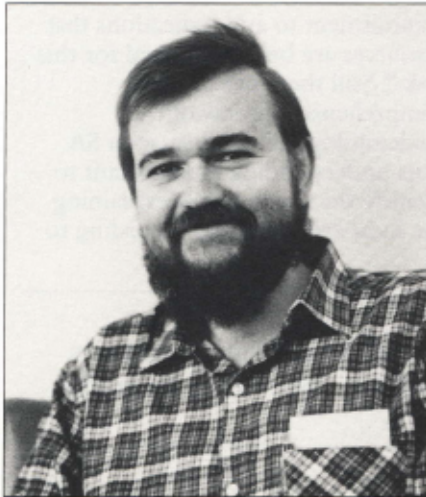


Measles in South Africa: A Comprehensive Interpretation of the Data

Part I — P Ferrinho, E Buch



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Curriculum vitae

Paulo Ferrinho had his school education in Mocambique and then went on to the University of Cape Town to obtain the MBChB in 1980. He did his internship at the Groote Schuur hospital in Cape Town and then worked at the Gelukspan Community Hospital from 1982 to 1986. After that he became a registrar in Community Health at the University of the Witwatersrand. At the moment he is the Clinic Manager and Director for Research of the Alexandra Health Centre and University Clinic/Institute for Urban Primary Health Care. Although specialising in Community Health, his professional interest remains in support to primary health care.

Summary

In South Africa (SA) there is a commitment to and indications that resources are being allocated for the eradication of measles. Still there has been no comprehensive review of the epidemiology of the disease in SA. This understanding is important to identify factors and trends to guide public health practice. This series of articles tries to cover this gap.

Part I reviews briefly the international literature on the epidemiology of the disease and describes the methodology followed, the sources of data and analysis strategy. The other articles review South African reports on morbidity-mortality and relationships to age, population group, sex and geographical distribution (part II); part III reviews information on measles related morbidity and mortality; part IV reviews other factors influencing measles morbidity and mortality in SA (protein-energy-malnutrition, age at infection, urbanisation, socio-economic status and health care) and contains appropriate conclusions and recommendations.

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Introduction

Measles is a doomed virus! Without doubt mankind will succeed in the control and eradication of this killer of small children.^{1,2,3} This could happen sooner rather than later if there was a clearer understanding of the behaviour of the virus in human communities and a clearer commitment and allocation of the necessary resources to its eradication.

Measles is a viral infection that affects susceptibles of all ages and both sexes, followed by lifelong immunity.⁴ It is still a significant cause of morbidity and mortality of small children in the developing world, including South Africa.^{5,6}

Incidence and/or severity of the disease has been associated with a number of factors. These include:

- Health policy factors like the practice of episodic opportunistic vaccination at all health services⁷ and policies on vaccination.⁸
- Personal characteristics like age^{9,10,11,12} and sex¹³ of the cases.
- Geographical and environmental determinants such as latitude,¹⁴ season,¹⁴ whether the case is the index or the secondary case in the household,¹⁵⁻¹⁸ nature of the human settlement,¹⁹ type (nuclear or extended, monogamous or polygamous) of family^{15,17,20} population mobility¹¹ and degree of overcrowding.^{11,16,18,21-25}
- Nutritional status including the degree of protein energy malnutrition^{9,10} and vitamin A deficiency.^{26,27}
- Traditional customs.^{28,29}
- Genetic background.³⁰

The patterns of the infection and

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some of the literature on the above factors have already been reviewed in a previous publication.³¹

A most important recent development in the understanding of the infection is that although vitamin A deficiency, genetic background and vaccination policies may have an

Most aspects impact on measles through the common pathway of a stronger virus

independent impact on measles severity and outcome, most of the other factors act through the common pathway of a higher infective dose of measles virus.^{11,22-25}

The importance of this new understanding is that strategies to correct the impact of measles in a community should not address confounders of the true pathway, but should rather take measures to overcome exposure to a heavy dose of infection, especially by improved vaccination coverage and by reduction of overcrowding, through better housing policies and effective fertility control.²² This theory is consistent with the changes in the epidemiology of measles in developed countries before the advent of vaccination.^{16,18,20} It also counters arguments that measles specific policies would not be effective in reducing childhood mortality in underdeveloped communities^{32,33,34,36} because its prevention would only result in deaths from other childhood illnesses associated with malnutrition or other diseases.

