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Measles complications: the importance of their management in reducing mortality attributed to measles

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Objective: To determine the effect of rates of complications among cases and management of complicated cases on measles case fatality rates.

Design: Measles disease surveillance.

Setting: City of Gweru, Department of Health.

Subjects: Children aged zero to 15 years.

Main Outcome Measures: Case fatality rates.

Results: Measles case fatality rates declined from 47.6 in 1967 to zero in 1989. Between 1967 and 1978 respiratory infections were the predominant complications (66.5%), while after 1979 diarrhoea was the predominant complication (60.6%). A significant partial correlation coefficient was observed between rates of mortality among complicated cases and case fatality rates ($r=0.89$, $df=20$, $p<0.001$).

Conclusion: Good management of complicated cases may have contributed towards the decline in measles case fatality rates.

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Introduction

Measles is among the commonest and most serious disease conditions in childhood accounting for an estimated 1.4 million measles deaths annually.^{1,2} However, in recent years measles deaths have been declining world wide. This decline has been attributed to many factors including improved care of complicated cases.² In the city of Gweru, Zimbabwe, mortality attributed to measles has been declining since 1967.³ This paper examines the occurrence of complicated measles in Gweru and the effect of the care of these cases on measles mortality in the period 1967 to 89.

Materials and Methods

The City of Gweru, third largest city in Zimbabwe, has a population of 124 735 people (1992 census). In Gweru measles cases and deaths are identified through a surveillance system which records cases and deaths which are reported from the city's health centres and those reported through active case searches in the community. Complicated cases are managed at the city's single infectious disease hospital. Surveillance data on measles cases and deaths are entered on line lists which indicate date of identification of a case, age at infection, presentation of the disease, whether admitted into hospital or not, outcome of illness (alive or dead) etc.

In this study measles surveillance data were reviewed. From this data the following were determined for each year: case fatality rates, spectrum of complications, rates of complications among cases and rates of mortality among complicated cases.

Rates of complications among cases and rates of mortality among complicated cases were correlated with case fatality rates. A partial correlation analysis was used to remove the effect of confounding.

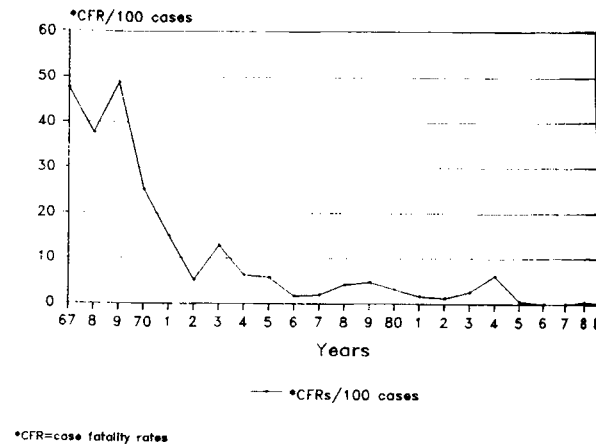
Limitations of the Study.

1. Efforts have been made to improve measles surveillance in Gweru. Despite this, however, there is the possibility that in the 1960s and early 1970s the system may not have sufficiently developed to report all measles cases and deaths. On account of this there could be under reporting of measles cases and deaths in this period.
2. Measles deaths cited in this study are those attributed to acute disease and not post measles deaths. There could be under reporting of measles deaths because post measles deaths are said to be substantial.⁴

