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Alissa C. Rhode  
Saginaw Valley State University, [acrhode@svsu.edu](mailto:acrhode@svsu.edu)

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# Injury and Illness in Marching Band and Color Guard Members and the Need for Athletic Trainers: A Critically Appraised Topic

## Cover Page Footnote

Dr. David Berry and Clayton Westdorp Undergraduate Student Research

# ***Injury and Illness in Marching Band and Color Guard Members and the Need for Athletic Trainers: A Critically Appraised Topic***

Alissa C. Rhode  
Saginaw Valley State University

**Purpose:** To determine the prevalence, incidence, risk, rate, and type of injury, illness suffered by collegiate, and high school marching band (MB) and color guard (CG) members and determine if there is a need for medical coverage. **Methods:** Articles were identified from: PubMed, CINAHL, MEDLINE, Physical Therapy and Sports Medicine Collection, ScienceDirect, and single-citation matching using search string, ["marching band" OR "color guard" OR "marching athlete" AND injury] from January 1990-to-October 2016, resulting in 141 articles. Following screening (title, abstract), six articles were reviewed. Four met these inclusion criteria: (1) peer-reviewed, cross-sectional studies, (2) high school or collegiate-aged members, (3) available abstract, (4) English language, (5) included prevalence, incidence, risk, rate, or type of musculoskeletal injury (MSI) and sudden illness (SI). Two reviewers assessed the level of evidence (LOE) and quality using the Oxford Center for Evidence-Based Medicine (2009) and STROBE instruments. Data of interest subjects, injury/illness prevalence/incidence and classification (descriptive statistics), and risk/rate of injury. **Results:** Four studies were evaluated (LOE=2b; STROBE 18.62±4.37 [based on a 36-point scale]). Pooled sample size was 2,272, in collegiate (n=3) and high school (n=1) aged members with MB only (n=1), MB and CG (n=2), and unidentified members (n=1) over different season lengths. All studies agree MB and CG are strenuous activities with significant potential for lower extremity (LE) MSI as it was between 27%-87.7% of reported injuries (n=3); illnesses were 22-34%. **Conclusions:** Results strongly indicate that MB and CG are likely to sustain LE MSI and the nature of the activity predisposes members to certain types. Thus athletic trainers should be present to provide injury prevention and manage MSI and SI when they arise. **Key Words:** *marching band, color guard, injury, illness, musculoskeletal injury.*

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## ***CLINICAL SCENARIO***

Marching band (MB) and color guard (CG) are popular organized team-based physical activities in secondary school and collegiate settings, yet there is often a limited amount of medical coverage for participants. Originally, MBs accompanied armies onto the battlefield, tasked with directing movements and relaying signals during armed conflicts.<sup>1</sup> The standard MB evolved over the years from a military asset to an entertainment display.<sup>1</sup> In 1846, the first college band was founded by Reverend Father Gouesse at The University of Notre Dame.<sup>1</sup> The transition from military strategy to a visual and auditory spectacle for the masses is second to none. Modern MBs have progressed into well-oiled machines of precise, coordinated, low-load cyclical movements practiced for countless hours during the preseason and

performance season. Working alongside the MB, CG has also transitioned from a military asset, once rendering military honors, to a visual expression of hand-eye coordination, balance, and agility. CG members today demonstrate synchronized choreography as they flip, toss, and spin equipment including flags, rifles, and sabres to provide a visual experience for viewers.

The 21st-century MB and CG are often seen in combination with athletic events as halftime entertainment for American football games, but many do not realize that they are sports in themselves. Although there is no denying the difficulty involved in MB and CG performances, the individuals who partake in this activity rarely receive the care necessitated by the significant demands that

the activity places on the body. When used in conjunction with dietary management, participation in the color guard was shown to result in a decreased body mass index, increased muscularity, and decreased cardiovascular risk status.<sup>2</sup> MB has been demonstrated to meet “the criteria for moderate activity in adolescents and therefore significantly contributed to overall physical activity.”<sup>2</sup> In addition to the physical benefits of MB and CG membership, the psychological benefits are comparable to those provided by other sports.<sup>3</sup> Participation in MB and CG can “entail feelings of confidence, pride, energy, and group loyalty contributing to adolescent personal growth,” just as in traditional sports like soccer or football.<sup>2</sup> Participating in MB and CG has numerous health and social benefits and therefore should qualify as an athletic event.

