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Social deprivation and childhood injuries in North and West Belfast

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SUMMARY

Injuries in childhood represent a major public health concern. North and West Belfast is an area in which a high rate of emergency department attendance due to injury has been observed, and in which social deprivation is widespread. We carried out a cross sectional survey of 479 injuries in children aged 0-12 years presenting to four emergency departments serving North and West Belfast. Injury rates were compared between the most deprived and least deprived areas, selected on the basis of Noble Economic Deprivation scores. A significant correlation between economic deprivation and injury rate was demonstrated (r =2.14, p≤ 0.001). Children living within the most deprived areas were particularly likely to be involved in road traffic accidents (relative risk RR=3.25, p=0.002). We conclude that children living within the most deprived areas of North and West Belfast are at greater risk of injury than those in less deprived areas. Specific causes of injury, for example burns and scalds, high falls, and motor vehicle accidents are particularly associated with deprivation. Targeting should be taken into account when injury prevention strategies are being developed.

INTRODUCTION

Epidemiology of Injuries to Children

Injuries represent a major cause of morbidity and mortality in the paediatric and young adult population of the developed world. In Northern Ireland, with an under-16 population of 398,000, 100,000 injured children seek medical attention each year, of whom over 5,000 are admitted to hospital, and 50 succumb.[1-2] Epidemiological studies have tended to use injury-related mortality as a surrogate for injury rate, and have shown that over the past two decades there has been a significant decline in deaths.[3] It seems, however, that this is due at least in part to improved hospital care of seriously injured patients (i.e. tertiary prevention) rather than a true decline in incidence of injuries.[4]

Relationship between Socio-Economic Status and Injuries

Understanding the socio-economic patterns of injury is important for provision of services and the targeting of resources toward accident/injury prevention. In addition, the magnitude of any injury risk gradient between affluent and deprived groups gives an indication of the potential for improvement if inequalities are addressed. Furthermore, an understanding of the mechanisms by which socio-economic status influences the risk of injury may allow for better understanding of the causation of injuries.[5]

Higher rates of injury have been found in the lower socio-economic groups in several studies worldwide.[6-9] In the United Kingdom, mortality rates

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due to injury show a steeper social class gradient than any other cause of death.[10] In the Trent region, Hippisley-Cox *et al*[11] studied a total of 56,629 hospital admissions in the age range 0-14 years, and found higher injury rates and greater severity of injuries in electoral wards with greater deprivation; and identified specific causes of injury most closely associated with deprivation.

It has been suggested not only that a socio-economic gradient in injury rate exists, but that this is widening, as accident prevention initiatives meet with more success among more affluent segments of society.[12, 3] Greater understanding of causative factors in childhood injury is therefore required if injury prevention initiatives are to be successful across the socio-economic gradient.

North and West Belfast

North and West Belfast (NWB) is an area with a high rate of emergency department attendance due to injury, and is also an area where social deprivation is widespread.[13] We therefore designed a study to examine the relationship between social deprivation and childhood injury in NWB.

METHODS

We utilised information captured from emergency department attendances after childhood injury to compare calculated injury rates between the most and least deprived districts, and to compare causes, location, and severity of injuries in the two groups. This was part of a broader prospective study of the injury profile in NWB for which AG was immediately responsible.

Patient Sampling

The four study centres involved were the paediatric emergency department at the Royal Belfast Hospital for Sick Children (RBHSC) and three general emergency departments at Belfast City Hospital, Lagan Valley Hospital and Mater Infirmorum Hospital, none of which provides secondary care paediatrics.

Children aged 0-12 years who attended any of these departments following injury and whose home address was within the postal districts BT 11-15 and BT17 were eligible for inclusion in this study. The sample was collected every fourth day over the 12-month period from 2nd January to 31st December 2001.