This model suggests that measles mortality is relatively independent of protein energy malnutrition. If correct this means that measles vaccination would in fact reduce childhood mortality independent of efforts to reduce protein-energy malnutrition.

A case control study from rural Bangladesh has shown the importance of measles vaccination in preventing not only measles mortality, but also overall mortality. Measles vaccination was shown to reduce the overall death rate by 36% and the rate of deaths directly attributable to measles, diarrhoea, respiratory illness or malnutrition by 57%.³⁷

Control of measles will therefore have a significant impact not only on morbidity and mortality caused directly or indirectly by measles but also will reduce the incidence and prevalence of many long term complications associated with the disease. Measles vaccination will

Vaccination reduces mortality independently of better nutrition

prevent not only measles mortality but also overall mortality. The impact of vaccination will be better felt if carried out in the context of comprehensive policies that also address the problem of overcrowding and of other factors that affect the occurrence and/or severity of measles.

In South Africa (SA) there is a

commitment to and indications that resources are being allocated for this task.³⁸ Still there has been no comprehensive review of the epidemiology of the disease in SA. This understanding is important to identify the feasibility of explaining the local epidemiology according to

Measles vaccination reduces measles and overall mortality

the above model and to identify factors and trends to guide public health practice. This series of articles tries to cover this gap.

Sources of Data

Published literature on measles epidemiology and control was selected for review from the Index Medicus for the period 1960-1989 and experts in the field were contacted. We focused on literature from Africa and from SA, in particular on reports on levels of morbidity and mortality due to measles.

Where appropriate the data will be grouped under the following headings: notification, certified deaths, active surveillance, hospital reports and miscellaneous.

Quality of the Data

Notifications

Measles has been a notifiable disease in SA since August 1979.³⁹ Measles and measles deaths are notifiable as separate occurrences. Notifications emanate from many sources and follow a process of collection and

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collation⁴⁰ that has inherent systematic and random bias. Still, notification data is the only data with sufficient regularity to allow the study of trends of the disease over time and to allow for regional comparisons.

The major bias in notification data is undernotification of cases.⁴¹ This is consistently so for whites and non-whites*, for urban and rural, for public facilities and for doctors in private practice.^{44,52} Kettles reports that 60% of 59 general practitioners surveyed by him did not know that measles was notifiable.⁴⁷ It seems therefore that the process of notification is hampered by ignorance on the part of notifying officers, ie doctors and nurses.

* Frequently we refer to asians, blacks, coloureds and whites. The use of these expressions is adopted for this paper since vital statistics and the social, economic and political institutions in SA are structured along these legally defined racial categories.⁴²

There is a significant body of literature on the lack of scientific justification to the use of racial expressions. Still in SA racial classification has been one of the determinants of political power, social class, economic experiences, environmental exposures, accessibility to health care and illness experience. As such it is justifiable to look at experiences of measles in the different races as legally defined in SA.^{43,44} More recently the expression "racial groups" has been replaced by "population groups". The use of expressions reflecting the legal structure of racial groups in the South African society does not imply that we accept their legitimacy.

As notification is done by health personnel it is also likely to be further biased in favour of communities with ready access to health care. This is exemplified by the observation that, in the Cape, 50% of notifications

Still no review of the epidemiology of measles in SA

originate from the single hospital for infectious diseases^{48,49} and, in Johannesburg 59% of notifications originate from hospitals, only 13% from general practitioners and 3% from local authorities.⁵³ In Natal-Kwazulu the Clairwood Infectious Diseases Hospital accounts for 40% of all notifications.⁵² This bias is likely to lead to underestimates of disease in rural communities and the urban poor. Disease rates for groups with poor access to local health care are either not acknowledged, or are reflected in the health service statistics of better served contiguous areas. Our impression is that nurses are usually, but not always,⁵⁴ less likely than doctors to notify the disease, possibly because they are not aware that they are allowed to. This compounds the underestimation of disease in rural areas where nearly all health centres are staffed only by nurses. These health centres are also not likely to have notification books.⁵⁴

Lastly, notification is more likely to occur in the more seriously ill, ie those in need of hospital care. As these are usually young infants, underestimates will be greater in older children.

