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Unintentional injury in England: an analysis of the emergency care dataset pilot in Oxfordshire from 2012 to 2014

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Abstract

Background – A pilot injury data collection exercise at the emergency departments (EDs) of Oxford University Hospitals NHS Foundation Trust (OUH) ran from 2012 to 2014 to inform the current development of the new NHS England emergency care dataset.

Methods - Data collected at the EDs of OUH 01 January 2012 to 30 March 2014 analysed for Oxford City and Cherwell District Council areas. Data completeness and quality checked against Hospital Episode Statistic (HES) returns for OUH.

Results - Of the 63877 injury attendances recorded at the two sites, 26536 were unintentional with a home postcode within Oxford City or Cherwell District council areas. The most frequent location, mechanism, activity and diagnosis were home (39.1% of all UIs), low-level falls (47.1%), leisure (31.1%) and “Injuries to unspecified part of trunk, limb or body region” (20.5%) respectively. The most deprived quintile of the population (IMD 1) had the highest EASR for all UIs while IMD 5 had the lowest, 54.4 (52.3 to 56.5) compared with 32.2 (31.4 to 33.0) per 1000 person-years respectively. There was a significant association between increasing levels of deprivation and an increasing IRR for all UIs, for those in the home, for low-level fall UIs and for non-sport leisure UIs with a particularly sharp increase in the IRR for IMD 1 compared to IMD 5. Sport related injuries showed no gradient apart from football.

Conclusion – This pilot has demonstrated both the feasibility and importance of prioritising the collection of a national injury dataset.

What is already known on this topic

- Unintentional injury is a major cause of attendance at NHS emergency departments (EDs) in the UK. Socio-economic deprivation is associated with unintentional injury. Detailed injury data are not routinely collected.

What this paper adds

- People living in the most deprived parts of Oxford City and Cherwell district council areas are 70% more likely to attend an ED with an unintentional injury than those living in the least deprived parts.
- The finding of much higher unintentional injury rates in areas with high levels of deprivation holds true for unintentional injuries in the home and from falls and non-sport leisure activities.
- There are higher sport related injury rates in areas with lower levels of deprivation, excepting football injuries which are higher among the most deprived.
- The injury dataset at the two Oxfordshire hospitals performed well and yielded useful results

Introduction

Unintentional injuries (UIs) are a major cause of morbidity and mortality worldwide. According to the World Health Organisation (WHO), they were responsible for 6.0% of all years lived with disability and 3.7 million deaths (6.7% of all deaths) in the world population in 2012. [1] In the United States the lifetime cost of all injuries, intentional and unintentional, was estimated in 2000 at $406 billion ($80 billion for medical treatment, $326 billion in lost productivity), around 3.9% of gross domestic product (GDP), while in the United Kingdom (UK) the cost of UIs alone to individuals, society and health services has been estimated to be between £148 billion and £160 billion annually or around 6% to 6.5% of GDP. [2-4] Preventing injury is a priority for both the WHO and the European Union. The WHO has urged governments to "greatly step up national efforts to prevent injuries and violence and to coordinate these efforts through their ministries of health". [5 6] However, many western countries, including the UK, do not gather systematic data on injuries hampering the development and evaluation of effective injury prevention policies and strategies. [5 7]

The UK is one of the few developed nations in the world without a national injury data collection system or database. [8] In 2008, the Royal Society for the Prevention of Accidents (RoSPA) in collaboration with the electricity safety charity the Electrical Safety Council and the product safety experts Intertek, commissioned a report into the feasibility of establishing a UK wide injury database. [8] In 2012, the Department of Health funded pilot injury data collection exercises in the emergency departments (EDs) of the Oxford University Hospitals NHS Foundation Trust (OUH) and St Mary's Hospital in London with a view to implementing a national dataset.

The incidence of and death from UI are associated with higher levels of area-level socio-economic deprivation in the UK. [9-19]. In Scotland for example, adults in the most deprived fifth of the population are 1.9 times more likely to be admitted to hospital as an emergency and 2.4 times more likely to die from a UI than those in the least deprived fifth. [12]

This study uses data from the OUH pilot to examine the effect of area level socioeconomic deprivation on UI ED attendance in relation to the home location; to falls and road traffic collisions; and to leisure and sport activities; in England using Oxford as a case study.

