hours and of ambulation 2 (range 0-5-5) hours. Intravenous fluids (dextrose) were given to two patients; none required oxytocics. All patients who were questioned 24 hours after delivery were completely satisfied with their labour, and 24 would have liked to have been ambulant longer, as they believed that their contractions were more comfortable when standing or walking than when sitting or lying in bed. Staff were equally enthusiastic because of the "naturalness" of the labour process. There were no cases of puerperal pyrexia or neonatal infection.

There were 28 normal deliveries. Outlet forceps were used on two occasions for failure to advance in the second stage. Whenever analgesia was required the patient was returned to bed. Eight patients received pethidine, two 50 mg, four 100 mg, and two 150 mg. The others needed no analgesia or inhaled nitrous oxide and oxygen for short periods in the second stage. All infants were well; the mean Apgar score was 8.87 at one minute and 9.93 at five minutes.

FIG 4-Accelerations in fetal heart rate in response to contractions (C) and fetal movement (FM).

CONCENDEP REPORTS

Regional variations in need for and provision and use of child health services in England and Wales

R R WEST, C R LOWE

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Summary

An analysis of indicators of the need for and provision and use of child health services in the 15 pre-1974 hospital board regions in England and Wales showed that need and provision were badly matched. There was a high degree of correlation between the indices within each of the three groups, indicating that a region with a small provision in one area of child health services would tend to have few resources in other areas also. Statistics on the use of services relate more to the provision of those services than to the need for them. Regions with large resources will justify these resources by claiming that their use statistics indicate needs, whereas they really indicate met demands. It is more important to identify demands and needs that are not being met.

Introduction

In England and Wales both general death rates and disease-specific death rates vary greatly from region to region.1-4 Broadly, the rates are much higher in the north-west than in the south-east. This has been so for a long time: William Farr drew attention to it in the early issues of the Registrar General's Annual report more than a century ago.4 One of the objectives of the National Health Service Act in 1946 was to ensure that everybody in the community—irrespective of means, age, sex, or occupation—should have equal opportunity to benefit from the best and most up-to-date medical and allied services available. Yet 30 years later regional differences in mortality persist, as do the differences in the provision of health service resources, whether measured in terms of hospital beds, annual hospital expenditure, community services, or total area health authority expenditure.5-18 Indeed, what Titmus called territorial justice (more equality of access to medical care services for people...
living in different parts of the country\textsuperscript{11}) is so far from having been achieved that in 1971 Hart coined the expression “the inverse care law” to draw attention to the continuing maldistribution of resources in relation to health needs.\textsuperscript{15} In his words “the availability of good medical care tends to vary inversely with the need for it in the population served.” Nevertheless, he produced little evidence to support this hypothesis.

If there is a serious geographical maldistribution of resources in relation to needs, it is likely to have serious consequences in the field of child health. We describe here our study of regional variations in the child health services.

### Methods

We analysed the relevant statistics on the need for and provision and use of the child health services in each of the 15 pre-1974 hospital board regions in England and Wales. These data were brought together for the Court Committee on Child Health Services, of which CRL was a member. Child health services included obstetric services and services for the care of infants, preschool children, and school-children up to the age of 15 years. In general the statistics related to the year 1973, but a few were available only for the two or three preceding years. Mortality statistics are published annually in the Registrar General’s Statistical Review and the hospital data are collected routinely by regional health authorities for the Department of Health and Social Security. Many of the statistics that we would like to have included were not available; in particular those relating to community services were deficient, either because they were not collected routinely or because they were not collected for hospital regions. We did not attempt to squeeze data into the 15 hospital regions. For example, we had to omit two useful measures—the attendance by children aged under 15 years to general practitioners and their attendance at casualty departments (obtained from the General Household Survey)—because they were available only for the standard regions and not for the hospital regions.

We considered the statistics in three groups: those relating to the need for child health services (appendix A), those relating to their provision (appendix B), and those relating to their use (appendix C).

\textbf{Need—}\textsuperscript{16}Nine statistics were selected as indicators of need in each region: the live birth rate, birth rate to young mothers (aged 15-19 years), birth rate to old mothers (aged 35-44 years), the proportion of births of low birth weight, the proportion of the population aged under 15 years, stillbirth rate, infant mortality rate, and mortality rates for children aged 1-4 and 5-14 years.

\textbf{Provision—}\textsuperscript{16}Similarly, nine statistics were selected to represent provision of services: numbers of paediatric medical staff and local authority medical staff (whole-time equivalent) per million children under 15 years of age; numbers of general practitioners, health visitors, and school nurses (whole-time equivalent) per 1000 population aged under 15; number of paediatric beds per 1000 population aged under 15; and numbers of obstetric and gynaecological medical staff and midwives (whole-time equivalent) and special care baby beds per 1000 live births.