Data Recording

A dedicated Injury Surveillance Module (ISM) computer package was used to record injury data in the RBHSC. Clerical staff and triage nurses were asked to input data on a number of variables relating to the injury, including location (eq home, school etc.) and cause, of which there are 31 in all, based on the Victorian Emergency Minimum Dataset.[14] For ease of analysis these were condensed into 13 categories; eg bicycle, vehicle etc. Anatomical diagnosis was also recorded. All staff using the ISM underwent training in its use. In the absence of the ISM in the other three centres, data was obtained at regular intervals by AG visiting the departments in person and scrutinising the clinical records, to add to the dataset. A patient was included in the study only if there was a one-to-one match between the BT address code and an enumeration district (defined below).

Patient "disposal" was used as a simple indicator of seventy. Injuries treated solely in the emergency department were classified as minor; those for which outpatient follow-up was thought necessary, as moderate; and those requiring hospital admission as severe.

Noble Index

The Noble Index ,[13] a measure of social deprivation specifically designed to provide detailed information for Northern Ireland, is based on a total of 45 indicators. Examples of indicators used to calculate the Noble Index include uptake of state benefits, crime rates and unemployment rates. A Noble Index Multiple Deprivation Score is available for each electoral ward in the Province. A number of subdivisions of the overall Noble Index are also available, including economic, social environment, and education-related indices, some of which are available at enumeration district (ED) level. Enumeration districts are small units comprised of around 200 households, into which electoral wards are divided. We used economic deprivation scores as a measure of socio-economic status; a high Noble deprivation score implies greater deprivation, and vice versa.

Demographic Information

Northern Ireland mid-census estimates of population were obtained (NISRA, personal communication).

TABLE

Comparison of Injury Rates by Cause of Injury

Cause of Injury	EDs Under Study (n=20)	Mean Injury Rate by Cause (per 1000 Children)	Std. Deviation	Relative Risk	p
Vehicle	Least Deprived	0.94	2.99		
	Most Deprived	2.70	5.75	2.88	0.23
Bicycle	Least Deprived	0.95	2.33		
	Most Deprived	2.30	4.25	2.43	0.22
Pedestrian	Least Deprived	0.74	2.30		
	Most Deprived	0.97	2.49	1.32	0.76
Other Transport	Least Deprived	1.34	3.38		
	Most Deprived	1.60	3.32	1.19	0.80
Animal-related	Least Deprived	0.00	0.00		
	Most Deprived	1.08	3.06	NIA	0.13
Burns and Scalds	Least Deprived	0.46	2.06		
	Most Deprived	1.66	2.74	3.65	0.13
Collision with Object	Least Deprived	5.19	6.83		
	Most Deprived	11.36	10.86	2.19	0.04
Collision with Person	Least Deprived	0.80	2.49		
	Most Deprived	2.26	4.27	2.83	0.20
Foreign Body	Least Deprived	0.89	2.74		
	Most Deprived	2.56	4.05	2.89	0.14
High Fall (>1 metre)	Least Deprived	0.80	2.50		
	Most Deprived	2.82	4.52	3.52	0.09
Low Fall (<1 metre)	Least Deprived	12.31	9.16		
	Most Deprived	23.34	18.35	1.90	0.02
Ingestion	Least Deprived	0.00	0.00		
	Most Deprived	2.08	5.92	N/A	0.13
Miscellaneous	Most Affluent	0.92	2.89		
	Most Deprived	0.91	2.36	10.99	0.99

Year-specific age data are not available in the public domain; the availbale 0-15 years population data multiplied by 0.81 were usd to estimate the 0-12 years population data within each ED. The latter are appropriate denominators for calculating injury rates for the majority of the causes of injury in the Table. One cause of injury for which the use of such denominators is inappropriate is bicycle – the correct denominator would depend on rates of bicycle ownership and helmet wearing, and perhaps traffic densities.

Data Compilation and Statistical Analysis

Microsoft Excel was used to compile a dataset for each ED in the study containing information on economic deprivation level, the estimated number of children under 12, the number of injuries, cause, location, and clinical diagnosis. From these data were derived both overall injury rates and injury rates categorised according to cause, location, severity, and anatomical diagnosis. Statistical analysis was carried out using SPSS v 11. Student's t-test was used to compare rates between the most deprived and least deprived areas. The significance level for all calculations was 5%.