Methods

1. Data sources

1.1 Injury Data

Injury data were collected from 1st January 2012 to the 30th March 2014 from patients attending the ED receptions of the John Radcliffe Hospital in Oxford and the Horton General Hospital in Banbury by clerical staff. The injury dataset complied with the requirements of the European Injury Data Base - Joint Action on Monitoring Injuries in Europe (IDB-JAMIE), the WHO guidelines on minimum injury datasets and international best practice. [20 21] It was incorporated into the electronic patient administration system on a specially designed form with field descriptions taken from the RCEM minimum dataset "Patient Injury" section. [22] Geographical location of home residence was recorded in the dataset using Lower Super Output Area (LSOA) under the 2001 coding system (LSOA2001) derived at the hospitals from patients' home postcodes. The primary diagnosis for each patient record was added to the dataset immediately prior to discharge by the clinician in the form of SNOMED Description ID codes from an unconstrained list in excess of 50000 terms. [23]

1.2 Population and Deprivation Data

ONS mid-year population data for 2013 by age, sex and LSOA for 2011 (LSOA2011) were used to calculate exposure as person-years across the full two years three months of the pilot. [24] Deprivation data by LSOA2011 were taken from the Index of Multiple Deprivation Scores for 2015 (IMD) for England, downloaded from the Department for Communities and Local Government, UK Government website and LSOAs were allocated into equal quintiles nationally by population, with IMD 1 the most deprived quintile. [25] Injury data were collected using LSOA2001 whereas population and deprivation data were available by LSOA2011. Details of how these were matched are available in Supplementary Materials.

2. Analysis

The commissioning of emergency care for the population of Oxfordshire is the responsibility of NHS Oxfordshire Clinical Commissioning Group (CCG). Analysis was based on patients resident within the two district council areas containing the two hospitals which collected data, Oxford City for the John Radcliffe Hospital and Cherwell for the Horton General Hospital. Oxford City has no external boundaries with any other county and the external boundaries of Cherwell are coterminous with those of Oxfordshire CCG area.

The total number of UIs and crude incidence for each district council area within Oxfordshire CCG were calculated. Number of UIs and crude incidence by gender, five-year age group and IMD2015 Quintile were also calculated. Numbers of UIs were analysed by location (Injury Place Type), mechanism, activity and diagnosis. European Age Standardised Rates (EASRs) to the European Standard Population 2013 [26] were calculated for all UIs. Poisson regression using Stata version 12.1 was used to produce incidence rate ratios (IRRs) by IMD Quintile (reference category IMD 5) for all UIs and for those UIs with: location home; mechanism low-level fall (under one metre) and RTC; and activities sport (non-football), football, and non-sport leisure.

The diagnoses in the form of SNOMED Description ID codes were grouped into SNOMED Concept IDs using files available from the Health and Social Care Information Centre (HSCIC) TRUD service. SNOMED CT is structured on a relational database model with tables of concepts and descriptions such that one single concept (relating to for example a diagnosis) can have any number of descriptions, one of which is the gold standard "Fully Specified Name" for that concept. [23 27] These concepts were then further converted into ICD-10 Chapter Blocks using a further set of HSCIC TRUD files.

3. Data Completeness and Quality

An extract of totals was obtained from OUH of Hospital Episode Statistics (HES) ED data returns from 01 Jan 2012 to 30 Mar 2014 by year and month of attendance and by gender and age in five-year age groups and by the HES field patient group. The completeness and quality of the dataset were checked against HES for all injuries and for all UIs and also for RTCs and sport injuries. Comparisons were made using the complete dataset, not just those attendances for patients within Oxfordshire CCG area as home location was not available in the HES data.

Results

There were 63877 ED injury attendances recorded, 41216 were UIs for patients resident within Oxfordshire CCG area of which 26536 (64.4%) had a home LSOA coded within Oxford City or Cherwell District council areas (see table A in supplementary materials). The crude UI rate varied across Oxfordshire district council areas, Oxford City and Cherwell District had the highest rates at 49.9 (95% Confidence Interval 49.2 to 50.7) and 28.3 (27.7 to 28.9) per 1000 person-years respectively, significantly higher than the other three Oxfordshire district council areas. The crude UI incidence for Oxford and Cherwell combined was 39.5 (39.0 to 40.0) per 1000 person-years (see table B in supplementary materials).

