Child Accident Prevention Foundation of Australia
Western Australia

WA Consumer Product Advocacy Network

Trampoline Injuries Research Report

Partner:

Government of **Western Australia**
Department of **Health**

Suggested Citation:
Tsvetkov, A, Skarin D. WA Consumer Product Advocacy Network, Trampoline Injuries Research Report. Perth (WA): Kidsafe WA (AUS); 2020 Jul.

This report was produced by Kidsafe Western Australia in collaboration with members of the WA Consumer Product Advocacy Network.

Government of **Western Australia**
Department of **Health**

Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**
Consumer Protection

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About the WA Consumer Product Advocacy Network

The WA Consumer Product Advocacy Network (WA CPAN) was established in October 2014 in partnership with the Department of Health Western Australia. WA CPAN provides leadership to ensure ongoing and emerging injury issues associated with unsafe products are identified and minimised, with a focus on products used by children. The network consists of representatives from organisations who are involved in the regulation, safe use, injury prevention, treatment and sale of products for use by consumers. These organisations include:

- the Department of Health Western Australia, Public and Aboriginal Health Division
- the Perth Children's Hospital Emergency Department
- the WA Poisons Information Centre
- the Australian Competition and Consumer Commission
- the Burn Injury Research Unit - School of Surgery, University of Western Australia
- the Department of Mines, Industry Regulation and Safety – Consumer Protection
- Goodstart Early Learning
- Kidsafe Western Australia

Products identified through the network are prioritised according to the level of risk posed or safety concerns raised by WA CPAN members. A documented action plan then supports the ability to advocate for change. The network aims to explore solutions for identified unsafe products and ultimately reduce the number and severity of childhood injuries related to consumer products.

WA CPAN members meet every two months, with approximately six meetings per year. The members are also in regular email contact between meetings so that emerging issues can be dealt with in a timely manner. Once a product safety issue is identified appropriate actions are taken and typically led by the member who could have the biggest impact. Actions can include:

- Advocating for changes;
- Delivering workshops to provide injury prevention information;
- Monitoring products through injury surveillance and safety checks;
- Providing safety messages in media releases and newsletters;
- Providing a number of resources such as brochures, fact sheets, tools and videos which are made available through websites and social media channels; and
- Enforcement of appropriate regulations or consumer law.

Perth Children's Hospital Injury Surveillance System

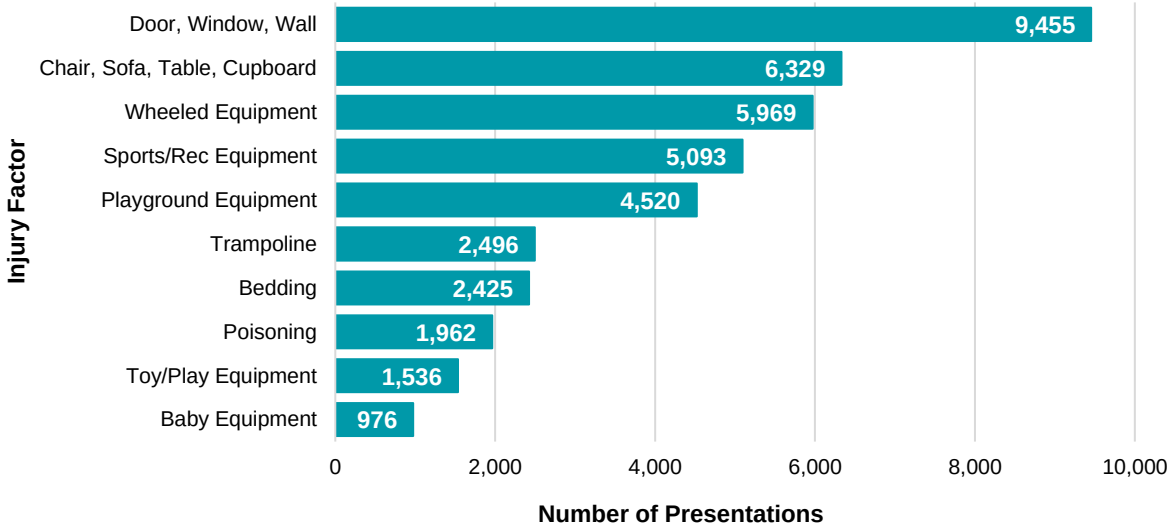
WA CPAN has identified trampoline injuries to children as an ongoing issue. This report provides an overview of trampoline injuries to Western Australian children between January 2015 and December 2019. The data used in this report was provided by Perth Children's Hospital Emergency Department (PCH ED). PCH is the sole tertiary paediatric hospital in Western Australia, acting as a key referral source for childhood injury and disease within the state. The PCH Injury Surveillance System is an electronic database that involves the systematic collection of all ED injury data. Data is collected by triage nurses who initially assess the child presenting to ED. All clinical information and basic demographic details are recorded, together with the child's triage code, indicating the level of urgency based on the presentation reason. Additional surveillance data is collected for those children presenting with an injury. This data is then validated by a dedicated Injury Surveillance Officer.

