

Beware of the bicycle! An increase in paediatric bicycle related injuries during the COVID-19 period in Western Australia

Sarah van Oudtshoorn ,* Kei Y. C. Chiut and Japinder Khosa*

*Paediatric Surgery Department, Perth Children's Hospital, Perth, Western Australia, Australia and

†Emergency Department, Perth Children's Hospital, Perth, Western Australia, Australia

Key words

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Correspondence

Dr Sarah van Oudtshoorn, Paediatric Surgery Department, Perth Children's Hospital, 15 Hospital Avenue, Nedlands, WA 6009, Australia.
Email: sarah.vanoudtshoorn@health.wa.gov.au

S. van Oudtshoorn MBBS, DRANZCOG;
K. Y. C. Chiut MBBS; **J. Khosa** MBBS, FRACS.

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Abstract

Background: In Western Australia, the media has reported on an increase in the purchasing, repairs and use of bicycles during the COVID-19 period. The study aimed to investigate for a relationship in bicycle related injuries in the paediatric population during the time of COVID-19 restrictions.

Methods: A retrospective study of the incident of motorized and non-motorized bicycle related injuries and trauma presentations during the COVID-19 'shutdown' period from March to June 2020. Data were collected from the Emergency Department Information System, discharge summaries, operation and radiology reports. The data presented is from Perth Children's Hospital, the only tertiary paediatric hospital and the only referral centre for childhood trauma in the state of Western Australia. Participants were children aged 15 years and younger attending the emergency department (ED) at Perth Children's Hospital during the designated time period. The primary outcomes included total ED presentations, bicycle related presentations and bicycle related admissions during the COVID-19 period.

Results: Bicycle related presentations to the ED increased by 42.7% over the COVID-19 period from 1.4% to 3.0% of all children attending the ED. Children admitted to the hospital with bicycle related injuries or trauma increased by 48.7% from 76 to 113 children in comparison to the same period in 2019.

Conclusion: During the period of COVID-19 restrictions, paediatric ED presentations decreased dramatically, but bicycle related injuries and trauma increased substantially. Safety equipment including helmets and protective gear should be worn for all children riding bicycles, and social distancing should be maintained.

Introduction

During the COVID-19 'shutdown' period in Western Australia, bicycle sales, repair shops and cycle paths saw an increase in popularity and demand.¹ Traffic on cycle paths increased by nearly 300% in April and May in Perth at popular locations such as the South Perth foreshore and Leighton Beach.² Bike riding provided an alternative to public transport, and a form of outdoor exercise and leisure which could be done within the parameters of social distancing. One Australian media article even declared bicycles as 'the new toilet paper' of the coronavirus pandemic.³

The coronavirus pandemic in Australia caused the shutdown of gyms, sporting teams, public gatherings and recreational centres across Australia in 2020. In Western Australia, a state of emergency

was announced on the 15th of March,⁴ and a hard state border was created on the 5th of April.⁵ Children were also encouraged to stay home from school, if possible, from the 30th of March to the 18th May.^{6,7} Phase 4 easing of restrictions occurred on the 27th of June 2020, which allowed larger public gatherings, and major sporting venues to have spectators at 50% capacity.⁸

Across Australia and the world, the COVID-19 period has resulted in changes to the number and types of trauma and injuries presenting to emergency departments (EDs). During this time, the Paediatric Surgery Department at Perth Children's Hospital noticed anecdotally an increase in bicycle related trauma presentations.

The aim of this study was to investigate the rates of bicycle related ED presentations, trauma admissions, surgical procedures and severity of injuries during the COVID-19 period.

Methods

This is a retrospective single-centre study from the only tertiary paediatric hospital in Western Australia, which is also the state-wide trauma referral centre for all children aged 15 years and younger. Data were collected inclusively from the 1st of March 2020 to the 30th of June 2020. These dates corresponded to the peak of the COVID-19 restriction period in Western Australia. This COVID-19 period was compared to data collected from 2019 during the same time frame.