\textbf{Use—}\textsuperscript{16}The nine statistics selected as indicators of service use were: numbers of new paediatric outpatients and of new and old paediatric outpatients per annum per 1000 population under 15 years of age; the perinatal discharge rates per 1000 population under 1 year; the annual discharge rates per 1000 children aged 4 and under and 5-14; the paediatric waiting list per 1000 population aged under 15 years; the number of antenatal attendances per birth, and the percentages of all births given polio and measles immunisation within two years of birth. Although many of these values have been considered as indicators of need (or demand) they could equally well be considered as indicators of “provision.” For example, the rate at which patients are seen and treated depends on both a demand for attention and a facility to provide.

### Results and comment

The values for each index in each of the 15 hospital regions are listed in appendices A (need), B (provision), and C (use). Many of these indices showed large and significant variations from region to region. For example, the stillbirth rates ranged from 9.8 per 1000 per annum in south-east London to 13.6 in Manchester (appendix A); the numbers of paediatric medical staff ranged from 63 per million under 15 years of age in East Anglia to 121 in north-west London (appendix B); and the perinatal discharge rates ranged from 55 per 1000 population in East Anglia to 167 in Wales (appendix C).

\textbf{Need—}\textsuperscript{16}As might have been expected several indices of need were inter-related (table 1). Among the nine indices considered there were 36 possible inter-relations, and in 13 of these the correlation coefficients showed significant positive associations (P<0.05). (All but one of the remaining non-significant correlation coefficients were also positive.)

\textbf{Provision—}\textsuperscript{16}Among the nine indices representing provision there were 17 significant associations, 14 positive and three negative (table A*). The number of paediatric medical staff (whole-time equivalent, all grades) per 1000 children in each hospital region was positively associated with five of the other indices (numbers of obstetric and gynaecological medical staff, health visitors, school nurses, special care baby beds, and paediatric beds). Each index of provision was significantly associated with at least three other indices of provision. Several of the positive associations observed were expected—for example, the association between numbers of paediatric medical staff and numbers of paediatric beds. But other positive associations indicated that provision of one type of health care resource was related to the provision of another health care resource—for example, general practitioners and health visitors, r=0.60—and showed that some regions were well provided while others were not. There was little evidence that regions with low provision of one type of resource had a compensatingly high provision of another type of resource. The three significant negative associations were between the number of midwives (whole-time equivalent per 1000 live births) and the numbers of obstetric and gynaecological medical staff, of general practitioners, and of health visitors.

\textbf{Use—}\textsuperscript{16}Similarly, among the nine indices of service use there were 12 positive and three negative significant correlations (table B). The discharge rate of children aged 4 and under was the statistic most associated with the other indices of service use. It correlated positively with the number of new outpatients, inpatient discharge rate in children aged 5-14, perinatal discharge rate, size of waiting list, and number of antenatal attendances but negatively with the percentage of children given measles immunisation. Most of the indices showed at least two positive associations with other indices: even the size of the paediatric list was significantly associated with the perinatal discharge rates and with the discharge rates of children under 4. The percentage of children given measles immunisation was negatively associated with the perinatal discharge rates and discharge rates for

\*Appendices A-C are available on request from the author.

\*Tables A-D are available on request from the author.
children aged 4 and under, and polio immunisation was negatively associated with birth rates.

Thus for all three groups of indices there were many significant within-group associations. Since many of the indices of need were positively inter-related there are likely to be regions low in several of the need indices studied. Similarly there are likely to be regions that are relatively low in service provision and use.

Relation between need and provision—The relation between need and provision is shown in table II. Among 81 possible correlation coefficients 19 showed a significant association (P < 0.05); 12 were negative and seven positive. The numbers of general practitioners and hospital beds per 1000 children showed significantly negative correlations with five indices of need. The numbers of paediatric medical staff and local authority medical staff per million population under 15 were both negatively associated with the live birth rates. The numbers of midwives, however, were positively associated with four indices of need, and the numbers of school nurses were positively associated with the birth rate of old mothers.

There is little evidence here to suggest that in regions of high need for child health care services the provision of such services is increased to any extent. Indeed, the reverse is true, and there are many more negative than positive associations between need and provision—that is, in regions with a high birth rate, high proportion of children in the population, or high infant mortality the numbers of general practitioners and local authority medical staff are low. Childhood mortality for those aged 4 and under was unrelated to any provision index and for those aged 5-14 only with the numbers of local authority medical staff, which means that in regions with high childhood mortality there is no compensatingly high provision of paediatric medical staff or paediatric beds.