Results

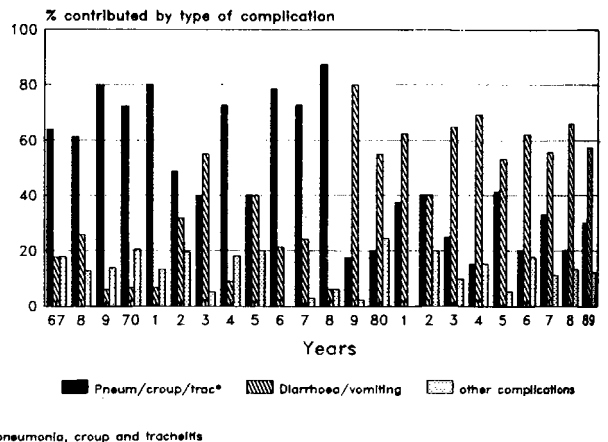
Measles case fatality rates: Measles case fatality rates declined from 47.6% in 1967 to zero in 1989. In this period the median case fatality rate was 4.2% ($Q_1=1.20$, $Q_3=12.9$) Case fatality rates declined from 47.6% in 1967 to 5.2% in 1975. In the period 1976 to 85 measles case fatality rates were on average 2%. For the period 1986 and after, except for 1988 when one death was reported, no measles deaths were reported in the City of Gweru (Figure I).

Figure I: Measles case fatality rate in the City of Gweru, 1979 to 1989.



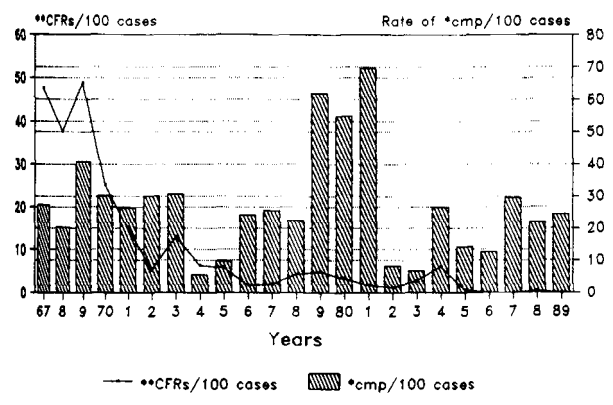
Spectrum of measles complications: In the period under review the spectrum of measles complications included pneumonia, diarrhoea, croup, tracheitis, malnutrition, *Otitis media*, tonsillitis, stomatitis and encephalitis. One case of corneal ulceration was reported in 1967. Between 1967 and 1978 respiratory complications (pneumonia, croup and tracheitis) on average accounted for 66.5% of reported complications while diarrhoea accounted for 21% in the same period. After 1979 diarrhoea on average accounted for 60.6% of reported complications while respiratory complications accounted for 27.3% in the same period (Figure II).

Figure II: Spectrum of measles complications among cases in the City of Gweru, 1967 to 1989.



Rates of complications among measles cases: Between 1967 and 1989 rates of complications among cases were of the range 5.4% to 69.5%. The highest rates of complications occurred in 1979, 1980 and 1981 which had 61.9%, 54.8% and 69.5% respectively. The median rate of complications in the period under review was 25.5% ($Q_1=14.2$, $Q_3=30.2$). Correlation of rates of complications among cases and case fatality rates gave a correlation coefficient of 0.09 ($r^2=0.01$, 95% CI=-0.033 to 0.49, df 1,21). The association was not statistically significant (Figure III).

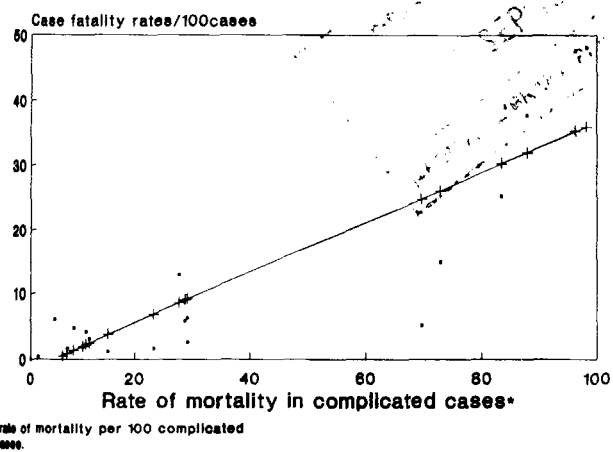
Figure III: Measles case fatality versus rates of complications among cases in Gweru, 1967 to 1989.