An ethics application was completed prior to commencing this study, and provided approval for publication (Child and Adolescent Health Service, Surgical Committee, GEKO application 35577). Initially data were retrieved from an electronic 'key word' search of the ED triage and management system (EDIS – Emergency Department Information System) for the following terms: 'bike', 'bicycle', 'motorbike', 'pedal bike', 'pedal bicycle', 'bmx', 'dirt bike', 'cyclist', 'bicyclist', 'biking', 'cycled', 'handlebar', 'motorcycle', 'motorcyclist', 'pocket bike', 'mini bike', 'dirt bike', 'moped', 'mba', 'scooter', 'motorcross', 'motorx', 'atv', 'all terrain vehicle', 'quad bike', 'quad cycle', 'quadricycle', 'two-wheeler', 'three-wheeler' and 'four-wheeler'.

Patients who were flagged from this EDIS search and admitted during the reference period in 2019 and 2020 had their discharge summaries, operation reports and radiology images reviewed for additional data on the length of hospital admission, type of injuries and need for surgery or intensive care unit (ICU) admission. Data were also collected on the type of bike responsible for the injuries. Patients were excluded on this detailed review if their injuries were not directly related to bike riding (see Fig. 1).

The data were organized and analysed to demonstrate basic demographics, and the chi-squared test with a *P*-value of <0.05 for significance was used to investigate for statistically significant relationships between variables.

Results

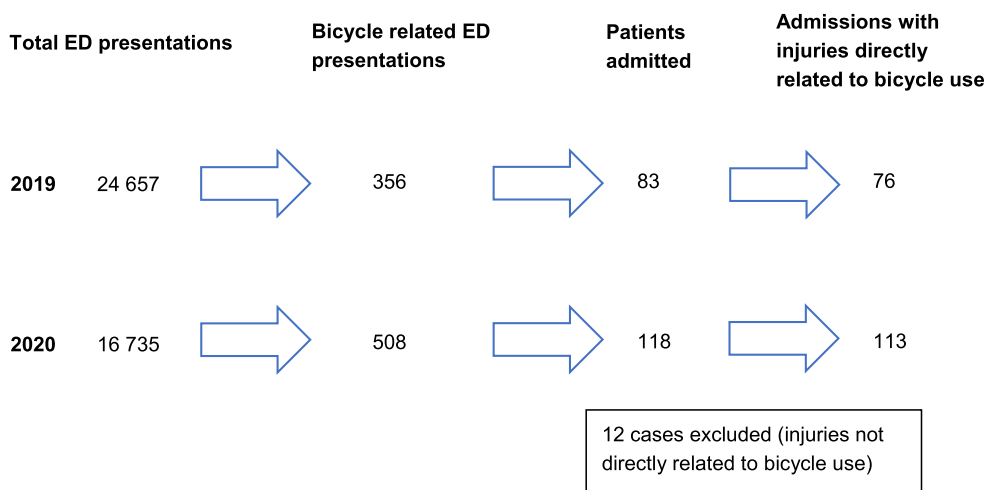
During the peak of the COVID-19 'shutdown' period in Western Australia from 1 March 2020 to 30 June 2020, there was a decrease

in both ED presentations and admissions at Perth Children's Hospital. Paediatric ED presentations decreased by 32% from 24 657 in the 2019 period, to 16 735 presentations to ED in the 2020 coronavirus 'shutdown' period. There were 508 bicycle related ED presentations during this period in 2020, making up 3.0% of total ED presentations. This can be compared to 356 of bicycle related presentations in 2019, which made up only 1.4% of total ED presentations (see Fig. 2). This was an increase in bicycle related presentations by 42.7% (*P*-value <0.00001). The busiest month for bicycle related ED presentations was April 2020, during which only 3185 patients presented to ED, but 5.6% (*n* = 178) had bicycle related presentations recorded on EDIS.

Overall admissions from the ED during March to June 2020 decreased by 24.3% compared to 2019. Hospital admission rates for children presenting to ED with bicycle injuries and trauma remained stable; however, the number of admissions increased by 48.7% from 76 to 113 patients. In the 2019 period, 1.64% of the 4646 children admitted to the ED had an injury directly from bicycle use, compared to 3.22% of the 3516 ED admissions that occurred in 2020 (*P*-value <0.00001). The number of hospital admissions from bicycle related ED presentations was 83 children in 2019, and 118 children in 2020, of which 76 and 113 children, respectively, had injuries or trauma directly related to motorized or non-motorized bicycle use. The 12 children excluded had an admission 'related' to bicycle use (i.e. patient included from keyword search of EDIS) but did not have injuries 'directly' caused by bicycle use (i.e. on detailed review had sustained a fall onto bicycle rack, or had scrotal pain after riding a bike) (see Fig. 1), and therefore were not included in any further statistical analysis (i.e. type of vehicle or type of injuries sustained).

