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brass</td>
<td>110 (44.7%)</td>
<td>72 (65.5%)</td>
<td>38 (34.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percussion</td>
<td>14 (5.7%)</td>
<td>11 (78.6%)</td>
<td>3 (21.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guard</td>
<td>21 (8.5%)</td>
<td>1 (4.8%)</td>
<td>20 (95.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice</td>
<td>1 (0.4%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piano</td>
<td>2 (0.8%)</td>
<td>2 (100%)</td>
<td>0 (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. sleep (hrs/day)</td>
<td>6.44 (1.25)</td>
<td>6.34 (1.12)</td>
<td>6.61 (1.43)</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>Avg. water drunk (oz/day)</td>
<td>41.12 (50.73)</td>
<td>39.50 (58.25)</td>
<td>43.64 (36.18)</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>Avg. exercise, outside of</td>
<td>3.14 (3.65)</td>
<td>2.66 (2.65)</td>
<td>3.92 (4.76)</td>
<td>t</td>
<td>.009**</td>
</tr>
<tr>
<td>marching band (hrs/week)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From this point, the various rehearsal protocols were analyzed to see how they differed from group to group. Rehearsal protocols include both actions influenced by the director of the ensemble (such as stretching, which is part of the daily rehearsal schedule and run by a student drum major) and the student (such as applying sunscreen or bringing water to rehearsal). For the most part, there are no significant differences in the rehearsal protocol amongst the two sub-groups of music and non-music majors. However, there were a few areas that did differ somewhat. This analysis is seen in Table 2, below. There was a significant difference in how often the students brought water to rehearsal. The music major sub-group responded with a mean value of 5.77 (as measured from 1 to 10 on a standard VAS scale, where 1 represented “never” and 10 represented “always”). The non-music major group responded with a mean value of 7.05.

There was also a significant difference in how often earplugs were worn to rehearsal. The music majors had a mean of 1.70 while the non-music majors had a mean of 0.79. The last area that showed a significant difference was how often athletic shoes were worn to rehearsal. The music majors responded with a mean of 9.42 while the non-music majors had a mean of 8.77. In all other areas of rehearsal protocol, there were no significant differences between music and non-music majors.

**Table 2. Rehearsal Protocols, Music and Non-Music Majors**

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Music Major</th>
<th>Non-Music Major</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you warm up before rehearsal?</td>
<td>6.38</td>
<td>6.69</td>
<td>5.88</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often do you stretch before rehearsal?</td>
<td>8.18</td>
<td>8.19</td>
<td>8.16</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often do you take breaks during rehearsal?</td>
<td>5.35</td>
<td>5.52</td>
<td>5.07</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often do you bring water to rehearsal?</td>
<td>6.27</td>
<td>5.77</td>
<td>7.05</td>
<td>t</td>
<td>.003**</td>
</tr>
<tr>
<td>How often do you apply sunscreen during outdoor rehearsals?</td>
<td>1.93</td>
<td>1.86</td>
<td>2.04</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often do you wear earplugs to rehearsal?</td>
<td>1.35</td>
<td>1.70</td>
<td>0.79</td>
<td>t</td>
<td>.002**</td>
</tr>
<tr>
<td>How often do you wear athletic shoes to rehearsal?</td>
<td>9.17</td>
<td>9.42</td>
<td>8.77</td>
<td>t</td>
<td>.022*</td>
</tr>
<tr>
<td>How often do you wear weather-appropriate clothes to rehearsal?</td>
<td>8.79</td>
<td>8.67</td>
<td>8.98</td>
<td>t</td>
<td>NS</td>
</tr>
</tbody>
</table>

* Significant at .050
** Significant at .010

The same variables were also compared by instrument groups. The results of this analysis are seen in Table 3, below. The results differed slightly from the previous analysis by major. When looking at the instrument groups, there were more variables that showed a significant difference. The same mean was used to compare data, on the standard VAS scale. There was a significant difference between the various sections of the marching band when it came to how often one stretched before rehearsal began.

