

The presence of severe postcoronary angina has now become an accepted indication for surgical intervention and, though the data as presented here do not substitute for well controlled randomised trials, knowing the course of essentially untreated disease in an unselected group of patients can aid in the evaluation of such interventions.

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Preventable childhood deaths in Wolverhampton

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Abstract

A retrospective survey was undertaken of all deaths in children under 5 in the borough of Wolverhampton over the years 1976-82. Cause of death was classified in terms of preventability and possibly preventable deaths studied in more detail. Birth weight in the study group was significantly lower than that of the local population; there was no difference in ethnic origin, but there were significantly more Asian girls than Asian boys. The association between potentially preventable death and various socio-economic indicators in the electoral wards in the borough was investigated. A significant association was found between mortality and overcrowding, lack of household amenities, unemployment, lack of car ownership, and households where the head was born in the new Commonwealth or Pakistan.

Introduction

In 1976 Wolverhampton was among the highest ranking local authority areas in England for perinatal and infant mortality.¹ Along with all other areas in England and Wales the mortality rates for all ages have declined since then, but in 1980 there was a sharp increase in mortality under 5 years of age in Wolverhampton, particularly for sudden infant deaths, which prompted this inquiry.

The lower child mortality rates in Scandinavian countries compared with Britain reflect their lower death rates from causes such as "acute infections," "cot deaths," and "treatable" diseases, while death rates from causes such as congenital heart disease are similar throughout northern Europe.² Reliable data on the causes of death

in childhood depend on specialist paediatric pathologists, and in parts of Britain where these are available the true rate of unexplained cot deaths may be similar to that in Finland and Sweden.³

It has been suggested that the prevention of deaths from treatable diseases in Britain is dependent on improvement in our primary health care and that a regular system of inquiry into child deaths should be an essential part of child health surveillance.² The Black report established the need for further work on the relations between indicators of social disadvantage and mortality.¹ This study describes the overall pattern and preventable causes of child mortality in a mixed urban population in the West Midlands and explores some of the environmental and social factors that may be implicated.

Subjects and methods

Deaths in childhood occurring during 1 January 1976 to 31 December 1982 were studied retrospectively. Any child under 5 whose parents' place of residence was within the Wolverhampton district and whose death was registered in Wolverhampton was included. The population of Wolverhampton Metropolitan Borough is about a quarter of a million, from which there are roughly 3500 births each year.

Cases were identified by searching the Registrar's returns. Each death was classified in terms of preventability in a similar way to that suggested by Taylor and Emery³ (see appendix). In view of the difficulty in judging retrospectively whether a particular death might have been prevented, only deaths in group A (diseases with a very poor prognosis) were regarded as inevitable and all the others as possibly preventable. A more detailed study of potentially preventable deaths was undertaken in an attempt to identify the characteristics of this group where increased use of resources might have averted death.

Information was taken personally from community health records including health visitors' notes and obstetric, paediatric, and casualty records. Notes were made of sex, birth weight, ethnic origin, infant feeding practice, clinic attendances, area of residence, and "adverse social factors." Adverse social factors included one or more the following: mother aged less than 20; single parent or absent father (in prison, working away, etc); dirty, overcrowded home or other housing problems; financial difficulties; inadequate child care or refusal of health advice; child minded or fostered, or either considered; behavioural problems in child; psychiatric illness in

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parents or siblings; repeated non-attendance for hospital appointments; maternal language problems.

Information from the 1981 Census was used to relate indicators of socioeconomic deprivation with potentially preventable deaths. The 20 electoral wards in the borough were ranked according to the number of preventable deaths per 1000 live births over the whole seven year period. Spearman's rank coefficient of correlation was used as a measure of the association between mortality and the following factors: overcrowding—that is, households living at densities greater than 1.5 people per room; lack of amenities—that is, households lacking exclusive use of bath or inside lavatory; total and male unemployment; single parent families; head of household born in new Commonwealth or Pakistan; car ownership; house tenure—that is, owner occupied or rented.

As a guide to the allocation of resources, Wolverhampton Borough Council has developed a scoring system using eight census indicators to rank electoral enumeration districts (the smallest geographical unit for which census information is collected) in order of deprivation. This system has defined in detail the worst (most deprived) 25% of the borough as deprived areas.

Results

There was a fall in mortality in all age groups over the period of study (table I). Table II lists the causes of death. Congenital abnormalities and obstetric complications accounted for more than half of the deaths, and these two categories remained relatively constant over the study period, averaging 30% a year for congenital abnormalities and 44% for obstetric complications.

