ACTIVE & SAFE

Evidence Summary: Cheerleading

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The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is *to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.*

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Evidence synthesis tool

SPORT:	Cheerleading	**Target Group:**	High School and College
Injury Types and Mechanisms:	Most common injuries: Strains and sprains of the ankle and lower back; abrasions, contusions, and hematomas of the knee; fractures and dislocations; concussions and closed head injuries (Waters, 2013; Jacobson et al., 2012). Mechanisms: The most common mechanism for both sprains and strains in cheerleading is stunting – regardless of role as a base, flier, or spotter (Waters, 2013). Stunting has been reported to increase risk of injury - spine compression results from lifting another cheerleader overhead, fliers are landing with strong force during stunts, and tumbling involves complex twisting and flexion (Colvin & Lynn, 2010; Shields & Smith, 2010, Waters, 2013). In addition, falling or landing incorrectly during stunts, catching another cheerleader, lifting or tossing another cheerleader, and failure to complete a maneuver are also common injury mechanisms (Waters, 2013).		

Incidence/Prevalence	**Risk Factors**	**Interventions**	**Implementation/Evaluation**	**Resources**
Overall The most typical injuries seen in cheerleaders are sprains and strains, with fractures and dislocations also being quite common. (Foley & Bird, 2013) Based on injury surveillance data in the U.S., there were a total of 79 fall-related injuries during a one-year period. Of these injuries, 67 happened at practice and 70 occurred while a stunt or pyramid was being attempted. The average fall height was between one and 11 feet (0.30–3.35 m) (mean 5 4.7 6 2.0 feet [1.43 6 0.61 m]). (Shields & Smith, 2009) **High School Students** Literature states that cheerleading results in 63 % of all direct catastrophic injuries within the female high school student	Risk factors for cheerleading include: BMI, previous injury, hardness of the surface of participation, and performing stunts and/or practicing in the presence of a coach with less coaching experience (Council on Sports Medicine and Fitness, 2012). **Previous Injury** Previous injury has been associated with an increased risk of future injury in many sports. In a report of high school cheerleaders, one or more previous injuries was associated with a two-fold increased risk of future injury (RR=2 (95%CI:0.8-4.7). (Schulz et al., 2004) **BMI** There is inconclusive evidence surrounding the effect of BMI on cheerleading injuries. During adolescence children tend to gain	There are no specific interventions that have been shown to reduce injury in cheerleading.	Currently there is no information on implementation or evaluation strategies in this sport.	Several governing bodies such as the American Association of Cheerleading Coaches and Administrators (AACCA), the National Cheerleading Association (NCA), the Universal Cheerleaders Association (UCA), the National Collegiate Athletic Association (NCAA), and the British Cheerleading Association (BCA) have all set guidelines for different levels of cheerleading. Each governing body also has recommendations for practice schedules, durations of practices, and information on coaching courses and how to attain additional certifications (Jacobson et al., 2004; Jacobson, Redus, & Palmer, 2005). www.cheerrules.org/2017-18-aacca-college/ www.cheerrules.org/2017-18-school-cheer-rules/

population. (Foley & Bird 2013) In a survey done in 2004 including 425 female cheerleaders, 41.3% of high school cheerleaders self-reported one or more injuries in a one-year period (mean ± SD, 1.7 ± 1.9) which resulted in an average of 3.4 missed practice or performance days (Jacobson et al., 2004). The most frequent sites of injury include the ankle (24.4%), back (16.1%), and wrist or hand (15.6%). (Jacobson et al., 2004) This is consistent with another study which reported that the most common injury sites were the ankle, back, wrist/hand, face, and knee for cheerleaders. (Jacobson et al., 2004; Machuca, 2014) A study investigating adolescent sports injury reported cheerleading as the leading sport for the number of days lost per injury with an average of 28.8 days. (Axe, Newcomb, & Warner, 1991) **Concussions** Concussions represent between approximately 5 and 20 percent of all injuries reported in high school cheerleading. High school concussion injury rates ranged between 0.06-0.12 per 1000 athlete exposures. (Marar, 2012; Meehan, 2011; Shields, 2009) **Collegiate Level**	approximately 50% of their adult weight and this fluctuation in weight can affect flexibility and strength. Cheerleaders often perform flipping, twisting, dancing and jumping movements, which if done improperly, can lead to injury. (Waters, 2013) A reported protective effect for cheerleaders in the highest BMI quintile has been reported in the literature [RR=0.4 (95%CI:0.1-1.4)]; (Schulz et al. 2004) however, this effect was not significant when explored in a multivariable model, and the role of the cheerleader was also not accounted for. **Coaching Experience** Practicing in the presence of a coach who has at least one year of coaching experience, has taken a coaching class, and/or has completed a college degree has been associated with a 40-50% reduction in injury risk [2/3 of the above criteria: RR=0.6 (95%CI:0.3-1.2)*, 3/3 of the above criteria: RR=0.5 (95%CI: 0.3-0.9) *adjusted for BMI and injury history]. (Schulz et al., 2004) **Flooring and Practice Material** Due to the acrobatic nature of cheerleading, many of the stunts performed are at significant height. Accordingly, the risk of falling is high. One study reported that out of			https://nfhslearn.com/courses/10000 https://nca.varsity.com/About/About https://uca.varsity.com/About/About .