**Table 3. Rehearsal Protocols by Instrument Groups**

<table>
<thead>
<tr>
<th></th>
<th>Woodwind</th>
<th>Brass</th>
<th>Percussion</th>
<th>Colorguard</th>
<th>ANOVA</th>
</tr>
</thead>
</table>

6
Table 4. Musculoskeletal Pain by Instrument Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>Woodwind</th>
<th>Brass</th>
<th>Percussion</th>
<th>Colorguard</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain experienced during marching band rehearsal</td>
<td>3.14</td>
<td>3.00</td>
<td>2.74</td>
<td>2.65</td>
<td>1.34</td>
</tr>
<tr>
<td>Pain experienced after marching band rehearsal</td>
<td>3.20</td>
<td>3.01</td>
<td>2.77</td>
<td>3.01</td>
<td>1.45</td>
</tr>
<tr>
<td>Pain intensity</td>
<td>2.39</td>
<td>2.30</td>
<td>2.22</td>
<td>2.24</td>
<td>1.68</td>
</tr>
<tr>
<td>How often pain stops the individual from</td>
<td>1.27</td>
<td>2.08</td>
<td>0.89</td>
<td>1.94</td>
<td>2.23</td>
</tr>
<tr>
<td>participating in marching band rehearsal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.14</td>
</tr>
<tr>
<td>How often pain interferes with daily activities</td>
<td>2.31</td>
<td>2.73</td>
<td>1.92</td>
<td>2.77</td>
<td>1.82</td>
</tr>
<tr>
<td>Number of Pain Sites</td>
<td>2.38</td>
<td>1.93</td>
<td>2.01</td>
<td>1.77</td>
<td>1.67</td>
</tr>
</tbody>
</table>

* Significant at .050
** Significant at .010
Muscular skeletal pain was also analyzed in regards to major. The participant group was divided into music and non-music majors. The results of this analysis are shown in Table 5 below. The first area that showed a significant difference was how often the individual stops playing their instrument due to pain. Not surprisingly, the music majors responded with a higher mean value of 1.63 compared to the non-music majors’ mean value of 0.91. There was also a significant difference between the two groups in how often pain interfered with daily activities. In this aspect, the music majors responded with a mean value of 2.43. The non-music majors had a value of 1.73. There were significant differences in how often the two groups experienced pain playing their primary instrument outside of marching band rehearsal. In this instance, the music majors had a mean value of 2.23 while the non-music majors had a mean value of 0.83. Similarly, there was also a significant difference in how often pain was experienced after playing one’s primary instrument, outside of marching band rehearsal. Here the music majors responded with a mean value of 1.84 while the non-music majors had a mean value of 0.93. The extent to which an individual’s playing was affected by pain was also significant when looking at the two groups. Music majors responded with a mean value of 1.97. In regards to the same variable, the non-music majors responded with 1.34. The last area that showed a significant difference was the number of pain sites. As with the previous table, there was a significant difference in regards to this variable. The music majors responded with a mean value of 2.19 while the non-music majors responded with 2.79. There were no other significant differences in the other variables listed.