In 1980 there was a sudden increase in mortality in all age groups under 5, and from all causes except congenital abnormalities and malignant disease,

TABLE I—Childhood mortality in Wolverhampton 1976-82

	1976	77	78	79	80	81	82	
Age <28 days	Total deaths	50	44	22	32	37	23	22
	No/1000 live births	14.9	13.2	6.6	9.0	10.0	6.8	6.7
Age 28 days to <1 year	Total deaths	22	17	10	13	21	16	14
	No/1000 live births	6.5	5.1	3.0	3.7	5.7	4.8	4.2
Age 1 year to <5 years	Total deaths	12	2	9	1	5	5	2
	No/1000 population at risk	0.76	0.20	0.72	0.15	0.52	0.58	0.43
Birth rate/1000 population		12.5	12.7	12.7	13.7	14.5	13.2	13.1

TABLE II—Childhood mortality under 5 years in Wolverhampton 1976-82 classified according to preventability

	1976	77	78	79	80	81	82
(A1) Congenital	25	17	10	13	13	16	14
(A2) Malignant diseases	2	0	0	0	1	1	0
(A3) Obstetric:							
(a) Prematurity	29	30	15	17	27	12	15
(b) Birth injuries	5	4	0	3	3	5	2
(B) Disease occasionally fatal	6	6	3	2	3	0	2
(C) Treatable diseases	2	1	2	0	0	0	0
(D) Sudden death:							
(1) Negative necropsy findings	7	2	4	4	12	5	4
(2) Positive necropsy findings	5	1	4	7	3	2	1
(E) Accidents	3	2	3	0	1	3	0
Total	84	63	41	46	63	44	38

and a large rise in the number of sudden infant deaths. There was also a peak in the birth rate in that year. Possibly this increase in mortality resulted from increased pressure on services due to the high birth rate. Further analysis, however, failed to show any statistically significant association between numbers of sudden infant deaths and birth rate over the seven years.

PREVENTABLE DEATHS

During the study period there were 100 children whose deaths may have been preventable. No significant trends were noted over this period, and because of the small numbers all these deaths were amalgamated. Table III gives the characteristics of this group.

The incidence of possibly preventable deaths in the first five years of life was higher in Asian girls than in non-Asian girls or in Asian boys (table IV). Altogether there were 28 possibly preventable deaths in Asian children, and 20 of these were in girls. The numbers of possibly preventable deaths over the seven years were summated and compared with the summated numbers of other outcomes (survival or non-preventable death). There was a significant excess of possibly preventable deaths in Asian girls when compared with non-Asian girls or with Asian boys (table V).

TABLE III—Data on 100 children whose death may have been preventable. Except where stated otherwise figures are numbers of children

Male:female ratio	1:1.3
Mean birth weight (g)	2880
Mean birth weight in Wolverhampton (g)	3220
Asian	28
Asian live births in Wolverhampton (%)	23
Breast fed	19
Adverse social factors	48
Residence in deprived area	64

*p<0.001
†Z=1.2 (NS)

*95% Confidence interval 2760-3000 g.
†95% Confidence interval -3.4-13.4% of live births.

TABLE IV—Sex and ethnic differences in mortality

	Potentially preventable deaths			Inevitable deaths		
	Total	Average population aged under 5	Rate/10000/year	Total	Average population aged under 5	Rate/10000/year
Asian girls	20	1918	14.89	26	1918	19.37
Asian boys	8	1973	5.79	33	1973	23.89
Non-Asian girls	37	6703	7.89	80	6703	17.05
Non-Asian boys	35	7119	7.02	113	7119	22.68

TABLE V—Sex and ethnic differences between potentially preventable deaths and all other outcomes

	Preventable deaths	All other outcomes
Asian girls	20	13 406
Non-Asian girls	37	46 884
Asian boys	8	13 803

$\chi^2=4.72$; $0.05>p>0.01$ } $\chi^2=4.65$; $0.05>p>0.01$ }

χ^2 with Yates's correction.

TABLE VI—Association of potentially preventable deaths with indicators of socioeconomic deprivation in 20 electoral wards. (Electoral wards ranked according to numbers of preventable deaths/1000 live births and compared with percentage of households with stated indicator)

Indication of deprivation	r*	p
Overcrowding:		
>1.0 person/room	0.303	<0.5 (NS)
>1.5 people/room	0.456	<0.05
Lack of amenities	0.6558	<0.01
Total unemployed	0.4620	<0.05
Man unemployed	0.4703	<0.05
Single parent families	0.2808	<0.5 (NS)
Head born in new Commonwealth or Pakistan	0.5538	<0.05
No car ownership	0.568	<0.01
Owner occupiers	0.3124	<0.5 (NS)

*Spearman's rank coefficient of correlation.

