International Journal of Injury Control and Safety Promotion, Vol. 14, No. 1, March 2007, 49 – 53

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Trends in fall injuries associated with children's outdoor climbing frames

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(*Received 15 March 2006; in final form 6 June 2006*)

Falls from publicly owned climbing equipment are often cited as the major cause of injury on children's outdoor playgrounds and have been the focus of substantial interventions in the UK since the early 1980s. Analysis of national data on falls from climbing frames for 1988 to 2002 shows that the main discernible trend during this period is an increase in the occurrence of injuries to the lower arm. Whether this is attributable to a behavioural response to some of the interventions, or to some other factor, is unknown.

Keywords: Children; Playgrounds; Climbing frames; Falls; Risk; Safety

1. Introduction

Within the child health community in the UK, falls from playground equipment have been identified as a matter of concern since the 1970s (Illingworth *et al*. 1975, Rivers *et al*. 1979). As a consequence, from the 1980s, a number of major safety interventions were gradually phased in and other changes, in the form of social adjustments, progressively ensued. Interventions included the use of formal risk assessment in the playground environment, a voluntary but often rigorous system of equipment inspection, new standards and various technological measures including the widespread installation of impact absorbing surfacing. The temporal evolution of these influences on children's play provision is dimly understood, although some attempt to reconstruct the history of one, the introduction of impact absorbing surfacing, has been made (Ball 2004). More importantly, the collective expenditure to date on these measures in the UK in terms of capital and revenue costs is possibly of the order of £0.5 billion. For this reason, as well as that of child welfare, it is appropriate to consider the available evidence regarding their benefits in terms of risk reduction (Jarvis *et al*. 1995). This paper seeks to do this by examining information on reported accidents involving falls from climbing frames. Such data are often considered to provide the final proof of whether or not interventions are effective.

2. Method

The UK Department of Trade and Industry maintained a national Leisure Accident Surveillance System (LASS) from 1988 until 2002. This system was based upon attendances at a representative sample (sample size in the range of 2 – 5%) of hospital Accident and Emergency (A&E) Departments around the UK, including the collation of personal details and information relating to the incident that led to the attendance. With regard to this paper, it is pointed out that LASS data relate to public playgrounds and equipment, not equipment in domestic environments. This system has been interrogated for information relating to climbing frames in particular, including numbers of cases, types and severity of injuries, temporal trends and contributory factors. There are no other equivalent data in the UK with anything approaching the stature of the LASS data other than fatality records kept by the UK Health & Safety Executive. However, fatalities associated with UK playground equipment of any

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International Journal of Injury Control and Safety Promotion
ISSN 1745-7300 print/ISSN 1745-7319 online © 2007 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/17457300600890137

type are exceedingly rare and do not add to this analysis, although for other purposes such information is necessary (Ball 2004).

The LASS data were subjected to some quality control checks because earlier studies have identified the presence of anomalies (Ball 2002). For example, some cases assigned to outdoor playgrounds simply happened elsewhere and, from the perspective of this analysis, judgements about what was rightly attributable to an item of playground equipment needed to be checked (e.g. playground injuries resulting from such items as cricket bats, catapults and fires were considered not relevant to this study). Quality checks required, in some cases, perusal of individual case records. This led in addition to the detection, at high levels of resolution, of apparent changes in coding practices over the period of study. These also caution against a too literal interpretation of the data.

3. Results

Figure 1 shows the trend from 1988 to 2002 of the reported A&E cases for which various items of playground equipment were named in the LASS records. This does not necessarily signify that the equipment was to blame for what occurred, since the detailed records indicate that many cases were attributable to behaviour and other factors (Ball 2002). Nonetheless, so far as climbing frames are concerned, these would appear to have usurped swings as the front-runner during this period. Thus, whereas cases involving swings have reduced quite considerably, from about 25 000 per annum in the late 1980s to 15 000 per annum in 2002, there is some evidence that there may have been an increase in cases involving climbing frames from about 15 000 to 18 000 per annum. Overall, climbing frames have been found to be associated by name with about 25% of playground equipment-related cases in the late 1980s rising to about 35% more recently. About 75% of cases naming climbing equipment also refer to falling as a factor.

Figure 2 shows trends in body part injured in all cases mentioning climbing frames. It appears from this that cases involving hands, arms and shoulders have risen, whereas injuries to other body parts are fairly static. By 2002 the upper limb accounted for half of the injuries being incurred. These upper limb cases are further investigated in figure 3, which shows in greater detail the location of the injury. From this it can be seen that the increase is associated with the lower arm/radius/ulna, elbow and wrist/carpus. The majority of these injuries, 70% or more, are attributed to falls.

Finally, table 1 looks at trends in outcomes, with the focus on head injuries. Head injuries are chosen here because the design intent of the safety intervention known as impact-absorbing surfacing was to reduce the risk of life-threatening brain injuries resulting from direct forehead impacts onto the ground (King and Ball 1989). During this period, this intervention was being implemented (Ball 2004). The outcomes have been sorted into three categories based on descriptions in the LASS data and these are described here as 'apparently minor', 'referred to some other clinic or hospital' and 'inpatient.' In reality these can only be very crude indicators of severity but they are arguably the best available in the LASS dataset. The cases include all those described as relating to a fall from one level to another and involving brain, skull or head.