Males accounted for most UI attendances (54.9%), and the mean and median age of attendances were 31.6 years and 25 years respectively (see table B in supplementary materials). The crude UI rates for men and women were 43.5 (42.8 to 44.2) and 35.6 (34.9 to 36.2) per 1000 person-years respectively and 10-14 years had the highest rate of attendance and 65-69 year olds the lowest, 79.3 (76.3 to 82.3) and 20.7 (19.0 to 22.4) per 1000 person-years respectively. The most socio-economically deprived IMD quintile, IMD 1, had the highest UI rate and IMD 5 the lowest, 59.1 (57.0 to 61.3) and 33.4 (32.6 to 34.3) per 1000 person-years respectively.

The most commonly recorded location was the home (39.1% of all UIs) followed by leisure type locations (21.9%) (see table C in supplementary materials and figure 1). Leisure (31.1%) and sport (informal 7.9%, organised 4.1%) were the most commonly recorded activities. Low-level falls were the most frequent mechanism of injury for most locations, responsible for 49.5%, 49.3%, 51.3% and 48.5% of UIs in the home, leisure, road, and education type locations respectively. For work related UIs, cuts and piercings by sharp objects was the most common mechanism with 25.4% of UIs followed by low-level falls with 22.2%. Cyclists were the largest category of RTC with 17.8% of UIs on the road. The most frequently recorded ICD-10 Chapter Block was “T08-T14 Injuries to unspecified part of trunk, limb or body region” followed by “S00-S09 Injuries to the head”, which accounted for 20.5% and 10.9% of all UIs respectively.

IMD 1 had the highest EASR for all UIs and IMD 5 the lowest, 54.4 (52.3 to 56.5) and 32.2 (31.4 to 33.0) per 1000 person-years respectively (see table 1 and figure 2). For all UIs, the IRRs for IMD quintiles 1 to 4 compared to IMD 5 were all greater than 1 (see table 1 and figure 3). IMD quintile 1, the most deprived quintile, had the highest IRR of 1.70 (1.63 to 1.78). The IRR for IMD 1 was significantly higher than that for all other quintiles. The same pattern existed for UIs in the home, for low-level falls and for non-sport leisure UIs with IRRs for IMD 1 of 1.90 (1.77 to 2.03), 1.57 (1.47 to 1.67) and 1.70 (1.57 to 1.84) respectively. For RTC UIs, there were no significant differences between the IRRs for IMD quintiles 1 to 4 but all were significantly greater than one; the IRR for IMD 1 was 1.72 (1.42 to 2.08) (see table 1 and figure 4). For non-football sport the gradient was the opposite to that for all UIs, the IRR for IMD 1 was 0.80 (0.69 to 0.92). For football the only IRR significantly greater than one was IMD 1 with an IRR of 1.61 (1.36 to 1.91).

There were 87125 injuries (intentional and unintentional) reported to HES from OUH from 01 Jan 2012 to 30 Mar 2014 compared to 63877 (73.3% of HES total) in OUH dataset. For UIs, there were 82209 reported to HES compared to 49731 (60.5%) in the OUH dataset. For RTCs and sport injuries, 77.0% and 216% respectively of the HES total were recorded.

Table 1. European Age Standardised Rates (EASRs) per 1000 Person-Years for all Unintentional Injuries (UIs) and Incidence Rate Ratios (IRRs) for UIs [All, In the Home, Leisure (Non-Sport), Low-Level Falls, Road Traffic Collisions (RTCs), Sport (Non-Football) and Football] with 95% confidence intervals by Index of Multiple Deprivation (IMD) 2015 Quintile
Oxford City and Cherwell District Council Areas, Oxfordshire

