

Child injury due to falls from playground equipment, Australia 2002–04

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Key findings

Hospitalised injury

- 12,091 cases of playground falls injury in the 0–14 years age group resulted in hospitalisation from July 2002–June 2004.
- Children aged 5–9 years were hospitalised at 3 times the rate of 0–4 year olds, and at four times the rate of 10–14 year olds.
- *Climbing apparatus* were the mechanism of injury for 33% of hospitalised playground fall injuries, followed by *trampolines* (24.6%).
- *Fractures* were the largest injury type (85.2% of cases).
- *Fractures to the forearm* were most common (56% of total fractures).
- *Fractures to the femur* recorded the longest Average length of hospital stay (9.4 days).
- Children aged 5–9 years had the highest proportion of *fractures, intracranial injuries, dislocations, and sprains and strains*.

Deaths

- No deaths attributed to playground injury were identified in the reporting period.

Playground Injuries

This report examines Australian hospital separations and deaths data for injuries coded as being due to unintentional falls involving playground equipment, which were sustained by children aged 0–14 years of age, in the reporting period July 2002–June 2004. Only injuries coded as falls involving playground equipment (W09) are included in this briefing. The ICD-10 cannot differentiate other types of playground injury (e.g. struck by swing, fall on a footpath in a playground). These and other technical points are addressed later in the briefing. A discussion on the current and relevant literature on mechanism and safety issues associated with the playground environment is included in this briefing.

Deaths, Australia, 2002–03 to 2003–04

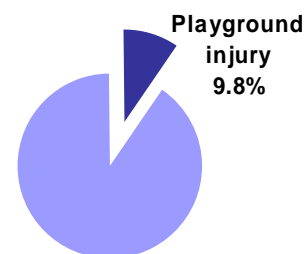
No cases in the ABS deaths data set were found with an Underlying Cause of Death (UCoD) of the ICD-10 (World Health Organisation 1992) code W09 ‘fall involving playground equipment’, within the data period reported. This was verified by a search of the National Coroners Information System (NCIS). A search of the ABS deaths records for the longer period 1997–2004 (calendar years) revealed only 2 deaths with an UCoD coded as W09, neither of which occurred within the data period reported in this briefing and one which occurred at an older age.

Hospitalisations, Australia, 2002–03 to 2003–04

Hospitalised cases of injury in Australia in the study period were coded to the third edition of the ICD-10, Australian Modification (National Centre for Classification in Health 2002). In the 2002–04 reporting period, over 12,000 playground fall injuries resulted in stays in Australian hospitals for children aged 0–14 years, constituting 9.8% of all external cause injury cases for that age group (Table 1). A slightly higher proportion of cases involved males, however the rates for males and females were similar. Female children had a higher proportion of playground fall injuries cases relative to all external cause cases than did males. There were no reported deaths while in hospital resulting from injuries due to playground falls for this age group.

Table 1: Hospital separations due to falls from playground equipment 2002–04, 0–14 year old children by sex, selected indicators; Australia

Indicators	Proportion of all injury separations			
	Males	Females	Persons	Ratios m:f
Number of separations ^a	6,567	5,523	12,091 ^c	1.2
Proportion of all injury separations	8.6%	11.9%	9.8%	0.7
Crude rate/100,000 population	33.3	27.6	30.4	
Age standardised (direct) rate/100,000 population ^b	33.2	29.4	31.3	1.1