RESULTS

The sample consisted of 479 injuries from 91 Enumeration Districts. A description of the injury profile will be given in another paper.

Economic Deprivation and Injury Rates

Noble economic deprivation scores and injury rates were plotted for each of the 91 EDs in question (*Figure 1*). Correlation analysis showed a significant positive correlation between economic deprivation and rates of injury for the EDs studied ($r = 0.25$, $p = 0.001$).

We selected the twenty EDs with the highest Noble Economic Deprivation scores (range 50.11 to 85.14, mean = 59.42), and the twenty with the lowest (range 0.47 to 16.49, mean = 7.71) – i.e. the most deprived and the least deprived – for further analysis. A highly significant difference in rates of injury was present between the most and least deprived EDs (mean injury rate/1,000 children 60.3 vs 28.2, $p < 0.001$, RR=2.14).

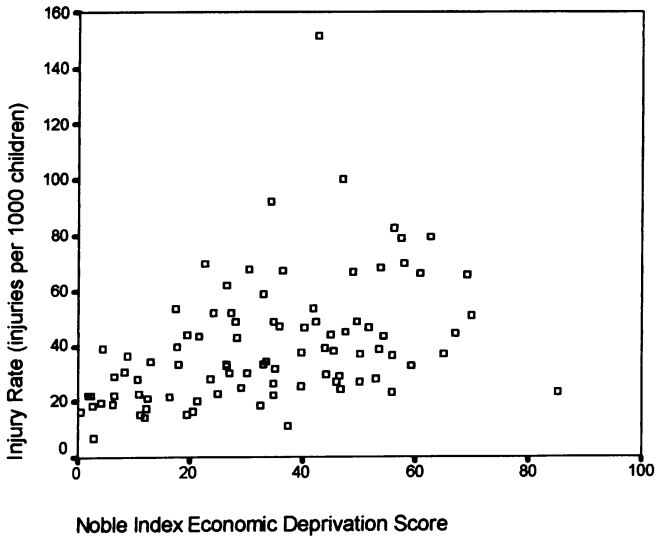

Fig 1. Scatter Diagram of Injury Rate against Economic Deprivation. Each point on the graph represents an ED.

Economic Deprivation and Causes of Injury

Thirteen coding options were available to record cause of injury. For each of these, we compared the rate of injury between the most deprived and least deprived groups (Table). In all but one, the rate of injury was greater in the most deprived districts compared with the relatively less deprived districts. However, this reached statistical significance in only two of the 13 causes of injury – namely, low falls and collisions with an object.

Economic Deprivation and Location of Injury

Significant differences were present between the most and least deprived areas in rates of injury both within the home (mean injury rate 24.5 vs 13.3 /1000 children, $p = 0.01$, RR = 1.84) and outside the home (including schools, roads, etc) (mean injury rate 24.6 vs 10.7/1000 children, $p = 0.001$, RR = 2.29). However, the difference was greater for injuries outwith the home than for home injuries (RR=2.29 vs 1.84).

Within the group of injuries occurring outwith the home, a highly significant difference was evident in injuries due to accidents on the road (mean injury rate 16.8 vs 5.1 / 1000 children, $p = 0.002$, RR=3.25). When road accidents were excluded, however, this difference was no longer present.

Severity of Injuries

Likewise we compared severity of injuries between the most deprived and least deprived areas (*Figure 2*).

The rates for mild injuries (38.0 vs 17.0/1000 children, p ≤(0.001, RR = 2.24) and moderate injuries (18.5 vs 8.7/1000 children, p = 0.001, RR = 2.12) were significantly higher among children in the more deprived EDs. This was not true, however, for injuries classed as severe (3.84 vs 2.51/1000 children, p = 0.38, RR = 1.53).

