Demographic analyses of primary bone cancer in 0-49 year olds in Great Britain, 1980-2005: a small-area approach

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(1) Introduction:

Primary bone cancers occur most often in children and adolescents.

Osteosarcoma and Ewing sarcoma family of tumours of bone are the most common bone tissue malignancies in children and young adults but their aetiology is poorly understood.

It is well recognised that incidence† of some childhood cancers varies with socioeconomic status.

(2) Purpose:

To examine geographical patterning in the incidence† of bone cancers diagnosed in 0-49 year olds in Great Britain (GB) during the period 1980-2005. Separate analyses were also carried out for ages 0-14 yrs; 15-29 yrs and 30-49 yrs.

The analyses focussed on the two most common types in this age range, osteosarcoma and Ewing sarcoma. We specifically aimed to analyse putative associations with area characteristics such as deprivation and population density.

†: Incidence is the number of newly diagnosed cases during a specific time period.

(3) Methods:

Data - The following sources of data were used to enable a series of geographical and statistical analyses:

- Case data (aged 0-49 years) on osteosarcoma and Ewing sarcoma family of tumours of bone were obtained from all regional cancer registries in GB and the National Registry of Childhood Tumours (NRCT).
- Census data such as number of residents in each geographical area, were accessed through CasWeb service, Mimas, University of Manchester.
- Digital boundary and postcode directory data were accessed through EDINA, University of Edinburgh in preparation for data linkage across non-contiguous boundaries and construction of maps.
- A time series of Townsend Deprivation scores was accessed through University of Leeds.

(3) Methods (cont'd):

Analysis - The time series of Townsend deprivation scores was constructed by apportioning relevant variables (households: (a) without a car, (b) overcrowded (c) not owner-occupied and (d) persons unemployed) from previous censuses to the 2001 census geography using residential postcode distribution as a proxy for population distribution. The resulting scores together with population density provided a measure of deprivation for each census ward/postcode sector for Scotland (small-area census unit). The score for each ward was ranked and the resulting distribution was divided into quintiles (fifths of population) with a higher score representing a more deprived area (see figs. 2-4).

Residential postcode was used as a proxy for population distribution and the foundation for making all census data compatible with 2001 census geography. Bone cancer cases were then linked and aggregated by 2001 small-area census units. Number of cases and age standardised rates (ASRs) were reported by gender and at Government Office Region (GOR) level (fig. 1 illustrates GOR regions. For examples of data description see figs. 5 & 6 and tables 1 & 2).

Poisson regression was used to examine the relationship between incidence† rates by small-area census unit and:

(i) population density

(ii) Townsend deprivation index (and its components) .

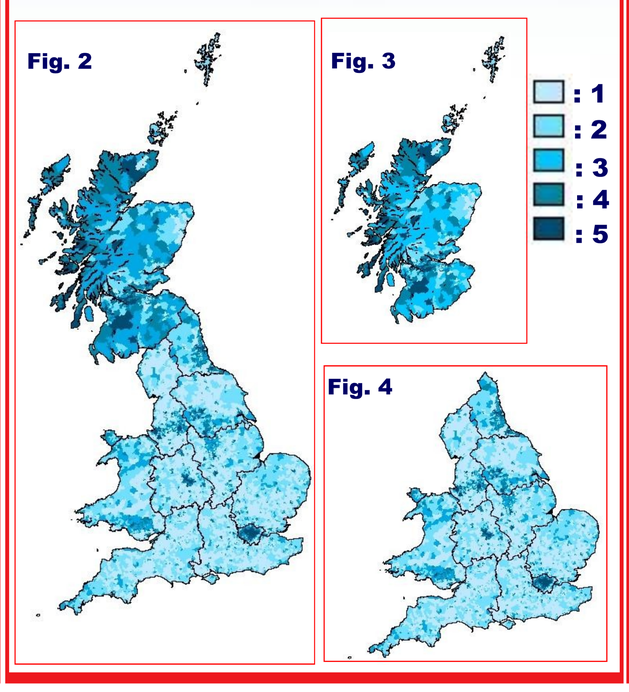
Univariable risks are reported (see fig. 7 for statistically significant results).