Childhood Injuries in Western Australia

On average, 27 Western Australian children die each year as a result of injury, with a further 7,000 children hospitalised[1]. Between January 2015 and December 2019 there were more than 92,594 injury presentations to the PCH ED for children aged under 16 years. Of these presentations, approximately 44 percent (n=40,761) involved an injury factor. An injury factor can be a product or a structure that contributed to the cause of injury.

Consistent with previous reporting, the most common injury factors were house structures/building components such as doors, walls, and windows accounting for 23.2 percent (n=9,455) of the presentations. This was followed by furniture, including items such as chairs, sofas, tables and cupboards (15.5%, n=6,329) (Figure 1).

Figure 1: Presentations to PCH ED by Injury Factor, 2015 - 2019



Each child presenting to the ED is assigned a triage category, which is based on the level of urgency (Table 1). Looking specifically at injuries with an associated injury factor, the majority of the presentations were recorded as semi-urgent, accounting for approximately 78.5 percent of the presentations (n=72,674). In most cases (56.7%, n=52,470) the child was able to depart the ED with treatment completed. A further 28.1 percent (n=26,017) were discharged after being admitted to hospital for further treatment, and the remainder were either admitted to hospital (13.9%, n=12,887), did not wait for treatment (0.8%, n=699), transferred to another department/hospital (0.5%, n=508) or unknown (0.01%, n=13).

Table 1: Triage Category

Category	Seen within (mins)
(1) Resus	0
(2) Emergency	10
(3) Urgent	30
(4) Semi-Urgent	60
(5) Non-Urgent	120

Trampoline Injuries to Children

Trampolining is a fun activity for children and assists with developing coordination, balance and motor skills, however it is associated with high risk of injury[2]. Trampolines were originally developed in the 1930's for gymnastics training[3]. This then led to trampolines being used recreationally in the backyard and at trampoline centres[4].

As trampolining became popular and the number of injuries increased, the need for a safety standard became evident. In 2003 a voluntary Australian Standard (AS 4989) for trampolines was developed[2]. This included requirements for trampoline design and information for the assembly and maintenance of trampolines[2,3]. As the incidence of trampoline injuries continued to increase, amendments to the standard were made in 2006, 2008, 2010 and 2015, taking into consideration the type of injuries presenting[2,4]. The latest standard AS 4989-2015 includes requirements for the safety enclosure, testing of all plastic components for UV degradation, tests for structural integrity, and testing of the frame-padding and enclosure[4]. During the revision of the standard in 2015 efforts were also made to mandate the standard, however the standard still remains voluntary[3,5]. Introducing safety standards aims to reduce to the number of trampoline injuries, however despite the introduction of these standards trampoline injuries continue to remain high.

In Australia there are over 1,700 trampoline injury presentations annually[2] with one of the contributing factors being the increased access to trampolines[4]. Each year in Australia approximately 200,000 trampolines are sold[5] and there are over 30 trampoline centres[4,5]. As trampoline injuries continue to present, a number of public health interventions to improve trampoline safety have been introduced[5]. The trampoline safety recommendations provided through these interventions focus on adult supervision, the age of the child, the number of concurrent users, safety features and maintenance of the trampoline[2,3,6]. Efforts have also been made in improving the design of trampolines to reduce the risk of common injuries. This includes the introduction of spring free trampolines to reduce exposure to the springs, and the addition of safety nets/enclosures to prevent the child from falling off the trampoline[6]. Despite these safety recommendations and new designs, the number of trampoline injury presentations continue to rise[2,7].

As children continue to present with injuries associated with trampolines it is important to identify the mechanism of injury to assist with an action plan to prevent these injuries in the future. To achieve this, trampoline injury presentations in Western Australia to PCH ED have been identified, analysed and summarised in this report.

Presentations to Perth Children's Hospital Emergency Department in Western Australia

Methods

Using Crystal Reports (v14) a custom search query was set up to identify potential injuries resulting from trampolining. The query searched the PCH ED injury surveillance database between January 2015 and December 2019. The following inclusion criteria were used:

- Injury cause: *All*
- Intent: *All*
- Location: *All*
- Injury factor: *Trampoline*

