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INJURY BULLETIN

Pram and Stroller Related Injuries in Queensland Children Under 5 years of age

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Summary

- An estimated 200 Queensland children under 5 years of age are injured every year in incidents involving prams or strollers
- The majority of injuries are due to falls from or falls with the pram or stroller
- Nineteen children were identified as having been caught in the pram or stroller mechanism (13 sustained finger injuries)
- Stairs and escalators were a factor in nearly 10 percent of pram or stroller fall injuries, with children being tipped out of the pram or stroller, or rolling down the stairs in the device.
- Roll away injuries accounted for eight percent of all pram or stroller fall injuries (some also involving stairs)
- Roll away injuries could be prevented by a default brake system similar to airport trolleys.
- Pram or stroller failure was identified in 2% of injuries

Introduction

On 1 July, 2008, the new mandatory standard for prams and strollers released by the Australian Competition and Consumer Commission came into effect [1]. This was developed after several incidents that resulted in the deaths of young children when prams or strollers rolled away from the children's carers. The mandatory standard is based on a portion of the voluntary standard (Australian/New Zealand standard 2088: 2000, *Prams and strollers—safety requirements*) and requires that the pram or stroller has a tether strap that connects the person controlling it, and that the brake device be red for improved visibility[2]. These mandatory requirements were introduced to try to minimise the likelihood of child injury due to loss of control of the pram or stroller by the carer.

Roll away incidents have continued to happen, despite the new mandatory standard and significant media attention to earlier incidents. There was a recent incident at a Melbourne train station where a 6-month-old baby survived after his pram rolled onto the railway tracks in front of an oncoming train[3]. The baby was restrained in his three-wheeled stroller, which rolled onto the railway track when the mother let go of the stroller. The stroller was hit and dragged several metres before the train

stopped. The baby sustained a minor head injury only.

This issue of the bulletin will analyse pram and stroller related injuries in children under 5 years of age in Queensland.

Methods

QISU data is collected at triage in participating emergency departments throughout Queensland. These data are representative of approximately one-quarter of emergency presentations in Queensland. Data were extracted using a keyword and major injury factor code search for "pram" or "stroller" related injuries among children younger than five years of age over a 10-year period, between January 1999 and December 2008. There were 590 cases extracted.

Extracted cases were further investigated by reading text descriptions of mechanisms of injuries in order to exclude injuries not directly related to prams or strollers.

There were 552 cases identified in the QISU data with these criteria. Further analyses were conducted on this dataset.

Death data

A search of the National Coroner's Information System database (NCIS) revealed 6 deaths associated with prams or strollers between 2002 and 2006 in Australia (only those cases where the coronial enquiry was complete can be accessed, so this may under represent the actual number of deaths)[4]. The children were all under 12 months of age, with the youngest being 2 weeks old and the eldest 11 months old. One child appeared to have suffered a SIDS related death (there was insufficient information to fully categorise this child), 4 children died from asphyxia after the pram either tipped and they were trapped or they slid under the front bar, over the back of the hood or over the side of the pram and became tangled in the harness. In all 4 of these deaths the harness was not fastened around the child and the child was put to sleep in the stroller with no direct supervision. In 2006, one child died after his 3-wheeled stroller rolled down an embankment and into the Torrens River, in Adelaide. His mother had stopped walking and had briefly turned away from the stroller, without holding on to the pram or applying the brake, when it rolled away.