Patient demographics for children admitted with a bicycle related injury or trauma between the two comparison periods, remained stable with the mean age staying at 10 years, and the majority of patients were male (71.1% in 2019 and 79.6% in 2020) (see Table 1). The rates of ICU admissions also did not change (2.6% in 2019 and 2.7% in 2020, *P*-value 0.99). The rates of surgical interventions for patients admitted with a bicycle related injury or trauma was 46.1% and 51.3% in 2019 and 2020, respectively,

Fig 1. Flow diagram – total emergency department (ED) presentations, bicycle related ED presentations and patients admitted with bicycle related injuries to Perth Children's Hospital during March to June 2019 and 2020.



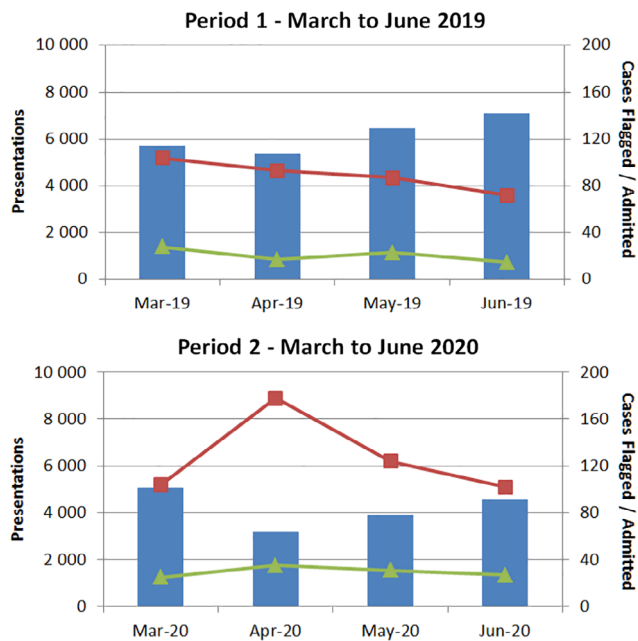


Fig 2. Graph – comparison between March to June 2019 and 2020 of emergency department (ED) presentations, and ED admissions with bicycle related presentations at Perth Children’s Hospital. Total presentations are coloured in blue with incidence along the left side. Cases flagged are coloured in red and are the number of presentations to the ED found on keyword search of EDIS related to bicycle use. Cases flagged and admitted are coloured in green and are the number of admissions from ED found on keyword search of EDIS related to bicycle use.

which was not a statistically significant increase (P -value 0.48). Non-motorized vehicles (i.e. pushbikes, BMX, scooters) were the most common culprit for the injuries (65.8% in 2019 and 67.3% in 2020), and more specifically pushbikes (51.3% in 2019, and 38.9% in 2020 of all admissions with bicycle injuries). The use of motorized vehicles (i.e. motorbikes, quad bikes, motorcross bikes) causing hospital admissions increased from 30.2% ($n = 23$) in 2019 to 32.7% ($n = 37$) in the same period in 2020, but was not statistically significant as a proportion of all children with injuries from bicycle use (P -value 0.86) (see Table 2).

Intra-abdominal injuries from bicycle use from both time periods were low in number, and without any significant change in severity. During the COVID-19 period in 2020 there were three liver lacerations (2 grade 4 lacerations), three splenic lacerations (1 grade 4 laceration), two renal lacerations, two adrenal injuries and two bowel

Table 2 Type of vehicle (motorized or non-motorized) involved in children admitted with injuries or trauma