The literature reports cheerleading as the cause of 56% of all direct catastrophic injures at the college level in the US. (Foley & Bird, 2013) A 2005 study at the collegiate level reported 78% of cheerleaders suffering one or more career ending injuries. (Jacobson, Redus, & Palmer, 2005) Of those injured, 39.7% reported that they had also sustained an injury the year before. (Jacobson, Redus, & Palmer, 2005) The injury suffered resulted in approximately 1.8 (SD: 2.2) days lost from sport. (Jacobson, Redus, & Palmer, 2005) The most common cheerleading injury sites at the colligate level are the ankles (44.9%) and wrist/hand (19.3%). (Jacobson, Redus, & Palmer, 2005) Collegiate level athletes have on average 205 practice days a year (range 80–300) with each practice averaging approximately 2.8 hours (range 1.5–4). (Jacobson, Redus, & Palmer 2005) Practices reported included stretching (99.7%), endurance activities (87.1%), and weight training (92.9%). (Jacobson, Redus, & Palmer 2005)	79 fall-related injuries in a one-year period, 67 occurred in practices and 70 occurred during stunts. It has been reported that the risk for serious injury increases with increasing fall height. (Waters, 2013; Shields & Smith, 2009) In addition, injury severity may increase as the impact-absorbing capacity of the surfacing material (such as the matting or floor) decreases. (Shields & Smith, 2009)			

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Review of Sport Injury Burden, Risk Factors and Prevention

Cheerleading

Incidence and Prevalence

Cheerleading is becoming an extremely common sport worldwide; however, there is a risk of injury due to the acrobatic nature and the complex stunts required. (Jacobson et al., 2004; Jacobson, Redus & Palmer, 2005; Foley & Bird, 2013; Machuca, 2014; Shields & Smith, 2009a; Shields & Smith, 2009b; Waters, 2013) In the U.S., cheerleading injuries among females account for 56% of total direct catastrophic injuries at the college level and 63% at the high school level. (Foley & Bird, 2013) A study done in the U.S. stated that in one year, out of the 9022 cheerleaders on 412 American teams, 567 injuries were reported - 83% occurred during practice, 52% occurred while attempting a stunt, and 24% occurred while basing or spotting one or more cheerleaders. (Shields & Smith, 2009a) Another study indicated that of high school cheerleaders, 41.3% had sustained one or more injuries in the previous year which resulted in an average of 3.4 days of missed practices or performances. (Jacobson et al., 2004) Axe, Newcomb, and Wagner (1991) noted in a study of adolescent sports injury that cheerleading was the leading sport in number of days lost per injury with an average of 28.8 days.