Table 7. Musculoskeletal Pain, Music and Non-Music Majors

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Music Major</th>
<th>Non-Music Major</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often pain is experienced during marching band rehearsal</td>
<td>3.04</td>
<td>3.06</td>
<td>3.00</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often pain is experienced after marching band rehearsal</td>
<td>3.10</td>
<td>3.14</td>
<td>3.07</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>Pain Intensity</td>
<td>2.38</td>
<td>2.46</td>
<td>2.31</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often pain stops the individual from playing their instrument</td>
<td>1.36</td>
<td>1.63</td>
<td>0.91</td>
<td>.018*</td>
<td></td>
</tr>
<tr>
<td>How often pain stops the individual from participating in marching band rehearsal</td>
<td>1.20</td>
<td>1.30</td>
<td>2.24</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>How often pain interferes with daily activities</td>
<td>2.16</td>
<td>2.43</td>
<td>2.90</td>
<td>.050*</td>
<td></td>
</tr>
<tr>
<td>How often pain is experienced while playing one’s primary instrument, outside of marching band rehearsal</td>
<td>1.69</td>
<td>2.23</td>
<td>2.93</td>
<td>.000**</td>
<td></td>
</tr>
<tr>
<td>How often pain is experienced after playing one’s primary instrument, outside of marching band rehearsal</td>
<td>1.49</td>
<td>1.84</td>
<td>2.60</td>
<td>.003**</td>
<td></td>
</tr>
<tr>
<td>How much playing is affected by pain</td>
<td>1.72</td>
<td>1.97</td>
<td>2.52</td>
<td>.044*</td>
<td></td>
</tr>
<tr>
<td>How much marching technique is affected by pain</td>
<td>2.40</td>
<td>2.38</td>
<td>2.72</td>
<td>t</td>
<td>NS</td>
</tr>
<tr>
<td>Number of Pain Sights</td>
<td>2.42</td>
<td>2.19</td>
<td>2.79</td>
<td>t</td>
<td>.035*</td>
</tr>
</tbody>
</table>

* Significant at .050
** Significant at .010

The figure below compares pain experienced in a non-marching, or typical concert ensemble/personal practice, setting to the Green Brigade marching band. The blue bars denote pain experienced during and after playing one’s primary instrument, outside of marching band rehearsal. The green bars denote pain experienced during and after playing one’s primary instrument in a marching band setting. This graph attempts to remove all other variables besides location of playing one’s primary instrument. In this way, the effect of marching band rehearsal alone can be seen clearly.
As shown in Figure 1, below, there is significantly more pain experienced during marching band than when playing outside of marching band. This occurs universally across all four sections of the marching band. There is more pain experienced during marching band as compared to concert band rehearsals, as well as after. Overall, the level of pain is higher in regards to marching band than concert band.

![Bar chart showing muscular skeletal pain by participation in non-marching ensemble versus marching ensemble](chart.png)

Figure 1. Muscular Skeletal Pain by Participation in Non-Marching Ensemble Versus Marching Ensemble

Following the analysis of muscular skeletal health, the next area examined was that of mental health. Combined with this section was the analysis of attitudes regarding the activity. This analysis was done in regards to the major sub-groups (music and non-music majors). The first table that examines the incidence of certain mental health symptoms can be seen below. As shown in Table 8, there were no significant differences in the amount of stress experienced by music and non-music majors as a result of marching band. The mean value for frequency of stress experienced by the marching band as a whole was 3.42. The intensity of this stress, which related only to marching band, was 2.94. This stress interfered with the daily activities of all students participating in marching band for a mean value of 2.86. In all three categories, the non-music majors experienced slightly higher levels of stress than music majors. However, the responses for music and non-music majors were close enough to the mean values for the total group that the differences were not deemed significant.
Table 8. Marching Band Related Stress, Music and Non-Music Majors

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Music Major</th>
<th>Non-Music Major</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Marching Band Related Stress</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.42</td>
<td>3.13</td>
<td>3.31</td>
<td>3.09</td>
<td>NS</td>
</tr>
<tr>
<td>Intensity of Marching Band Related Stress</td>
<td>2.94</td>
<td>2.90</td>
<td>2.78</td>
<td>2.84</td>
<td>NS</td>
</tr>
<tr>
<td>How often this stress interferes with daily activities</td>
<td>2.86</td>
<td>3.04</td>
<td>2.77</td>
<td>2.95</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 9 below shows the analysis on how attitudes towards marching band differ by major. It is important to note that participation in marching band is required for some music majors. Secondary level music education majors are required to participate in marching band for three years; elementary level music education majors are required to participate for two years.