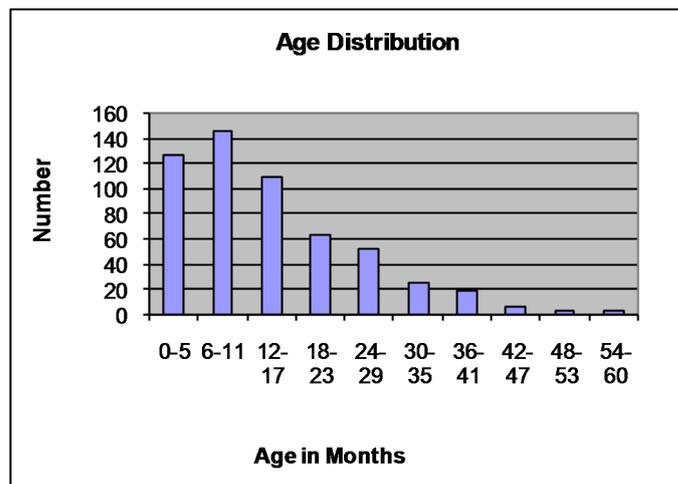
A media search revealed 2 other reports of fatal incidents involving prams or strollers in Australia in the last 5 years. A second child, a 10-month-old girl died after her stroller also rolled into the Torrens River, four months after the event described above [5]. In 2008, a triple fatality followed a pram rolling or tipping off the end of Tathra Wharf in NSW [6]. A 15-month-old boy was restrained in the pram, and it is thought that the 2 year old may have nudged or tried to climb into the pram. Both children fell into the sea and the father and a bystander jumped in to try to save them. The father and both boys drowned.

Results

Demographic Information

There were 552 emergency presentations with pram or stroller related injuries during the 10-year period. The median of annual presentations was 55.6 (range 45 – 79). Among those presentations, 282 (51%) were male.

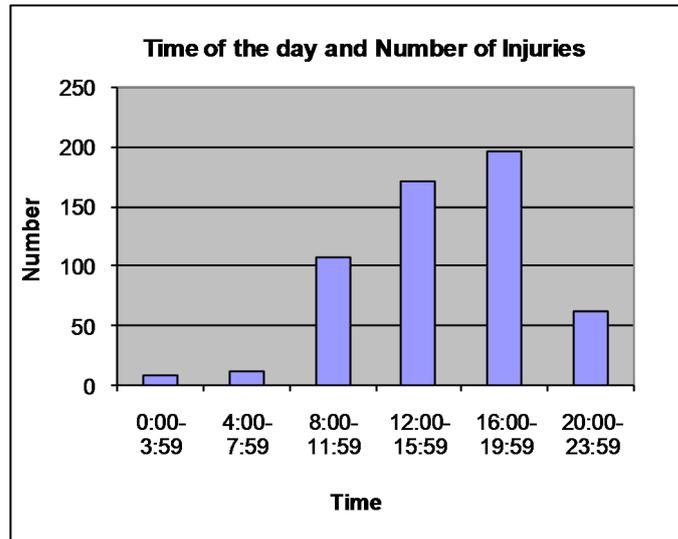
Figure 1. Age distribution of children presenting with pram or stroller related injuries



Time of Injuries

The majority of injuries occurred during the afternoon and evening from noon to 8pm (66.2%, n=368) (Figure 2).

Figure 2. Time of day by number of pram or stroller related injury presentations



The majority of cases were less than 2 years of age (81%, n=447). Median age was 12 months (IQR 6 – 20 months) (Figure 1).

Location of Incidents

Table 1 shows locations where pram or stroller related injuries occurred. Incidents most commonly took place in locations where prams or strollers are used, footpaths, parks, and roadways (36%, n=199). Thirty-nine injuries occurred on stairs and six occurred on escalators where prams or strollers rolled down or tipped

when lifted or manoeuvred.

Four incidents occurred at a railway station, 2 on stairs and 2 on the platform. All four incidents resulted in a fall: in two cases, the pram/stroller fell onto a railway track. None of the children injured at the railway station required resuscitation on presentation to the emergency department, but one (aged 1 month) required admission. The precipitating factor for these incidents is unclear, except for one case, where text information states that the brake failed when the pram was on the platform.