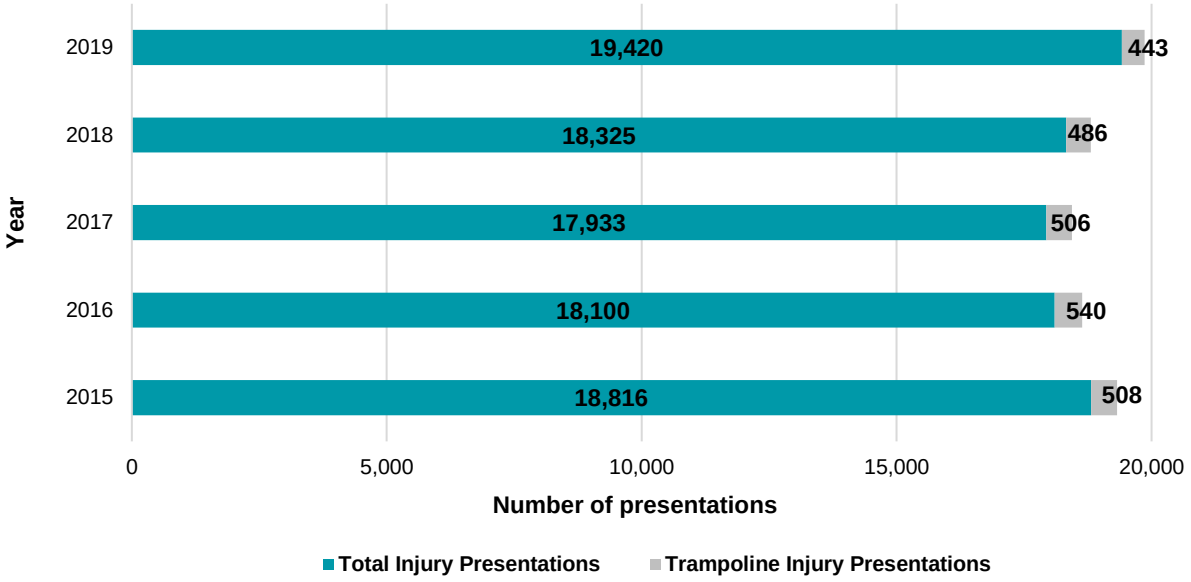
After identifying 2,946 cases, these were manually reviewed and 2,483 true trampoline injuries were identified. Presentations which were removed during this process included those that were miscoded and did not involve a trampoline, and cases where a child was injured from running into a trampoline. During the analysis process injury mechanism was grouped into the following categories based on the information provided at the time of triage:

- Acrobatics
- Collision
- Double bounced
- Entrapment
- Fell off trampoline
- Fell on trampoline
- Fell onto frame/springs
- Mounting/dismounting
- Other
- Unspecified

Results

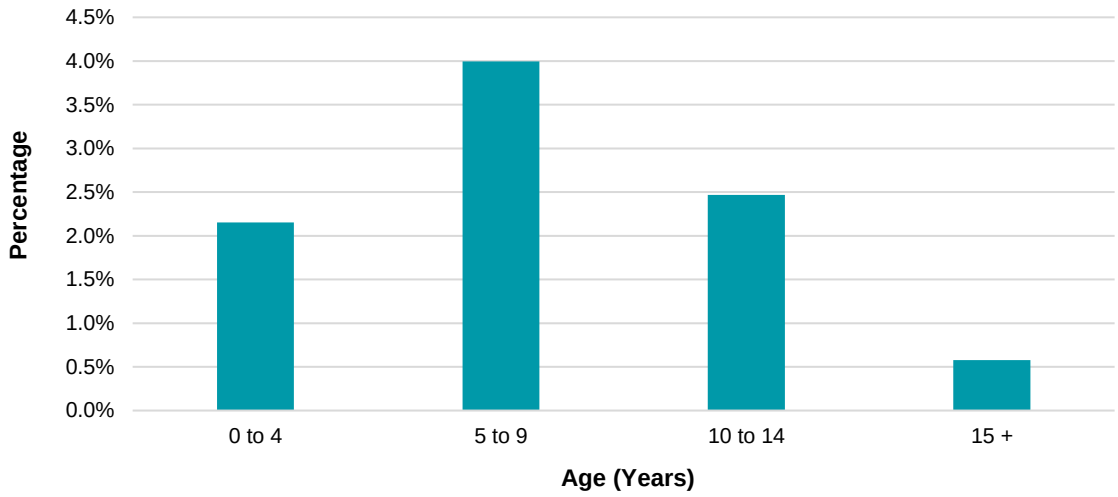
Between January 2015 and December 2019, there were 2,483 trampoline injury presentations to PCH ED, with the highest number of presentations seen in 2016 (21.7%, n=540). When considering trampoline injuries as a proportion of total injury presentations to PCH ED, a decrease in the prevalence of trampoline injuries is observed from 2.7 percent (n=508) in 2015 to 2.3 percent (n=443) in 2019, with a peak occurring in 2016 (3.0%, n=540) (Figure 2).

