Archives of Disease in Childhood 1996; **74:** 50–52

Deprivation and bronchiolitis

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Abstract

***Objective*—To test the hypothesis that socioeconomic deprivation is associated with an increased risk of admission with clinically suspected bronchiolitis.**

***Design*—Case-control study.**

***Setting*—Children under 1 year living in Sheffield in 1989–90.**

***Subjects*—307 children resident in Sheffield admitted to Sheffield hospitals with clinically suspected bronchiolitis between 1 October 1989 and 28 February 1990.**

***Methods*—Children admitted with clinically suspected bronchiolitis were ascertained from laboratory records of nasopharyngeal aspirates cultured for respiratory syncytial virus. Case notes were examined to determine whether these children had required medical intervention and postcode of residence was recorded. Controls were selected from the Sheffield child development study (SCDS) data. Postcodes were converted to electoral wards which were assigned Townsend deprivation index scores. Electoral wards were then categorised by Townsend score into five levels of deprivation. Data on family smoking for cases and controls were extracted from the SCDS.**

***Results*—Of the 307 children admitted with suspected bronchiolitis during the study period, 127 required one or more medical intervention. The risk of admission with clinically suspected bronchiolitis and with bronchiolitis requiring medical intervention rose with increasing level of deprivation score of electoral ward of residence. Children living in electoral wards in the two more deprived groups were more than 1·5 times as likely to be admitted (odds ratio (OR) 1·67, 95% confidence interval (CI) 1·25 to 2·24) or admitted requiring a medical intervention (OR 1·74, 95% CI 1·16 to 2·62) than children living in other parts of the city. Similar results were obtained after exclusion of children living in homes classified as smoky by the health visitor.**

***Conclusion*—Residence in an area of social and material deprivation increases the risk of admission with bronchiolitis even after taking account of parental smoking and when only more severe cases were considered.**

(*Arch Dis Child* 1996; **74:** 50–52)

Keywords: bronchiolitis, deprivation.

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Accepted 26 September 1995

Respiratory infection is the commonest reason for the admission of infants to hospital.[1] Bronchiolitis, associated with respiratory syncytial virus (RSV),[2] is the commonest lower respiratory infection of infancy[3] with annual epidemics occurring in the winter months.[4]

In Britain, RSV infection has been associated with urban industrial populations where overcrowding, poor housing, and unemployment are prevalent.[2] It has been estimated that children from industrial areas have a one in 40 chance of admission with severe RSV infection in the first three months of life.[2] An outbreak in Naples in 1977 in which many infants died was linked to RSV infection in conditions of severe deprivation.[3]

The 1989/90 RSV outbreak, the largest for some years,[5] and the routine data collection on all Sheffield children at birth and 1 month of age undertaken as part of the Sheffield child development study (SCDS)[6] provided the opportunity to examine the relationship of hospital admission with clinically suspected bronchiolitis and residence in areas of deprivation using a case-control design.

Methods

CASE DEFINITION AND ASCERTAINMENT

The policy in Sheffield paediatric units was to obtain a nasopharyngeal aspirate in all infants suspected of having bronchiolitis. Cases were therefore defined as infants under the age of 1 year admitted to Sheffield paediatric units during the study period (1 October 1989 to 28 February 1990) who were recorded by the laboratory as having had a nasopharyngeal aspirate. Infants dead on admission were included if they had a clear history of respiratory illness compatible with bronchiolitis before death. Children with addresses outside the Sheffield city boundary were excluded.

CONTROL GROUP

The next two infants on the SCDS register of the same sex and born on the same day still resident in Sheffield at age 1 year with no recorded hospital admission for respiratory illness in the first year of life were taken as controls for each case.

DATA COLLECTION

Data were collected for cases and controls on postal code of address at birth. From SCDS data collected at 1 month of age by the family health visitor, infants were allocated to groups according to whether or not they were living in a smoky atmosphere. For cases, a retrospective measure of medical/nursing intervention was made by one of the authors (NS) from the hospital records. Cases were classified as having required intervention if one or more of

Table 1 OR for admission with clinically suspected bronchiolitis by level of deprivation of electoral ward of residence

Deprivation level of area of residence	Case (n=307)	Control (n=612)	OR
I	30	101	1·00
II	31	95	1·10
III	109	217	1·69
IV	82	127	2·17
V	55	72	2·57

χ^2 for linear trend 19·031, p=0·00001.

the following was recorded in the hospital records: artificial ventilation; intravenous infusion; nasogastric feeding; oxygen treatment; or complications requiring treatment.

