



Evidence Summary: Trampoline

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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:	Trampoline	Target Group:	Mostly children		
Injury Types and Mechanisms:	Most common injuries are fractures or sprains or other soft tissue injuries of the ankle, elbow, head, and spine (Arora et al., 2016; Bhangal, Neen, & Dodds, 2006; Briskin et al., 2012; Furnival, Street, & Schunk, 1999; Levine, 2006; Nysted & Drogset, 2006). Mechanisms of injury most typically include falling off the trampoline, although landing incorrectly also causes injury (Arora et al., 2016; Bhangal, Neen, & Dodds, 2006; Briskin et al., 2012; Furnival, Street, & Schunk, 1999; Levine, 2006; Nysted & Drogset, 2006).				
Incidence/Prevalence	Risk Factors	Interventions	Implementation/ Evaluation	Resources	
<p>Trampolines have been a common form of entertainment for children since the early 1970's however, use of trampolines can lead to severe injuries (Arora et al., 2016; Briskin et al., 2012; Furnival, Street, & Schunk, 1999). In the US and Canada, it has been reported that 100,000 patients a year received treatment for  trampoline injuries within hospital emergency departments (Arora et al., 2016; Briskin et al., 2012; Furnival, Street, & Schunk, 1999; Levine, 2006).</p> <p>Children</p> <p>Trampoline injuries are common in children aged 5–14 years (Furnival et al., 1999; Levine, 2006). A study based on medical records of 727 trampoline injury patients found that those that were injured had a median age of 7 and 37% of the injured were  less than 7 years old (Furnival et al., 1999). Of those injured, just over half (53%) were female.</p>	<p>Risk factors for injuries on the trampoline have not been thoroughly evaluated. Based on the information from studies examining incidence and mechanism of injury, potential risk factors include falls, multiple people on the trampoline, improper safety equipment, lack of supervision and attempting of risky actions (Arora et al., 2016; Bhangal, Neen, & Dodds, 2006; Briskin et al., 2012; Furnival, Street, & Schunk, 1999; Levine, 2006; Nysted & Drogset, 2006).</p> <p>Multiple Individuals on the Trampoline</p> <p>Multiple studies have concluded that approximately 75% of trampoline injuries occurred when multiple people were using the trampoline at the same time (Briskin et al., 2012; Levine, 2006). Multiple simultaneous users on a trampoline can result in injuries due to collisions with other individuals or individuals tripping</p>	<p>There is no evidence examining injury prevention interventions in trampoline; however, recommendations for safer environments include having adult supervision, proper instructions, limiting the age of the children that use the trampoline to 6 and over, and ensuring the trampoline should not be placed in play areas (Briskin et al., 2012; Nysted & Drogset, 2006).</p> <p>Potential safety precautions would be to have circumferential netting around the trampoline to prevent individuals from falling off the trampoline or adding additional padding around the trampoline on the ground (Bhangal et al., 2006). However, it should also be noted that there is limited research on the effectiveness of these methods (Briskin et al., 2012).</p> <p>No more than one person at a time on a trampoline has been</p>	<p>The American Society for Testing Materials (ASTM) has safety standards that have been reinforced such as all trampolines must come with padding to cover the frame, hooks and springs (Briskin et al., 2012). The ASTM also has additional recommendations such as always having adult supervision, enclosing areas of trampoline with netting, restricting the use of trampolines to those over the age of 6, warning labels on trampoline alerting jumpers about hazards of somersaults and multiple jumpers, and even the exclusion of ladders on trampolines to stop younger children gaining access to the trampoline (Briskin et al., 2012; Levine, 2006). However, it should be noted that parental supervision and these other factors may not always prevent injuries (Levine, 2006). More information on implementing methods for safe use of the</p>	<p>AAP guidelines for trampoline use are the only guidelines available (Briskin et al., 2012). http://pediatrics.aappublications.org/content/130/4/774</p>	