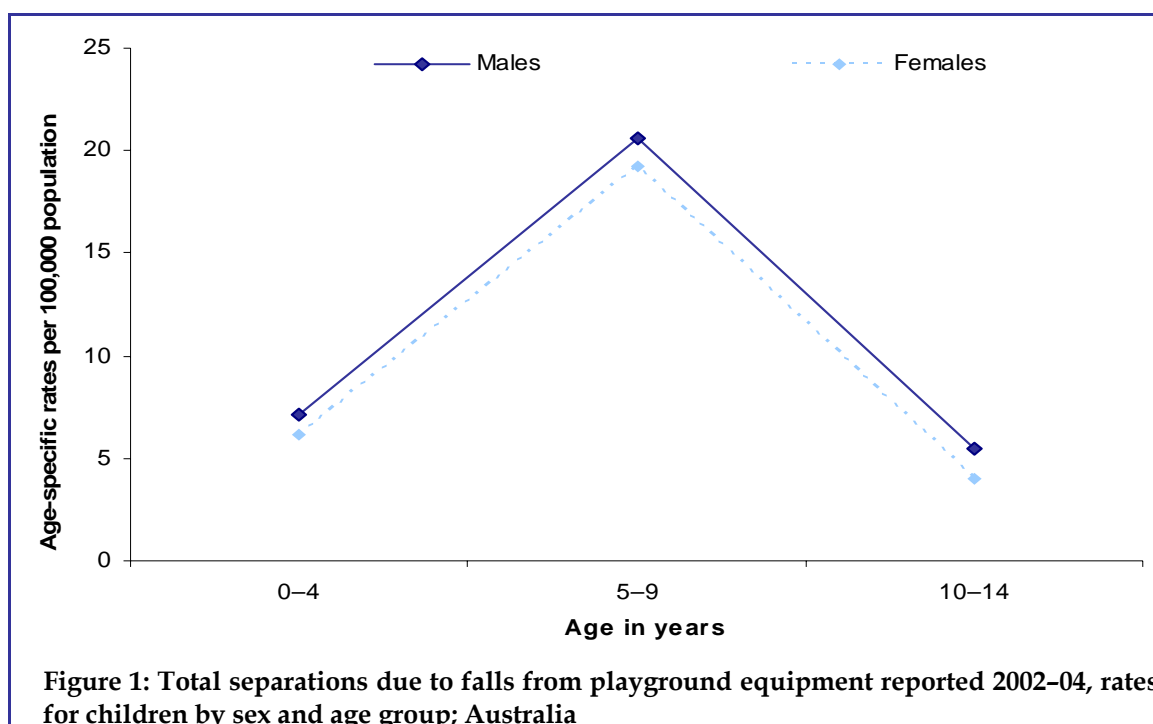
a Includes inward transfer cases.

b Rates are annual averages over the two years 2002–2004, separation numbers are two year totals.

c Person count includes 1 case for which sex was not reported.