DATA ANALYSIS

Postcode data were converted to electoral ward data using a district health authority data package. Based on 1981 census data, a Townsend deprivation index (TDI)[7] was calculated for each Sheffield electoral ward.[8] Electoral wards were classified as: V=most deprived (TDI +4 or greater); IV=deprived (TDI +2 to +3·99); III=average (TDI +1·99 to −1·99); II=privileged (TDI −2 to −4); I=most privileged (TDI −4 or less).

Odds ratios (ORs) and Cornfield 95% confidence intervals (CIs)[9] associated with level of deprivation of area of residence, for residence in deprived (IV or V) versus non-deprived (I, II, or III) areas for admission to hospital with clinically suspected bronchiolitis, and for admission with this diagnosis requiring medical intervention were calculated. The same analyses were repeated after excluding cases and controls classified as living in a smoky atmosphere. Where appropriate a χ^2 test for linear trend was performed. ORs and Cornfield 95% CIs associated with living in a smoky atmosphere for admission and for admission requiring intervention were also calculated.

Results

During the study period, 307 children under the age of 1 year with addresses within the Sheffield city boundary were admitted on at least one occasion with clinically suspected bronchiolitis. A total of 127 of these infants required intervention during the admission. Living in an area of deprivation (groups IV and V) was associated with an increased risk of admission with clinically suspected bronchiolitis compared with children living in other areas (groups I, II, and III) (OR 1·67, 95% CI 1·25 to 2·24). The risk of admission rose steadily with the level of deprivation of area of residence; the OR associated with residence in an electoral ward classified as in the most deprived group (V) was 2·57 (χ^2 for linear trend 19·031, p=0·00001) (table 1).

Living in an area of deprivation (groups IV and V) was associated with an increased risk of admission requiring intervention compared with children living in other areas (groups I, II, and III) (OR 1·74, 95% CI 1·16 to 2·62). The risk of admission requiring intervention rose with the level of deprivation of area of residence; the odds ratios associated with residence in the electoral wards classified as in the deprived (IV) and most deprived (V) groups were 2·82 and 2·42 (χ^2 for linear trend 8·869, p=0·0029) (table 2).

Information related to the presence of a smoky atmosphere at the time of the 1 month visit by the health visitor as part of the SCDS was available for 225 cases and 457 controls. The risk of admission was increased for children classified as living in a smoky atmosphere (OR 2·93, 95% CI 1·95 to 4·41).

After exclusion of children classified as living in a smoky atmosphere, residence in a deprived area (IV and V) was still associated with an increased risk of admission (OR 1·54, 95% CI 1·01 to 2·24) and admission requiring intervention (OR 1·86, 95% CI 1·06 to 3·27) compared with children living in non-deprived areas (I, II, and III).

Discussion

These results support the previously reported association between bronchiolitis and adverse social and environmental factors.[2] In this study residence in an area of deprivation is associated with an increased risk of admission with clinically suspected bronchiolitis.

The increased risk of hospital admission of children living in deprived areas has been attributed to an increased readiness of health professionals to admit children from socially deprived homes.[10] However, our results show that, for one of the most important acute infections of infancy, the higher risk of admission for infants from deprived areas holds when infants with mild symptoms not requiring medical or nursing intervention are excluded from the analysis. This new finding suggests that the links between social deprivation and hospital admission in childhood are related as much to increased risk of significant morbidity as to professional behaviour.

The increased risk of respiratory infection in children from more deprived families has been attributed to higher levels of parental smoking.[11] In this study living in a house classified by the health visitor as 'smoky' was associated with a significant increase in the risk of admission. However, even after exclusion of children living in smoky houses, there was a significantly increased risk of admission and of disease severe enough to warrant intervention. The 'smoky' atmosphere measure used in the SCDS was not validated against parental smoking habits and caution must be used in

Table 2 OR for admission requiring intervention by level of deprivation of electoral ward of residence

Deprivation level of area of residence	Intervention group (n=127)	Controls (n=612)	OR
I	11	101	1·00
II	17	95	1·64
III	41	217	1·39
IV	39	127	2·82
V	19	72	2·42

χ^2 for linear trend 8·869, p=0·0029.

interpreting these results. However, it is possible that the family health visitor's assessment is a more accurate measure of the infant's exposure to passive smoking than more conventional measures such as self reported parental smoking habits.