Figure 2 : Total Presentations and Trampoline Injury Presentations to PCH ED by year; Jan 2015 to Dec 2019



Almost half of the children presenting with a trampoline injury were between 5 - 9 years old (41.2%, n=1,024), with 6 year olds presenting most (9.1%, n=226). This is followed by children between 10 -14 years (29.0%, n=719). When looking at the age of the child for trampoline injuries as a proportion of the age of the child of the total injury presentations, a similar pattern is seen where 5 - 9 years olds are most at risk (Figure 3).

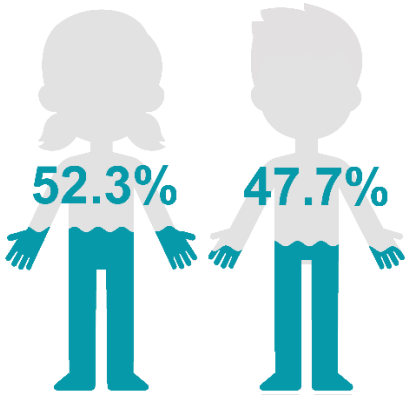
Figure 3: Trampoline Injuries as a proportion of Total Injuries by Age, Jan 2015 to Dec 2019



Most of the children presenting lived in the metropolitan area (93.9%, n=2,331), while the remaining children resided in regional Western Australia (5.0%, n=123), overseas or interstate (0.9%, n =22) and a small portion were unknown (0.3%, n=7). Aboriginal and Torres Strait Islander (ATSI) children account for 2.7 percent (n=68) of trampoline injury presentations to PCH ED.

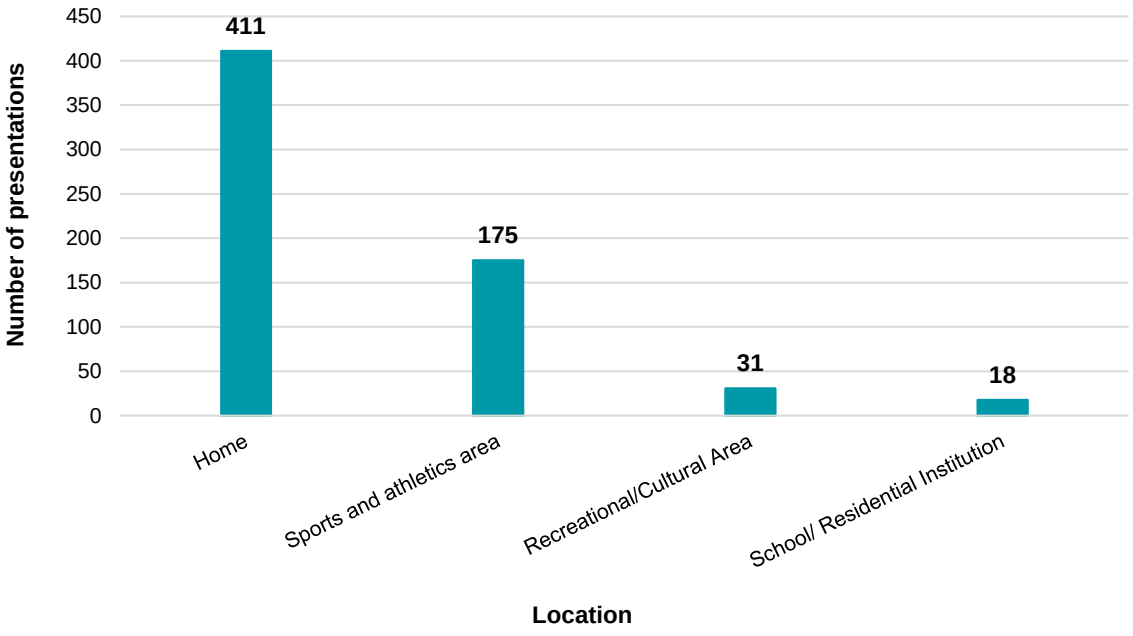
Unlike the traditional 3:2 male to female ratio seen in other injury presentations, for trampoline injuries the ratio was almost 1:1. Females accounted for 52.3 percent (n=1,298) of trampoline injury presentations and males 47.7 percent (n=1,185) (Figure 4).