Table 1. Location of pram or stroller related incidents (n=552)

Location	Subtype	Number
Grounds, Road, Street, Car Park	Footpath	83
	Park	46
	Roadway	36
	Car park	24
	Bikeway	3
	Others	7
Subtotal		199
Room or Internal Area	Living/Bedroom	61
	Kitchen/Laundry	17
	Office	9
	Hall	9
	Others	2
Subtotal		98
Part of Building	Stairs	39
	Veranda	12
	Escalator	6
	Others	5
Subtotal		62
Outside	Playground	9
	Swimming pool	2
	Beach	1
Subtotal		12
Structure and Sheds	Garage	8
	Others	1
Subtotal		9
Unspecified		172
Total		552

Mechanism of Injuries

The most common mechanism of pram or stroller related injuries was a fall (92 %, n=507) (Table 2). Of those, 418 children fell from prams or strollers and 89 children fell with them. There were 10 cases in which a child riding in a pram/ stroller was involved in a MVA (hit by a car). In 19 cases, the child became caught in the pram mechanism.

Table 2. Mechanism of pram / stroller related injuries

Mechanism	Number
Fall	507
Caught in Mechanism	19
MVA	10
Unspecified	15
Total	552

FALL INJURIES (n=507)

Factors of Incidents

There are several mechanisms by which children can be injured by a fall associated with a pram or stroller. In this series, children fell out of prams/strollers (418) or fell with prams/strollers (89). Injuries associated with the child falling out of the pram/ stroller, usually indicate that the child was unrestrained at the time, either placed in the pram/ stroller by the carer, but not strapped in, or climbing (in or out), or standing in the pram / stroller.

There was insufficient information to fully explain the trigger for the fall in the majority of cases (71%, n=359 of 507).

Where there was sufficient text to interpret the mechanism of the fall (148), the majority of cases were due to the pram/ stroller tipping (53%, n=79 of 148) (Table 3).

Table 3. Factors of Fall Injuries (n=507)

Stability	fell from	fell with	Grand Total
Child climbed and fell	11		11
Child standing and fell	15		15
Child climbed and tipped		5	5
Tipped	14	39	53
Lifted and tipped	18	3	21
Collapsed	1	3	4
Rolled		34	34
Brake failure and rolled		5	5
Unspecified	359		359
Grand Total	418	89	507

Table 4. Nature of Injuries due to a fall from or with a pram or stroller (n=507)

Nature of Injuries	Number
Intracranial Injuries	194
Abrasion	177
Laceration	67
Fracture	23
Dental/Eye	6
Sprain/Dislocation	5
Others	4
No Injury	21
Unspecified	10
Total	507

Nature of Injuries following a fall (n= 507)

The most common nature of injury following a fall from or with the pram was an intracranial injury (38%, n=194 of 507) followed by an abrasion/

superficial injury (32%, n=177) (Table 4). The head or face was the most common body location for injuries following a fall (88.7%, n=449) (Table 5).

Table 5. Body Location of injuries following a fall from or with a pram/ stroller n=507)

Body Location	Number
Head/Face	449
Extremities	23
Trunk	1
Multiple	4
No Injury	22
Unspecified	8
Total	507

Among children who sustained head or face injuries following a fall from or with a pram/ stroller (n=449), the majority sustained intracranial injuries (predominantly concussion) (43%, n=194), followed by abrasions to the head or face (38% n=171). There were 7 presentations with head or facial fractures following a fall (5 skull fractures and 2 facial fractures).

Table 6. Nature of head or facial injury sustained by children following a fall from or with a pram/ stroller (n=449)

Head/Face Injuries	Number
Intracranial	194
Abrasion	171
Laceration	65
Fracture	7
Eye	3
Dental	3
Other	3
Unspecified	3
Total	449

Table 7: Causes for roll away injuries (n= 39)

Factor	brake failure and rolled	rolled	Grand
Bag snatching		1	1
Driveway		6	6
Railway platform	1	1	2
Slope	1	2	3
Stairs	2	23	25
Unspecified	1	1	2
Grand Total	5	34	39

Roll away injuries

Roll away injuries accounted for 39 fall injuries (8% or 39/507). Five of these were said to have involved failure of the brake and 25 of these involved stairs. Two occurred on a railway platform, with the

child and pram falling onto the railway tracks and six on a driveway. In one case, the sibling was known to have pushed the pram down the stairs.

