Trampoline-associated injuries are more common in children in spring

Michael S Yule, Sanjeev Krishna, Jamie-Lee Rahiri, Andrew G Hill

ABSTRACT

AIMS: Trampoline use is a popular pastime amongst children in New Zealand, and has many advantages for child development. However, recent reports claim that trampoline-associated injuries are still highly prevalent. In order to help prevent these injuries in the future, this study aims to provide more up-to-date epidemiological information in children, with emphasis on the time of year that injuries most commonly occur.

METHODS: A retrospective review was carried out utilising a prospective maintained trauma database. The database was searched electronically for injuries involving trampolines in children aged 0–15 years. Patient demographics and information regarding month of injury, injury type and management were extracted.

RESULTS: There were 344 admissions to hospital for trampoline-related injuries between June 2000 and January 2015. Injuries were uncommon in winter, but rose in spring and summer. Fracture of the radius and/or ulna was the most common injury (34.0%), followed by humeral fracture (32.0%).

CONCLUSION: The peak incidence of trampoline-related injuries occurred around the beginning of spring daylight savings time each year. This could therefore prove an opportune time to remind children and parents about trampoline safety at the same time as daylight savings reminders.

Trampoline use is a popular past time among children. Trampolines provide the opportunity for physical activity, as well as contributing to childhood development through risk taking and play. [1] While an enjoyable activity, the advantages of trampoline use do come at a cost.

Unpublished data by the New Zealand Injury Prevention Research Unit claims that there were 1,537 hospital admissions for trampoline-related injury between 2007 and 2011 among children aged 0–14.[2] Children between the ages of 3–6 years accounted for more than 40% of all the trampoline-related admissions. Comparing these data to an older study that reported 2,098 first admissions into public hospitals between 1979 and 1988, there has been a clear increase in the number of trampoline-related injuries in recent years.[3]

While the importance of trampoline safety has been recognised through child injury prevention initiatives, such as Safekids Aotearoa, there is still a need to decrease the burden of injury from trampolining. One approach to decreasing trampoline-associated injuries may be to target public safety campaigns just before the peak incidence of injuries.

This retrospective study, carried out in the Counties Manukau District Health Board (CMDHB) population, aims to give more up-to-date epidemiological information about trampoline-related injuries in children ages 0–15 in order to identify periods of peak incidence of injury, thus enabling strategically targeted injury prevention public safety campaigns.

Methods

This retrospective review was carried out by identifying patients from a prospectively collected trauma database. The trauma database includes all trauma admissions to the Emergency Department at Middlemore Hospital, and Kidz First Hospitals in South Auckland, New Zealand, from June 2000 to January 2015. The 'cause of injury' field

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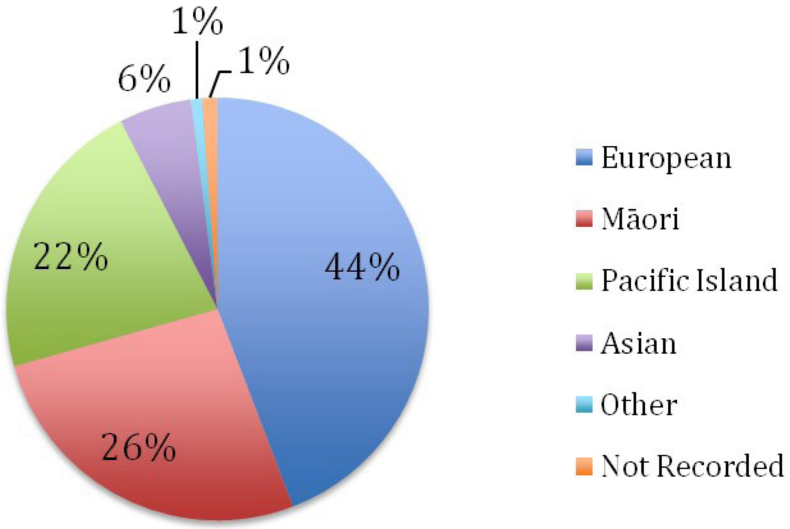
Figure 1: Pie chart showing ethnicity distribution of trampoline associated injuries n=344.



was searched electronically using the key word “tramp”. All those over the age of 15 at the time of admission were excluded. Patients were also excluded if their reason for admission was not trampoline related. Data were extracted from electronically stored patient files and discharge summaries. Paper records of notes were reviewed when necessary information was not available electronically.