Figure 4: Trampoline Injuries by Sex, Jan 2015 to Dec 2019



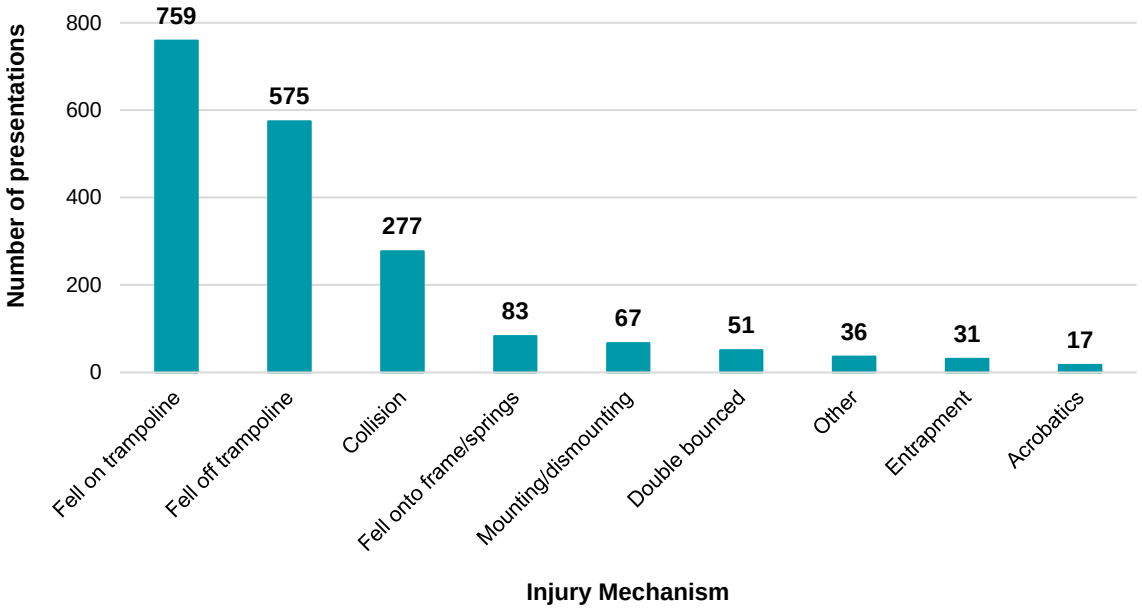
The injury location for a large number of the presentations was unknown, accounting for 74.4 percent (n=1,848). These locations are unknown as this was not reported at the time of triage. Of the documented locations, 64.7 percent (n=411) occurred at home, followed by sports and athletic areas (27.6%, n=175), recreational or cultural areas (4.9%, n=31) and school or residential institutions (2.8%, n=18) (Figure 5).

Figure 5: Trampoline Injuries by Location, Jan 2015 to Dec 2019



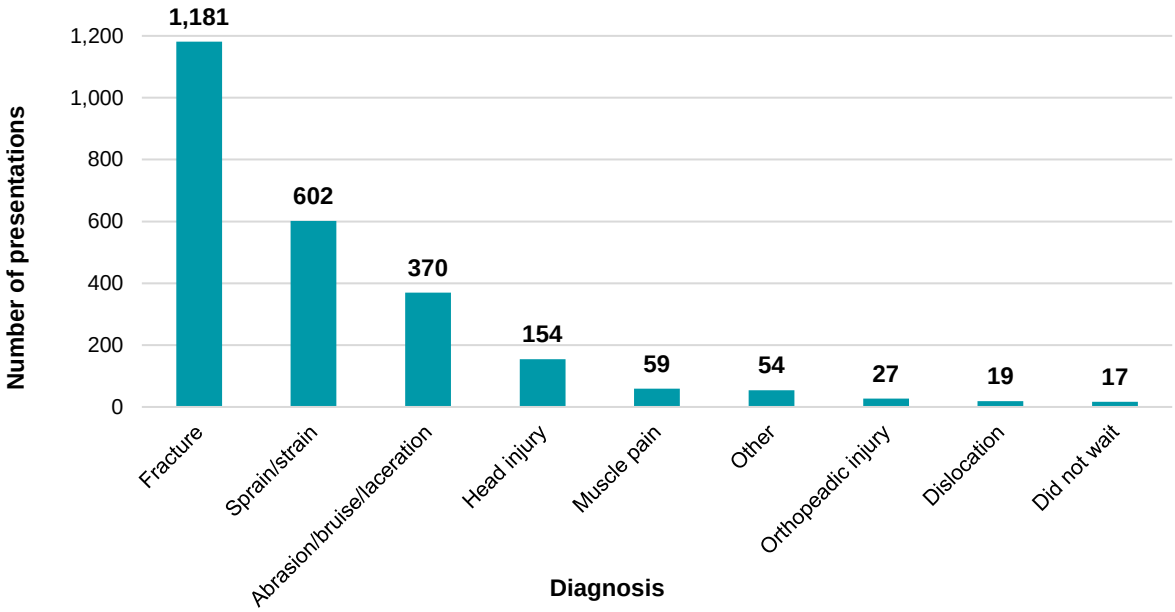
Most trampoline injuries were falls (62.0%, n=1,539), this was followed by blunt force (18.1%, n=450). For a large number of trampoline presentations the injury mechanism was not specified (23.6 %, n=587). Of the known injury mechanisms, just under half of the children injured themselves by falling onto the trampoline (40.0%, n=759). This was followed by falling off the trampoline (30.3%, n=575) and collisions (14.6%, n=277) (Figure 6). Collisions include the child colliding with objects, another person, with themselves i.e. knee vs head or with a structure.