The overall opinion towards marching band was significantly different as compared to these two groups. The music majors responded with a mean value of 2.24, while the non-music majors responded with a value of 3.34. The perceived impacts on the individual’s own health was also significantly different. Music majors responded with a mean of 1.94 while non-music majors responded with 2.82. Another area of significant difference was the perceived impact on the proficiency on one’s marching band instrument. Music majors responded with a value of 2.50. Non-music majors responded to the same question with a mean value of 3.07. Similarly, there was a significant difference in the perceived impact on overall musicianship. Music majors responded with 1.80, where non-music majors said 2.99.

Questions were also asked regarding some of the more far-reaching influences marching band could have on an individual student. Interestingly enough, all three of these areas showed a significant difference. The first of these was how marching band participation affected one’s opinion on the University of North Texas. Music majors responded to this question with a mean value of 3.22. Non-music majors responded with a 3.93. Regarding marching band’s effect on one’s perceived ability to make friends, music majors replied with a value of 8.30. Non-music majors responded to this same variable with a mean of 7.57. Lastly, when asked about marching band’s effect on one’s other academic commitments, music majors replied with a mean value of -0.43. Non-music majors replied with 0.80. In regards to this last variable it is important to make clear that the students answered this question where “-5” signified a negative influence, “+5” signified a positive influence, and “0” represented no influence at all.

Table 9. Attitudes Towards Marching Band, Music and Non-Music Majors

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Music Major</th>
<th>Non-Music Major</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opinion Towards Marching Band</td>
<td>2.66</td>
<td>2.85</td>
<td>2.24</td>
<td>3.00</td>
<td>NS</td>
</tr>
<tr>
<td>General Commitment Level Towards Marching Band</td>
<td>7.18</td>
<td>2.57</td>
<td>7.17</td>
<td>2.54</td>
<td>NS</td>
</tr>
<tr>
<td>Commitment Level During Marching Band</td>
<td>7.16</td>
<td>2.34</td>
<td>7.25</td>
<td>2.21</td>
<td>NS</td>
</tr>
<tr>
<td>Perceived Impact on Health</td>
<td>2.28</td>
<td>2.56</td>
<td>1.94</td>
<td>2.64</td>
<td>NS</td>
</tr>
<tr>
<td>Perceived Impact Marching Band Participation has had on Marching Instrument</td>
<td>2.10</td>
<td>2.52</td>
<td>1.50</td>
<td>2.64</td>
<td>NS</td>
</tr>
<tr>
<td>Perceived Impact on Overall Musicianship</td>
<td>2.25</td>
<td>2.29</td>
<td>1.80</td>
<td>2.31</td>
<td>NS</td>
</tr>
<tr>
<td>Effect on Opinion of University of North Texas</td>
<td>3.49</td>
<td>1.90</td>
<td>3.22</td>
<td>1.99</td>
<td>NS</td>
</tr>
<tr>
<td>Effect on Ability to Make Friends</td>
<td>8.02</td>
<td>2.68</td>
<td>8.30</td>
<td>2.38</td>
<td>NS</td>
</tr>
<tr>
<td>Effect on Other Academic Commitments</td>
<td>0.04</td>
<td>2.90</td>
<td>-0.43</td>
<td>2.70</td>
<td>NS</td>
</tr>
</tbody>
</table>

* Significant at .050
Going further, Table 10 below, examines the connection between musculoskeletal and mental health by gender. In the table below, female participants responded with an average of 2.78 separate sites of musculoskeletal pain. Male participants reported 2.13 pain sites. In regards to frequency of stress due to marching band alone, females responded with a mean of 3.99 while males responded with a mean of 3.03. As shown in this table, females showed an increased amount of pain sites as well as a higher level of stress than males in marching band.