4. Discussion

With reference to the data in figure 1, interpretation is hampered because exposure cannot be quantified. There are no national data on usage of UK playgrounds let alone usage of individual categories of equipment. The firm belief within the play sector is that playground usage diminished over the study period, and that there were fewer playgrounds available, implying that exposure also diminished. This is consistent with the parallel and more widely held perspective that British children are becoming more obese,

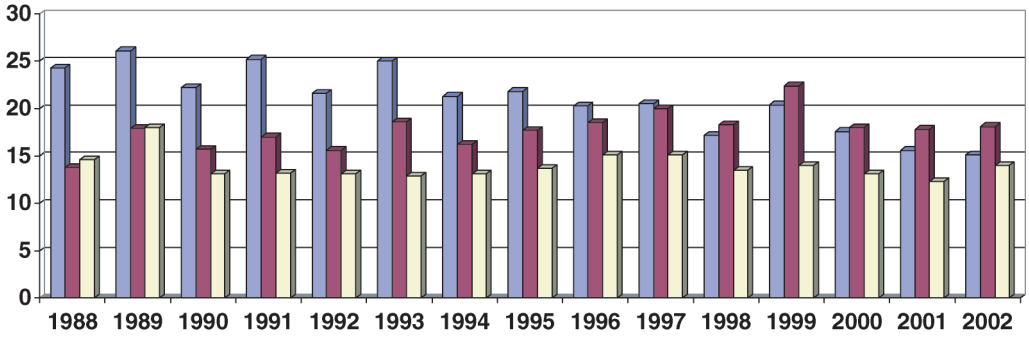

Figure 1. Trends in LASS-reported A&E cases (thousands) for selected items of playground equipment. No allowance for usage or availability is made here. *Note*: (left to right) swings; climbing frames; slides.

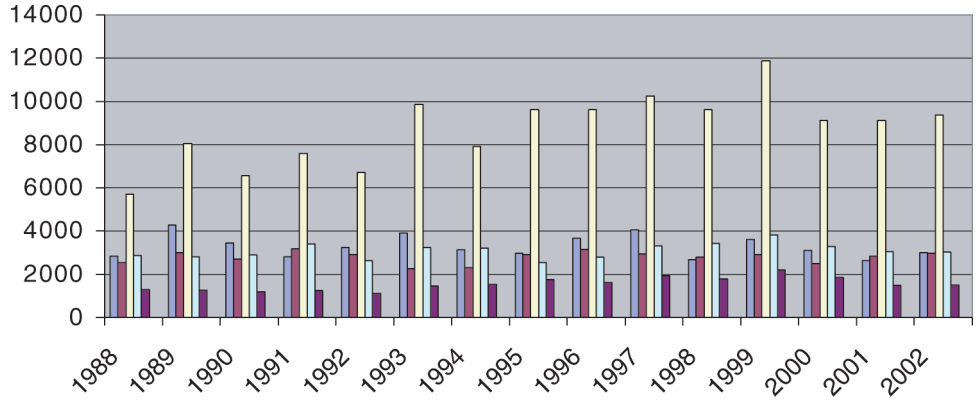

Figure 2. Annual numbers of A&E cases associated with climbing frames in terms of body region affected. *Note*: individual cases may involve several body parts. (Left to right) facial; head/skull; hand/arm/shoulder; lower limb/foot; other.

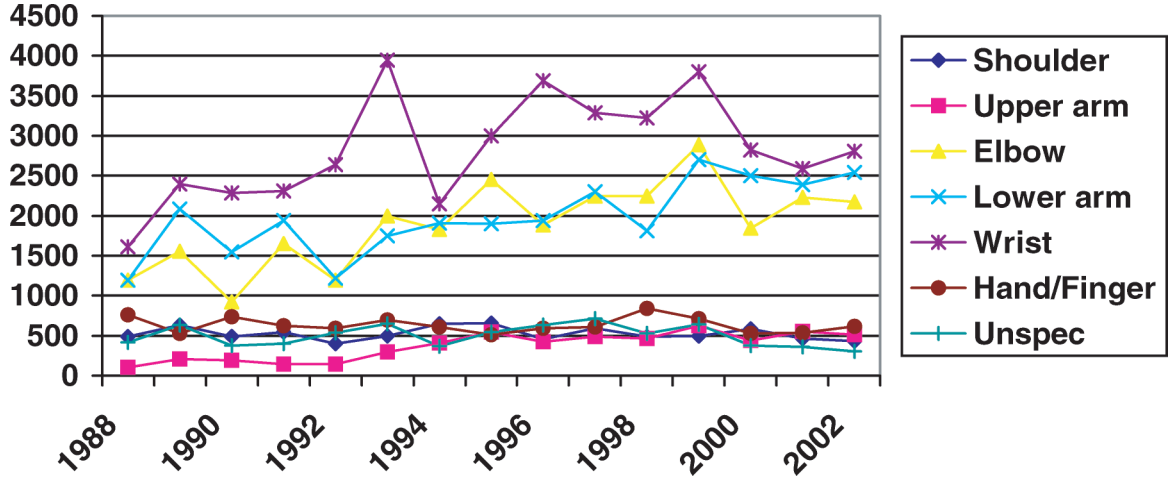

Figure 3. The location of upper limb injuries for all climbing frame cases.