<p>(Furnival et al., 1999).</p> <p>The incidence of trampoline injuries within paediatric populations is reported to be between 34.9 and 38.1 per 100,000 injuries (Briskin et al., 2012). The most common types of injuries are fractures and ligament injuries. The most common site of injuries was the lower extremity (Briskin et al., 2012).</p> <p>Adults</p> <p>There are no known incidence rates for adult trampoline injuries. The most common types of trampoline injuries that adults tend to sustain are sprains, strains, contusions, or other soft tissue injury (Arora et al., 2016). Lower limb and spinal injuries are the most prevalent types of injuries in adults (Arora et al., 2016).</p> <p>Falls</p> <p>Falls account for 27% to 39% of all trampoline-associated injuries (Briskin et al., 2012).</p>	<p>or landing on one another (Briskin et al., 2012; Nysted & Drogset, 2006).</p> <p>Safety Equipment and the Surrounding Environment</p> <p>Trampoline injuries tend to occur as a result of falls on the frame or springs of the trampoline, or falls onto the ground (Briskin et al., 2012). Literature shows that 20% of all trampoline injuries have been linked to direct contact with the springs and frame (Briskin et al., 2012).</p> <p>Lack of Supervision</p> <p>Since most of the injuries occur in children, another factor that should be considered is whether or not there is adult supervision. Twenty-two percent of children injured under the age of 11 had adult supervision when the injury occurred, meaning 78% were unsupervised at the time of injury (Bhangal et al., 2006; Briskin et al., 2012; Furnival et al., 1999).</p> <p>Risky Actions</p> <p>Trampoline injuries most often occur due to falling, which many times is the result of failed attempts at somersaults or other risky actions (Bhangal et al., 2006). Other common risky behaviours include individuals trying to propel themselves to higher heights,</p>	<p>recommended as a safety precaution for injury prevention (Briskin et al., 2012; Nysted & Drogset, 2006).</p> <p>It is also recommended that children be supervised while trampolining (Bhangal et al., 2006; Briskin et al., 2012; Furnival et al., 1999)</p> <p>Economic</p> <p>One study has estimated that the hospital charges for the acute medical care of trampoline-related injuries cost approximately \$700, 000 a year (Furnival et al., 1999).</p>	<p>trampoline is needed.</p>	
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	<p>which can also increase injury risk (Bhangal et al., 2006; Briskin et al., 2012). More research is needed on risky behaviours performed on trampolines.</p>			
<p>Works Cited:</p> <p>Arora, V., Kimmel, L. A., Yu, K., Gabbe, B. J., Liew, S. M., & Moaveni, A. K. (2016). Trampoline related injuries in adults. <i>Injury</i>, 47(1), 192–196.</p> <p>Bhangal, K.K., Neen, D., & Dodds, R. (2006). Incidence of trampoline related pediatric fractures in a large district general hospital in the United Kingdom: lessons to be learnt. <i>Injury Prevention</i>, 12(2), 133–134.</p> <p>Briskin, S., LaBotz, M., Brenner, J.S., Benjamin, H.J., Cappetta, C.T., Demorest, R.A., Loud, K.J. Council on Sports Medicine and Fitness. American Academy of Pediatrics. (2012). Trampoline safety in childhood and adolescence. <i>Pediatrics</i>, 130(4), 774–779.</p> <p>Furnival, R.A., Street, K.A., & Schunk, J.E. (1999). Too many pediatric trampoline injuries. <i>Pediatrics</i>, 103(5), e57–e57.</p> <p>Levine, D. (2006). All-terrain vehicle, trampoline and scooter injuries and their prevention in children. <i>Current Opinion in</i></p>	<p>Works Cited:</p> <p>Arora, V., Kimmel, L. A., Yu, K., Gabbe, B. J., Liew, S. M., & Moaveni, A. K. (2016). Trampoline related injuries in adults. <i>Injury</i>, 47(1), 192–196.</p> <p>Bhangal, K.K., Neen, D., & Dodds, R. (2006). Incidence of trampoline related pediatric fractures in a large district general hospital in the United Kingdom: lessons to be learnt. <i>Injury Prevention</i>, 12(2), 133–134.</p> <p>Briskin, S., LaBotz, M., Brenner, J.S., Benjamin, H.J., Cappetta, C.T., Demorest, R.A., Loud, K.J. Council on Sports Medicine and Fitness. American Academy of Pediatrics. (2012). Trampoline safety in childhood and adolescence. <i>Pediatrics</i>, 130(4), 774–779.</p> <p>Furnival, R.A., Street, K.A., & Schunk, J.E. (1999). Too many pediatric trampoline injuries. <i>Pediatrics</i>, 103(5), e57–e57.</p> <p>Levine, D. (2006). All-terrain vehicle, trampoline and scooter injuries and their prevention in children. <i>Current Opinion in</i></p>	<p>Works Cited:</p> <p>Bhangal, K.K., Neen, D., & Dodds, R. (2006). Incidence of trampoline related pediatric fractures in a large district general hospital in the United Kingdom: lessons to be learnt. <i>Injury Prevention</i>, 12(2), 133–134.</p> <p>Briskin, S., LaBotz, M., Brenner, J.S., Benjamin, H.J., Cappetta, C.T., Demorest, R.A., Loud, K.J. Council on Sports Medicine and Fitness. American Academy of Pediatrics. (2012). Trampoline safety in childhood and adolescence. <i>Pediatrics</i>, 130(4), 774–779.</p> <p>Furnival, R.A., Street, K.A., & Schunk, J.E. (1999). Too many pediatric trampoline injuries. <i>Pediatrics</i>, 103(5), e57–e57.</p> <p>Nysted, M., & Drogset, J. O. (2006). Trampoline injuries. <i>British Journal of Sports Medicine</i>, 40(12), 984–987</p>	<p>Works Cited:</p> <p>Briskin, S., LaBotz, M., Brenner, J.S., Benjamin, H.J., Cappetta, C.T., Demorest, R.A., Loud, K.J. Council on Sports Medicine and Fitness. American Academy of Pediatrics. (2012). Trampoline safety in childhood and adolescence. <i>Pediatrics</i>, 130(4), 774–779.</p> <p>Levine, D. (2006). All-terrain vehicle, trampoline and scooter injuries and their prevention in children. <i>Current Opinion in Pediatrics</i>, 18(3), 260–265.</p>	