Despite the benefits from participation, previous research (although limited), has demonstrated that there an injury and illness risk is involved in MB and CG participation. For example, injuries may result “from the demands of playing an instrument, handling a piece of equipment, or from the art and style of marching.”<sup>4</sup> Injuries can also result from complicated neuromuscular activity and muscle coordination such as eccentric muscle contractions that occur in everyday movements like running or high-step marching.<sup>2</sup> The marching band injury spectrum is diverse. Delayed onset muscle soreness, swollen deformed joints, fatigue, muscle strains, and other musculoskeletal injuries are just some of the commonly documented injuries.<sup>2</sup> With thousands of participants across the nation, an enormously underserved population appears in need of medical care for their sport due to the potential risk of injury. Certified athletic trainers (ATs) can reduce risk and treatment of subsequent injuries.<sup>5</sup> ATs are health care professionals who provide preventative care, emergency services, clinical diagnosis, and rehabilitative measures in line with their scope of practice. They can often be found in

high schools, colleges, universities, clinics, and, more recently, the military, and industrial settings. Therefore, the purpose of this review is to determine the prevalence, incidence, risk, rate, and type of injury and illness suffered by collegiate and high school marching band and color guard members and determine if there is a need for medical coverage.

### **FOCUSED CLINICAL QUESTION**

What is the prevalence, incidence, risk, rate, and type of musculoskeletal injuries (MSI) and sudden illness (SI) reported during activity in high school and collegiate marching band and color guard members?

### **SUMMARY**

The operational epidemiological terms used in this CAT include:

- **Period Prevalence** = (# of injured subjects (old & new) ÷ total population) x 100
- **Injury risk** (incidence proportion) = (# of newly injured/cases ÷ # of total subjects/population) x 100
- **Injury rate** (incidence rate) = (# of new injuries ÷ total # of participant exposures) x 1,000

A synopsis of the level of evidence and key findings from relevant articles as they pertain to MSI and SI prevalence/incidence, risk or rate, and type of condition were generated. Four cross-sectional studies met the criteria for inclusion.<sup>2,4,5,6</sup> Lower extremity (LE) MSI rates in three studies ranged from 27%-87.7% of reported injuries and illnesses were 22-34%.<sup>2,4,6</sup> One study found overall injury rate for one week of band camp to be 124.03/1,000 exposures, while the LE injury rate was 68.18/1,000 exposures.<sup>5</sup> Injury rates in another study ranged from 21/100 students for piccolo players to .05/100 students for snare drummers.<sup>4</sup> In comparison, MB and CG participants sustained an injury rate of 0.7 and 1 injury per hour during practice (149/216.1) and performances (19/19.2); while marching performances

resulted in 3.6 injuries per hour (15/4.2).<sup>6</sup> Injury risk during band camp was reported at 267 (267/178=150%) and 423 (423/224=188%) over two seasons.<sup>2</sup> Results strongly indicate that MB and CG participants are likely to sustain LE MSI and the nature of the activity predisposes members to certain types.

### **CLINICAL BOTTOM LINE**

There is moderate evidence that MB and CG participants are likely to sustain LE injuries because of participation in their respective activities.

### **Strength of Recommendation**

Level B evidence<sup>8</sup> exists that marching band and color guard members are likely to become injured, although not necessarily ill, during the season.

### **METHODS**

#### **Terms Used to Guide Search Strategy**

- Population: collegiate OR high school AND marching band OR color guard
- Intervention: participation in marching band OR color guard
- Comparison: none
- Outcome(s): prevalence OR incidence OR risk OR rate OR type of musculoskeletal injuries OR sudden illness

#### **Sources of Evidence Searched**

The following were searched for relevant articles to include in this review:

- *Cumulative Index to Nursing and Allied Health Literature* (CINAHL)
- *PubMed*
- *The Medical Literature Analysis and Retrieval System Online* (MEDLINE)
- *Physical Therapy and Sports Medicine Collection*
- *ScienceDirect*
- *Single-citation matching*

### **Inclusion and Exclusion Criteria**

#### **Inclusion**

To be included in the review, articles were required to meet the following criteria: investigate prevalence, incidence, risk, rate, or type of MSI and SI, provide an available abstract, and be an observational, peer-reviewed, cross-sectional study, level 2b or higher, in English language, limited to humans and collegiate or high school-aged population, and be written within the last 16 years (January 1990 to July 2017)

#### **Exclusion**

Articles containing the following criteria were excluded from the review

- Studies using non-high school or collegiate members (e.g., army)
- Studies using mixed subject pool (e.g., adult and adolescent)

### **RESULTS**

Four observational cross-sectional studies were identified and met the inclusion criteria. Two studies<sup>5,6</sup> examined the rate of injury, one study<sup>2</sup> examined the incidence, and one study examined prevalence.<sup>4</sup> Appendix A contains Table 1, a summary chart of the extracted data for the five studies (based on Levels of Evidence, Centre for Evidence-Based Medicine, 2009).