Since the rate of severe injury was low, we selected fractures as an objective marker of relatively severe injury - i.e. some requiring admission, but all in need of some follow up. The rate of fractures differed significantly between the two groups (8.0 vs 3.6/1000 children, p = 0.04, RR = 2.24). There was no relationship between the presence of a fracture and the cause of injury – likely due to small numbers.

DISCUSSION

Economic Deprivation and Injury Rates

We found a statistically significant correlation between economic deprivation and rate of injury. For further work, we compared directly the most deprived areas with the least deprived. By comparing an average injury rate for the 20 most deprived EDs with that in the 20 least deprived, we confirmed the previously noted correlation between economic deprivation and injury rate, with a relative risk of injury of 2.14 ≤(P0.001) for the most deprived over the least deprived districts.

The most recent population figures available were mid-census estimates dating from 1996, and were thus 5 years older than the actual injury data. This anomaly might be sufficient to explain our findings only if the number of under-12 year olds had dramatically increased in the most deprived areas between 1996 and 2001. This would lead to an underestimate of the number of children in these more deprived areas and a falsely high estimate of injury rates. Conversely, if the number of children in the less deprived areas had declined significantly, this could result in a similar bias. Within the context of the area under study, we are unaware of evidence to support either of these putative demographic trends.

Our findings accord with other literature on this topic. They were, for example, comparable to those of Hippisley-Cox et al,11 who found the difference in injury-related paediatric hospital admissions between the 20% most deprived electoral wards compared to the least deprived to be highly significant (RR=1.96).

Causes of Injury

We compared rates of injury due to each cause or mechanism of injury between the most and least deprived EDs *(Table)*. For all causes of injury except the miscellaneous category, the rate was higher in the more deprived areas. For several categories,