IMD2015 Quintile	EASR Per 1000 Person-Years	All	Home	Low-Level Falls	Leisure (Non-Sport)	RTCs	Sport * (Non-Football)	Football
1 (least deprived)	54.4 (52.3 to 56.5)	1.70 (1.63 to 1.78)	1.90 (1.77 to 2.03)	1.57 (1.47 to 1.67)	1.70 (1.57 to 1.84)	1.72 (1.42 to 2.08)	0.80 (0.69 to 0.92)	1.61 (1.36 to 1.91)
2	41.5 (40.1 to 42.9)	1.27 (1.22 to 1.32)	1.39 (1.30 to 1.48)	1.22 (1.15 to 1.29)	1.23 (1.15 to 1.33)	1.49 (1.27 to 1.75)	0.83 (0.74 to 0.92)	1.05 (0.90 to 1.23)
3	40.8 (39.7 to 41.9)	1.24 (1.20 to 1.29)	1.32 (1.25 to 1.40)	1.22 (1.16 to 1.28)	1.13 (1.05 to 1.20)	1.52 (1.31 to 1.75)	0.92 (0.84 to 1.01)	0.95 (0.82 to 1.09)
4	34.9 (34.1 to 35.8)	1.10 (1.06 to 1.14)	1.10 (1.04 to 1.17)	1.07 (1.02 to 1.13)	1.09 (1.03 to 1.16)	1.40 (1.22 to 1.61)	1.02 (0.94 to 1.11)	1.01 (0.89 to 1.15)
5	32.2 (31.4 to 33.0)	1	1	1	1	1	1	1

DATA SOURCE: Oxford University Hospitals NHS Foundation Trust Emergency Departments 01 January 2012 to 30 March 2014

* - Sport injuries were identified as those where either a specified sport or "Other Specified Sport" was coded in the Injury Sport field except for those which were also coded as Road Traffic Collisions (RTCs) which were classified as RTC injuries rather than sport injuries.