Stairs and escalators (n = 45)

Overall, 39 pram/stroller fall related injuries occurred on stairs and 6 on escalators (9% or 45/507). Mechanisms include brake failure and the pram rolling down the stairs (2), losing control of the pram/ stroller and it rolling down the stairs (23) and tipping the child out of the pram or stroller when lifting to negotiate the escalator or stairs (20).

Motor Vehicle Crash (MVC) (n=10)

There were 10 pram or stroller related injuries caused by MVC. Four children sustained intracranial injuries and one sustained a skull fracture. The majority of incidents occurred on a roadway. Two incidents occurred in a car park (one when the mother was reversing the car and bumped the pram) and one on the footpath. Two cases required resuscitation on presentation to the ED.

Caught in pram mechanism (n=19)

There were 19 incidents where a part of the child's body was caught in the mechanism of the pram or stroller representing 3% of all pram/ stroller related injuries. Median age for this type of injury was 19 months (IQR: 8.5-27.5)

Three-quarters of these cases (15/19) sustained injuries after being caught in the folding mechanism of the pram, (13 finger injuries, one hand and one wrist). In two of these cases, the pram collapsed and trapped the child's finger.

One finger injury occurred due to the child being caught in the wheel spokes, and another due to the child being caught in the lock mechanism. There were two other injuries (finger and leg) where the mechanism was unclear.

Pram or Stroller Failure

Injury associated with pram failure could be identified in 11 cases. In two cases (as described above) a child's finger was trapped in the folding mechanism when the pram/ stroller collapsed. Five cases of a roll away injury occurred after the brake had been activated but failed. In four cases, the child fell after the pram collapsed; 2 cases where the front wheel gave way and the child fell with the pram, one case where the child fell from the pram after the front step gave way and one case where there was an unspecified breakage and the child fell with the pram.

Severity of injury

Overall, the majority of pram or stroller related injuries were triaged as semi urgent (58% or 318/552) followed by urgent presentations (34% or 186/552). Nineteen cases presented requiring attention within 10 minutes (Table 8), 3 of these required immediate resuscitation. Four cases were due to a MVC, where the child was in the pram and struck

Table 8 High acuity pram or stroller related injuries: mechanism of injury by nature or injury (n=19)

Mechanism	Factor	Crush injury finger	Fracture limb	Abrasion head	Laceration head	Facial fracture	Intracranial injury	Skull fracture	Unspec	Total
caught in mechanism	unspecified	1								1
lifted and tipped	escalator							1		1
	stairs								1	1
tipped	unspecified			1						1
rolled	stairs			2						2
	unspecified						1			1
MVC	footpath							1		1
	road		1				1		1	3
unspecified	unspecified		1		1	1	5			8
Total		1	2	3	1	1	7	2	2	19

by a vehicle (one of these occurred on the footpath). The nature of injuries sustained by these children is described in Table 8. Overall, 97 children were admitted to the presenting hospital and 2 were transferred for further care (99 of 552 or 18%).

Discussion

This report describes the pattern of pram and stroller related injuries for children under 5 years of age in Queensland over the last 10 years. As QISU data are representative of approximately one-quarter of ED presentations, we estimate that every year there are 200 children under 5 years of age who sustain a pram or stroller related injury in Queensland. The mechanisms of these injuries have changed little in 20 years [7], with falls from the pram or stroller predominating. In the report developed by Monash Accident Research Centre in 1990, pram or stroller related falls were associated with children climbing or standing in the pram, the pram tipping and the pram rolling or being pushed down stairs or a slope.

