Tuberculosis and poverty

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Abstract

***Objective*—To examine whether the historical link between tuberculosis and poverty still exists.**

***Design*—Retrospective study examining the notifications of all forms of tuberculosis by council ward over a six year period and correlating this with four indices of poverty; council housing, free school meals, the Townsend overall deprivation index, and the Jarman index.**

***Setting*—The 33 electoral wards of the city of Liverpool.**

***Subjects*—344 residents of Liverpool with tuberculosis.**

***Results*—The rate of tuberculosis was correlated with all measures of poverty, the strongest correlation being with the Jarman index ($r=0{\cdot}73$, $p<0{\cdot}0001$). This link was independent of the high rates of tuberculosis seen in ethnic minorities.**

***Conclusion*—Tuberculosis remains strongly associated with poverty.**

Introduction

Almost all health indicators confirm the association between ill health and poor social and economic circumstances.[1,2] Respiratory and infectious diseases are two groups specifically related to the effects of deprivation.[3,4] Tuberculosis in particular has historically been associated with high levels of poverty. The decline in the number of notifications of tuberculosis, which began before the advent of effective chemotherapy,[5,6] may have been due to reduced overcrowding and improved nutrition and social conditions.

Since 1987 the numbers of cases of tuberculosis in England and Wales have shown a steady increase,[7] a similar rise to that seen in the United States.[8] In the United States this has largely been attributed to a rapid rise in cases among younger men, particularly black people and Hispanic populations, in which HIV has a high prevalence. More recently, however, particularly in New York, poverty and social deprivation are thought to have played a part in the rise of the incidence of tuberculosis.[9] In an analysis of the increase in incidence in England and Wales by age and sex[10] we have shown that HIV is not yet implicated in the increase in the number of cases notified. The biggest rises have been seen in young females and in older men and women. To determine whether poverty is a factor in the rising trends in tuberculosis we undertook a study of rates of tuberculosis by area by using various indices of social deprivation. We used the city of Liverpool as our working model.

Subjects and methods

Notifications of tuberculosis and population estimates were used for each of the 33 wards of Liverpool for the six years from 1985 to 1990 to provide a mean annual rate of tuberculosis for each ward. The population of each ward and several indices of social deprivation are available from the local small area database.[11] This is based on returns from the 1981 census with some recent information from Liverpool city council. Data on the ethnic mix of the population of each ward were from preliminary data from the 1991 census. The numbers of cases of tuberculosis from ethnic minorities were derived from examination of the names of all notified cases and identifying those with foreign sounding names.[12]

The chosen measures of poverty or deprivation, or both, for each electoral ward in the city were related to the notification rate of tuberculosis in that area. Several indices of deprivation of increasing complexity were examined. These were, firstly, the proportion of council housing in each ward; secondly, the proportion of children in receipt of free school meals; thirdly, the Townsend overall deprivation index,[13] which is designed to reflect material deprivation and is based on the percentage of economically active residents aged over 16 years who are unemployed, the percentage of households with no cars (a surrogate for current income), the percentage of owner occupied houses (a longer term estimate of income), and the percentage of households with more than one person to a room; and, finally, the Jarman index, a composite score designed to identify underprivileged areas where the workload of general practitioners may be expected to be high.[14] The Jarman index aggregates the following factors: the number of old age pensioners living alone; number of children aged under 5 years; proportion of single parent families; number of unemployed, unskilled workers; people living more than one to a room; and those of high mobility (moved main residence at least once in a year). The Townsend indices used are based on the average for Mersey region.[15] Pearson product moment correlations were made between the indices of social deprivation and rates of tuberculosis for each ward.

Results

The total mean population of Liverpool studied during the period of the study was 452 000. The total number of cases of tuberculosis notified during that time was 344, 58 of which were non-pulmonary, giving a mean annual rate of 12·7 cases per 100 000 population. During the six years studied there was no appreciable change in the notification rates of tuberculosis (1985: 67, 1986: 61, 1987: 42, 1988: 50, 1989: 67, 1990: 57). Notifications were most prevalent among older people (table). Forty nine cases of tuberculosis

Numbers of notifications of tuberculosis (all forms) by age and sex, 1985-90

Sex	Age (years) 0-14	15-34	35-54	55-74	75+	Unknown	Total
Male	15	27	55	77	25	2	201
Female	19	25	25	43	24	7	143
Total	34	52	80	120	49	9	344