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Review of Sport Injury Burden, Risk Factors and Prevention

Trampoline

Incidence and Prevalence

Trampoline use and popularity has been variable throughout the years, however trampoline injuries are a still common reason for visiting the emergency department (Briskin et al., 2012; Furnival, Street, & Schunk, 1999; Levine, 2006). The American Academy of Pediatrics states that based on data from the emergency department, the incidence of trampoline injury is between 34.9 and 38.1 injuries per 100,000 people (Briskin et al., 2012). While trampoline injury affects people of all ages, children under the age of 6 account for 22% to 37% of trampoline-related injury and up to 75% of injuries occur in children under the age of 15 (Briskin et al., 2012; Furnival et al., 1999; Levine, 2006). The most common trampoline injuries include fractures, sprains, or other soft tissue injuries to the ankle, elbow, head and spine (Nysted & Drogset, 2006; Bhangal, Neen, & Dodds, 2006; Briskin et al., 2012; Furnival et al., 1999; Levine, 2006). Children aged five and younger are more prone to bony injury such as fractures, with 48% of the injuries in that age range being fractures or dislocations compared to 29% of injuries in those aged six to 17 (Briskin et al., 2012; Furnival et al., 1999). In one study on the mechanism of injury while trampolining 66% of injuries occurred while on the trampoline, 28% of injuries were due to falling off the trampoline and 4% of mechanism were unknown (Furnival et al., 1999). The same study found that fractures were more common when individuals fell off the trampoline as compared to spinal injuries, which were more likely to occur on the trampoline. Of those injuries, 17% were severe enough to require hospitalization (Furnival et al., 1999).

In the adult population, lower limb and spinal injuries are the most prevalent trampoline injuries (Arora et al., 2016). The majority of the literature and studies on trampoline injuries focus on a pediatric population under the age of 18. Therefore more information is needed on adult injury risk and incidence.

Risk and Protective Factors

Risk factors that are included in trampolining include sex, age, multiple people on the trampoline, quality of the equipment, supervision, and attempting stunts on the trampoline. One study found that more males (56%) came in with trampoline-related injuries than females (44%), however there is limited information on sex as a risk factor for trampoline injuries (Nysted & Drogset, 2006). Most of the injuries on trampolines are seen within a pediatric population, and those who are under the age of 6 are at a greater risk of sustaining a fracture (Briskin et al., 2012; Furnival et al., 1999). Risk factors in adults are not well investigated and more research needs to be done to see if age is a risk factor in older populations.

