The impact of diarrhoeal disease on childhood deaths in the RSA, 1968 - 1985

D. YACH, P. M. STREBEL, G. JOUBERT

Summary

Diarrhoeal disease remains a major cause of morbidity and mortality in children in the RSA. In 1984, 8 984 deaths from diarrhoea of children under 5 years of age were registered, representing 27.7% of all registered deaths in this age group. Assuming a case/fatality ratio (deaths per 100 episodes of diarrhoea) of 0.6, it is estimated that 1.5 million cases of diarrhoea in children occurred during 1984 in the RSA. Analysis of diarrhoeal disease mortality rates revealed that the group at highest risk is black and coloured children under the age of 1 year. Over the period 1968 - 1985 there have been steady declines in diarrhoeal disease mortality rates for whites, coloureds and Asians. Uncertainty exists as to the true mortality rate in black children. A marked seasonal cycle is evident in diarrhoeal disease mortality rates for blacks and coloureds with peaks occurring in the period December - March. No seasonal effect on mortality is evident in the white and Asian groups. A nationally co-ordinated diarrhoea control programme is urgently needed in the RSA. This would involve a primary prevention component involving improved water supply, sanitation and sewerage, and a death prevention component emphasising the use of oral rehydration solutions. The seasonality in mortality suggests that the health education component of this programme should be aimed at the period just preceding the summer/autumn epidemic.

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Methods

Mortality figures for the RSA were derived from registered deaths collated by Central Statistical Services and made available on computer tapes. For whites, coloureds and Asians data were available from 1968 to 1985. For blacks, data were only available nationally for the period 1980 - 1985. It is recognised that, as in many developing countries, there is considerable under-registration as well as misclassification of the causes of death, particularly among blacks.4

Population figures were derived from the 1970, 1980 and 1985 census figures published by Central Statistical Services. Linear interpolation between census years was used to calculate age- and race-specific population figures for the years 1968 -1985. Census as well as mortality data exclude Transkei, Bophuthatswana, Venda and Ciskei. The census enumeration
has been shown seriously to underestimate the population, particularly the number of blacks. No adjustments for underenumeration have been made. The diarrhoea mortality data and estimated population figures were used to calculate diarrhoea mortality rates (/1000). To obtain stable rates, 6-year periods were averaged.

The impact of summer diarrhoea mortality (December - March) relative to winter diarrhoea mortality (June - September) was calculated using rate ratios. The effect of region (using the four provinces, Cape, Transvaal, Orange Free State and Natal) and season was determined only for blacks between 1980 and 1985.

**Results**

In 1984 the total infectious disease category (ICD chapter 1) accounted for 20014 deaths in the RSA. Of these deaths 52,2% were attributable to diarrhoeal disease. Diarrhoea therefore accounted for the largest proportion of all deaths from infectious disease.

Almost half (44.8%) of all post-neonatal deaths of coloureds and 43.5% of post-neonatal deaths of blacks were caused by diarrhoea, as opposed to 25.0% for Asians and 3.4% for whites. Among children 1 - 4 years of age, 32.6% of deaths of coloureds and 31.3% of deaths of blacks were caused by diarrhoea, as opposed to 16.7% for Asians and 3.5% for whites.

Table I shows the diarrhoea mortality rates in the RSA from 1968 to 1985. Overall, there have been steady declines in all population groups for which information is available over the whole period. The mortality rates are also considerably higher for the under-1-year-olds than for 1 - 4-year-olds.