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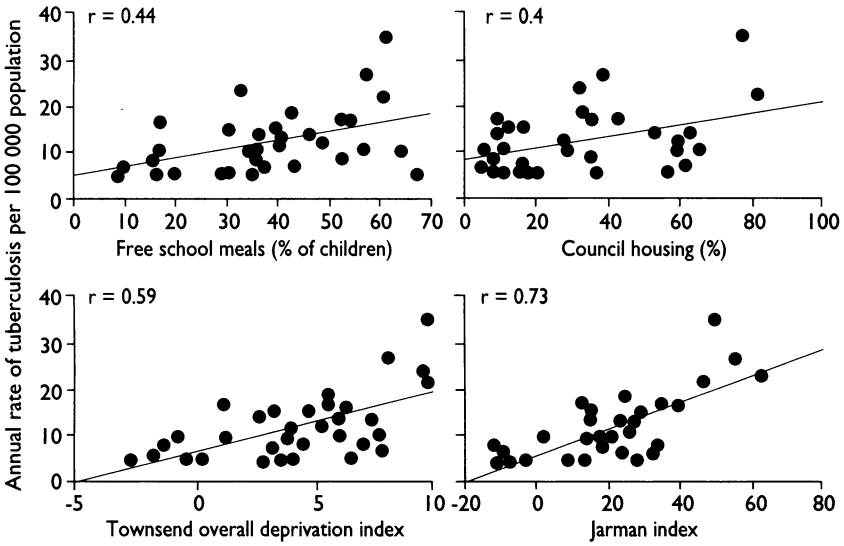
BMJ 1993;307:759-61



Scatter plots showing relation between four indices of poverty and rate of tuberculosis (all forms) in all ethnic groups for all 33 council wards in City of Liverpool

were notified from ethnic minorities, of which 21 were non-pulmonary, giving a rate among ethnic minoities of 47·9 per 100 000 population.

Simple indices of deprivation for each ward correlated with the rate of tuberculosis (all forms) in that area, proportion of council housing ($r=0·4$; 95% confidence interval 0·07 to 0·66; $p<0·02$), proportion of children in receipt of free school meals ($r=0·44$; 0·11 to 0·68; $p<0·01$) (figure).

The more complex indices of poverty and deprivation, the Jarman and Townsend indices, correlated more strongly with the rate of all forms of tuberculosis. For the Townsend overall deprivation index $r=0·59$ (0·31 to 0·78; $p<0·0005$) and for the Jarman index $r=0·73$ (0·51 to 0·86; $p<0·0001$).

When the data were reanalysed by excluding cases of tuberculosis in ethnic minorities the relation between rates of tuberculosis and indices of poverty remained: Townsend overall deprivation index $r=0·57$ (0·28 to 0·76; $p<0·001$) and Jarman index $r=0·6$ (0·33 to 0·78).

Discussion

We have shown that a strong relation continues between notification rates of tuberculosis and poverty in the last decades of the 20th century in the 33 electoral wards of Liverpool.

Liverpool has a long history of diseases associated with poverty. In 1847 the first medical officer of health appointed to the city reported that "fevers were rampant" with epidemics of tuberculosis, pneumonia, whooping cough, and cholera.[16] In the 1980s Liverpool still suffered exceptionally high rates of certain chest dieases—for example, for malignant neoplasms of the trachea, bronchus, and lung it ranked 197th for men and 198th for women out of the 198 health districts in England and Wales.[17]

Tuberculosis has traditionally been a disease of the poor, but as poverty is multifaceted it is difficult to measure. Furthermore, levels of poverty are relative to the wealth of society as a whole. The indices of poverty and deprivation we used ranged from the very simple to complex. Only the Townsend overall deprivation index was specifically designed to assess material deprivation.[13] None of these measures take account of social or cultural deprivation.

We found the strongest correlate of the notification rate of tuberculosis was the Jarman index (developed to identify areas where workload of general practitioners might be expected to be high), which, in addition to other aspects of social deprivation, includes an index of ethnic minorities. With immigration from the Indian subcontinent during the 1960s and 1970s tuberculosis has tended to become a disease of ethnic minorities living in the United Kingdom. Liverpool's ethnic population, however, which comprises only 3·8% of the population, is largely black and Chinese. Households describing their ethnic group as from the Indian subcontinent accounted for only 0·5% of the population.[18] Tuberculosis in ethnic minorities comprised only 14% of notifications and contributed little to the overall relation between deprivation and rate of tuberculosis. This is confirmed by the relation between rates of tuberculosis and poverty remaining when cases from ethnic minorities were excluded. Selecting those patients from ethnic minorities by name may not identify those of West Indian origin. The number of this group is small in Liverpool (0·3% of the population) and rates of disease among them are considerably lower than in Asians.[19]

Age, another factor used in the Jarman index, is likely to be important. We have previously shown that notification rates standardised by age are significantly raised among people aged 65-74 years in Liverpool.[20] Whether this is related to high levels of poverty in this group or to previous exposure to disease, or both, is unclear.

Exactly how poverty may directly cause tuberculosis still remains unclear. Poverty probably results in fairly poor nutrition, which is likely to render the immune system more vulnerable to invading organisms such as *Mycobacterium tuberculosis*. Protein undernutrition is associated with alterations in immune functions mediated by T cells, and animal studies have shown that BCG vaccination is less effective in protein deficient animals than normally nourished controls.[21,22] The mechanism by which protein malnourishment impairs immunity is unclear but seems to be rapidly reversible with the adoption of a normal diet.