Overall, the majority of children in this report who sustained an injury following a pram or stroller related fall, fell from the pram (82%, 418 of 507) rather than with the pram (89). This suggests that many of these children were unrestrained in the pram; either placed in it and not clipped in, or were climbing in or out of the pram. There was insufficient text description to sufficiently categorise all cases as being restrained or not. In many of the cases, where children were injured whilst negotiating stairs or escalators, the child was said to have slipped or tipped from the pram or stroller, suggesting that they were unrestrained at the time.

Whilst few injuries in this report (11) have been identified as being directly due to product failure (brake failure, pram or stroller collapsing), it is likely that many other injuries occur due to poor product design. The risk of finger amputation when assembling or folding the pram or stroller is inherent in many designs, despite current legal action being taken against one manufacturer following finger amputations in the UK [8] and CPSC recall of strollers [9].

Serial reviews by *Choice* [7,10], have demonstrated shortcomings in the design and manufacture of prams and strollers. In 2007, *Choice* tested 3-wheeled "jogging" strollers to the 2000 Australian Standard [11] and demonstrated that five out of 11 models tested failed the safety test (all due to head entrapment risks) and three failed a durability test, with a loose or broken front wheel. The safety review also tested length and adequacy of the 5 point harness, and adequacy of the brakes (according to the AS).

Coronial findings following pram or stroller related deaths have variably commented on issues relating to the pram or stroller itself. Following two separate incidents where infants died after becoming entangled in the pram/stroller harness, the coroner recommended reviews of pram and stroller performance specifications:

.....That the AS/NZS pram and stroller standard be modified to require stability to a level of foreseeable use (such as sleeping infant left unattended; restraint not used, and the infant is able to move into different positions along the pram/stroller).

and.....*That the manufacturer.... modify the design of its strollers to ensure that the backrest is automatically locked when in the reclined position. Noting that.....modification of the backrest mechanism to include detent buttons, preventing the backrest being moved upright by pulling on the shoulder straps, may reduce the risk of such an unfortunate incident recurring.*

Following the 2 drowning deaths of children whose strollers rolled away from carers into the Torrens River in 2006, calls were made to review the need for barriers along the length of the Torrens pedestrian path [5]. A new mandatory standard came into effect in July 2008, requiring a tether strap for all prams or strollers and improved visibility of the brake system. These measures, however, still require behavioural changes on the part of carers, in order to avoid roll away injuries. Measures following these deaths fell short of requiring a default breaking system or “dead man’s brake” for prams or strollers, as is common on airport trolleys.

As evidenced by the recent incident on a Melbourne train platform, although public awareness of roll away incidents is likely to be high following significant media attention, failure to retain control of prams and strollers still occurs, with potentially dire consequences.

Prevention tips:

1. When purchasing a pram or stroller, ensure that it meets the current Australian Standard and the new requirements of the mandatory standard.
2. Always use the tether strap provided with your pram or stroller when the parking brake is not engaged.
3. If you have a stroller without a tether strap, ask the manufacturer or supplier about retrofitting one.
4. When parking the stroller on a slope, face the stroller perpendicular to the slope to minimise the risk of a roll away incident.
5. Keep your child secured in the 5 point safety harness provided with the product at all times.
6. Don't let the child stand up in the pram or stroller as this could cause it to tip over
7. Where possible, store additional items underneath the pram, rather than balancing them on top or hanging them from the handle and making the pram prone to tipping.
8. Do not leave a sleeping child unsupervised in a pram or stroller.

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Recommendations

1. That the Australian Standard committee for safety requirements for prams and strollers incorporate performance requirements for a default brake system in prams and strollers.
2. That there be enhanced incorporation of knowledge in relation to safety requirements at the design stage of pram and stroller production.
3. That there be enhanced quality assurance and performance testing of prams and strollers pre-market.
4. That there be wider distribution of coronial findings following product-related deaths.
5. That there be systematic and timely adoption of coronial recommendations following product-related deaths.