Table 10. Link Between Number of Musculoskeletal Pain Sites and Frequency of Stress, Gender

<table>
<thead>
<tr>
<th>Variables</th>
<th>All</th>
<th>Female</th>
<th>Male</th>
<th>Test</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Pain Sites</td>
<td>2.42</td>
<td>2.78</td>
<td>2.13</td>
<td>1.93</td>
<td>.019</td>
</tr>
<tr>
<td>Frequency of Stress due to Marching Band</td>
<td>3.42</td>
<td>3.99</td>
<td>3.03</td>
<td>3.15</td>
<td>.019</td>
</tr>
</tbody>
</table>

* Significant at .050
** Significant at .010

Discussion

Marching band is a very different activity that participating in a “sit down” concert ensemble. As demonstrated in Figure 1, there is more pain experienced in a marching band, “moving”, setting than in a concert ensemble. Although there has always been some level of acknowledgement that marching band is more physically demanding and therefore more painful to participate in than concert band, Figure 1 shows definite proof of this common knowledge. It is important to continue research in the area of marching band. As these “common knowledge” statements continue to be proven by hard facts and data, that is where additional resources can become available to those participating in this activity.

The group surveyed for this study featured very low rates of exercise per week and water drunk per day. These could be indicators of the overall health level of those who participate in marching band. An individual’s overall level of health can greatly impact the stress on the body when participating in a physical activity, such as marching band. Therefore, it is important that students participating in marching band make overall health more of a priority. Marching band counts as the physical education credit in many public schools. However, marching band students are not always the epitome of a healthy young person. It is therefore very important to put more emphasis on the general health and fitness level of those young people in marching band.

Some of the most alarming responses to this study were seen in the table regarding rehearsal protocols; in particular were those referring to what is done after pain is experienced. This is seen in Tables 6 and 7, in the responses to how often pain stops one from participating in a musical ensemble. These responses indicate the attitude towards musical injury and how to treat it. There was a significant difference between music majors and non-music majors in regards to how often pain results in halting of playing one’s instrument. Music majors were far more likely to have to stop playing due to pain, and showed higher levels of pain overall than non-music majors. Such low responses in these areas overall however show that there is very little respect for such injuries and even less knowledge on what to do when such injuries occur.
At this time, it is the recommendation of the researcher that further steps be taken to protect the health of those participating in marching band. As shown in Table 2 and 3, regarding rehearsal protocols, there are certain areas, which are significantly lower than others. These areas include wearing earplugs, applying sunscreen during outdoor rehearsals, and taking breaks during rehearsal. Anything that the director of the marching ensemble can do to increase the incidence of these preventative measures will help to decrease the amount of pain experienced by the participating members.

College students who participate in marching band fall into one of two categories: music or non-music majors. Music majors are required by their degree plan to participate in marching band for three fall semesters. However, there is no requirement for non-music majors as to how long they must participate in the activity. Therefore it is not surprising that there were more students who were required to be there, than not. What is even more interesting is looking at the various actions taken by these two groups and subsequently, the type of pain experienced.

Levels of pain were similar between the music and non-music major groups while in marching band rehearsal. However, the lingering pain and the way the pain interacted with the individual’s life differed amongst these groups. For the most part, music majors experienced more pain while playing their instrument in general, and their playing was more affected by this pain. This could be due to the additional playing pressures that college music majors undergo as they pursue perfection in terms of their craft. Similarly, music majors were more likely to stop playing their instrument due to pain. Ceasing participation in marching rehearsals was not significantly different, which could be a nod to musculoskeletal issues stemming from other ensembles that music majors participate in, which then becomes exacerbated by marching band rehearsal.

Overall, the colorguard featured more symptoms of musculoskeletal pain. Although the colorguard section does not play an instrument during rehearsals, they combine marching technique with dance technique as well as work with the traditional equipment. These choreographed routines can become very complex, and utilize various pieces of equipment (such as the plastic rifle or saber, or the silk flag). Perhaps the incidence and difficulty of the dance technique plays a part in the colorguard’s increased incidence for physical pain. However, much more research in this area is necessary before any definite statements can be made.