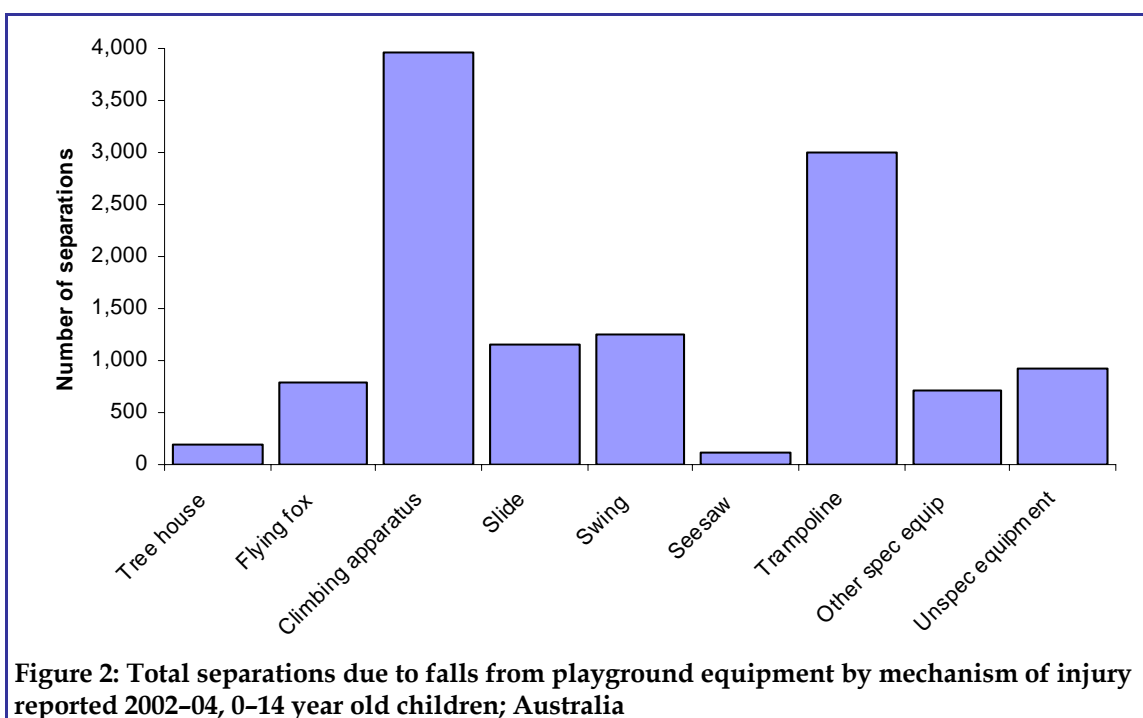
Age and sex distribution

Rates for males and females were similar (Figure 1). Rates for boys were slightly higher than rates for girls. Rates of playground falls were highest in the 5–9 year age group for both males and females. The rate for 5–9 year olds was three times higher than the rate for 0–4 year olds, and four times higher than the rate of playground falls for 10–14 year olds.



Mechanism of injury

Of the nine available fourth character descriptors associated with W09 'fall involving playground equipment', seven relate to specific mechanisms contributing to the injury that resulted in hospitalisation (Figure 2). Of those seven, *climbing apparatus* accounted for one third (32.8%) of all cases in this age group. Injuries involving *trampolines* accounted for the second highest proportion of cases (24.6%), cases involving *swings* (10.3%) and *slides* (9.5%) had similar proportions of cases. A similar distribution of injury across mechanisms for hospital admissions and for Emergency Department presentations was found in a recent Victorian study (Clapperton & Cassell 2005).



The highest age standardised rates of injury for the 0–14 age group were for falls involving *climbing apparatus* (10.3 per 100,000 population per year) and *trampolines* (7.8 per 100,000 population per year) (Table 2). Females were injured at a higher rate than males on *climbing apparatus*, but reported lower rates than males for all other mechanisms of injury. Average length of hospital stay did not differ greatly between groups, though it was highest for falls from seesaws (1.5 days), and falls from trampolines (1.5 days).

Table 2: Total separations due to falls from playground equipment by mechanism of injury reported 2002–04, 0–14 year old children by sex; Australia

Mechanism of injury	Males			Females			Persons		
	Counts	Std rate	ALOS	Counts	Std rate	ALOS	Counts	Std rate	ALOS
Fall involving tree house	113	0.6	1.3	79	0.4	1.3	193 ^a	0.5	1.3
Fall involving flying fox	437	2.3	1.3	351	1.9	1.3	788	2.1	1.3
Fall involving playground climbing apparatus	1,897	9.6	1.3	2,063	11.0	1.3	3,960	10.3	1.3
Fall involving slide	711	3.6	1.4	446	2.4	1.2	1,157	3.0	1.4
Fall involving swing	720	3.6	1.4	535	2.9	1.4	1,255	3.3	1.4
Fall involving seesaw	59	0.3	1.3	54	0.3	1.7	113	0.3	1.5
Fall involving trampoline	1,616	8.2	1.5	1,377	7.3	1.5	2,993	7.8	1.5
Fall other specified playground equipment	424	2.1	1.4	286	1.5	1.5	710	1.8	1.4
Fall unspecified playground equipment	590	3.0	1.4	332	1.8	1.4	922	2.4	1.4
Total	6,567		1.4	5,523		1.4	12,091^a		1.4

Shaded areas indicate highest counts and rates of cases by specified mechanism of injury.

^a Person count includes 1 case sex not reported.