Relation between provision and use—There were 32 significant positive correlation coefficients between provision and use (table C). The provision of paediatric medical staff, paediatric beds, obstetricians and gynaecologists, special care baby beds, local authority medical staff, and school nurses were all highly associated with indices of use. Paediatric waiting lists and the percentage of children given polio and measles immunisations were exceptions. The numbers of general practitioners and health visitors were less likely to have a direct effect on service use measured in terms of hospital discharges than the numbers of midwives, however, were positively associated with four indices of need, and the numbers of school nurses were positively associated with the birth rate of old mothers.

Relation between need and use—There were only 13 significant associations (four positive and nine negative) between indices of need and use (table D). Perinatal discharge rates were positively associated with the proportion of the population under 15 and stillbirth rates. Paediatric waiting lists were positively associated with the proportion of the population under 15, and numbers of antenatal attendances per birth were positively associated with birth rates to older mothers. The new outpatients attendance rates in paediatrics were negatively associated with live birth rates, however, and the proportions of children given polio and measles immunisation within two years of birth were negatively associated with five indices of need.

Discussion

The list of indices we compared in analysing the relation between need, provision, and use in child health services was far from comprehensive, but many relevant data were not available. Certain indices may be relevant only in specific sections of the child health care field—for example, figures on midwives apply only to the birth period and those on school nurses to children aged 5 and over—and certain indices are not wholly attributable to the child health care field—for example, data on general practitioners and health visitors. We attempted to compensate for these differences by including a broad range of indices in each of the three spheres of need, provision, and use. Our study lends statistical support to the hypothesis that regions of high need have low provision—the inverse care law of Hatt.15

Even at a crude regional level general practitioners, health visitors, and home nurses are seriously maldistributed—there are fewer of them where they are most needed. When data become available for area health authorities even greater differences between need and provision will probably be uncovered between areas than between regions. Poverty and ill health are fellow travellers, particularly in childhood, and the provision of health services has tended to move in the opposite direction. The health of children rests at least as firmly on quality of living and provision of good general and personal preventive services as it does on the technical excellence of the medical services to which they and their parents have access.16 In a study of health indices sensitive to medical care variation only 18%, of the inter-regional variation in infant mortality was sensitive to medical care variation while 39%, was sensitive to sociodemographic differences.17 Where the standard of living is high the health of the children is better and at the same time there is more money to spend on providing hospital beds and other health care facilities. This makes these areas more attractive to doctors because of the better occupational environment and to their wives because of the better social and educational opportunities.

Clearly there are territorial injustices crying out for correction and we believe that high priority should be given to this problem. Nevertheless, we are not convinced that correcting these injustices would guarantee an ironing out of the inter-regional differences in childhood mortality and morbidity. There is a need also for a close look at the distribution of paediatric, obstetric, and gynaecological medical staff; clinical medical officers (previously on the staff of the local authorities); school nurses; and paediatric and special care baby beds, as these appear to bear little or no relation to regional needs.

Many of the values traditionally thought of as indicators of morbidity or need—for example, new outpatient attendance and hospital discharge rates—are in fact highly associated with