Further notable is how low the responses were in terms of how often an individual will stop participation, either on playing their primary instrument or in marching band rehearsal, when they do experience pain. These extremely low responses indicate the attitude towards musculoskeletal pain in general. Many teachers still abide by the old adage of “play through the pain”. This mindset has passed onto the students, as many are afraid to step out of rehearsal even if they are in pain, due to being thought of as lazy or weak. It is vital to change these attitudes, so that when a student legitimately experiences pain, they are able to take the necessary steps to halt further injury such as sitting out of rehearsal to rest. One would not expect a marathoner to run a couple laps on a sprained ankle, after all, he could really injure himself and ruin his career! However, this same concern does not always apply to a young marching musician who hurts himself or herself in rehearsal. Only when these attitudes towards injury change can injury prevention become a more attainable goal.
As proven through earlier research\(^2\), there are dangerously high levels of sound produced by a marching band ensemble. Although marching band participants did not state high levels of ear pain, they are still probably experiencing some level of hearing damage.

According to the National Association of Schools of Music (NASM)\(^7\):

> It is the obligation of the institution that all students in music programs be fully apprised of health and safety issues, hazards, and procedures inherent in practice, performance, teaching and listening both in general and as applicable to their specific specializations. This includes but is not limited to information regarding hearing, vocal, and musculoskeletal health and injury prevention, and the use, proper handling, and operation of potentially dangerous materials, equipment, and technology. Music program policies, protocols, and operations must reflect attention to injury prevention and to the relationships among musicians’ health, the fitness and safety of equipment and technology, and the acoustic and other health-related conditions in practice, rehearsal, and performance facilities.

As such, it is the duty of those teachers to inform and reasonably protect their students from any known factors that could cause injury. Since hearing loss is a known danger to those participating in marching band, where decibel levels can reach extremely high levels, it is the responsibility of the teacher to require ear plugs to be worn. In an ideal situation, the responses from all students in Tables 2 and 3 would be a sweep of “10” across the board. All of these rehearsal protocols can act as additional measures to protect students from injury and increase the overall health level. As such, these procedures should be done at every rehearsal, not only at some. Therefore, it is the recommendation of this researcher that directors strive to increase the incidence of such protocols at all rehearsals.

Although the director of this ensemble was not interviewed in this particular study, he can have a huge impact on this area. An ensemble director’s level of knowledge about musical injuries will relate to the action taken when someone does experience pain in his or her group. When the director acknowledges injury and furthermore promotes proper treatment of injury, students will feel more comfortable taking steps to preserve their own health, such as falling out of the rehearsal block when experiencing pain.

It is very important for the teacher to take a personal responsibility for the health and well being of their students, because there is no current requirement from the state for them to do so. At present, classes such as marching band count as the physical education credit in many public schools. However, music teachers are not certified to teach physical education. For example, in a local school district in the Dallas-Fort Worth area, band directors are only required to be certified in basic first aid, CPR and AED (automated external defibrillator)\(^8\). Although such certifications are important, especially in an emergency, they do not fully prepare teachers to properly and safely teach an activity such as marching band. Music teachers do not receive education or training in physical education, such as preventative measures or how to spot injury. There is a lack of accountability as an educator can teach a “physical education” course, such as marching band, without all the proper training to do so. Perhaps it would be better to model a marching band class after athletics. An activity such as football features teachers, or coaches, who have considerable
training in physical education and protecting the health of their students. Furthermore, before participating in such an activity, the student and their parents receive information outlining the risks. From here, they sign a consent form acknowledging that they are aware of such risks. The same model could be applied to marching band, but only after further research recognizes all of the health concerns associated with participation and solutions are given. A continued effort towards research and education is necessary in the area of musical injury. Education on the subject will lead to a healthier attitude towards musical injuries and treatments of such injuries when they occur.

Further Aims

Following the experience at Scholar’s Day, lead researcher Melissa Hatheway will continue to develop the other two areas of health examined in this study (audiological and dermatological). She has been accepted to present a poster of this research at the Performing Arts Medicine Association Summer Symposium later this summer. Following this presentation and further feedback from colleagues in the field, Hatheway will look into publication of her work in a music and medicine journal. Hatheway also plans to begin another study with the Green Brigade Marching Band in Fall 2012.