The extracted data included: month of injury; injury pattern/type; treatment required; age; gender; ethnicity; and if the patient had a previous trampoline-associated injury. Injury pattern/type was further categorised into: musculoskeletal sprain/strain; fracture managed without operative intervention; fracture requiring operative intervention; minor head injury; major head injury; and other. A diagnosis of intracranial haemorrhage defined major head injury, separating it from minor head injury. Treatment required was classified as: conservative management (eg, pain relief, rest from activities); fracture manipulation and casting; and operative intervention. Operative intervention was defined as treatment that required a skin incision to be made, eg, insertion of a Kirschner wire, a titanium elastic nail or washout and debridement of a wound. For ease of data handling, subject ethnicity was classified according to Level 1 of the Statistic New Zealand (SNZ) Ethnicity Classification, producing five categories: European, Māori, Pacific Island, Asian, and Other ethnic groups.

Using SPSS® (IBM, 2015) descriptive statistics were calculated. The final database was then reformatted into count data for each month of each year of the study (ie, how many injuries occurred in each month of each year). Poisson regression was then performed to give a ratio of incidence and p-values for each month of the year.

Because of the format of the available census data,[4] only years that were observed in whole were included in the calculation of the age standardised incidence rate, using World Health Organization standard populations.[5] This was calculated in Excel® (Microsoft, 2007).

Results

Electronic search of the trauma database with the keyword “tramp” produced 378 results. Of these, four were excluded because there was no evidence that these admissions to hospital were related to a trampoline accident. Twenty-nine were excluded because they were outside the age range selected for this project. One was excluded as it was a duplicate. This left 344 subjects in total for analysis.

Of the subjects, 14 (4.1%) had experienced a previous trampoline-related injury. There was a small female dominance (1.06:1) in the number of trampoline-related injuries. Europeans made up the majority of subjects (Figure 1), but this was expected given they are represented similarly in the population. The Māori population was overrepresented (around 15.7% of CMH population), which was in stark contrast to the Asian population which is underrepresented (24.0% of CMH population).

Table 1: Classification and incidence of trampoline associated injury types.
MSK = musculoskeletal.

Injury Classification	Number of subjects	Percentage
MSK strain/sprain	5	1.5%
Fracture not requiring operative intervention	162	47.1%
Fracture requiring operative intervention	151	43.9%
Minor head injury	2	0.6%
Major head injury	0	0.0%
Other	24	7.0%
Total	**344**	**100.0%**

Table 2: Trampoline associated injuries classified by site.

Injury Site	Number of subjects	Percentage
Fracture of radius and/or ulna	117	34.0%
Fracture of humerus	110	32.0%
Fracture of tibia and/or fibula	41	11.9%
Laceration/degloving injury	14	4.1%
Fracture of ankle	10	2.9%
Fracture of femur	13	3.8%
Fracture of digit	6	1.7%
Fracture of facial bone including dental trauma	4	1.2%
Elbow dislocation only	6	1.7%
MSK strain/sprain/ligament damage	6	1.7%
Head injury	2	0.6%
Other	10	2.9%
Multiple injuries	5	1.5%
Total	**344**	**100.0%**

Table 3: Number of trampoline associated injuries classified by month.