On examining the community child health records the general impression was that infants in the study group attended the local clinics infrequently and made less use of health facilities than the general population. Poor clinic attendance was difficult to evaluate because of the lack of comparable figures for the remainder of the local population and the retrospective nature of the study. In Wolverhampton infants were found to visit the child health clinics on average once a month in the first year of life, whereas only 13 (37%) of 35 infants in the study group who died between the ages of 3 and 12 months were taken to clinics as frequently as this. In 1981 only half of the infants in

the study group attended for their six week medical examination compared with 82.2% of the infant population of Wolverhampton.

In the electoral wards of the borough a significant positive association was found between the preventable death rate and overcrowding at >1.5 people per room, lack of household amenities, total and male unemployment, low car ownership, and households where the head was born in the new Commonwealth or Pakistan. No association was found with single parent families or house tenure (table VI).

Discussion

This study suffered from being retrospective and so reliant on information which was incomplete and whose accuracy could not be verified. Minor discrepancies among records were found but information was available from at least two different sources for most of the cases. For example, statements describing social circumstances could be found in the health visitor's notes, in the community records, and also in the hospital records.

Inaccuracies were also found in death certificates compared with necropsy reports, particularly a failure to register congenital malformations. Examining the validity of child death certificates, Sunderland and Sunderland found important differences in 15% when compared with necropsy reports.⁴ Recording of the sudden infant death syndrome as a cause of death is notoriously subject to error. In one study a fifth of cases recorded as sudden infant death syndrome were later reclassified.⁵ It became apparent during this study that many sudden deaths certified as asphyxia, suffocation, inhalation of vomit, or acute respiratory infection could have been described as cases of sudden infant death syndrome. All these were classified as sudden death in group D and further subdivided according to necropsy findings (table II).

Identifying preventable deaths in childhood is subjective. Nevertheless, an attempt was made. These children died from treatable diseases (but symptoms went unrecognised or were treated too late); accidents (where supervision may have been inadequate); and sudden deaths (some of which may not have been avoidable but are included here for practical purposes). Children so identified start life with lower than average birth weights, supporting the suggestion that events in the antenatal period may determine later survival.^{3,6} Evidence of growth retardation was found at necropsy in some unexpected deaths,⁷ and an inverse relation between height and mortality in men suggests that this may have far reaching consequences.⁸

The socioeconomic conditions under which these children fail to thrive and are at increased risk of dying are well documented.^{1,6,9,10} Clustering in the deprived areas of Wolverhampton mirrors the Newcastle survey.¹¹ Adverse social and environmental factors have been found to affect mortality independently of social class or unemployment of the father.^{9,12} Not surprisingly, the educational level of the mother and the standards of the home have a greater influence than other factors.¹⁰ Few children in this survey were breast fed for any length of time, but the benefits of breast feeding have been found to have an effect only in the absence of adverse sociological conditions.¹⁰

The unexpected finding in this survey was the excess of girls among the preventable deaths in Asians. This is at variance with other studies of juvenile mortality, which show a preponderance in boys.^{10,13} The numbers in this study were small and should be interpreted with caution. A similar picture may not exist in other parts of Britain. Further studies are warranted.

Whether this sex difference reflects a true increase in susceptibility among Asian girls or whether it is based on differences in parental attitudes to the care of daughters deserves consideration. Producing a son has been an important cultural aspect of Asian

families, and in China there has been an increase in the incidence of cot deaths in girls since the state has been trying to limit families to only one child.¹⁴

A recent multicentre study on postneonatal mortality concluded that two thirds of infants seen by general practitioners and a quarter admitted to hospital had received inappropriate management.⁶ Improving the standards of health care for mothers and young children must remain a priority if some children are to be prevented from dying needlessly. More local surveys are needed to identify and monitor those at risk. In Sheffield possibly preventable deaths have fallen from 5.2 to 1.9 per 1000 since the introduction of extra care for high risk infants.¹⁵ In Wolverhampton Asian girls from socially disadvantaged backgrounds are an easily identified and previously unrecognised group who might benefit from increased health surveillance.

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APPENDIX—Classification of childhood deaths

(A) Diseases with a very poor prognosis

- (1) Congenital abnormalities and hereditary degenerative diseases
- (2) Malignant diseases
- (3) Obstetric complications
 - (a) Prematurity
 - (b) Birth injury

(B) Deaths due to diseases occasionally fatal

Diseases include those which were inadequately identified in life or failed to respond to treatment—for example, septicaemia, epiglottitis, status asthmaticus, and hypernatraemic dehydration—and those of unknown aetiology—for example, encephalitis, cardiomyopathy, and Reye's syndrome

(C) Deaths within the course of diseases not normally fatal

Cases were those where delay in recognition of illness and inadequate treatment probably contributed to death; these were mainly acute illnesses—for example, gastroenteritis, lower respiratory tract infections

(D) No recognisable disease

- Sudden death
- (1) Negative necropsy findings
 - (2) Positive necropsy findings

(E) Accidents

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