Figure 6: Trampoline Injuries by Injury Mechanism, Jan 2015 to Dec 2019



Almost half of the presentations resulted in fractures (47.6%, n=1,181). This was followed by sprains and strains (24.2%, n=602) and abrasions, bruises and/or lacerations (14.9%, n=370) (Figure 7).

Figure 7: Trampoline Injuries by Diagnosis, Jan 2015 to Dec 2020



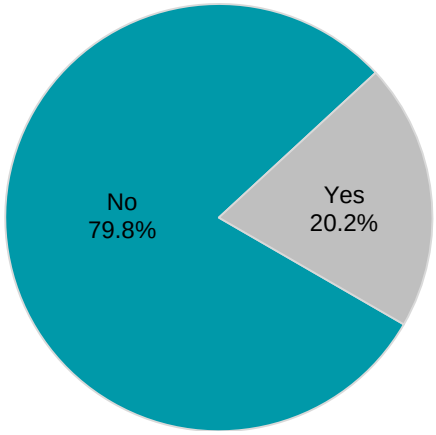
The body region injured most was the lower limbs, accounting for over a third of the injuries (37.5 %, n=930). This was followed by injuries to the upper limbs (33.3%, n=828) and injuries to the head, neck and face (23.5%, n=583).

Fractures to the lower limbs were more common when the child fell on the trampoline, accounting for 44.2 percent (n=480) of the lower limb fractures. While fractures of the upper limb were more likely to occur when falling off the trampoline, accounting for 35.8 percent (n=215) of the upper limb fractures.

The number of trampoline users at the time of injury was not specified for many of the presentations. Of the trampoline injury presentations that specified the number of users (14.1%, n=351), 99.4 percent (n=349) reported that the child was jumping with at least one other person on the trampoline when the injury occurred.

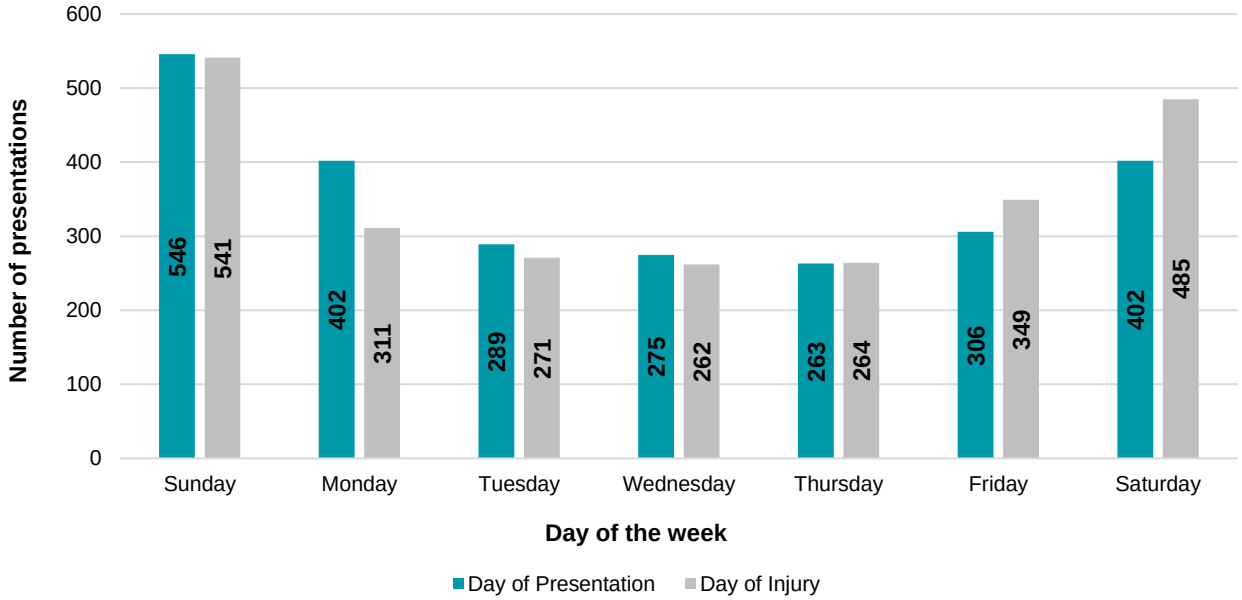
Reporting on adult supervision was also low. Of the cases where supervision was documented (4.0%, n=99) the majority had reported that the child was not supervised by an adult. This accounted for 79.8 percent (n=79) of the presentations, while 20.2 percent (n=20) reported that there was adult supervision (Figure 8).

