

# Injury surveillance in children — usefulness of a centralised database of accident and emergency attendances

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## Abstract

**Objective**—To assess the usefulness of a centralised injury database in monitoring progress towards nationally set health targets for the reduction of childhood injuries.

**Setting**—West Glamorgan County, Wales.

**Methods**—Analysis was undertaken of data held in the West Glamorgan injury database which amalgamates population data with data from the three hospital units covering a population of 370 000. All first attendances due to a new injury in children aged 0–14 occurring in 1993 were analysed, with subgroup analysis for injuries occurring in the home and injuries resulting in fractures. Standardised injury ratios were compared with the distance travelled, car ownership, and Townsend index of deprivation at the ward level, using multiple linear regression.

**Results**—A total of 10 117 first time visits due to injuries were recorded, representing a rate of 182 injuries/1000 children aged 0–14 in West Glamorgan County. Distance from home to the accident and emergency departments was inversely correlated with total injury attendances, and injuries occurring at home, but not with injuries resulting in fractures. Visit rates for any type of injury were not associated with local car ownership rates or deprivation indices.

**Conclusions**—Proximity to accident and emergency departments is a strong determinant of the use of the service by children with overall injuries, and injuries occurring at home. The lack of a significant association between travel distance and injuries resulting in fractures suggests that it is more meaningful to use a centralised database of accident and emergency department attendances to monitor the more severe spectrum of childhood injuries in assessing progress towards national targets for their reduction. The absence of an association between severe injuries and local socioeconomic factors suggests that national targets for the reduction of socioeconomic differentials in childhood

injuries may need to be reassessed. These databases are also useful in generating information to direct preventive strategies and to target resources to areas of greatest need.

(*Injury Prevention* 1995; 1: 173–176)

Keywords: surveillance, database, socioeconomic factors.

Injuries have recently been selected in England and Wales as a key area for action to improve the nation's health.<sup>1,2</sup> In order that health gain objectives are realised, targets have been established and priorities for service development identified. Featured high in the recommendations of both the English and Welsh documents is the need to develop an injury surveillance system so that preventive efforts can be efficiently organised and resources better targeted. Because Wales has by far the longest experience in target setting in Western Europe,<sup>3</sup> it has also produced a more comprehensive range of targets in injury control than its English counterpart. Two of the Welsh targets relate to childhood injuries that aim, firstly, at reducing the variation in the incidence of injury among children from different socioeconomic backgrounds by 25% by 1997 and 50% by 2002, and secondly, at reducing injuries to children, as measured by numbers attending accident and emergency departments, by 15% by 1997 and 25% by 2002.

Many factors are known to influence attendance at accident and emergency departments for both trauma and non-trauma cases. These include patients' perceptions of their problems and access to their doctors,<sup>4–6</sup> socioeconomic status,<sup>7</sup> and proximity of the accident and emergency department.<sup>8–10</sup> It is not certain, however, whether these factors similarly influence the use of accident and emergency departments by children with injuries. The aim of this study was to determine whether national injury prevention targets could appropriately be monitored using a centralised database of accident and emergency attendances, by modelling data from the West Glamorgan injury database.

## Method

West Glamorgan is a compact county on the south coast of Wales with a population of

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370 000 residents in an area of 30 miles by 20 miles. The National Health Service provides general practitioner and hospital care to the entire population free of charge to the individual user. Treatment of injuries is provided by 200 general practitioners or by two accident and emergency departments and a casualty department in the county's three hospitals. General practitioners and the casualty department tend to treat minor injuries; all suspected fractures or more serious injuries are referred to the accident and emergency departments. The vast majority of the population live within six miles of a hospital; the maximum distance from an accident and emergency department is about 15 miles. The distribution of the general population and the location of hospitals means that very few residents receive treatment in out of county facilities (approximately 1.5% of the total accident and emergency attendances by West Glamorgan residents).