(4) Results

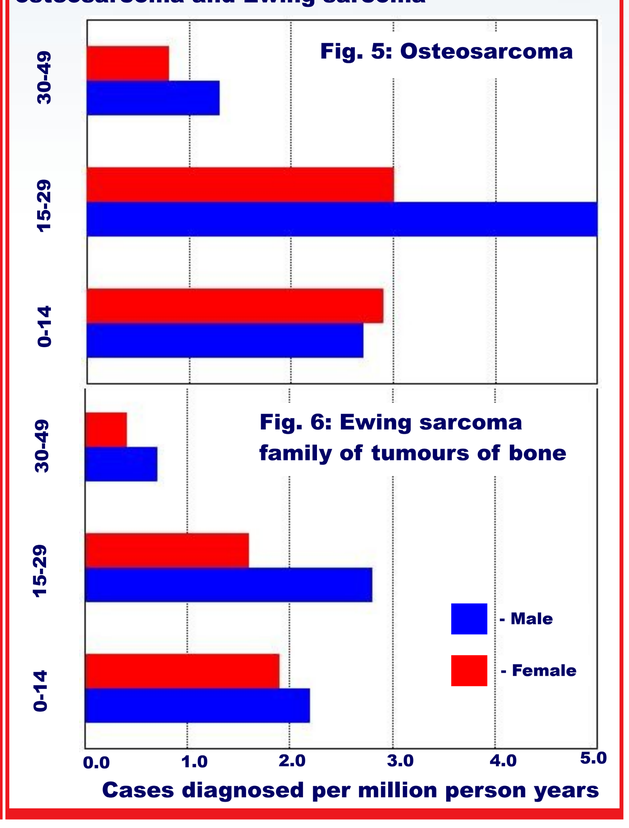
Fig. 1. Map of Great Britain illustrating study regions

Case numbers are presented at Government Office Region (GOR) level to ensure patient confidentiality is maintained.

Maps illustrating deprivation distribution according to Townsend Score by quintiles (fifths of population) across fig. 2: Great Britain; fig. 3: Scotland only and fig. 4: England & Wales only (1 = least deprived to 5 = most deprived)



Bar Charts illustrating age standardised rates by specified age group (in years) and gender for osteosarcoma and Ewing sarcoma



For Ewing sarcoma family of tumours of bone, decreased risk was associated with greater levels of area-level population density (most densely populated quintile: RR = 0.78; 95% CI: 0.67-0.91; *P* for linear trend < 0.001 for 0-49 yrs) (see fig. 7).

For children (aged 0-14 years) decreased risk was associated with lower levels of car ownership (quintile of least car ownership: RR = 0.83; 95% CI: 0.65-1.05; *P* for linear trend = 0.010*) (see fig. 7).

(5) Key Points & Conclusions:

There was no statistically significant evidence of any association for osteosarcoma with area-level population density for all age groups. However, results suggest that living in a less densely populated area may be linked with increased risk of Ewing sarcoma family of tumours of bone.

A statistically significant relationship was found between car ownership for osteosarcoma and Ewing sarcoma family of tumours of bone in 0-14 years. This study suggests that greater levels of car ownership may be a risk factor for osteosarcoma and Ewing sarcoma family of tumours of bone especially for cases occurring among children.

Number of cases (N) and Age Standardised Rates (ASRs) with 95% Confidence Intervals (CIs) (ASRs expressed as cases per million person years)