Figure 8: Trampoline Injuries by Adult Supervision, Jan 2015 to Dec 2020



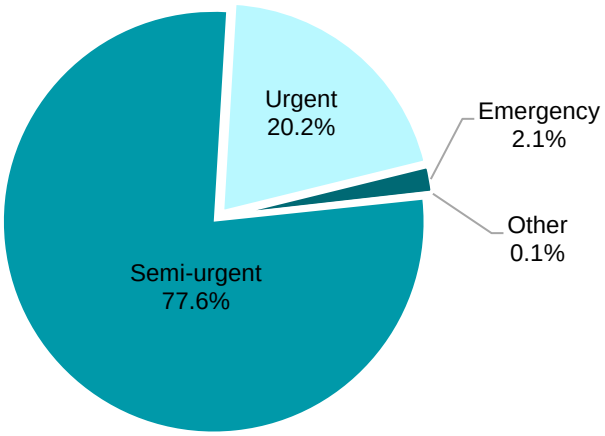
The day of presentation to PCH ED was highest on Saturday and Sunday accounting for 21.8 percent (n=541) and 22.0 percent (n=546) of injuries respectively. A similar pattern is seen when looking at the day the trampoline injury actually occurred. Thursday recorded the lowest number for both day of presentation and day of injury (Figure 9).

Figure 9: Trampoline Injuries by Day of Presentation and Day of Injury, Jan 2015 to Dec 2019



A large number of the presentations (77.6%, n=1,927) were triaged as semi-urgent. This was followed by urgent presentations (20.2%, n=502), while the remaining were either triaged as resus, emergency or non-urgent (2.2%, n=54). The majority of children (84.0%, n=2,085) that presented for a trampoline injury were able to depart the ED with treatment completed, while 15.1 percent (n=374) were admitted to hospital for further treatment. The remaining children were either transferred to another hospital for treatment or did not wait to be seen in the ED (1.0%, n=24) (Figure 10).

Figure 10: Trampoline Injuries by Triage Category, Jan 2015 to Dec 2019



Discussion

This report describes trampoline injury presentations to PCH ED between January 2015 and December 2019. During this five year period 2,483 trampoline injuries were identified. A slight decrease from 2.7 percent in 2015 to 2.3 percent in 2019 is observed when looking at trampoline injuries as a proportion of total injury presentations over that time period.

In this report children between 5 - 9 years old presented the most, accounting for 41.2 percent (n=1,024) of the trampoline injury presentations. This is similar to observations in other studies where 5 - 9 year olds present most with trampoline injuries[2]. It is likely that children within this age group are becoming more independent and/or confident and are pushing the limits by taking more risky behaviours to make trampolining more fun. Although older children are more likely to make more decisions about safety they are also more easily influenced by others behaviours[3].

The vast majority of the children presenting with trampoline injuries resided in metropolitan areas (93.9%, n=2,331) and a small number of the children resided in regional areas. This could be a reflection that most of Western Australia's children reside in metropolitan areas[4]. Another factor is that children from regional areas may present to facilities closer to home and not to PCH ED.

Unlike other injuries the male to female ratio is 1:1, with females accounting for 52.3 percent (n=1,298) of the trampoline injuries presenting to PCH ED. An overrepresentation of females presenting with trampoline injuries was also observed in other studies[7,8,9], however some studies demonstrated the opposite[2,6]. These studies looked at both trampoline injuries occurring at home and/or trampoline centres. Looking at the PCH ED data the rates of injury for males and females in each location are similar, with no statistical difference between males or females presenting with injuries from trampolines at home or at trampoline centres.

Of the known locations for trampoline injuries 64.7 percent (n=411) occurred at home. This was followed by sports and athletic areas accounting for 27.6 percent (n=175) of the injury locations. The higher rate of injuries occurring on trampolines at home suggests that domestic trampolines are more convenient and/or more popular than trampoline centers. This aligns with previous trampoline studies[7,10].

Of the known mechanisms just under half of the children injured themselves by falling onto the trampoline (40.0%, n=759). This was followed by falling off the trampoline (30.3%, n=575). These findings support previous research where falls are the most common cause of trampoline injuries[2,8,10]. Injury mechanism is still unclear in this report and in other studies, as limited details are provided when trampoline injuries are documented. Information on injury mechanism relies on reporting provided by the adult attending the hospital and/or the child injured.

Just under half of the presentations resulted in fractures (47.6%, n=1,181). This is consistent with other studies where fractures are the most common diagnosis for trampoline injuries[2,6]. Fractures

however may be overrepresented as people may be more likely to present to a hospital with injuries such as fractures which require medical treatment.

Lower limbs were injured most, accounting for over a third of the trampoline injury presentations (37.5 %, n=930). This was followed by injuries to the upper limb (33.3%, n=828) and injuries to the head, neck and face (23.5%, n=583). Similar to this report other studies also demonstrate that the limbs are most commonly injured. Some studies demonstrate that lower limbs were injured most frequently[6], while others demonstrate that upper limbs were injured most[2].