There is widespread variation in socioeconomic status across the county. Unemployment rates vary between 4% and 28% between electoral wards and the percentage of households with cars varies from 35% to 88%. The Townsend index of deprivation,<sup>11</sup> a standardised measure that incorporates unemployment, overcrowding, and lack of car or home ownership, and which has a county average of zero, varies from -6.8 in the most affluent ward to +11.3 in the most deprived ward. In 1992 a county-wide computerised database was established in West Glamorgan that captures data on all attendances at the two accident and emergency departments and on childhood attendances (0-14 years) at the casualty department of the third hospital in the county. The database used a diagnostic filter so that only first attendances due to a new injury were accepted, that is repeat attendances for the same injury were excluded. Each attendance record contained data on age, sex, addresses and postcode, nature and site of injury, date and place of occurrence, and follow up treatment. Each postcode was validated using a CD-ROM disc that contained the complete postcode address file (PAF on CD).<sup>12</sup> It also provided missing postcodes if that field was incomplete on the casualty record. For this study, only children aged between 0 and 14 who attended the hospital departments for the first time between 1 January 1993 and 31 December 1993 and whose addresses were in West Glamorgan County were selected. Three categories of injuries were examined: all injuries and two subsets: injuries occurring at home, and injuries resulting in fractures. Because fractures are classified as major cases based on the Nuffield Provincial Hospital Trust classification,<sup>13</sup> we used this category as a proxy indicator for severe injuries.

Using the postcode information, each patient was assigned to one of the 82 electoral wards in West Glamorgan. The average distance between each electoral ward and each hospital department was calculated as the hypotenuse of a triangle formed from the horizontal and vertical distances between the centroid of that electoral ward and the hospital. The distribu-

tion of attendances between the three units per ward was examined, and a weighted distance calculated according to proportional attendance rates. Thus, the weighted distance for injuries occurring at home in one ward represents the average distance in miles travelled over the study period by those children with home injuries from that electoral ward to the three hospital departments.

Attendance rates per 1000 population from each ward were calculated for each category of childhood injuries by five year age group and sex. Population denominators were derived from the 1991 census.<sup>14</sup> Standardised attendance ratios were calculated to adjust for differences in age and sex composition between wards. In less than 10% of adult attendances was occupation recorded in sufficient detail to enable a social class be allocated; for children, parental occupation was almost never recorded. Therefore, to investigate the effect of social position on attendance rate, the Townsend index of deprivation for the 82 electoral wards was used.<sup>11</sup> Standardised attendance ratios for each category of injury from each electoral ward were compared, using multiple linear regression, with the weighted distance travelled, car ownership rates, and the ward Townsend index. The latter two factors were derived from 1991 census data.<sup>14</sup> Unlike the distribution of the attendances due to total or home injuries, the distribution of the standardised attendance ratio due to injuries resulting in fractures was skewed, and the data were transformed using natural logarithms (log<sub>e</sub>) to provide an appropriate normal distribution. The analysis was performed using the statistical package for the social sciences (SPSS PC).

## Results

During the one year period, a total of 50 305 attendances due to injuries by children and adults were recorded at the three hospital departments. Of these, 85% (42 948) were new episode attendances. In relation to all injuries in children aged 0-14, a total of 10 117 new episode attendances were recorded during the study period, representing a rate of 182/1000 children in West Glamorgan. Thus, approximately one child in five presented to a hospital in a year because of injury. Of the 10 117 new episode attendances, 36.1% and 5.4%, were home injuries and fractures, respectively. The latter is equivalent to an annual fracture rate of 9.8/1000 children.

The relationship between the attendance rate at hospital departments due to childhood injuries and distance travelled, car ownership, and Townsend index of deprivation is summarised in the table. Distance from the home ward to hospitals was significantly associated with the standardised attendance ratio in children for all injuries and injuries occurring at home. Approximately 20% of the total variation in the standardised attendance ratio of children at hospital departments with all or home injuries is explained by the variation in travelling distance. However, car ownership and Townsend index of deprivation did not

Correlation between standardised attendance ratio due to childhood injuries at accident and emergency departments and distance travelled, car ownership, and Townsend index of material deprivation

Childhood injuries	Correlation coefficients (r)		
	Weighted distance	No car	Townsend index
Standardised attendance ratio due to total injuries	-0.42*	0.15	0.06
Standardised attendance ratio due to home injuries	-0.45*	0.12	0.02
Log of standardised attendance ratio due to injuries resulting in fractures	-0.11	0.15	0.15

\* $p < 0.001$ .

significantly increase the explanatory power of the regression. The final equations describing the relationship of all injuries and injuries occurring at home indicated that the attendance rate of children with home injuries living 10 miles from an accident and emergency department might be expected to be approximately half that of those living a mile away.