It has been shown in multiple studies that three-quarters of injuries occurred while more than one individual was present on the trampoline, and there is an association between

increased number of people on the trampoline and the number of trampoline injuries that occur (Briskin et al., 2012). Another risk factor is the physical quality of the trampoline and frame (Briskin et al., 2012). One of the most obvious risk factors within trampoline participation is the ability to propel to increasing heights or attempting stunts such as somersaults or backflips (Briskin et al., 2012). Attempting these stunts can put participants at an increased risk of head and cervical spine injury (Bhangal et al., 2006; Briskin et al., 2012; Nysted & Drogset, 2006).

Protective factors can include rules such as no more than one person on a trampoline at once, supervision for younger children, padding on all exposed surfaces (which include supporting bars, strings and surrounding landing surfaces), limiting complex maneuvers such as somersaults and flips, and limiting the force of the falls off the trampoline by padding the ground surrounding the trampoline, or digging the trampoline into a pit level with the ground and having netting around the trampoline (Bhangal et al., 2006; Briskin et al., 2012; Levine, 2006; Nysted & Drogset, 2006). Due to the number of younger children that are injured on trampolines, a protective factor might be to limit the use of trampolines for those under the age of 6 (Briskin et al., 2012; Furnival et al., 1999; Nysted & Drogset, 2006). Other protective factors might be improving the quality of material used to make the trampoline and additional padding when using the trampoline (Briskin et al., 2012; Nysted & Drogset, 2006)

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

There are no interventions or evaluations within the trampoline literature that focus on injury prevention aspects. There are multiple recommendations that are in place through a number of organizations to help reduce trampoline related injuries. These include extra padding to cover the frame, hooks, springs, supporting bars, strings and surrounding landing surface; limiting the ages allowed to use the trampoline to 6 years and above; warning labels on trampolines that include a maximum number of jumpers and the dangers of attempting stunts; and limiting the force of the falls from the trampoline by padding the ground surrounding the trampoline or digging the trampoline into a pit level with the ground and having netting around the trampoline (Bhangal et al., 2006; Briskin et al., 2012; Levine, 2006; Nysted & Drogset, 2006). In addition, multiple authors have highlighted the importance of adult supervision and instruction, even despite in one-third of instances, children were injured with parent supervision (Briskin et al., 2012; Nysted & Drogset, 2006). The economic costs of healthcare to treat trampoline related injuries in one study for 727 was approximately \$700 000 (Levine, 2006).

There is more information needed on which of these recommendations help reduce injuries and which are currently ineffective. In addition, more established interventions are needed to help prevent trampoline injuries in both pediatric and adult populations.

References

- Arora, V., Kimmel, L. A., Yu, K., Gabbe, B. J., Liew, S. M., & Moaveni, A. K. (2016). Trampoline related injuries in adults. *Injury*, 47(1), 192–196.
- Bhangal, K.K., Neen, D., & Dodds, R. (2006). Incidence of trampoline related pediatric fractures in a large district general hospital in the United Kingdom: lessons to be learnt. *Injury Prevention*, 12(2), 133–134.
- Briskin, S., LaBotz, M., Brenner, J.S., Benjamin, H.J., Cappetta, C.T., Demorest, R.A., Loud, K.J. Council on Sports Medicine and Fitness. American Academy of Pediatrics. (2012). Trampoline safety in childhood and adolescence. *Pediatrics*, 130(4), 774–779.
- Furnival, R.A., Street, K.A., & Schunk, J.E. (1999). Too many pediatric trampoline injuries. *Pediatrics*, 103(5), e57–e57.
- Levine, D. (2006). All-terrain vehicle, trampoline and scooter injuries and their prevention in children. *Current Opinion in Pediatrics*, 18(3), 260–265.
- Nysted, M., & Drogset, J. O. (2006). Trampoline injuries. *British Journal of Sports Medicine*, 40(12), 984–987.