Figure 1

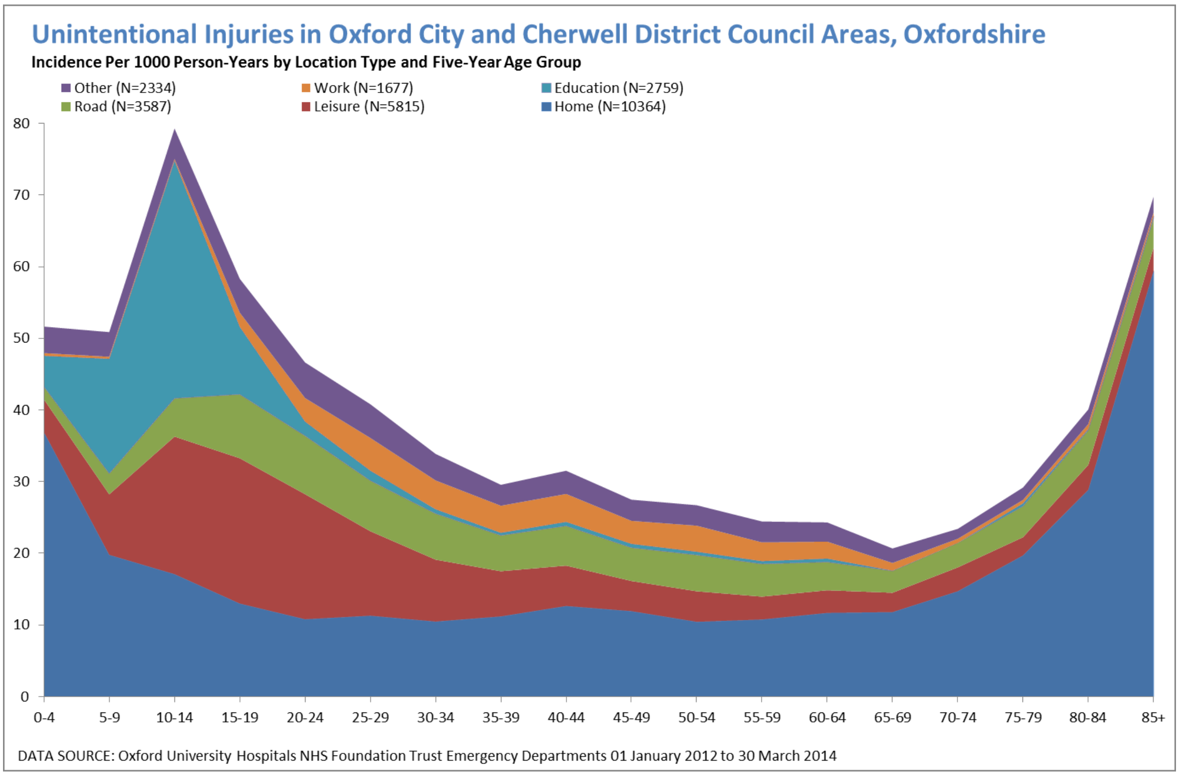


Figure 2

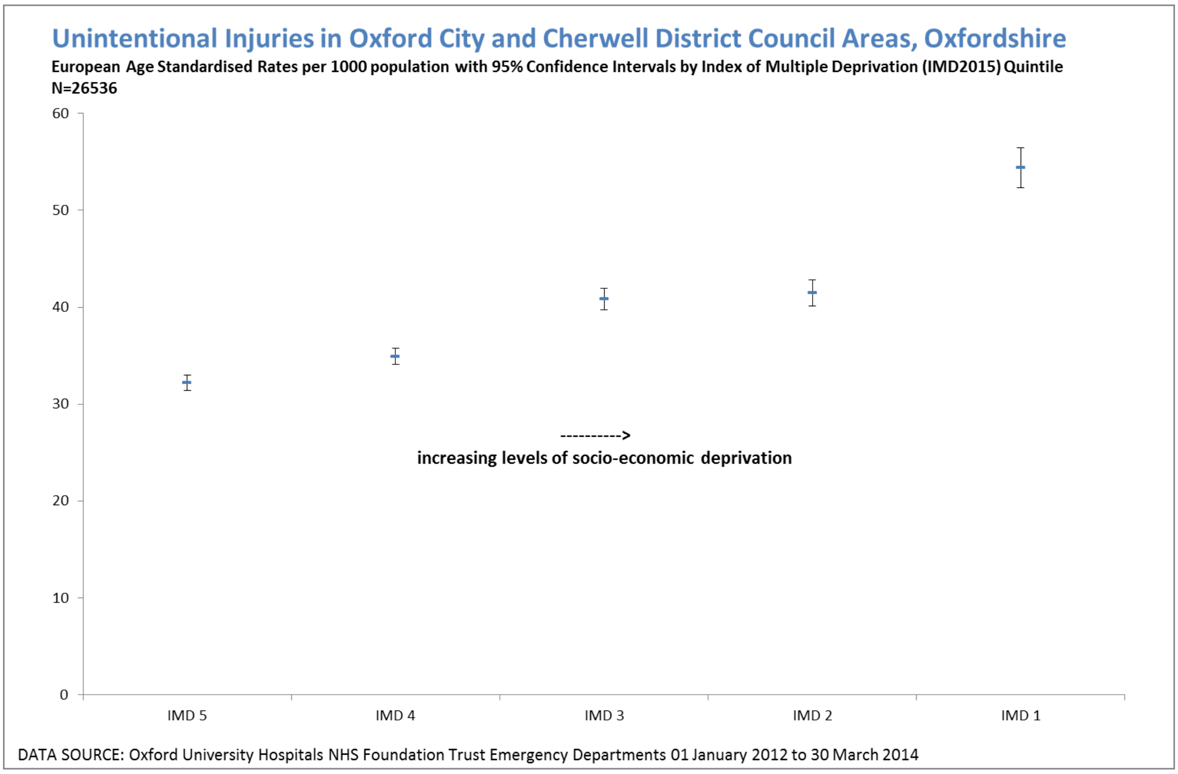