Looking at the injury mechanism and the nature of the resulting injuries, two injury modalities were revealed. Fractures of the lower limb were more likely to occur when falling on trampolines (44.2%, n=212), while fractures of the upper limb were more likely to result from falling off the trampoline (35.8%, n=215). The location of the fracture could be due to the way the child lands, which is likely different when falling onto or off the trampoline.

The number of trampoline users and adult supervision is difficult to measure due to lack of reporting. Of the trampoline injury presentations that specified the number of users almost all of these cases (99.4%n=349) reported that the child was jumping with at least one other person. Of the cases where there was reporting on supervision, the majority had reported that the child was not supervised by an adult (79.8 percent, n=79). Similar studies have also reported that there was a lack of adult supervision for the majority of the trampoline injuries presenting[2,10]. This makes it more difficult to identify injury mechanism as reporting relies on information provided by the child.

Trampoline injury presentations were greatest on Saturday and Sundays accounting for 21.8 percent (n=541) and 22.0 percent (n=546) respectively. Trampoline injuries are more likely to occur on weekends due to children having more free time to use trampolines.

The majority of trampoline injury presentations were triaged as semi-urgent, accounting for over three quarters (77.6%, n=1,927) of the presentations. This was followed by urgent presentations (20.2%, n=502). This is similar to all other injuries with an injury factor, where the majority of the presentations are also deemed as semi-urgent (78.5%). The trampoline injuries which were triaged as more severe and either a resus or emergency situation, were injuries of the abdomen and pelvis (4.3%, n=1), followed by the upper limbs (2.8%, n=23) and injuries to the head, neck and face (2.6%, n=15).

The majority of the children (84.0%, n=2,085) that presented for a trampoline injury were able to depart the ED with treatment completed, while 15.1 percent (n=374) were admitted to hospital for further treatment. This is slightly higher than the baseline admission rate for all injuries (13.9%) with an injury factor within the same time period.

In conclusion, trampoline injuries are still occurring even though safety measures have been put in place. It is evident that some of the safety recommendations are not being followed as young children are still presenting with trampoline injuries, multiple kids are jumping on the trampoline at the same time and adult supervision is low. However, there will always be children who still push the limits and take risks regardless of the safety measures in place.

This report along with other research on trampoline injuries provides some insight. However more specific data is required to understand the injury mechanisms to further guide trampoline safety information and safety standards in the future. This would include a more thorough collection of location, cause, supervision level and number of concurrent jumpers data.

Recommendations

To reduce the risk of trampoline injuries to children the following safety steps should be taken:

- Follow the manufacturer's recommendations when installing the trampoline.
- Take note of the age recommendation in the trampoline manual and safety information.
- Ensure that there is only one person at a time jumping on the trampoline.
- Ensure children do not try risky stunts.
- Teach children to bounce in the centre of the trampoline rather than the edge.
- Supervise children while they are using the trampoline. If there is a ladder or a step, make sure this is removable to prevent small children from accessing the trampoline without supervision.
- Encourage children to use the step ladder if available and avoid jumping off the trampoline.
- Conduct regular maintenance checks and replace any parts which are worn, defective or missing.
- Ensure there are no hazards on or surrounding the trampoline. This includes trees, washing lines, fences, toys and other potential hazards.
- Before using the trampoline, make sure there is no one under it.
- Ensure the surface under and around the trampoline is soft i.e. grass or sand.
- Use safety features such as pads to cover the frames and springs of the trampoline and a net/enclosure.
- Ensure safety net/enclosure is zipped up before children commence jumping.

Limitations

The data used in this report has some limitations. A considerable portion of paediatric injuries in Western Australia may go unreported, as many children may not present to a healthcare facility. Children that do present to a healthcare facility may also present to general practitioners or other local hospitals which may have different injury patterns compared to the PCH ED sample used for this report.

In addition, the accuracy of this report's data is heavily dependent on parental recollection under stressful circumstances, good triage recording and data validation by the Injury Surveillance Officer.

WA Consumer Product Advocacy Network's Role

It is important WA CPAN raise community awareness of the dangers associated with trampolines and how to reduce the risk of trampoline injuries. This includes promoting safety messages and recommendations within the WA community through education, data dissemination, advocacy, digital media and regulation. Members of the network may also have influence on relevant Australian Standards Committees.

In addition, WA CPAN will continue to identify other unsafe products and advocate for change in order to reduce the number and severity of child injuries associated with consumer products. WA CPAN will use its network to:

- Identify emerging child product safety issues through data collection and research;
- Continue to monitor existing child product safety issues;
- Advocate for appropriate product safety measures in children's products;
- Raise public awareness of child product safety concerns; and
- Collaborate to achieve the best outcome for Western Australian children.

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