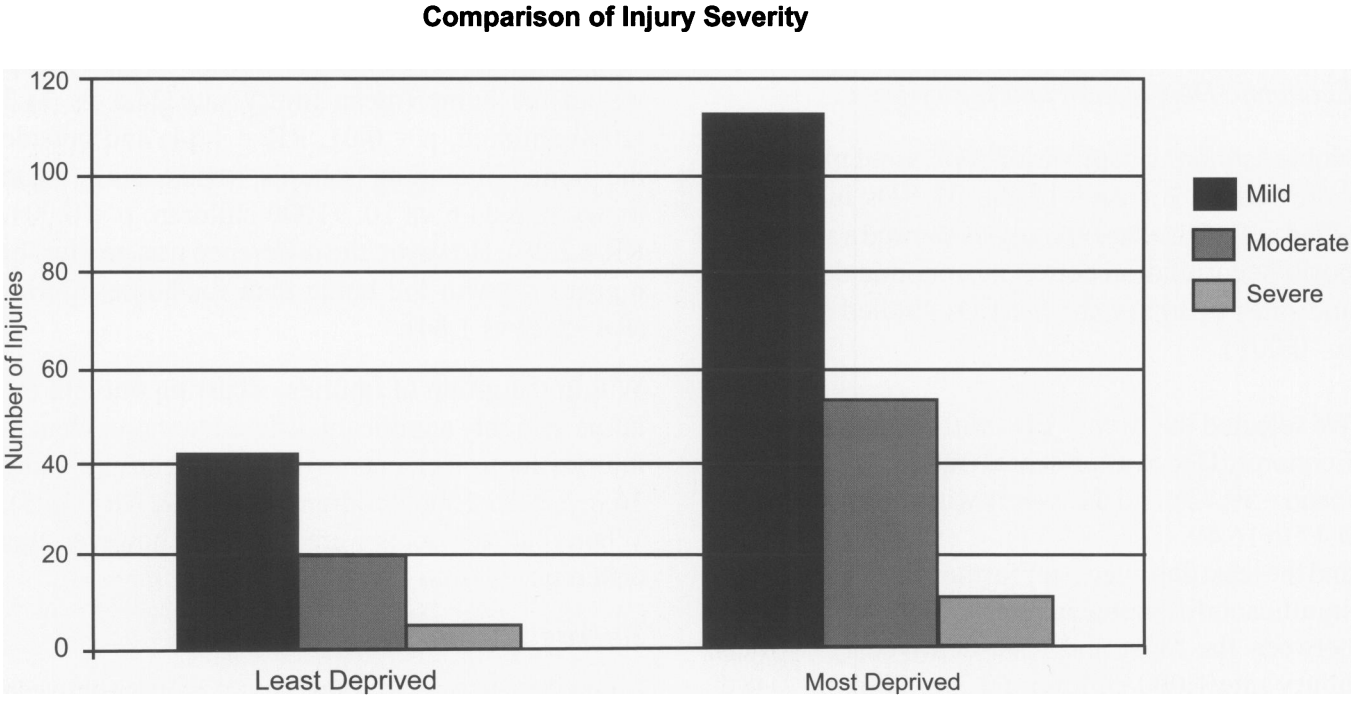

Fig 2. Injury Severity compared between Most and Least Deprived Areas.

the relative risk of injury due to the specific cause exceeded 2.0. Although statistical significance was not reached for the majority of causes, this probably reflects the small numbers involved.

In the study by Hippisley-Cox *et al*,[11] six causes of injury were shown to be significantly associated with deprivation: pedestrian injuries (RR = 3.65), burns and scalds (RR = 3.49), ingestion of toxic substances (RR = 2.98), bicycle-related injuries (RR = 1.61) falls (RR = 1.53), and other transport injuries (RR = 1.25). Our findings were consistent with this much larger study.

Location of Injury

Injuries outwith the home were more strongly associated with economic deprivation than injuries within the home, a finding that is accounted for almost entirely by injuries on roads. This finding is noteworthy since it identifies a specific location where inequalities are important in determining risk. There are many potential factors which may form the basis for this finding: differential impact of road safety initiatives across the socioeconomic gradient, access to safe play areas, and differences in driver behaviour or alternatively, risk-taking behaviour by children. This is a challenge for various groups and professions as diverse as the Department of Environment and Belfast City Council, the police, as well as health professionals – not to mention parents themselves. Moreover, our findings suggest that greater effort should be focused upon more deprived areas rather than more generally as might be the case at present.

Seventy of Injury

We found a strong association with economic deprivation for minor and moderate injuries. Statistical significance was, however, not reached for severe injuries. Although this would suggest attendance bias as an explanation for our positive findings, there is little evidence in the literature to suggest that attendance rates are directly related to socioeconomic status. Distance from an accident and emergency department has, however, been shown to correlate inversely with attendance.[15-16] Since accident and emergency departments tend to be located closer to inner city areas than more affluent suburbs, this is a potential confounding variable. However, in our study, the most and least deprived areas were in close proximity (although the entire area under study could be described as deprived), and the most likely explanation for the failure to detect a difference in rates of severe injuries is therefore the relatively small numbers of injuries in this category.

On the basis of earlier work in NWB carried out by one of us (JFTG), it is known that 77% of injured children are brought directly to an emergency department; few of those seen at general practice required onward referral (4%).[17] However, any attendance bias is likely to apply equally to the most and the least deprived EDs. In addition, the severity scale used was somewhat crude. For these reasons we selected fractures as an example of more severe injury that because of the degree and uniformity of symptoms we would expect virtually 100% attendance at casualty, thus further eliminating possible bias; and in the work just cited, seven of the eight who sustained bony injury did not go to a GP but attended emergency directly.[17] A significantly higher rate of fractures in more deprived areas therefore gives further credence to the overall finding of higher injury rates in this socio-economic group.

CONCLUSIONS

This small prospective study based on data collection every fourth day throughout 2001 demonstrated an association between socioeconomic deprivation (as measured using a locally specific index) and childhood injuries within North and West Belfast. It identifies a number of causes of injury which show a particularly strong association with economic deprivation, particularly those outside the home (i.e. motor vehicle accidents). These findings suggest pointers for future research, and further, that injury prevention initiatives be focused particularly in the most deprived districts of Northern Ireland.

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