Poverty resulting in overcrowded living conditions is likely to increase the risk of disease transmission. A recent report from Edinburgh cites a case in a 21 year old man with smear tests of sputum yielding positive results for tuberculosis; he lived in a two bedroomed council house with his mother and six siblings, and shared a bed with three siblings under the age of 10. All members of the family were infected and three of them developed disease.[23] Such severe overcrowding is unusual but may be relevant in hostel dwellers, who often live in close contact with other disadvantaged people and in whom compliance with antituberculous drugs may be poor.[9]

A single study at one point in time does not prove the hypothesis that the increase in tuberculosis seen in the United Kingdom since 1987 is as a direct result of poverty or indeed that the rise in tuberculosis is associated with a rise in levels of poverty. The strong relation between tuberculosis and indices of deprivation, however, remains consistent with the underlying hypothesis that the rise in tuberculosis may be related to a rise in underlying social deprivation among a minority of the population. A recent case-control study from South Africa found no convincing evidence that any particular aspect of the socioeconomic environment could be related to pulmonary tuberculosis.[24] Probably only a large longitudinal study could detect those specific aspects of deprivation which predispose to tuberculosis.

The fact that tuberculosis in England and Wales is increasing without any obvious association with HIV infection[10] is of concern because as the prevalence of HIV increases those infected with tuberculosis bacillus will probably develop tuberculosis thus resulting in a further rise. It is important that underlying factors likely to lead to continuing problems with tuberculosis are faced. Our results suggest that where social deprivation is rife, particularly in areas of poor housing, high unemployment, and low incomes, an increased awareness of tuberculosis as a possible

Clinical implications

- Historically, tuberculosis has been associated with poverty
- Notification rates for tuberculosis have increased in the United Kingdom since 1987
- This study shows that tuberculosis remains more common in underprivileged people
- An increased diagnostic awareness of tuberculosis, particularly when dealing with underprivileged patients, is required

diagnosis is necessary. Far from diminishing, tuberculosis both worldwide and in the United Kingdom is increasing. Poverty may be a factor causing this increase.

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(Accepted 15 July 1993)

Investigation of urinary tract infection in childhood

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Abstract

***Objectives*—To determine the number of laboratory confirmed urinary tract infections in children and to ascertain general practitioners' practices and attitudes towards their investigation and management.**

***Design*—Prospective one year survey of urine specimens submitted for bacteriological investigation; review of radiology department records; questionnaire survey of general practitioners.**

***Setting*—Gloucester health district.**

***Subjects*—57 432 children aged <15 and 7143 children aged <2 registered with a general practice in Gloucester health district and their 195 general practitioners.**

***Results*—4317 urine specimens were submitted from children aged <15, of which 563 from 442 children were culture positive. The rate (number/100 children/practice) of culture positive urine specimens in these children varied more than 10-fold between general practices, and this correlated closely with the rate of referral of urine specimens for investigation. A follow up specimen to check for clearance of infection was taken in 22% (125/563) of infections. Of the 821 specimens submitted from children aged <2, 103 from 89 children were positive. Of these children, 28 underwent radiological imaging. Most general practitioners would aim to obtain bacteriological confirmation of urinary tract infection on weekdays but only a minority said they would do so at weekends. They were apparently more likely to refer boys and younger children for renal tract imaging after a first urinary tract infection.**

***Conclusions*—Urinary tract infection in children was underdiagnosed, and after a confirmed infection only a minority of patients received renal tract imaging or microbiological follow up. Greater awareness of the importance of investigation and management of urinary tract infection in children is needed, and the practical difficulties faced by general practitioners must be resolved.**

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BMJ 1993;307:761-4

Introduction

Optimal management of urinary tract infection in children is important because of the risk of renal scarring, especially in the presence of vesicoureteric reflux.[1-5] The risk of permanent damage is greatest in children aged under 2,[6-8] but diagnosis can be difficult in young children because symptoms such as fever, vomiting, screaming, anorexia, and irritability that may indicate urinary tract infection are common in other childhood illnesses such as gastroenteritis and viral infection.[3 9] Diagnosis of urinary tract infection in children requires confirmation by finding a single organism at a concentration of at least 100×10^6/l in a fresh sample of urine.[10 11] It is, however, particularly difficult to obtain a sample of urine free of contamination from children who have not achieved bladder control.

Recently an expert multidisciplinary working group of the Royal College of Physicians proposed guidelines for the investigation and management of children with urinary tract infection.[11] The group emphasised the importance of making a bacteriological diagnosis, of instituting treatment without delay after a urine sample is taken, and of checking for eradication of infection by means of a follow up urine specimen. The group also recommended that all children, regardless of gender, should have renal tract imaging after a first episode of confirmed urinary tract infection and gave recommendations on the type of imaging for