Table 1. National estimates of numbers of climbing frame, fall-related, head injury cases sorted by outcome.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Minor	878	600	952	1197	1221	900	609	915	1191	1103	1035	1225	993	1017	1312
Referred	667	671	707	798	568	300	284	366	327	374	273	183	337	214	164
Admitted	176	282	272	285	341	50	122	73	192	79	78	73	71	107	62
Total*	1720	1553	1958	2280	2187	1250	1056	1354	1729	1557	1406	1481	1437	1357	1558

*Includes a few cases of 'other' and 'unknown'.

which in turn is associated to some degree with less physical activity. If true, this would indicate that the risk of A&E attendance per exposure to play equipment has actually increased over the study period.

Concerning the apparent changeover in the relative number of climbing frame and swing-related cases, this is almost certainly dominated by the demise, although unquantified, of swings on playgrounds. Swings are far less common now, not because of any expressed lack of interest by children, but because of an increased risk aversion by providers, insurers and the like to the obvious hazards that they pose. Second, with the advent of modular

equipment, it is plausible that some equipment items are simply being designated as 'climbing equipment' in the absence of any more obvious descriptor.

Figure 2, of climbing frame cases (all causes) by crude body part injured, shows that upper limb injuries have increased over the period and account for most of the change in number of climbing frame cases. Figure 3 shows the growth in number of these upper limb injuries to be associated with injuries to the lower arm, elbow and wrist primarily, many of which are classified in LASS as fractures and most of which are associated with falls.

One can only speculate about what might underlie such a trend. Some case–control studies of playground safety interventions such as impact-absorbing surfacing (e.g. Chalmers *et al*. 1996) discern a reduction in risk factor from falls associated with the use of these products, which appears to be operative beyond the realm of life-threatening brain injuries for which they were designed. Given that the usage of these products has become widespread in the UK during the period covered by this study (Ball 2004), one might have expected a reduction in limb injuries as well as head injuries. However, such studies do not account for possible behavioural adaptations that might ensue in the presence of such interventions. Behaviour is an extremely important determinant of playground accidents (Pain 1992), almost certainly outweighing that of surface type, and could manifest itself, for example, through childhood antics on the playground or via the degree of supervision that parents perceive as necessary. Viscusi (1992) has described such 'lulling effects' in other contexts, and Graham and Wiener (1995) provide copious examples of safety interventions that have either transferred risks to other parties or transformed them into some other danger.

In terms of the effectiveness of impact-absorbing surfaces as a risk reduction measure for climbing frames, biomechanical studies suggest that for falls onto outstretched arms, compliant surfaces alone may be inadequate to attenuate the risk of fracture (Robinovitch and Chiu 1998). Robinovitch and Chiu suggest that height restrictions would also be required were further risk reduction required, a measure that has also been proposed by Chalmers *et al*. (1996). This, however, prompts the further debate about the nature of play and the significance of risk on playgrounds. Some agencies maintain that children need and want to take risks (UK Play Safety Forum 2002), and that 'emasculation' of playgrounds merely drives children into other pursuits that may be more dangerous still. Such debates are trans-science, being anchored in ethical dilemmas (Jaeger *et al*. 2001).

Finally, there remains the issue of whether or not the significant capital and revenue interventions since the 1980s might perhaps have had a beneficial effect in terms of lessened injury severity, even if a reduction in injury rates cannot be claimed. It has often been argued that the benefit, for example, of impact-absorbing surfacing, is that the severity of injuries is reduced, in particular head injuries, these being the focus of this intervention. LASS data are not particularly well-suited to addressing this question, although they do provide some information on body part affected and the nature of the subsequent treatment.

Table 1 summarizes an attempt at categorizing the LASS data for head injuries arising from falls into lesser and potentially more serious injuries. The data in the table, which are national estimates based on the LASS cases, are not easily interpreted. It would appear, however, that there has been a reduction in the proportion of fall head injury cases involving referral or being an inpatient from about 50% to 20% during the period of study. What this signifies, however, is unclear and uncertain. The numbers of actual admission cases involving the head, falls and climbing frames recorded by LASS even in the 1980s was only in the range of five to ten, so the numbers involved are very small. It is also conceivable that changes in health service provision and A&E practices might have influenced the distribution of outcomes, as might other factors such as the readiness with which parents and guardians take their wards to A&E departments. The hard evidence, therefore, of a reduction in injury severity, remains very weak.

Acknowledgements

The views expressed here are the responsibility of the author. Thanks are due to the Health & Safety Executive for sponsoring part of the work underpinning this paper (Contract CRR 426/2002) and to Louise Neel and Dianne Hooper at the Royal Society for Prevention of Accidents for data provision.

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