The design of this study does not allow detailed examination of the factors which may mediate the observed link between residence in an area of deprivation and increased risk of admission with clinically suspected bronchiolitis. In addition to passive smoking,[11] overcrowding,[12] and damp housing[13] have been implicated. Individual household level data were not available in this study related to overcrowding and damp but overcrowding is one of the variables that makes up the TDI and it can be assumed that infants from deprived areas are more likely to live in overcrowded households.

A further possible explanation for the link might lie in the known association between lower mean birth weight and residence in deprived areas.[14] Intrauterine growth retarded infants may have smaller airways as may infants of mothers who smoke in pregnancy,[15] which predisposes them to wheezing in infancy. RSV bronchiolitis has been linked with atopy and subsequent asthma[15]; it is possible that social deprivation increases exposure to allergens such as mould and house dust mite, which combined with the effects of small airways and increased exposure to passive smoking leads to increased susceptibility to respiratory infections.

The TDI scores used in this study were derived from the 1981 census and were calculated at electoral ward level. During the eight years between the 1981 census and the study, it is possible that the geographical distribution of deprivation changed; however, unemployment data for Sheffield electoral wards collected in 1985[8] show the same distribution of high levels of unemployment as the deprivation areas identified by TDIs derived from 1981 census data.

Electoral wards are heterogenous and levels of deprivation may vary greatly within them.[14] Using socioeconomic data derived from electoral wards of residence rather than individuals will tend to bias results towards the null hypothesis, underestimating the magnitude of the underlying social class differentials.

This study adds weight to the view that socioeconomic factors continue to influence child health[16 17] and remain important in the causal pathways to adverse health outcomes in childhood. These pathways need further elucidation; some of the mediators worthy of further study are considered above.

1 Primavesi R, MacFaul R. Paediatric medical audit. *Arch Dis Child* 1990; **65:** 1170–4.
2 Report to the Medical Research Council Subcommittee on Respiratory Syncytical Virus Vaccines. Respiratory syncytial virus infection: admissions to hospital in industrial, urban and rural areas. *BMJ* 1978; ii: 796–8.
3 Gardner PS. Virus infection and respiratory disease of childhood. *Arch Dis Child* 1968; **43:** 629–45.
4 Martin AJ, Gardner PS, McQuillan J. Epidemiology of respiratory viral infection among paediatric inpatients over a six-year period in north-east England. *Lancet* 1978; ii: 1035–8.
5 Communicable Disease Surveillance Centre. *Communicable disease report.* CDR weekly edition 90/06. London: CDSC, February 1990.
6 Carpenter RG, Gardner A, Jepson M, *et al.* Prevention of unexpected infant death: evaluation of the first seven years of the Sheffield intervention programme. *Lancet* 1983; i: 723–7.
7 Townsend P, Phillimore P, Beattie A. *Health and deprivation: inequality and the north.* London: Croom Helm, 1988.
8 Sheffield Health Authority. *Health care and disease: a profile of Sheffield.* Sheffield: Sheffield Health Authority, 1991.
9 Greenland S, Robins JM. Estimation of a common effect parameter from sparse follow up data. *Biometrics* 1985; **41:** 55–68.
10 Rosenberg K. Poverty and the health of children. *Lancet* 1984; ii: 814.
11 Evans J-A, Golding J. Parental smoking and respiratory problems in childhood. In: Poswillo D, Alberman ED, eds. *Effects of smoking on the fetus, neonate and child.* Oxford: Oxford Medical Publications, 1992.
12 Ranson R. *Healthy housing: a practical guide.* London: E and FN Spon on behalf of WHO Europe, 1991.
13 Martin CJ, Platt SD, Hunt SM. Housing conditions and ill health. *BMJ* 1987; **294:** 1125–7.
14 Reading R, Openshaw S, Jarvis S. Measuring child health inequalities using aggregations of enumeration districts. *J Public Health Med* 1990; **12:** 160–7.
15 Martinez F, Wright AL, Taussio LM, Holberg CJ, Halonen M, Morgan WJ. Asthma and wheezing in the first six years of life. *N Engl J Med* 1995; **332:** 133–8.
16 Spencer NJ. Poverty and child health: an annotation. *Children and Society* 1990; **4:** 352–64.
17 Kumar V. *Poverty and deprivation in the UK: the effects on children.* London: National Children's Bureau, 1993.