### **DISCUSSION**

The studies included in this critically appraised topic (CAT) utilized the best available evidence. We selected these studies because of their focus on the appropriate population; they graded with a level evidence 2b or higher, they investigated injury or illness in MB and CG, and included at least one of the following key outcomes: prevalence, incidence, risk, rate, or type of MSI and SI.

This review is intended to determine the prevalence, incidence, risk, rate, and type of injury and illness suffered by collegiate and high school marching band and color guard members and determine if there is a need for medical coverage. All studies in this review

demonstrated that MB and CG members are more likely to sustain a MSI while participating in their activity compared to SI.<sup>2,4,5,6</sup> SI accounted for 22-34% of all reported conditions, while LE MSI accounted for 27%-87.7% of reported injuries.<sup>2,4,6</sup> If ATs covered MB and CG, they would be able to manage and reduce injury incidence and rate by utilizing critical domains in their scope of practice.

Despite the possible benefits for medical coverage of MB and CG by ATs, a few variables can prevent ATs from reducing risk accordingly. First, the high costs associated with medical coverage. ATs in colleges/universities and high schools often have several sports and hundreds of athletes to provide health care coverage for at any one time. Adding MB and CG coverage may be impossible with current staffing due to the sheer volume of members. Providing adequate medical coverage would require schools to hire additional staff members (i.e., ATs) or reduce coverage for other sports, placing the neglected sports (and their associated athletes) at greater risk for injury or illness. MB and CG have an estimated Health Care Unit (HCU) rating of 10.56 per the "*Recommendations and Guidelines for Appropriate Medical Coverage of Intercollegiate Athletics*" published by the National Athletic Trainers Association.<sup>9</sup> An AT should be responsible for approximately 12 HCUs, so this HCU indicates that there should be one full-time AT covering MB and CG. However, other sports, such as football, have an HCU of 15.8 suggesting that there should be two ATs covering football and the potential need for the AT is greater in the case of limited staffing.

Notwithstanding the costs associated with MB and CG coverage, the costs associated with injury may be more significant. The majority of injuries reported by Beckett, Seidelman, Hanney, Liu, and Rothschild were ankle sprains.<sup>4</sup> In this study, there were 1379 respondents, and 25% of those respondents reported that they sustained an injury during

marching band. 22.6% of these injuries were to the ankle, and the average cost of non-surgical treatment of an ankle sprain that involves wrapping the ankle costs \$128 per injury.<sup>10</sup> These MB and CG members altogether could have spent upwards of \$9,856 altogether on ankle sprains alone. A critical aspect to lowering health care costs is prevention, and improperly managed ankle injuries can result in higher costs due to "recurrent instability, chronic pain, osteochondral lesions of the talus, premature osteoarthritis, and other significant long-term disability," and, as such, are considered a public health issue.<sup>11</sup> As noted by an athletic training summit on public health, athletic training intersects with and furthers the objectives of public health-related initiatives.

These [initiatives] include osteoarthritis (OA) in general and chronic management of post-traumatic OA in particular; concussion management and return-to-participation guidelines; sudden cardiac death prevention relating to emergency action plans and screening initiatives; heat-illness prevention pertaining to heat-acclimatization and environmental policies; prevention of overuse injuries (ulnar collateral ligament and shoulder injuries in youth baseball players); disaster relief efforts; and shifting to models of wellness, optimal performance and disease and injury prevention rather than treatment of injury and illness.<sup>12</sup>

Because of their unique opportunity to provide care to MB and CG members, ATs can work to reduce the greater public health issues that begin in adolescence. An AT can adequately manage the condition and alleviate maladies of ankle sprains (recognizing that this is only one of the possible injuries that a MB or CG member can suffer). Moreover, ATs improve functional outcomes and specialize in patient education to prevent injury and re-injury. Preventative care provided by an AT has a positive return on investment for employers. ATs can also

reduce injury damage and shorten rehabilitation time for their patients, which translates to lower absenteeism from work or school and reduces health care costs.