Month	Total no. of injuries	Average no. of injuries per month	Average % of injuries per month
January	42	2.8	11.9
February	42	3.0	12.8
March	28	2.0	8.5
April	26	1.9	7.9
May	12	0.9	3.7
June	7	0.5	2.0
July	12	0.8	3.4
August	11	0.7	3.1
September	28	1.9	8.0
October	51	3.4	14.5
November	48	3.2	13.7
December	37	2.5	10.5
Total	**344**	**23.5**	**100.0**

Table 4: Poisson regression of trampoline associated injury data by months. December is used as the reference month.

Month	Monthly ratio of incidence	95% Confidence Interval	p-value
January	1.135	0.730–1.766	0.574
February	1.129	0.720–1.771	0.596
March	0.782	0.476–1.284	0.331
April	0.724	0.436–1.202	0.212
May	0.347	0.181–0.666	0.001
June	0.189	0.084–0.424	<0.001
July	0.324	0.169–0.622	0.001
August	0.270	0.134–0.543	<0.001
September	0.757	0.463–1.236	0.266
October	1.378	0.903–2.105	0.137
November	1.270	0.826–1.954	1.270
December	1	-	-

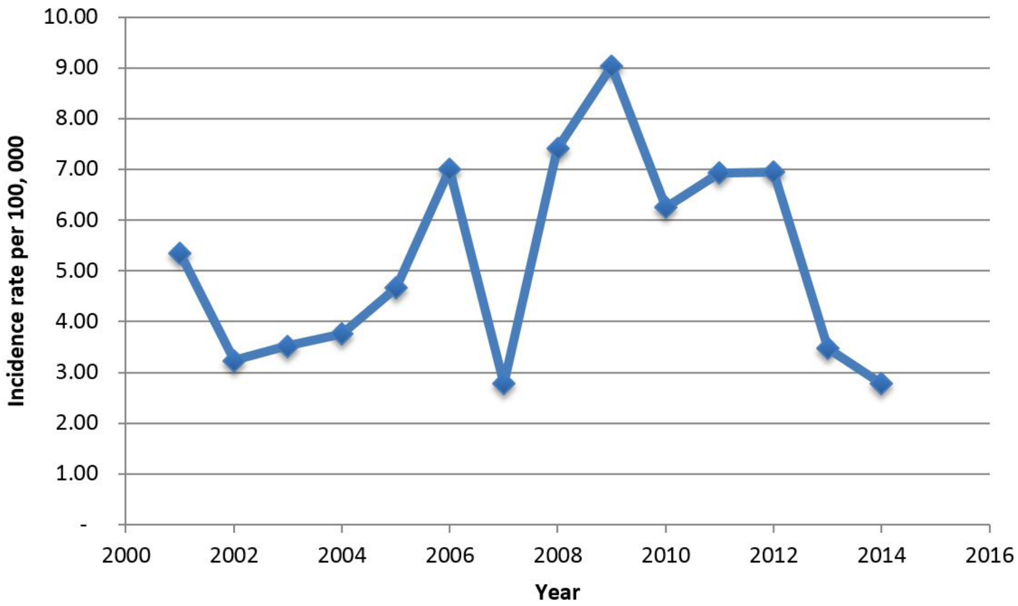
Table 5: Poisson regressions of injury data by season. Summer is used as reference month. Spring = September, October, November. Summer = December, January, February. Autumn = March, April, May. Winter = June, July, August.

Season	Ratio of season incidence	95% Confidence Interval	p-value
Spring	1.044	0.812–1.342	0.736
Summer	1	-	-
Autumn	0.568	0.419–0.770	<0.001
Winter	0.240	0.160–0.361	<0.001

Table 6: Age distribution of 0–14 year olds included in study.

Age Group	Number of subjects	Percentage
0–4	111	32.9%
5–9	156	46.3%
10–14	70	20.8%
Total	**337**	**100.0%**

Figure 2: Age standardised incidence of trampoline associated injuries between years 2001–2014 (based on 2006 and 2013 census data).



The majority of injuries sustained were fractures (Tables 1 and 2). Laceration or degloving injuries and musculoskeletal sprains, strains or ligament damage totalled only 5.8%.