Nature of injury

In 85.2% of separations following falls from playground equipment the Principal diagnosis was a fracture (Table 3). A much smaller proportion of *open wounds* (3.9%) were reported, followed by *intracranial* injuries (2.6%). Boys outnumbered girls for nearly all specified types of injury, though the distribution of types of injury was very similar for both sexes.

Table 3: Total separations due to falls from playground equipment by nature of injury reported 2002–04, 0–14 year old children by sex; Australia

Principal diagnosis	Males		Females		Persons	
	Count	Col %	Count	Col %	Count	Col %
Superficial injury	65	1.0	60	1.1	126 ^a	1.0
Open wound	253	3.9	213	3.9	466	3.9
Fracture ^b	5,563	84.7	4,742	85.9	10,305	85.2
Dislocation	77	1.2	63	1.1	140	1.2
Sprain/strain	35	0.5	32	0.6	67	0.6
Nerve & spinal cord	11	0.2	..	0.1	14	0.1
Blood vessel	..	0.0	4	0.1	7	0.1
Muscle/tendon	5	0.1	9	0.2	14	0.1
Amputation (including partial)	..	0.0	0	0.0	..	0.0
Internal organ	36	0.5	18	0.3	54	0.4
Eye injury (all)	5	0.1	0	0.0	5	0.0
Intracranial	187	2.8	130	2.4	317	2.6
Other specified nature of injury	71	1.1	58	1.1	129	1.1
Unspecified nature of injury	255	3.9	191	3.5	446	3.7
Group total	6,567	100	5,523	100	12,091^a	100

Shaded areas indicate highest counts and proportions of cases by specified nature of injury.

a Person count includes 1 case sex not reported.

b Excludes fracture of the tooth.

Separation counts are two year totals.

Patterns of injury types were similar across the three age groups. The 5–9 year age group had the highest proportion of *fractures* (Table 4). This finding echoes a previous report that found that playground falls involving equipment most commonly resulted in fracture injuries, particularly in the 5–9 years age bracket (Bradley & Harrison 2004) *open wounds* were most common in the 0–4 and 5–9 years age groups, but were much less common for those aged 10–14 years. *intracranial* injuries, *dislocations*, and *sprains and strains* were also higher in the 5–9 year age group. Very few cases involved *blood vessels*, *eyes* or *muscles and tendons*.

Within the 0–4 years age bracket, fourteen cases of injury were reported for infants aged 0–1 year, eight of those cases involved fractures.

Table 4: Total separations due to falls from playground equipment by nature of injury reported 2002–04, children, five year age groups by sex; Australia

Nature of injury	0–4 years		5–9 years		10–14 years		Group total	
	Count	Col %	Count	Col %	Count	Col %	Count	Col %
Superficial injury	48	1.9	44	0.6	34	1.8	126 ^a	1.0
Open wound	215	8.4	203	2.7	48	2.6	466	3.9
Fracture ^b	1,960	76.3	6,863	89.8	1,482	78.9	10,305	85.2
Dislocation	16	0.6	70	0.9	54	2.9	140	1.2
Sprain/strain	17	0.7	34	0.4	16	0.9	67	0.6
Nerve & spinal cord	0	0.0	6	0.1	8	0.4	14	0.1
Blood vessel	..	0.1	..	0.0	..	0.1	7	0.1
Muscle/tendon	..	0.1	9	0.1	..	0.2	14	0.1
Amputation (inc partial)	..	0.0	0	0.0	0	0.0	..	0.0
Internal organ	..	0.1	36	0.5	16	0.9	54	0.4
Eye injury (all)	..	0.1	..	0.0	..	0.1	5	0.0
Intracranial	88	3.4	145	1.9	84	4.5	317	2.6
Other spec nature of injury	55	2.1	50	0.7	24	1.3	129	1.1
Unspecified nature of injury	160	6.2	179	2.3	107	5.7	446	3.7
Age group total	2,569	100.0	7,644	100.0	1,878	100.0	12,091	100.0

a Person count includes 1 case sex not reported.

b Excludes fracture of the tooth.

Shaded areas indicate highest counts and proportions of cases by specified nature of injury per age group. Separation counts are two year totals.