Figure 3

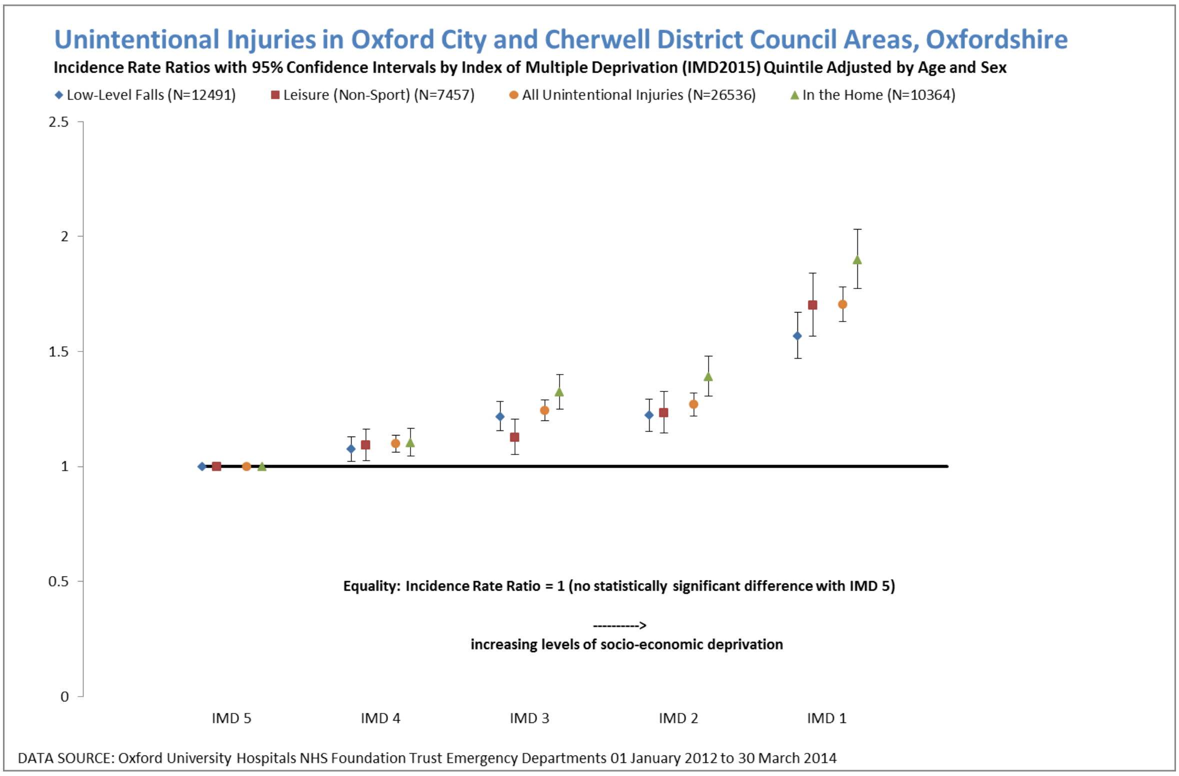
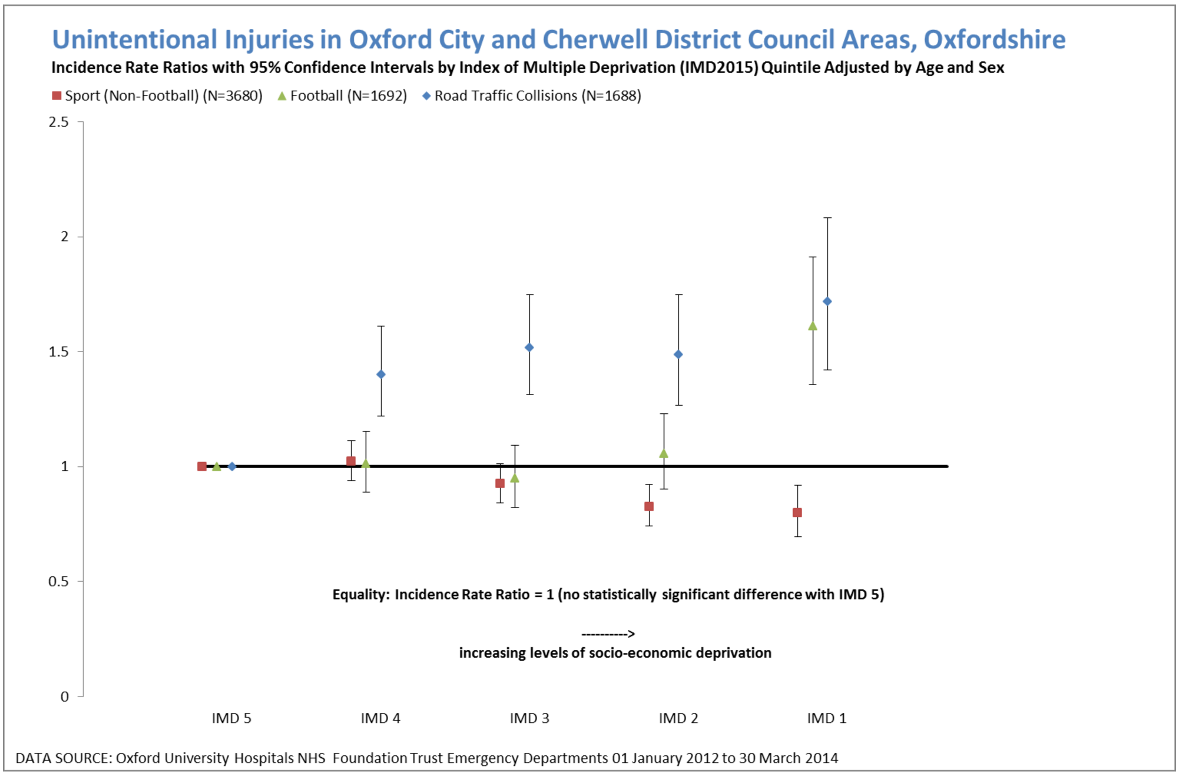


