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Ethnic and geographic variations in the epidemiology of childhood fractures in the United Kingdom☆,☆☆,☆☆☆

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ABSTRACT

Background: Fractures are common in childhood, and there is considerable variation in the reported incidence across European countries, but few data relating to ethnic and geographic differences within a single country. We therefore aimed to determine the incidence of childhood fractures in the United Kingdom (UK), and to describe age-, ethnicity- and region- specific variations.

Methods: The Clinical Practice Research Datalink (CPRD) contains anonymised electronic health records for approximately 7% of the UK population. The occurrence of a fracture between 1988 and 2012 was determined from the CPRD for all individuals <18 years of age, and used to calculate fracture incidence rates for age, sex and ethnicity. Regional fracture incidence rates were also calculated based on general practitioner location within 14 Strategic Health Authorities (SHA) within the UK.

Results: The overall fracture incidence rate was 137 per 10,000 person-years (py). This was higher in boys (169 per 10,000 py) than girls (103 per 10,000 py) and white children (150 per 10,000 py) compared to those of black (64 per 10,000 py) and South Asian (81 per 10,000 py) ethnicity. Marked geographic variation in incidence was observed. The highest fracture rates were observed in Wales, where boys and girls had 1.82 and 1.97 times greater incidence, respectively, than those residing in Greater London.

Conclusion: In the period 1988–2012, there was marked geographic and ethnic variation in childhood fracture incidence across the UK. These findings also implicate lifestyle and socio-economic differences associated with location and ethnicity, and are relevant to policy makers in the UK and internationally.

1. Introduction

Fractures are common in childhood and adolescence, and can result in significant periods of inactivity, [1] missed schooling and parental time off work. [2] Furthermore, there is evidence from some, but not all studies, [3] to suggest that sustaining a fracture in childhood is associated with lower indices of bone strength [4] and an increased risk of fracture in adulthood. [5] Previous studies have found considerable variation in incidence rates of childhood fracture across European countries, ranging from 120 to 361 per 10,000 person years (Table 1) [1,6–17], although recent epidemiological studies from Scandinavia have suggested that overall childhood fracture incidence increased from the mid to late 20th century and has been followed by a more recent plateau or decline. [6,8,15] It is well recognised that childhood fractures are more common in boys than girls [12], and peak in incidence during the puberty [12], however, there are few published data

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☆☆☆ **Summary:** We have documented the epidemiology of childhood fracture in the UK between 1988 and 2012, demonstrating marked differences in site-specific fracture incidence by age, sex, geographic location and ethnicity.

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Table 1
Previously reported fracture incidence rates in children.

Author	Country	Study Period	Age	Fracture incidence rate (per 10,000 per year)
Landin, 1983 [6]	Sweden	1950–1979	0–16 years	212
Worlock, 1986 [7]	England	1981	0–12 years	160
Kopjar, 1998 [1]	Norway	1992–1995	0–12 years	128
Tiderius, 1999 [8]	Sweden	1993–1994	0–16 years	235
Lyons, 2000 [9]	Wales	1996	0–14 years	361
	Finland			178
	Sweden			155
	Norway			169
Moustaki, 2001 [10]	Greece	1996–1998	0–14 years	120
Brudvik, 2003 [11]	Norway	1998	0–16 years	245
Cooper, 2004 [12]	UK	1988–1998	0–18 years	133
Rennie, 2007 [13]	Scotland	2000	0–16 years	202
Hedstrom, 2010 [14]	Sweden	1993–2007	0–19 years	201
			0–16 years	208
Mayranpaa, 2010 [15]	Finland	2005–2006	0–16 years	163
Randsborg, 2014 [16]	Norway	2010–2011	0–16 years	180
Ramaesh, 2015 [17]	Scotland	2000	0–16 years	201

pertaining to geographic or ethnic variation in fracture rates within a single country. Knowledge of these detailed epidemiological patterns could enable regional and/or ethnicity specific targeting of advice to prevent childhood fractures and promote bone health. In the present study we therefore aimed to document childhood fracture incidence by age and sex across the UK, stratifying by ethnicity and geographic location.