Rates of mortality among complicated measles cases:

Between 1967 and 1976 rates of mortality among complicated cases declined from 96.3% to 23.3%. After 1977, except for 1983 when the rates rose to 29.2%, the rates were on average 6.6%. In the period under review the median rate of mortality among complicated measles cases was 15.3% (Q₁=6.8, Q₃=69.6). Correlation of rates of mortality among complicated cases and case fatality rates gave a correlation coefficient of 0.93 (r²=0.86, 95% CI= 0.65 to 0.79, p<0.001, df 1, 21). The association between the two variables was found to be statistically significant (Figure IV).

Figure IV: Correlation of measles case fatality rates and rates of mortality among complicated cases in Gweru, 1967 to 1989.



A significant partial correlation coefficient was observed between rate of mortality among complicated measles cases and measles case fatality rates (r=0.89, df=20, p<0.001) but not between rate of complications among measles cases and measles case fatality rates (r=0.21, df=20, p>0.05).

Discussion

In this study a change in the spectrum of measles complications which occurred in 1979 to 1980 has been observed. A recent

epidemic study in a highly vaccinated community in Zimbabwe has shown that diarrhoea is the predominant complication among cases, with pneumonia ranking second.⁵ In a hospital study in Malaysia, where 85% of admitted cases were not immunized against measles and 60% of admitted cases showed features of malnutrition, (median age of cases was 12 months) the main complications were pneumonia (74.1%) and diarrhoea (38.5%).⁶ In a study from Ghana the major indications for admission among children with low vaccination were pneumonia, malnutrition and diarrhoea.⁷

From these studies it seems the factors that are at play in determining the spectrum of complications are vaccination status, age at infection and nutritional status of cases. Thus the change in the spectrum of complications observed in the current study could have been occasioned by changes in age epidemiology of measles which arose from sharply rising vaccination coverages which occurred in the 1980s after the inception of the Expanded Programme on Immunization.³

Complicated measles cases are associated with high case fatality rates.^{4,8,9} Respiratory complications, particularly pneumonia and croup, are attended with high case fatality rates.^{5,9-12} It follows that changes in rates of complications among cases would affect case fatality rates. In the current study no association was found between rates of complications among cases and case fatality rates. This could be explained on the basis that rates of complications among cases ranged between 20% and 30% for most of the period under review and did not decline while case fatality rates declined.

In this study a strong association has been found between rates of mortality in complicated cases and decline in measles case fatality rates. It is thought this is a result of improved quality of care of measles cases admitted into the infectious disease hospital since all such cases are admitted into this facility as a matter of policy. Although no direct measurements of quality of care of measles cases were carried out in the current study, within the authors' experience improvements in care of measles cases have occurred over the years. Over and above all the other therapies provided to complicated cases, vitamin A supplements have been provided to all measles cases since 1964 as a matter of policy. Vitamin A is known to have an effect on survival of measles cases.^{2,11,13-15}

That quality of care could have made a difference to case fatality rates is further strengthened by the fact that in the current study it has been found that rates of complications among measles cases were not associated with the decline in measles case fatality rates.

The importance of care of complicated measles cases is underlined by the observation that in most developing countries if measles deaths are to be reduced it would not be enough to rely on measles immunization alone. The majority of children infected with measles can be saved from death by improvements in case management and treatment of complications.^{2,8,13} Findings from the current study confirm this observation.

Despite the above findings, it would be safe to speculate that in the 1980s measles immunization, which is known to have an impact on measles mortality,¹⁶ would have played a role in maintaining low rates of measles deaths. Effect of immunization on measles mortality was not examined in this study.

Conclusion: Good management of complicated measles cases may have been an important facet in the decline of mortality attributed to measles in the City of Gweru.

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