### TABLE I. CHILDHOOD DIARRHOEA MORTALITY RATES* IN THE RSA, 1968 - 1985

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Coloured</th>
<th>Asian</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants (&lt; 1 yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1968 - 1973</td>
<td>1,84</td>
<td>60,42</td>
<td>10,94</td>
<td>NA</td>
</tr>
<tr>
<td>1974 - 1979</td>
<td>1,13</td>
<td>37,86</td>
<td>5,46</td>
<td>NA</td>
</tr>
<tr>
<td>1980 - 1985</td>
<td>0,39</td>
<td>19,68</td>
<td>2,46</td>
<td>13,74</td>
</tr>
<tr>
<td>Children (1 - 4 yrs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1968 - 1973</td>
<td>0,09</td>
<td>5,93</td>
<td>0,67</td>
<td>NA</td>
</tr>
<tr>
<td>1974 - 1979</td>
<td>0,10</td>
<td>4,11</td>
<td>0,35</td>
<td>NA</td>
</tr>
<tr>
<td>1980 - 1985</td>
<td>0,04</td>
<td>1,79</td>
<td>0,17</td>
<td>1,24</td>
</tr>
</tbody>
</table>

*Average over 6 years, expressed /1000 population.

NA = not available.

Analysis of diarrhoea mortality rates by age using single years (finer analysis was not possible) showed that rates were 3 - 4 times higher among infants than among children 1 - 2 years of age in all race groups. After 2 years, rates declined rapidly.

Fig. 1 shows that on a national basis mortality rates for diarrhoea (/1000/month) were higher in summer than in winter and substantially higher among blacks and coloureds than among Asians and whites. Data for blacks were only available from 1980 and are difficult to interpret because of the under-reporting of deaths. The rate ratio for the summer rate divided by the winter rate is, however, not likely to be affected by under-reporting. These rate ratios are shown in Table II. It can be seen that for coloureds and blacks there is a three- to fourfold increased risk of diarrhoea mortality in summer compared with winter months. This difference completely disappears for whites and Asians. The rate ratio for coloureds has not declined over time despite a decrease in the incidence rate (Fig. 1).

The shape of the curve for blacks shown in Fig. 1 is probably a true indication of the seasonality of diarrhoea mortality. The level, however, is not a true reflection of the absolute rates because of denominator and numerator underestimation as well as numerator misclassification.

Fig. 2 shows that for 1980 - 1985 the excess summer mortality (using the rate ratio) is highest for 1-year-old blacks and coloureds and declines with age. Asians and whites, however, showed no excess summer deaths at any age. Diarrhoea mortality rates for Blacks varied considerably by province within seasons. However, it is likely that this variability could be related to the quality of mortality reporting. The degree of seasonality (using the rate ratio) for diarrhoea mortality among blacks (1980 - 1985) also varied by province, being considerably higher in the Orange Free State (7,0), the Cape (5,1) and the Transvaal (4,1) than in Natal (2,0). Similar patterns were observed for individual years in this period.

The overall impact of diarrhoeal disease in the RSA and globally is shown in Table III. The 8984 deaths from diarrhoea registered among children under 5 years of age in the RSA in 1984 represent 27.7% of all deaths in this age group. The case/fatality ratio was calculated after analysis of 22 active surveillance programmes among children under the age of 5 years in developing countries and is expressed as deaths per 100 episodes of diarrhoea. Applying the global estimate for the case/fatality ratio to the number of deaths from diarrhoea of children aged under 5 years in the RSA, it can be estimated that about 1,5 million cases of diarrhoeal disease occur annually in the RSA.

### Discussion

Of registered deaths of blacks under the age of 5 years, 15% are categorised as being ill-defined, as opposed to 6,4% for...
Deaths per 100 episodes of diarrhoea.

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Table III. Impact of Diarrhoeal Disease

<table>
<thead>
<tr>
<th></th>
<th>Global estimates</th>
<th>RSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case/fatality ratio*</td>
<td>4.6 million</td>
<td>8,984</td>
</tr>
<tr>
<td>Estimated No. of diarrhoea cases</td>
<td>0.6†</td>
<td>0.6†</td>
</tr>
<tr>
<td></td>
<td>766.7 million</td>
<td>1.5 million†</td>
</tr>
</tbody>
</table>

*Deaths per 100 episodes of diarrhoea.
†Estimated.