Figure 4



Discussion

People living in the most deprived parts of Oxford City and Cherwell district council areas are 70% more likely to attend an ED with a unintentional injury (UI) than those living in the least deprived parts. This analysis has found a non-linear relationship between deprivation and ED attendance for UI with a sharp, significant increase in attendance rates in the most deprived quintile of area-level socio-economic deprivation. This association persists for UIs in the home, for low-level falls and non-sport leisure activity UIs but not for those from sport or RTCs.

The pattern of incidence of UI attendance found in this study is identical to that found in Wales for all injuries, in particular the same highest and lowest rates for 10-14 year olds and 65-69 year olds respectively are evident in both settings. [28] Other studies have also found similar patterns with respect to inequality, in particular sharp increases in injury rates among the most deprived. An analysis of Office for National Statistics data on deaths from injury in England from four year periods around the 1981, 1991 and 2001 censuses found children of parents who were long term unemployed or had never worked were 13 times more likely to die from injury and 38 times more likely to die in a fire than children of parents who had managerial or professional jobs. [14] Children aged under five years with parents in unskilled occupations have been found to be more than four times as likely to be unintentionally injured in the home than those whose parents had professional or managerial occupations. [11] Although child injury mortality injury rates fell in England and Wales in the 1980s, these reductions were accompanied by a widening socioeconomic mortality differential between rich and poor. [29]

This study found some effect from deprivation on incidence of RTC UIs, but only in that the least deprived quintile of the population had a lower rate than the other four quintiles. Other studies have had different findings; an analysis of HES admissions data for serious injuries in children 0-15 years from 01 April 1999 to 31 March 2004 found pedestrians in the most deprived tenth of the population were four times more likely to have been injured and admitted to hospital than those in the least deprived tenth; for cyclists the ratio was 3:1; and for car occupants almost 5:1. [15] A separate study of English HES ED attendance data from financial year 2010/11 found RTCs significantly more prevalent in the most deprived quintiles of the population. [16] These differences for Oxfordshire are interesting and may be related to local initiatives around road safety but this is speculative and will require more detailed investigation. This is one of the advantages of a local study such as this over national studies where local effects may be lost as they are evened out. [30]

Housing tenure, household overcrowding, maternal unemployment, young maternal age and distance to hospital are all associated with socio-economic deprivation and UI. [9 11 17 30] None of these potential variables were available in the dataset analysed here. Two previous studies carried out on 0-4 year olds and 5-14 year olds in Norwich, England found a relationship between increasing numbers of children presenting to the ED with injuries and heightened area-level socioeconomic deprivation although this reduced after the protective individual household factors, number of adults in the house and the age gap between the child and the oldest female in the house were added into the model. [9 10]

In their English HES ED data study, Hughes et al also found sport injury ED attendance decreased with increasing deprivation, the same pattern to that found here except for football. [16]

Unfortunately individual sports are not collected by the current ED data systems making this finding for football unique at the moment. Rates of sport participation for individual sports vary by socio-economic status and this is likely to have been a factor in the patterns found. [31] There is also no facility to record a fall (the most common mechanism of injury) as mechanism within the current ED data systems although inpatient admissions due to falls have been found to be linked to deprivation. [15] The new Emergency Care Data Set (ECDS) will collect much more detailed activity and mechanism information than that currently collected, including falls and individual sports, creating a far richer data environment for analysis than exists at the moment. [32]