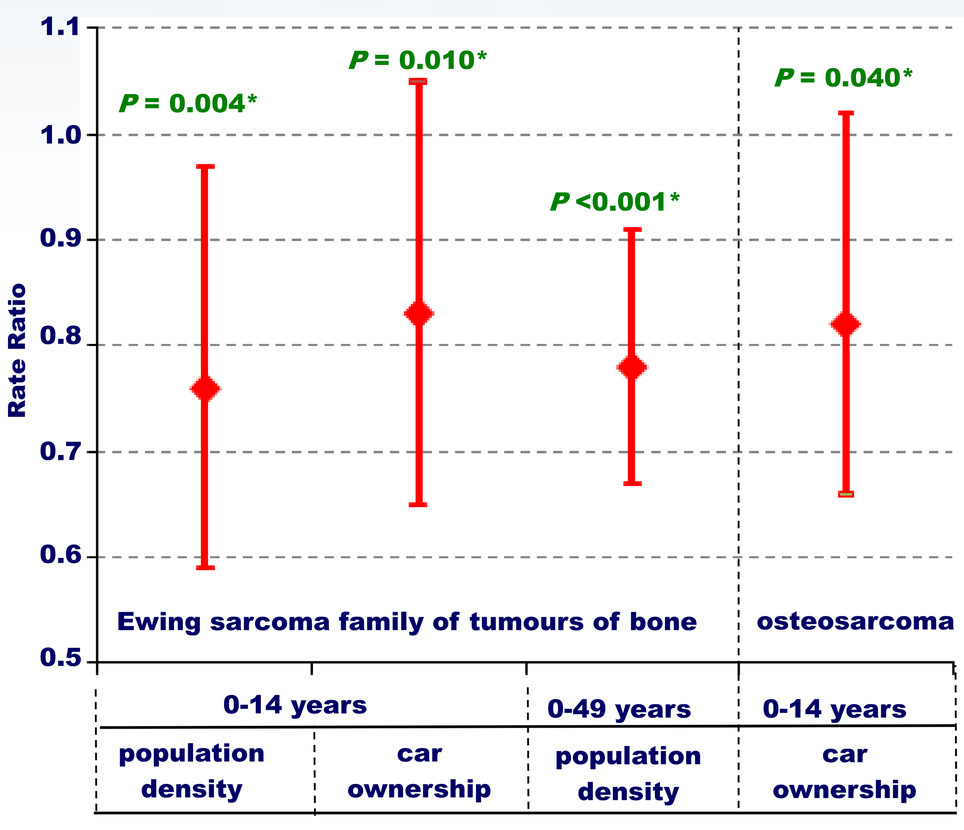
Table 1: Osteosarcoma		ASRs		
Region	N	Male	Female	All persons
North East	123	3.2 (0.9,5.5)	2.3 (0.3,4.3)	2.7 (1.2,4.3)
North West	278	2.7 (1.4,4.0)	1.9 (0.8,3.0)	2.3 (1.5,3.2)
Yorkshire & Humber	236	3.3 (1.6,5.0)	2.1 (0.7,3.5)	2.7 (1.6,3.8)
East Midlands	193	2.8 (1.1,4.5)	2.7 (1.0,4.4)	2.7 (1.5,4.0)
West Midlands	238	2.7 (1.2,4.1)	2.5 (1.0,4.0)	2.6 (1.6,3.6)
East of England	233	2.9 (2.4,3.4)	2.4 (1.9, 2.9)	2.6 (2.3,3.0)
London	341	3.3 (1.8,4.8)	2.5 (1.1,3.8)	2.9 (1.9,3.9)
South East	353	2.9 (1.6,4.2)	2.4 (1.2,3.6)	2.7 (1.8,3.5)
South West	198	2.8 (1.2,4.5)	2.2 (0.7,3.7)	2.5 (1.4,3.6)
Wales	119	3.0 (0.9,5.1)	1.7 (0.1,3.4)	2.4 (1.0,3.7)
Scotland	228	3.2 (1.6,4.8)	1.9 (0.6,3.2)	2.6 (1.5,3.6)
Great Britain [1.]	2566	3.0 (2.5,3.5)	2.3 (1.8,2.7)	2.6 (2.3,3.0)

[1.] *Includes 26 cases with unknown region*

Table 2: Ewing Sarcoma		ASRs		
Region	N	Male	Female	All persons
North East	69	2.1 (0.2,4.0)	1.2 (-0.1,3.0)	1.6 (0.4,2.8)
North West	191	1.9 (0.8,2.9)	1.4 (0.4,2.3)	1.6 (0.9,2.3)
Yorkshire & Humber	152	2.2 (0.8,3.6)	1.5 (0.3,2.7)	1.8 (0.9,2.7)
East Midlands	140	1.9 (0.5,3.3)	2.1 (0.6,3.7)	2.0 (1.0,3.1)
West Midlands	130	1.7 (0.5,2.9)	1.2 (0.2,2.2)	1.5 (0.7,2.2)
East of England	141	2.0 (0.7,3.3)	1.4 (0.2,2.5)	1.7 (0.8,2.6)
London	181	2.0 (0.8,3.1)	1.2 (0.3,2.1)	1.6 (0.8,2.3)
South East	212	1.8 (0.8,2.9)	1.6 (0.6,2.5)	1.7 (1.0,2.4)
South West	141	2.4 (0.9,3.9)	1.3 (0.1,2.5)	1.9 (0.9,2.8)
Wales	85	2.4 (0.4,4.3)	1.2 (-0.1,3.0)	1.8 (0.6,3.0)
Scotland	197	1.2 (0.3,2.1)	0.8 (0.0,1.5)	1.0 (0.4,1.6)
Great Britain [1.]	1650	1.9 (1.5,2.3)	1.4 (1.0,1.7)	1.6 (1.4,1.9)

[1.] *Includes 11 cases with unknown region*

Fig. 7. Statistically significant rate ratios (5th most deprived as compared with the 1st least deprived quintile) for osteosarcoma and Ewing sarcoma family of tumours of bone



P values are likelihood ratio tests for possible linear trend and * confirms the goodness of fit for a linear model.

(6) Further work:

Further work will involve investigating the significant findings associated with population density and car ownership.

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