The most common injuries in cheerleading are strains and sprains of the ankle and lower back; abrasions, contusions, and hematomas of the knee; fractures and dislocations; concussions and closed head injuries. (Jacobson et al., 2004; Shields & Smith, 2009b; Jacobson et al., 2012; Waters, 2013) These injuries can be caused in a variety of ways, but the complex nature of the stunts involved are often the root in many cases, regardless of role as a base, flier, or spotter. (Waters, 2013) Stunting can increase the risk of injury - spine compression results from lifting another cheerleader overhead, fliers are landing with enormous force during stunts, and tumbling involves complex twisting and flexion. (Colvin & Lynn, 2010; Shields & Smith, 2010, Waters, 2013) In addition, falling or landing incorrectly during stunts, catching another cheerleader, lifting or tossing another cheerleader, and failure to complete a maneuver are also common injury mechanisms. (Waters, 2013) Concussions are the most common head injury in cheerleading. (Waters, 2013) Concussions account for 5-20% percent of all injuries reported in high school cheerleading. High school concussion injury rates are reported to range between 0.06 - 0.12 per 1000 athlete exposures. (Marar, 2012; Meehan, 2011; Shields, 2009) Concussions also represent 12.5% of college-level cheerleading injuries. (Marar, 2012; Meehan, 2011; Shields, 2009)

Risk and Protective Factors

There is a lack of quality research examining the risk factors for injury in cheerleading. Some studies report risk factors to include the type of surface performed on, attire worn, body composition, technique adaption, biomechanics, falling height, and the ability to properly fall. (Colvinn & Lynn, 2010; Machuca, 2014; Waters, 2013). The best surfaces to perform on are spring floors or 4-inch thick landing mats instead of foam floors. However, most of the time,

cheerleaders tend to practice and compete on hardwood floors, wrestling mats, and grass, which may result in increased injury risk. One study reported that of the 15 most serious injuries (concussions or closed head injuries, dislocations, fractures, and anterior cruciate ligament tears), 87% (13/15) were sustained while the cheerleader was performing on artificial turf, grass, a traditional foam floor, or a wood floor. (Shields & Smith, 2009b) The fall height ranged from 4 to 11 feet (1.22–1.52 m) in 87% (13/15) of these cases. (Shields & Smith, 2009b) Proper cheerleading attire can include shoes with proper ankle support and no jewelry. (Waters, 2013)

There is inconclusive evidence on body mass index (BMI – the ratio of weight to height) on cheerleading injuries. A reported protective effect for cheerleaders in the highest BMI quintile has been reported in the literature (RR=0.4, 95%CI:0.1-1.4); (Schulz et al. 2004) however, this effect was not significant when explored in a multivariable model, where the role of the cheerleader was also not accounted for. Literature shows that children tend to have growth spurts between the ages of 8 to 17. During growth spurts, the child may lose flexibility and in cases where they attempt to force the same dynamic exercises, stress may be increased in parts of the body that can lead to chronic pain later in life. (Waters, 2013) Children also tend to gain about 50% of their adult weight throughout adolescence. Changes in weight can affect flexibility and strength and in cases where flipping, twisting, dancing and jumping are common, routines may have to be adapted to avoid injury. (Waters, 2013) Being taught proper techniques, formations and skills for tumbling, landing, and falling are important technical aspects that may reduce the risk of injury risk. (Shields et al., 2009; Shields & Smith, 2009b; Waters, 2013) The biomechanics of techniques are extremely important in any sport, especially cheerleading. (Waters, 2013)

Opportunities for Prevention: Effective Interventions, Cost-Effectiveness, Implementation and Evaluation

The most common injuries seen in cheerleading are ankle sprains, spinal injuries, concussions, and lower back pain. (Jacobson, Redus, & Palmer, 2005; Jacobson et al., 2004) There are no studies that specifically examine ankle sprain prevention in cheerleading; however, injury prevention programs in other sports have concluded that balance training and neuromuscular training exercises can reduce the number of ankle sprains. (Machuca, 2014) For cervical and spinal injuries, there are no current injury prevention strategies in place; however, extrapolating data from contact sports such as football and rugby indicates that strengthening the neck, upper trapezius, shoulder, and middle back musculature could significantly reduce the risk of injury. (Machuca, 2014) Previous literature also shows that neck muscles can stabilize the cervical spine during a fall or upon contact with another person; therefore, increasing strength and improving cervical stabilization through the use of isometric exercises may possibly reduce the impact of a fall. This hypothesis; however, has not been evaluated. Finally, although periodization has not been studied in cheerleading, it has been proposed as a strategy to reduce the risk of overtraining and facilitate adequate recovery. (Machuca, 2014)

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