Notification of deaths are suspect for

the same reasons as notifications of disease. Wittenberg reported that only 83 (23%) of 356 deaths due to measles in two academic hospitals in Natal-Kwazulu were notified.⁵²

Death certificates

Death certification in SA, as distinct from death notification, also has many problems, especially for the black population group.^{55,56,57} Problems again occur from selective reporting due to differential rates of accessibility to and inadequate skills of the certifying officers (health workers and police officers) leading to misclassification of causes of death. There have been no changes in the classification of measles in the International Disease Classification so this will not have affected mortality statistics.

Notified measles deaths in SA represent between 3% (1980) and 4,4% (1983) of deaths registered with the central statistical services in Pretoria.⁴⁶

Active surveillance data

There is only one report of what approaches active surveillance of measles in SA. The study is based on follow up of notified cases of measles and their contacts in Johannesburg and Benoni.⁵³

Hospital data

Data on hospital inpatients and outpatients with measles or dying from it has never been rigorously assessed and reported. The data is limited and the quality is unassessable. The most common reports are found in the correspondence column of the South African Medical Journal.

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The most important bias of these data sets are younger age profile, more severe disease, higher mortality and greater accessibility to health care.

Miscellaneous

One report based on a mix of methodologies is also reviewed. Loenig and Coovadia report on surveys of communities and health centres in the Natal-Kwazulu area to postulate a relationship between urbanisation and measles.⁵⁸ Although the limitations of their methods have been debated in the literature^{59,60} the case for this relationship remains strong.

Statistical analysis

The raw data used to calculate rates and trends is reported elsewhere.⁶¹

Some of the notification data reviewed is converted by us from absolute numbers to rates. Some of the rates reported in the literature are

60% of GPs in a survey did not know that measles was notifiable!

further submitted to statistical analysis to improve the interpretability of the data.

The denominators used to calculate rates have some limitations. One is undercounting, particularly of the Black population group. Still this has been corrected to some extent in the population figures utilised here.⁶² Secondly, with the granting of "independence" to the TBVC

countries (Transkei, Bophuthatswana, Venda, Ciskei) a significant proportion of cases and of individuals at high risk for measles have been removed from the numerator and the denominator leading to reduced national rates. Thirdly, some areas of SA are occupied by refugees of local or foreign civil wars. These refugees are not counted in the denominators used to calculate rates and they are a high risk group very likely to be represented in the numerator.

Notified incidence has been extensively reported upon by the National Directorate of Epidemiology. Their data is essentially of a descriptive nature with little analytical and inferential statistics.⁶³ When appropriate, linear regression is applied to the data as reported by them to identify statistically significant changes in trends over time. If trends over time are statistically significant for data sets of more than one population group, these are then compared statistically with each other by multiple linear regression methods.

Death certification data was similarly analyzed. This data was further analysed for the time periods up to 1979 and thereafter and up to 1978 and thereafter. The reasons for these cut off points include the perception, from looking at the data, that major gains in reducing mortality took place before 1978 but not thereafter; the fact that mortality for blacks is not available before 1979; lastly to assess the gains for the 1980 decade as opposed to preceding years. Again, if the slopes of the regression lines for each one of the time periods is found statistically significant, then the slope of the regression line for

each one of the two time periods are compared using multiple linear regression.

All analyses were stratified by population groups. The rates for population groups are compared with one another, using the regression methodologies mentioned above.

For each population group the data for death certificates is grouped into 5 age groups: 0-to-<1 year; 1-to-<5

Nurses are not aware that they are allowed (and should!) notify measles

years; 5-to-<10 years; 10-to-<20 years and 20 years and over. Each group is studied as a proportion of the total. Trends over time of these proportions are plotted and analyzed, again using linear and multiple linear regression.

Despite the limitations of the data described above, it does provide trends and patterns that are useful for the planning of health services.

Conclusions

It is apparent that the study of the epidemiology of measles will have to be based on incomplete data sets (notified data and certified mortality) or data sets of dubious quality (hospital reports). Still the qualitative and quantitative nature of some of the bias are known and will be taken into account when analysing, speculating, concluding or making recommendations.

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