<p>| Table II—Correlation coefficients relating indices of need to indices of provision in 15 hospital regions of England and Wales |
|---------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|</p>
<table>
<thead>
<tr>
<th>Need</th>
<th>Provision: No of paediatric medical staff</th>
<th>No of paediatric beds</th>
<th>No of obstetric and gynaecological medical staff</th>
<th>No of special care baby beds</th>
<th>No of midwives</th>
<th>No of general practitioners</th>
<th>No of health visitors</th>
<th>No of local authority medical staff</th>
<th>No of school nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live birth rate</td>
<td>-0.44</td>
<td>-0.44</td>
<td>-0.41</td>
<td>0.02</td>
<td>0.47</td>
<td>0.67</td>
<td>0.49</td>
<td>0.54</td>
<td>-0.39</td>
</tr>
<tr>
<td>Birth rate, mothers aged 15-19</td>
<td>-0.15</td>
<td>0.00</td>
<td>-0.42</td>
<td>0.09</td>
<td>0.25</td>
<td>0.39</td>
<td>0.14</td>
<td>0.12</td>
<td>0.05</td>
</tr>
<tr>
<td>Birth rate, mothers aged 35-44</td>
<td>-0.33</td>
<td>-0.34</td>
<td>-0.18</td>
<td>0.23</td>
<td>-0.05</td>
<td>-0.20</td>
<td>0.04</td>
<td>0.18</td>
<td>0.31</td>
</tr>
<tr>
<td>Low birth weight rate</td>
<td>0.01</td>
<td>0.42</td>
<td>0.00</td>
<td>0.13</td>
<td>0.39</td>
<td>0.36</td>
<td>0.32</td>
<td>0.34</td>
<td>0.19</td>
</tr>
<tr>
<td>Of population under 15 years</td>
<td>0.04</td>
<td>-0.24</td>
<td>0.17</td>
<td>0.07</td>
<td>0.48</td>
<td>0.52</td>
<td>0.34</td>
<td>0.19</td>
<td>0.32</td>
</tr>
<tr>
<td>Stillbirth rate</td>
<td>-0.16</td>
<td>0.24</td>
<td>-0.17</td>
<td>0.30</td>
<td>0.03</td>
<td>0.52</td>
<td>0.50</td>
<td>0.19</td>
<td>0.32</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>0.04</td>
<td>0.11</td>
<td>0.26</td>
<td>0.07</td>
<td>0.29</td>
<td>0.32</td>
<td>0.14</td>
<td>0.17</td>
<td>0.25</td>
</tr>
<tr>
<td>Mortality in those aged 1-4</td>
<td>0.14</td>
<td>0.11</td>
<td>0.26</td>
<td>0.17</td>
<td>0.10</td>
<td>0.08</td>
<td>0.08</td>
<td>0.20</td>
<td>0.23</td>
</tr>
<tr>
<td>Mortality in those aged 5-14</td>
<td>0.10</td>
<td>0.39</td>
<td>-0.12</td>
<td>0.17</td>
<td>0.10</td>
<td>0.08</td>
<td>0.08</td>
<td>0.20</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Correlations in italic are significant: r > 0.44 P < 0.05; r > 0.59 P < 0.01.
Genetic susceptibility in diabetes mellitus: analysis of the HLA association

A G CUDWORTH, J C WOODROW

British Medical Journal, 1976, 2, 846-848

Summary

Two hundred and eighty-eight patients with insulin-dependent diabetes who were aged 30 or under at onset and 150 patients with late-onset diabetes, 50 of them dependent on insulin and 100 not dependent on insulin, were HLA-typed. There was a significant positive association between the young-onset insulin-dependent patients and HLA-B8, BW15, and B18 and a significant negative association with B7. These data were combined with those from two other centres. There was a significant concordance for the distribution of all the HLA antigens among these three series, producing evidence in favour of an HLA-linked diabetogenic gene (or genes) having a major role in all cases of juvenile-onset insulin-dependent diabetes.

There was a positive association between late-onset insulin-dependent diabetes and B8, but no association between non-insulin–dependent diabetes and the HLA system. This provides further evidence for the existence of different pathogenetic mechanisms in the two major clinical forms of diabetes mellitus.

Introduction

There is a positive association between juvenile-onset diabetes and HLA-B8 and BW15 in both Copenhagen and Liverpool.1-3

An increased prevalence of HLA-B18 in similar patients living in Montpellier has also been reported.4 One interpretation of these findings is that only those diabetics who are positive for B8, BW15, or B18 possess an HLA-linked diabetogenic gene. An alternative hypothesis is that the same HLA-linked disease susceptibility gene is present in all patients with juvenile onset diabetes but that because of linkage disequilibrium with the HLA-B locus, it occurs more often on chromosomes with certain B series genes—for example, B8 and BW15—than on others. Consideration must also be given to the possibility of several HLA-linked diabetogenic genes, associated in each case with particular alleles, interacting with different environmental factors.

We analysed the results of HLA typing in an enlarged series of patients with juvenile-onset diabetes, both on their own and together with the results from other centres.4-6 HLA typing was also performed on patients with a later age of onset, both insulin and non-insulin dependent, to determine whether the basic genetic mechanisms underlying the aetiology of the disease were fundamentally different in the two major forms of clinical diabetes.

Patients and methods

Two hundred and eighty-eight patients with insulin-dependent diabetes with an age of onset of 30 years or less were HLA typed. Another 50 patients with insulin-dependent late onset diabetes and 100 with late-onset disease but no dependence on insulin were also typed. The 375 controls consisted mainly of normal blood donors living in the same geographical area. All the patients studied were Caucasian and permanently resident in the Liverpool area.

HLA typing was performed by the two-stage microlymphocytotoxicity method.8 Twenty-three specificities were determined using sera obtained from the National Tissue Typing Reference Laboratory, Bristol, and the serum bank of the National Institutes of Health, Bethesda, Maryland.

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