This study has some limitations. First there are issues to do with both the numerator and the denominator used in the incidence calculations and regression modelling. Minor injury units run by Oxford Health NHS Foundation Trust do not collect data and this together with the loss of some data due to cross border flows of patients out of Oxfordshire may have underestimated the number of injuries. To minimise this, only the district council areas with the two EDs located in them were used, Oxford City and Cherwell. Also the estimated exposure calculated in person-years for particular locations and activities is necessarily exaggerated as individuals do not spend 24 hours a day at home, on the road, playing sport etc, which is the explicit assumption in calculating exposure as person-years exposed based on the population at risk and the total elapsed time in the study. Both these issues will have led to an underestimation of the true rates of injuries. They are also likely to have led to an altering of the effect of socio-economic deprivation. Second, there are issues with respect to data quality which may be a function of the coding structures in the dataset. For activity 22.6% of records were coded as “Not Applicable”, 8.5% as “Other Specified Activity” and 7.5% as “Unspecified Activity”; in other words 38.6% of UIs where we do not know the activity and for UIs in the home this was 54.0%. In addition 17.0% had no identifiable mechanism; and 8.7% had no meaningful diagnosis recorded. Although there were issues with completeness of data, this quality of data is better than HES where in the most recent year available, 2014-15, 72.7% of patients were recorded as attending the ED with reason “Other”, 19.9% attended ED due to “Other accident” and for a further 3.0% the reason was “Not known”; in other words 95.6% of patients with very little detail on their reason for attending the ED. In addition 35.6% of patients were recorded on HES with a blank diagnosis or one that is unmatchable to HES categories.

Specific sports were under recorded in the dataset with 26.1% of female and 13.5% of male sport related UIs coded as “Other Specified Sport”. Completeness was higher for RTCs where these were coded using the options under Injury Activity, for example “RTC Cyclist” [22]. Similarly for sport injuries the ED reception data recorded more than double that reported to HES. This tends to suggest that the availability of more detailed recording options leads to higher levels of data recording. Finally, the model used was that of Poisson regression with the assumption that that each injury event is independent which may not always be the case especially with recurring injuries. An alternative model, the negative binomial, was tried but made very little difference to the results.

This study has provided further evidence that unintentional injuries occur mainly in the home, mainly from low-level falls and mainly from leisure activities including sport. It has also added to the evidence that socio-economic deprivation is associated with unintentional injury, particularly in the most deprived geographical areas. It has shown that subject to refinement, the RCEM minimum dataset for injuries could be implemented and used to inform the design, implementation and evaluation of injury prevention initiatives. Shortfalls in the ED data collection systems and in HES should be rectified when the new Emergency Care Data Set (ECDS) goes live. [32]

There are examples of good practice to follow in the UK. In Wales, the All Wales Injury Surveillance System is used to evaluate injury prevention initiatives on a population scale, the effect of which may be too small to pick up in a small scale trial or survey. [28] In England, the Information Sharing to Tackle Violence initiative allows hospitals to share non-confidential ED data with Community Safety Partnerships in turn allowing police to target and prevent violent injuries in the community. [33] The new ECDS combined with in-depth surveys could be used plan and target prevention initiatives, particularly in disadvantaged communities.

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Contributors: TH was responsible for the design of the dataset, its implementation in the hospitals and ensuring efficient collection of data. GK analysed and reported on the data. GK, TH, and AP drafted and edited the manuscript. TH takes responsibility for the integrity of the data and GK had access to the study data and takes responsibility for the accuracy of the data analysis.

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Competing interests: GK is employed under a grant awarded to the Centre for Trauma Sciences project by the Barts Charity; TH is chair of the Informatics Committee of the College of Emergency Medicine, which develops case mix measures and high quality data collection and information technology systems for the specialty of emergency medicine, and had a scholarship from the Royal Society for the Prevention of Accidents to conduct another related study of emergency department data in 2011; AMP has no competing interests to declare.

Ethics approval: Information Governance for the data extract was approved by the Caldicott Guardian at Oxford University Hospitals NHS Foundation Trust.

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