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Considerable research conducted over the past 25 years in the Soweto/Johannesburg area has examined the contribution of diarrhoeal disease to morbidity and mortality in this area. Infant mortality rates (IMRs) have declined substantially over the last 45 years in all population groups. The decrease has largely been due to the decline in the contribution of diarrhoeal disease as a cause of death. In addition, there has been a substantial decline in kwashiorkor and marasmus and an improvement in socio-economic conditions in the region. In 1956, when the population of Soweto was 300,000, there were 2,400 admissions to the Baragwanath gastro-enteritis unit and 650 deaths from diarrhoea. This increased to a peak of 4,673 admissions in 1969 and in 1978 had fallen to 3,267 admissions despite an increase in the Soweto population to over 1.5 million. Fifty-three deaths from diarrhoea were reported in that year. In the 1960s it was documented that diarrhoeal disease was strongly associated with socio-economic conditions and malnutrition. Spencer and Coster considered that improvements would occur, since the last slums were being rebuilt in Soweto!

Analysis by suburb of admissions to the Baragwanath Hospital drip room of children aged under 5 years with dehydrating diarrhoea showed that within Soweto there was a threefold variation in the rate of admission for severe diarrhoea from 16.1/1,000 children aged under 5 years for the worst suburb to 5.6/1,000 for the best suburb. Since Baragwanath is the major referral hospital in the area and it is likely that severe cases of dehydrating diarrhoea have equal likelihood of admission, it was considered that it would be useful to determine whether differences in socio-economic factors between the suburbs could explain variations in the admission rate. There was an ecological correlation between several socio-economic factors derived from the 1985 census and drip-room admission rates. The percentages of males and females (separately) with less than Standard 4 education showed a positive correlation with admission rates by suburb (Spearman's correlation coefficient 0.55 and 0.45 respectively). Similarly, negative correlations were found for the percentages of males and females with at least matric or professionally employed (unpublished data).

Further work is required to determine the factors at individual level responsible for high rates in specific intra-urban settings. It was recognised by the 1930s that in the USA and Europe, as the overall rate declines, the seasonal fluctuation in incidence rates diminishes. This was not found on analysis of mortality rates for coloureds in the RSA. Further work is required to determine reasons for the failure of the summer/winter ratio to decline. An excess of diarrhoea deaths in the summer in the USA, observed earlier this century, has now converted to an excess in the winter. No such winter excess was found in this study.

Roux and co-workers showed in 1963 that summer epidemics of diarrhoea in Soweto were predominantly related to enteropathogenic Escherichia coli, Shigella and Salmonella and were not related to viruses. Spencer and Coster demonstrated a fivefold increase in the incidence of gastro-enteritis causing dehydrating diarrhoea and necessitating admission to Barag-
wanath Hospital in summer versus winter months of 1965. Further studies in Baragwanath in 1977 - 1980 showed that among blacks diarrhoea was correlated with a number of factors related to weather (atmospheric temperature and humidity), but that this was not so among whites.12

Several studies conducted between 1959 and 1979,13-15 examined specific pathogens involved in diarrhoeal disease and also elucidated risk factors for diarrhoea. In a recent review Koornhof et al.,16 stated that bacterial enteritis was the most common contributor to the summer epidemic among blacks. It had previously been shown that while rotavirus was the main aetiological agent in acute winter diarrhoea in white infants, it was not as important among blacks.22 This could be due to the masking effect of bacterial diseases.

The reasons for the regional variation in the seasonality of diarrhoea mortality rates, never previously documented, need further investigation.

Conclusions

Diarrhoeal disease accounts for considerable mortality in the RSA. Annual summer epidemics of diarrhoea, particularly among blacks and coloureds under 2 years of age, account for most of the deaths. Mortality rates have declined in all races for which data are available over the whole period. The black and coloured rates are still substantially higher than those for whites and Asians.

There is an urgent need to introduce a nationally co-ordinated diarrhoea control programme along the lines suggested by the WHO.23-25 Such a programme should include a death prevention component that stresses case management using oral rehydration therapy or salt-and-sugar solutions3,4,13-15 and a primary prevention component that includes improvements in water supply, sanitation and sewerage.36

Finally, a seasonally timed health education programme using all possible media should be given the highest priority to prevent annual epidemics of diarrhoea deaths.

REFERENCES