	March–June 2019, n (%)	March–June 2020, n (%)	P -value
Motorized:			
Total	23 (30.2)	37 (32.7)	0.86
Motorbike	10 (13.2)	24 (21.3)	0.16
Quad bike	5 (6.6)	2 (1.8)	0.086
Motorcross	2 (2.6)	2 (1.8)	0.69
Dirt bike	5 (6.6)	9 (8)	0.72
4 W Buggy	1 (1.3)	0	—
Non-motorized			
Total	50 (65.8)	76 (67.3)	0.86
Pushbike	39 (51.3)	44 (38.9)	0.093
BMX	2 (2.6)	9 (8)	0.12
Mountain bike	2 (2.6)	4 (3.5)	0.73
Scooter	6 (7.9)	18 (15.9)	0.10
Skateboard	1 (1.3)	1 (0.9)	0.78
Not determined	1 (1.3)	0	—
Other			
Exercise bike	1	0	—
Bike chain	1		

injuries. This is in comparison to the 2019 period with four liver lacerations (2 grade 4 lacerations), four splenic lacerations (1 grade 4 lacerations), two renal lacerations, one adrenal injury and 0 bowel injuries (see Table 3). Closed head injuries and concussions occurred in nine children in 2019 and 11 in 2020. Spinal fractures occurred in 10 children in 2019 and six in 2020, while spinal ligamentous injuries increased from three to six children. Other fractures (excluding spinal fractures) increased from 36 to 48 children with increases in facial and nasal fractures, and lower limb long bones (tibia, fibula and femur), but forearm (radius and ulna) fractures remained stable. Burn injuries also increased from one to four children, with the mechanism being friction or motorbike exhaust contact. Other injuries requiring surgery also increased such as lacerations (17 in 2019 to 27 children in 2020), and dental trauma requiring surgery (four in 2019, nine in 2020).

Discussion

In Perth, Western Australia, the coronavirus restriction period presented an excellent opportunity for bike riding for leisure or as a form of transportation. Cycling during this time was supported by the perfect storm of both adults and children having more time at

Table 1 Demographics of children admitted with bicycle related injuries or trauma

	March–June 2019	March–June 2020	P -value
Total number of children admitted with bicycle related injuries	76/4646 (1.64%)	113/3516 (3.22%)	<0.00005
Age (years)	Mean 10.63 (range 2.13–15.83 years)	Mean 10.3 (range 2.82–15.67 years)	—
Male	54/76 (71.1%)	90/113 (79.6%)	0.17
Female	22/76 (28.9%)	23/113 (20.4%)	0.17
Length of stay in hospital (days)	Mean 3.76 (range 1–38)	Mean 2.68 (range 1–34, excluding 1 outlier of 105 days)	—
Intensive care unit admission	2/76 (2.6%)	3/113 (2.7%)	0.99
Surgery required	35/76 (46.1%)	58/113 (51.3%)	0.48

Table 3 Type of injuries sustained in children admitted with bicycle related injuries or trauma

	March– June 2019	March– June 2020	P- value
Intra-abdominal injuries			
Liver laceration (total)	4	3	0.35
Grade 1	0	0	—
Grade 2	1	0	—
Grade 3	1	1	—
Grade 4	2	2	—
Splenic laceration (total)	4	3	0.35
Grade 1	0	1	—
Grade 2	0	1	—
Grade 3	3	0	—
Grade 4	1	1	—
Renal laceration	2	2	0.69
Adrenal injury	1	2	0.81
Bowel injury	0	2	—
Head injuries			
Closed head injury/ concussion	9	11	0.93
Scalp haematoma/ subgaleal haemorrhage	2	2	0.69
Subdural haemorrhage	1	0	—
Diffuse axonal injury	1	0	—
Spinal injuries:			
Spinal fracture	10	6	0.057
Spinal ligamentous injury	3	6	0.67
Fractures			
Any fracture/s (excluding spinal fractures)	36	48	0.51
Forearm (radius/ulnar)	18	19	0.24
Humerus	2	1	0.35
Fingers (phalanx)	3	2	0.36
Scaphoid	0	1	—
Clavicle	2	2	0.69
Rib	2	0	—
Mandible	2	2	0.69
Facial fractures (excluding mandible)	0	2	—
Nasal	0	2	—
Skull	2	0	—
Pelvic	2	1	0.35
Femur	2	4	0.73
Tibia/fibula	2	5	0.52
Foot	3	4	0.88
Burn injuries	1	4	0.35
Other injuries requiring surgery			
Laceration	17	27	0.81
Nail bed injury	3	2	0.36
Traumatic fingertip/toe amputation	1	2	0.81
Dental trauma requiring surgery	4	9	0.47

This table represents the incidence of injuries; some children will be included in multiple categories due to multiple injuries sustained.

home, the shutdown of schools and sporting activities, and the lack of stricter ‘lock down’ restrictions that could have prohibited families from leaving their homes or from travelling around the metropolitan area. These may be the key reasons why bicycle use increased in popularity, and why our data reflect more children injuring themselves on bikes. April 2020 had the highest rates of bicycle related ED presentations, perhaps this was associated to the peak of the shutdowns and children being encouraged to stay home from school during this time.