Fractures in detail

As fractures constituted the highest proportion of injury type (85% of all hospitalised injury due to falls involving playground equipment), a closer look at the types of fracture is warranted. For a total of 10,305 fractures (excluding fractures of the tooth), 14,338 bed days were reported (Table 5). The largest proportion of fractures were those to the *forearm* (56% of total), followed by fractures to the *shoulder and upper arm* (23.6). Fractures to the *lower leg, including ankle* (12%) were next most frequent. Fractures to the *femur* were much less frequent (1.8% of total). Similarly, fractures to the *neck* and to the *lumbar spine and pelvis* were low in number.

Table 5: Total separations due by type of fracture due to falls from playground equipment reported 2002–04, 5 year age groups by sex; Australia

Type of fracture	0–4 years		5–9 years		10–14 years		Group total	
	Males	Females	Males	Females	Males	Females	Count	ALOS
S02 skull/facial bones ^a	17	16	17	19	11	4	84	1.4
S12 neck	..	..	..	..	..	..	12	4.8
S22 rib/sternum/thor spine	0	..	..	..	4	..	14	2.0
S32 lumbar spine/pelvis	0	0	..	..	..	..	6	4.8
S42 shoulder/upper arm	306	339	789	838	88	88	2,448	1.0
S52 forearm	590	435	2,663	2,248	669	419	7,024	1.0
S62 wrist and hand	..	..	14	8	18	10	56	1.1
S72 femur	57	36	47	23	11	10	184	9.4
S82 lower leg inc ankle	74	72	86	90	71	57	450	1.8
S92 foot, except ankle	4	..	5	..	7	7	27	1.7
Total specified fractures	1,054	906	3,628	3,236	881	600	10,305	1.4

^a Excludes fracture of the tooth.

Length of stay

For total playground injuries, there was no difference in average length of stay between males and females (Table 6). For specified body regions, female children reported a slightly longer ALOS for *trunk* injuries than male children, and male children reported a longer ALOS than female children for injuries to the *hip and lower limb*. Same day stays made up 48% of total bed days for cases of injury to the *Head*, 20% of total bed days for *trunk* injuries, 22% of bed days for injuries to the *shoulder and upper limbs*, and 7% of bed days for injuries to the *hip and lower limbs*. Average length of stay by type of *Fracture* is reported in Table 5. Fractures to the *femur* resulted in an average stay of 9.4 bed days per case, followed by fractures to the *neck* and to the *lumbar spine*, both with an average of 4.8 bed days.

Table 6: Length of hospital stay due to falls from playground equipment by body region of injury reported 2002–04, 0–14 year old children by sex; Australia

Principal diagnosis by body region		Head	Trunk	Shoulder/ upper limb	Hip/ lower limb	Body region not spec	Total
Males	Cases	696	203	5,234	423	11	6,567
	Same day	366	82	1,386	98	5	1,937
	Total days	769	363	6,236	1,680	11	9,059
	ALOS	1.1	1.8	1.2	4.0	1.0	1.4
Females	Cases	514	184	4,476	339	10	5,523
	Same day	281	70	1,217	82	5	1,655
	Total days	571	391	5,488	1,055	14	7,519
	ALOS	1.1	2.1	1.2	3.1	1.4	1.4
Persons	Cases	1,211	387	9,710	762	21	12,091
	Same day	647	152	2,603	180	10	3,592
	Total days	1,341	754	11,724	2,735	25	16,579
	ALOS	1.1	1.9	1.2	3.6	1.2	1.4

Although the 5–9 year age group reported the highest proportion of hospitalised cases, this age group recorded the lowest ALOS (Table 7).