The National Athletic Trainers' Association (NATA) released 13 guidelines for band directors to implement to reduce injury for their members.<sup>13</sup> However; band and color guard directors may be unable to implement these guidelines for several reasons. For instance, one guideline states to "hold and manage sousaphones, drums, flutes and other instruments correctly to avoid ergonomic injuries."<sup>13</sup> While this guidance appears reasonable, band and color guard directors often have little knowledge of ergonomics and biomechanics, unlike an AT. Also, even when using correct ergonomics are used, band and color guard members can become injured because of the required position, as demonstrated by the high rate of flute and piccolo injuries.<sup>5</sup> A recent survey by the NATA, found 85% of companies reported that the number and cost of work-related injuries decreased by at least 25% after employing AT.<sup>14</sup> 90% of the businesses that responded also reported that they used their athletic trainers to assess ergonomics.<sup>14</sup> By utilizing ergonomic assessments and implementing corrections, an AT could help decrease injury rates in MB and CG. An AT could more efficiently implement these guidelines to educate and prevent and manage injuries more effectively than band and color guard directors could.

ATs have typically been seen in the collegiate and high school setting, but have continued to

expand into other professional settings. Today, ATs work in the performing arts (i.e., ballet and orchestra), in the military, and in-hospital clinics. These emerging settings demonstrate that ATs have a broad range of employable skills in a multitude of settings, and given such; the AT would serve well to cover MB and CG.

### ***CONCLUSION***

Although this CAT demonstrates the need for ATs in the care of MB and CG participants, continued research should be conducted to solidify this rationale. Only four articles were examining the topic, demonstrating a lack of evidence; thus, more research should be performed to make a stronger recommendation. Future research should include large sample sizes, well-designed data collection methods, and full-season data collections. Studies should also be conducted on other musical performers such as drum corps because the techniques performed by these individuals are often more rigorous than collegiate and high school MBs and CGs. Lastly, there should be more research on the different styles of marching (i.e., high stepping versus roll-stepping) to determine if injuries vary based on the style.

## Appendix A

### Table 1. Summary of Data Extraction

Author(s)	Study Question	Sample	Design	Outcome Measures	Results	LOE
Kilanowski JF <sup>2</sup>	What is the frequency and types of injuries sustained by student members of HS MB?	178 and 224 HS 14-18 yo. MB members during the 2005 and 2006 preseason respectively.	The study retrospectively inspected MB camp health clinic logs for a 2-year period.	Injury/Illness Incidence	Most common chief complaints: (LE) MSI, gastrointestinal distress, heat distress, trauma, upper extremity musculoskeletal injuries, and other illnesses.  Significant positive correlations were found between the day of camp, blisters, menstruation, insect bites, asthma, heat distress, and chief musculoskeletal complaints.	2b
Beckett S, Heidelman L, Hanney WJ, Liu X, Rothschild CE. <sup>4</sup>	What is the prevalence of musculoskeletal injury in collegiate MB and CG members?	1,379 members (average age= 19.8yo.) of 21 collegiate MBs who were above 18yo. and currently participating in MB or CG programs in the 2012 season.	An electronic survey of 46 questions was developed and distributed to collegiate MB members.	Prevalence	25% of respondents sustained a MSI as a direct result of participation in MB or CG.  Females and those with a higher body mass index (BMI) were significantly more likely to sustain MSI.	2b
Moffitt DM, Ross AC, Mansell JL <sup>5</sup>	What is the injury rate during the preseason for collegiate MB?	154 collegiate MB members	Members were instructed to self-report any injury experienced using the provided form, as soon as injury occurred if possible.	Injury Rate	The overall injury rate was 124.03/1,000.  Males (65.53/1,000 exposures) were slightly more likely to experience MSI than females (57.14/1,000 exposures)	2b
Mehler A, Brink D, Eickmeier K, Hesse D, McGuire J <sup>6</sup>	What are the potential trends or indications of the types of injuries that may occur in MB as the collegiate level?	337 collegiate MB and CG members	The band members completed forms at the time of damage and were collected by a medical officer. At the end of the season, all MB members completed an exit survey.	Injury Rate	85.5% of the injuries reported involved the Les. Of there, the ankle was the most commonly injured, followed by the knee and foot.  First year members constituted only 33.1% of the band but accounted for 40.9% of injuries reported.  The injury rate for practice was .7 injuries/hr., performance was 1.0 injuries/hr., and marching performance was 3.6 injuries/hr.	2b

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