Injuries were lowest during the month of June, and remained low during winter. Injury rates rose at the start of spring (September), peaking in October, and were sustained over summer. Injury levels then fell as autumn approached (March) (Tables 3, 4 and 5).

Table 6 shows the breakdown of ages involved in trampoline related accidents. The 5–9 age group were responsible for the greatest number of trampoline-related injuries.

Figure 2 shows the age standardised incidence rate/100,000 per annum. The age standardised incidence rate/100,000 per annum across years 2001–2014 was 5.60. An increase in incidence was noted between 2002 and 2006. From 2010 till 2014 there was decrease in the incidence of injuries.

Discussion

The principal aim of this study was to determine the time of year that trampoline injuries most commonly occurred. The highest incidence of injuries tended to occur during the spring and summer months, with the peak incidence occurring in October. The vast majority of injuries were fractures, with the most common site affected being the upper limb.

The time of peak incidence coincides with the beginning of spring and daylight saving time. Since 2009, the clocks in New Zealand have changed on the last Sunday of September. Unsurprisingly, June and July, on average, were found to have the lowest

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number of trampoline-related injuries. Outside temperature and favourable weather conditions clearly play a key role here.

The pattern of injuries suggests most trampoline-related injuries that resulted in hospital admission are the result of a fall onto the outstretched hand. This is a mechanism of injury that one would not expect to occur during safe trampoline use. Unsafe trampoline use, such as multiple users and the performance of 'stunts' without appropriate supervision, are therefore likely to be the cause of these injuries.

The Māori population were over represented in trampoline-related injuries. This could simply be due to the small sample size of this study, or reflect the dynamic nature of changing demographics in the CMDHB area. If studied over a longer period of time and confirmed, then further targeting of injury prevention strategies may be appropriate.

The incidence of head injuries in this study was much lower than previously reported in other studies.[6] This may be because the neurosurgical unit for the greater Auckland area is based at Auckland City Hospital (ACH), and there is no neurosurgical service in South Auckland. It may be that emergency services sent children with severe head injuries to ACH without the patients being admitted. A search of all admissions to the neurosurgical unit at ACH between June 2006 and January 2015 would need to be conducted to determine if this was the case. However, improved padding and safety enclosure nets have been introduced since previous studies were conducted. These interventions may account for the lower number of head injuries witnessed in this study.

A significant limitation of the database is underreporting of injuries. Hume et al[6] found that for every one admission to hospital, there were 12 emergency department presentations with trampoline-related injuries. This is reflected by the very small percentage of MSK strain/sprain reported among subjects in this study. There would have also been a significant number of minor injuries which may have presented to general practice, or did not present at all to a healthcare professional. This underreporting could be seen in the database. Of the 14 subjects who had a previous trampoline-related injury, only one patient appeared in the database twice. The others patients had sustained injuries which were not significant enough to warrant inclusion on the trauma database.

Conclusion

In summary, the demographics reported in this study compare well to larger ones carried out previously. The peak incidence of trampoline-related injuries occur in spring around the time that New Zealand clocks change to daylight savings time. We therefore recommend that at the same time or closely before the public are reminded about the change of clocks to daylight savings time, that public safety campaigns concerning safe use of trampolines are issued. This would hopefully reduce the incidence of trampoline-related injuries and remind children and their families about safer recreational environments.

Competing interests:
Nil

Author information:
Michael S Yule, Medical Student, University of Aberdeen, Aberdeen, Scotland, UK; Sanjeev Krishna, Research Fellow, Department of Surgery, University of Auckland, Auckland; Jamie-Lee Rahiri, Research Fellow, Department of Surgery, University of Auckland, Auckland; Andrew G Hill, Professor of Surgery, Department of Surgery, University of Auckland, Auckland, New Zealand.
Corresponding author:
Sanjeev Krishna, South Auckland Clinical Campus, Level 2, North Wing, Esme Green Building, Middlemore Hospital, Otahuhu, Auckland, New Zealand.
Sanjeev.Krishna@middlemore.co.nz

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