Table 7: Length of hospital stay due to falls from playground equipment reported 2002–04, 0–14 year old children by 5 year age group; Australia

	0–4 years	5–9 years	10–14 years	Group total
Cases	2,569	7,644	1,878	12,091
Total bed days	3,803	9,985	2,791	16,579
ALOS	1.5	1.3	1.5	1.4

Discussion

Falls are the most common reason for children to be admitted to hospital, and falls from playground equipment are the most common types of fall (Nixon et al. 2001). An analysis of Victorian Emergency Department data showed that falls accounted for nearly 90% of playground equipment injuries (Clapperton & Cassell 2005). The same report found that playground equipment was the grouping of consumer products that was linked to the highest number of hospital injury admissions for children. For the 2001–02 reporting period, playground falls accounted for approximately 24% of all falls hospitalisations for 0–14 year olds, with 5–9 year olds having the highest proportion of cases (Berry & Harrison 2006). This briefing found that the most common injury type resulting from playground falls is fractures (85.2% of total, Table 4).

The playground environment

The condition or state of repair of equipment, including the height of apparatus and the nature and depth of the playing surface are major risk factors (Laforest et al. 2001; Nixon et al. 2001; Sherker & Ozanne-Smith 2004).

Several standards exist in relation to general safety requirements, in relation to installation, inspection and maintenance and operation of playground equipment and surfacing in Australia (Standards Australia and Standards New Zealand 1996; Standards Australia and Standards New Zealand 1997; Standards Australia International 2004a). There are additional standards for specific apparatus such as swings (Standards Australia International 2004b), slides (Standards Australia International 2004c), runways (flying fox apparatus) (Standards Australia International 2004d), rocking equipment (Standards Australia International 2004f) and carousels (Standards Australia International 2004e). There is also a standard that covers trampoline safety requirements (AS4989–2003).

Although standards exist for many aspects of playground equipment and environment, unless all aspects are addressed simultaneously, risk of preventable injury remains. For example, a Victorian study found that for all arm fractures sustained in playgrounds, 85% of those playgrounds conformed to the equipment height limits and recommended surface type, but that less than 5% of those playgrounds complied with the recommended depth of surfacing material (Sherker & Ozanne-Smith 2004). The same study noted that the safety standards focussed on minimising the potential for fatal head injury, and that while hospitalisation for playground injury was increasing in Victoria, it was due mainly to an increase in arm fractures, not head injuries. A conclusion of the Victorian study was that even where impact attenuation (the degree to which the surface deforms and reduces the impact of the object/child) was within the parameters of the standard, arm fractures were frequent, suggesting that current standards do not adequately guard against this injury type.

In a report analysing hospital episodes and Emergency Department presentations due to playground injury for the financial years 2002–2004 in Victoria, arm fractures were identified as the largest type of injury (Clapperton & Cassell 2005). For both Victorian ED presentations and admissions, the most frequent mechanism of injury was climbing apparatus/monkey bars, followed by trampolines, slides, swings and flying fox apparatus, in common with the findings of this report.

Data issues

Hospital cases in this briefing were coded to the third edition of the International Classification of Diseases, Version 10, Australian Modification (ICD-10-AM)(National Centre for Classification in Health 2002). The selection criterion was all separations where the Principal diagnosis code was in the range S00–T75 or T79, and external cause code W09 appears anywhere in the record.

Deaths occurring in Australia during the reporting period were coded to the tenth revision of the International Classification of Diseases (ICD-10). This revision contains the Falls code W09 '*fall involving playground equipment*', but does not have the added specificity of the fourth character descriptors that are available in the morbidity coding. No cases with this code were identified in the reporting period.

ICD-10-AM Place of occurrence codes cover many situations, but *playground* is not specifically indicated in the morbidity or the mortality coding. This briefing does not represent all cases of injury occurring in playgrounds, only those that fit the coding criteria. Within the morbidity fourth character descriptors, mechanisms are listed that are less likely to be widely available in public playgrounds (such as *trampolines* and *treehouses*), and more likely to be found on private properties. In accordance with this, it must be acknowledged that a proportion of cases in this briefing may have occurred in the grounds of private homes, schools or places other than what might be expected to be described as public playgrounds, but where the mechanism of injury has been reported as being playground equipment. It is also not possible to discern injuries occurring in commercial, fee paying playgrounds or play cafes.

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