There was no significant association between the natural logarithm of the standardised attendance ratio due to injuries resulting in fractures and distance ( $r = -0.11$ ;  $p = 0.34$ ), car ownership ( $r = 0.15$ ;  $p = 0.2$ ), or deprivation ( $r = 0.15$ ;  $p = 0.18$ ).

### Discussion

Injuries are the leading cause of mortality and morbidity in childhood.<sup>15</sup> The high priority accorded to injury prevention by the United Kingdom government underlines its determination to minimise the impact of injuries to its population thereby contributing to health improvements in the 1990s.<sup>12</sup> Because the health service is at the forefront of care, it has a unique part to play in injury prevention, ranging from the formulation of preventative strategies to the monitoring of injury trends.<sup>16</sup> In this respect, data from accident and emergency departments are obviously an important source of information.

Our results showed that the closer the home is to the accident and emergency department, the greater the attendance rate of children with injuries. However, the regression equations revealed little difference in the relationship between standardised attendance ratios for home or total injuries with travel distance. This indicates that the two thirds of injuries that occur outside the home are likely to occur near the home, and that the home address is a good proxy for the location of injuries in childhood. Although previous studies have reported that proximity is a strong determinant of the use of hospital services,<sup>8-10</sup> none has confined their investigation to childhood injuries. It is therefore important that in the surveillance of these injuries using data from the accident and emergency departments the effect of travel distance on attendance rate be taken into account.

The distance effect is probably a reflection of ease of access. Although our finding that, on average, one child in five annually presents to hospital with an injury is consistent with the rate reported by Sibert *et al*,<sup>17</sup> this may not be

applicable to other districts, particularly to those whose accident and emergency departments are situated within locations that are more densely, or sparsely, populated than West Glamorgan. The implications for meeting health targets are considerable; changing the location of an accident and emergency department to a more or less populated area would be expected to result in changes in attendance rates for which an appropriate correction would need to be made to the targets. The lack of a significant association between travel distance and injuries resulting in fractures suggest that it is more meaningful to have a target relating to the more severe spectrum of childhood injuries, where a reduction in attendance rate implies a real health improvement.

Our findings that deprivation is not significantly correlated with the three categories of childhood injuries examined is similar to the observation made by McKee *et al*.<sup>8</sup> This is contrary to the Black report — that is, that poorer people suffer greater morbidity and mortality due to injuries.<sup>18</sup> A possible explanation is that ward based attendance rates as a measuring tool are sensitive to the ecological fallacy — that is, aggregated data at the population level may obscure real individual differences. This problem could be overcome by putting in place a better method of collecting data on social class at the individual level. However, the extra work involved in the collection of sufficient information on occupation to enable a social class to be assigned may not be practical in a busy hospital setting. This lack of an association between childhood injury rates, as measured by hospital attendance, and socioeconomic status requires further study. The lack of variation in fracture rates is particularly interesting. It may well be that similarities in fracture rates between affluent and deprived areas mask major differences in risk exposures. Poorer children are likely to be exposed to greater levels of environmental hazards (for example traffic) whereas wealthier children have more opportunity to participate in higher risk sports (for example horse riding). Further work is required to test this hypothesis.

### Implications for prevention

This study has demonstrated the usefulness and limitations of a centralised database of accident and emergency departments in childhood injury surveillance. So long as the limitations are recognised, the database can generate useful information for many groups. For instance, it provides a baseline rate against which change can be measured; a tool to allow geographical variations to be studied; a method of evaluating a wide variety of injury prevention measures; and useful data for health care commissioners to study factors associated with access and utilisation. As a result of our work in this area, we have been funded by the Welsh Office to examine childhood injuries in three areas of West Glamorgan with high injury rates and to test a community development approach to prevention.

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### Smoking and risk behaviour

A study in Advance Data from the Centers for Disease Control and Prevention in the US shows interesting, albeit not surprising, relationships between smoking and use of seat belts among adolescents. Overall, 65.8% of adolescents did not always use seat belts . . . Among current smokers the rate of non-use was 76.6% compared to 55.7% among adolescents who had never smoked. A similar correlation is found with carrying weapons and physical fights: adolescent male smokers were more than twice as likely as males who had never smoked to have carried a weapon (39.4% v 16.5%). Similarly, 64.1% were more likely than males who had experimented with cigarettes (47.1%) and those who never smoked (38.4%) to have been involved in a physical fight.