2. Materials and methods

The information for this study was obtained from the Clinical Practice Research Datalink (CPRD). CPRD contains the anonymised electronic health records from General Practitioners (GP) in the UK. GPs play a key role in the healthcare system of the UK, as they are responsible for primary healthcare and specialist referrals. The population in the CPRD reflects the wide distribution of contained General Practices across the UK (providing around 6.9% national coverage), rather than individualised recruitment, and has been shown to be broadly representative of the UK population as a whole [18]. Clinical data are stored and retrieved by means of READ codes for disease or causes of morbidity or mortality, which are cross referenced to the International Classification of Diseases, 9th edition (ICD-9). From the data collected we were able to extract information on patient demographics including ethnicity, clinical events, prescriptions, referrals, hospital admissions and their major outcomes. The capture of ethnic group information in routine health records is recognized in the UK as a necessary pre-requisite to addressing inequalities in health service usage and outcomes. Within primary care, the incentivization of ethnicity recording under the Quality and Outcomes Framework (QOF)11–13 between 2006/07 and 2011/12 dramatically improved the completeness of ethnicity data for newly registered patients. QOF results data show that over 90% of UK general practices are now recording ethnicity for all of their newly registered patients, and ethnicity is also recorded by hospital staff when an individual is admitted to hospital [19]. Since there is no standard, in our study, we used the ethnicity classification as developed and tested by Mathur [19], for which a high level of concordance within and across NHS sources was found in an analysis of CPRD records of ethnicity.

The study population consisted of all permanently registered individuals aged <18 years who had a fracture recorded in their medical record during the period of time from the enrolment date of their practice in CPRD until the end of data collection. The data collection period was 1988 to 2012. Children were followed from entry into the database to the occurrence of fracture or censoring (death, withdrawal from the database, reaching age 18 years or the end of data collection), whichever came first. The fractures were classified into the following categories: skull, vertebra, rib, pelvis, clavicle, scapula, humerus, radius/ulna, carpus, femur or hip, patella, tibia/fibula, ankle, foot, or unspecified.

This research was conducted in accordance with the principles of the Helsinki declaration and the protocol for this study was approved by CPRD's Independent Scientific Advisory Committee. All data on patients were stored anonymously in CPRD and, therefore, informed consent was not required for this study.

2.1. Statistical analysis

The fracture incidence rates were calculated by dividing the number of children with a fracture by the total person-years of follow-up. The total person-years was the sum of the number of people registered on the database at July 1 of each calendar year from 1988 to 2012. In CPRD, as in many similar datasets, differentiation of 2 distinct fracture events at the same site, from one fracture event recorded twice, is extremely difficult. In order to prevent double-counting, the incidence analyses were therefore based on the first-ever occurrence of a fracture at a particular location. If a child had multiple records of fractures at the same location, only the first record was used in the incidence rate calculation. Children were censored if there was a record without details on location of the fracture (unspecified type). The incidence analyses were stratified by age, sex, ethnicity and geographic region. Geographic regions were defined based on GP location within one of 14 strategic health authorities (SHA) within the UK. The incidence rates in different regions in the UK were compared using Cox proportional hazards regression. These analyses were adjusted for age and calendar year.

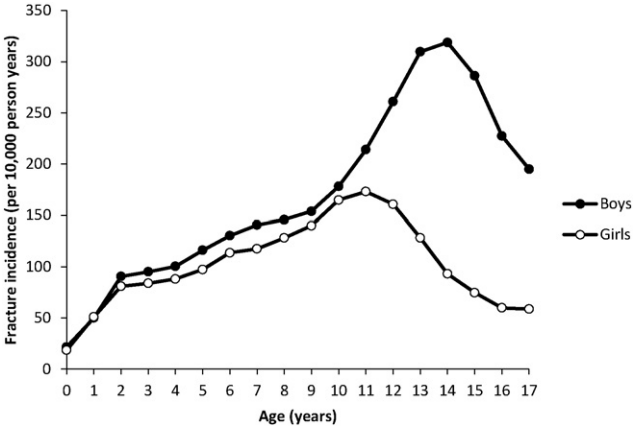

Fig. 1. Age and sex specific incidence rates of fractures at any sites, 1998–2012.