In comparison to other experiences around Australia, results published from a level 1 adult trauma hospital in Sydney found a decrease by 15.6% in emergency orthopaedic operations during March and April 2020, but a statistically significant increase in bicycle related injuries from 2.9% to 11% of all patients requiring emergency orthopaedic surgery.⁹ Paediatric trauma calls at the Women’s and Children’s Hospital in South Australia, remained unchanged in number during the COVID-19 restriction period, but were unable to comment on the rates of bicycle related injuries. The results from South Australia did, however, make note of a ‘cluster’ of quad bike and motorbike trauma presentations in their data.¹⁰ Recently published in the *Medical Journal of Australia*, trauma statistics from the John Hunter Hospital in Newcastle, NSW during March to May 2020 showed a decrease in trauma admissions, injury severity, and patients requiring surgery, however, there was no change in the type of mechanism of the trauma sustained.¹¹ The Western Sydney Local Health District also shared their ED data in *Medical Journal of Australia* from the 29th March to the 31st of May 2020. Kam *et al.* found an almost 25% decrease in ED presentations, a decrease in admissions from ED, an increase in mental health presentations, but a decrease in wrist or hand fractures.¹²

From an international perspective, paediatric orthopaedic trauma during the COVID-19 period from a Pennsylvania hospital found nearly a 60% decrease in fractures, but also showed an increase in fractures related to bicycle use (18.3% during the COVID-19 period, compared to 8.2% previously).¹³ Data from Waikato Hospital in New Zealand during level 4 lockdown found a 48% reduction in paediatric admissions for injuries, but their combined (paediatric and adult) data provided on bicycle related injuries remained unchanged.¹⁴ Starship Hospital, in Auckland New Zealand, had the lowest rates of paediatric trauma admissions in 5 years during the - COVID-19 level 4 lockdown period, and an increase in bicycle related paediatric trauma admissions from 3.6% to 19%.¹⁵ A paediatric orthopaedic department in Barcelona, Spain, found a decrease in ED presentations for trauma and orthopaedics, but that the number of emergency orthopaedic procedures occurring remained steady.¹⁶

Limitations of this study include that it is a single-centre review, and other centres may have had a different experience during the same time period. There could also be interstate differences, as the - COVID-19 experience has been varied throughout states and regions within Australia. The case numbers regarding specific injuries sustained and ICU admissions are relatively low; therefore, conclusions were unable to be reached from this data set, particularly in regards to severe injuries which are less common. ED presentations decreased substantially during the COVID-19 shutdown period, it is unknown whether there was an increase in less severe injuries (i.e. simple lacerations, dental trauma, suspected fractures) being managed conservatively at home by parents or managed in the community by general practitioners.

Conclusion

During the COVID-19 ‘shutdown’ period in Western Australia, there was a statistically significant increase in bicycle related ED presentations. These findings highlight the importance of

reinforcing bicycle safety education for cyclists and all road users. A future investigation could review if this is a momentary change in recreational activities (i.e. bicycle use) or if these changes will be sustained beyond the COVID-19 period in Western Australia.

Bicycle riding has been shown as an alternative to the use of gyms, team sports and school sporting activities during the time of coronavirus restrictions in Perth. However, with such heavy bicycle traffic on popular bike paths within our city, precautions should also be made to ensure that social distancing is being effectively achieved. If COVID-19 cases increased in Western Australia with local transmission, stricter rules might need to be introduced to space out bicycle traffic, and to decrease the risk of transmission from this popular activity.

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Author contributions

Sarah van Oudtshoorn: Data curation; formal analysis; investigation; methodology; writing-original draft; writing-review & editing. **Kei Yu Chiu:** Data curation; writing-review & editing. **Japinder Khosa:** Conceptualization; supervision; writing-review & editing.

Conflicts of interest

None declared.

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