Acknowledgements

Melissa Hatheway is currently a sophomore working towards her bachelor’s degree in Music Education student at the University of North Texas, in Denton, Texas. Dr. Chesky is an Associate Professor at the University of North Texas College of Music and is also the Director of the Texas Center of Music and Medicine. Hatheway gratefully acknowledges the undergraduate and graduate students who helped administer this survey in Fall 2011. She also extends appreciation to the Wind Studies Department for their cooperation with this research, in particular Dr. Nicholas E. Williams and the Green Brigade Marching Band.
Resources


Appendix A. Subject Questionnaire

Subject Number: ______________
Date: _______________________

Section 1: Demographics and Music Background
1. Age: _____ Birth date: ___/___/_____
2. Gender (Circle): Male Female
3. Ethnicity/Race (Circle): African-American Asian Caucasian Hispanic Other_________________________________
4. Marital status (Circle): Single Married Separated Divorced Widowed
5. Number of children: _____
6. Average amount of sleep: _____ (hours/day)
7. Health insurance (Circle): Yes No
8. Degree: ____________ Major: __________
9. Primary Instrument: ___________
10. Average amount of exercise, not including marching band practice: _____ (hours/week)
11. List other athletic activity you regularly engage in:

________________________________________________________________________

12. Average amount of time you spend in marching band rehearsals: _____ (hours/week)
13. Total number of years participating in marching band: ______(years)
14. Approximate age you started playing your instrument or participating in color guard: _____
15. Years of college instruction on your primary instrument: ______(years)
16. Other instruments you play regularly: ______________________________
17. Average amount of time you spend playing your instrument outside of marching band rehearsals: ______(hours/week)

Section 2: Marching Band Practice Habits
All questions apply to this semester only.
1. Do you warm-up before you begin marching band rehearsal? ____________________________
   Never Always
   (Please place a vertical mark along the line to the degree that represents your response)
2. Do you stretch before you begin marching band rehearsal? ____________________________
   Never Always
3. Do you take breaks during marching band rehearsal? ____________________________
   Never Always
4. What do you do on your break? ___________________________________________________________________
5. How long is the break and how often does it occur? ______(min) every _____(hours)
6. Do you stop participation in marching band rehearsal when you feel physical fatigue? ____________________________
   Never Always
7. Do you stop participation in marching band rehearsal when you feel mental fatigue? ____________________________
   Never Always
8. Average amount of water that you drink: ______(ounces/day)
9. How often do you bring water to marching band rehearsal?
   Never    | Always

10. How often do you apply/wear sunscreen to marching band rehearsal?
    Never    | Always

11. How often do you wear earplugs during marching band rehearsal?
    Never    | Always

12. How often do you wear athletic shoes to marching band rehearsal?
    Never    | Always

13. How often do you wear weather appropriate clothes to marching band rehearsal (i.e. light colored, short sleeved shirts and shorts in warm weather)?
    Never    | Always

Section 3: Medical History and Background

Musculoskeletal Problems Associated with Marching Band Participants

All questions apply to this semester only.

1. Do you experience pain during marching band rehearsal?
   Never    | Always

2. Do you experience pain after marching band rehearsal has ended?
   Never    | Always

3. How intense is the pain that you experience?
   None    | Extreme

3. Does pain ever stop you from playing your instrument of performing in guard?
   Never    | Always

4. Has pain ever stopped you from participating in marching band rehearsal?
   Never    | Always

5. Has pain ever interfered in your day-to-day activities?
   Never    | Always

6. Do you experience pain when playing your primary instrument, outside of marching band rehearsal?
   Never    | Always

7. Do you experience pain after playing your primary instrument, outside of marching band rehearsal?
   Never    | Always

8. How much of your playing is affected by your pain? (Consider speed, dynamics, repertoire, time spent, etc.)
9. How much of your marching is affected by your pain? (Consider technique, ease of movement, flexibility, time spent, etc.)

10. List areas of your marching that are affected by pain in order of impact. (Consider technique, ease of movement, flexibility, time spent, etc.)

11. List areas of your playing that are affected by pain in order of impact. (Consider speed, dynamics, repertoire, time spent, musicality, etc.)

12. How often do you experience “ringing in your ears” during marching band rehearsal?

13. How often do you experience “ringing in your ears” during a marching band performance?

14. How often do you experience pain in your ears during marching band rehearsal?

15. How often do you experience pain in your ears during a marching band performance?

16. How often do you experience a short-term decrease in your hearing quality during marching band rehearsal?

17. How often do you experience a short-term decrease in your hearing quality during a marching band performance?

18. How much of your playing ability has been affected by your decrease in hearing ability?

19. How much of your day to day activities have been affected by your decrease in hearing ability?

20. How often do you experience sunburns as a result of your outdoor marching band rehearsals?

21. How intense is the pain you experience as a result of your sunburns?

22. How much of your playing ability is affected by these sunburns?

23. How much of your day-to-day activities is affected by these sunburns?
Please review the drawing on the next page and mark where you experience pain during marching band using the listed key, as well as the 1 to 5 pain intensity scale as noted below.

**Grade 1:** Pain occurs only while marching; should be consistent rather than occasional; pain ceases when not marching.

**Grade 2:** Pain occurs only while marching; and may also have transient weakness or loss of control; this pain does not interfere with other activities.

**Grade 3:** Pain occurs while marching; pain persists after marching rehearsal ends; some other uses of this location cause pain; may have weakness, loss of control; loss of muscular response or dexterity.

**Grade 4:** All criteria for Grade 3 apply; also other activities involving the affected area also cause pain – housework, driving, writing, turning knobs, dressing, washing, etc. – however this pain is tolerable.

**Grade 5:** All criteria for Grade 4 apply, including loss of use of location due to disabling pain.

---

**Possible locations:**

Right Side

- Fingers
- Wrist
- Forearm
- Upper Arm
- Hand
- Elbow
- Shoulder
- Neck
- Knee
- Toes
- Calf
- Lower Back
- Hip
- Thigh

Left Side

- Fingers
- Wrist
- Forearm
- Upper Arm
- Hand
- Elbow
- Shoulder
- Neck
- Knee
- Toes
- Calf
- Lower Back
- Hip
- Thigh

---

Please indicate the type of pain you experience (using the key above) at the site of pain. Also indicate the intensity of the pain using the 1 to 5 grade scale on the previous page.
Section 4: Medical History and Background - Performance Anxiety

All questions apply to this semester only.

1. How often this semester have you been stressed or anxious about marching band?

   - Never
   - Always

2. How intense is your stress or anxiety about marching band?

   - None
   - Extreme

3. How often does this stress or anxiety interfere with your day-to-day activities?

   - Never
   - Always

4. What do you feel causes your stress or anxiety?

_____________________________________________________________________

Section 5: Attitude Regarding Marching Band

All questions apply to this semester only.

1. What is your opinion towards marching band?

   - Negative
   - Positive
   - No Opinion

2. What is your commitment level towards marching band?

   - None
   - Extreme

3. What is your commitment level during marching band rehearsal?

   - None
   - Extreme

4. What impact do you feel that marching band has had on your health?

   - Negative
   - Positive
   - None

5. How has your participation in marching band affected your proficiency on the instrument you march?

   - Negative
   - Positive
   - Not At All

6. How has your participation in marching band affected your proficiency on your primary instrument?

   - Negative
   - Positive
   - Not At All

7. How has your participation in marching band affected your overall level of musicianship?

   - Negative
   - Positive
   - Not At All

8. How has your participation in marching band affected your opinion on the University of North Texas?

   - Negative
   - Positive
   - Not At All

9. How much has your participation in marching band affected your ability to make friends on campus?
10. How has your participation in marching band affected your other academic commitments?

[Scale from None to Extreme]

Negative | Positive

Not At All