

SECOND CARNEGIE INQUIRY INTO POVERTY  
AND DEVELOPMENT IN SOUTHERN AFRICA

Meeting basic health needs: A Cross  
sectional study of some determinants  
of mortality and life expectancy  
among Coloured South Africans

by

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MEETING BASIC HEALTH NEEDS : A CROSS-SECTIONAL STUDY  
OF SOME DETERMINANTS OF MORTALITY AND LIFE EXPECTANCY  
AMONG COLOURED SOUTH AFRICANS

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1. INTRODUCTION

The author is currently investigating aspects of the relationship between economic growth and the satisfaction of basic needs in South Africa. As the policy environment and the background of different population groups differ, it has been necessary to investigate the relationship between economic and social conditions for each group separately. This paper looks at only one group, the Coloured population, for whom data are readily available. The paper is largely based on results from the 1970 census.

Basic needs provision is widely used as a measure of economic progress and is seen as a form of human capital development in international and local development circles. However, very little analysis and research has been done in South Africa using this approach to economic development as a unifying framework. Although the present study is an attempt at investigating linkages between the process of economic growth and meeting the basic needs of the poorer segments of the population (i.e. at investigating poverty in its wider ramifications), this paper will look only at mortality/life expectancy and its relation to other variables readily available. The selection of variables was determined partly by the availability of data and partly by results from similar studies in other countries. However, as will be seen later, not all the variables show the expected statistical relationship with the independent health variables.

Most people interested in poverty are familiar with the literature on basic needs provision; a theoretical exposition of the linkages between economic growth and basic needs provision will thus not be attempted here.

The focus in this paper will be on health as the most central basic need.<sup>1</sup>

For cross-sectional analysis, a fairly substantial population base is required for each unit of observation (or case) if measures such as mortality rates, life expectancy, availability of rooms per thousand population, persons per doctor, fertility rates, and percentage of families in poverty are to be used. Accordingly, magisterial districts with a Coloured population exceeding 1 000 were chosen. This gave 127 (out of 263) districts for the cross-sectional investigation.

## 2. DATA

Data were obtained from the census results for 1970 and other publications of the SA Department of Statistics (now known as the Central Statistical Service or CSS), as well as from mortality figures by year, age, race and district made available by the CSS through the Medical Research Council.

As is usual in a developing country, the data are subject to various limitations, but these do not appear substantial enough to invalidate the conclusions. However, statistical results should always be treated with caution in any research of this kind.

A large number of variables were used. Apart from persons per doctor and proportion female-headed households, all the other variables can be grouped into a number of main categories, relating to:

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1) Seers wrote the following regarding the JASPA-ILO mission to Nigeria: "... the chronic and fundamental problems of poverty in Nigeria imply the need to concentrate on first things first. The mission took as a starting point that there is one central objective, health." (Seers, Dudley, "What needs are really basic in Nigeria? Some thoughts prompted by an ILO mission", International Labour Review, vol. 120, no. 6, Nov.-Dec. 1981, p. 742.)

- income and poverty
- housing/squatting, which can be broken down into formal housing and informal housing
- fertility
- life expectancy and mortality
- population, its distribution and composition
- education.

The variables used in the cross-sectional analysis are shown in appendix A. As the number of extreme values is limited, all the data were used in the analysis, without any adjustment.<sup>2)</sup>

### 3. ANALYSIS BASED ON CORRELATIONS

Health is held to be a basic human need, yet its measurement provides some difficulty. Mortality rates in different age-intervals are probably the best indicators of health conditions which were readily available and not subject to definitional problems (though they are, of course, only partial indicators as they exclude morbidity). Summarising mortality experience over different age-groups can best be accomplished by using life expectancy, which is not sensitive to differences in age structure.

As the mortality rate in the critical first year of life (so-called infant mortality) has such a large effect on total mortality and life expectancy at birth, it is useful to consider infant mortality separately and thereafter to compute life expectancy at age 1. Another age-specific mortality rate which is also highly sensitive to socio-economic conditions is child mortality, i.e. the mortality rate in the age-group 1 - 4 years. It has accordingly been included.

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2) Note, however, that there are some missing values; such values are not taken into consideration in the analysis, reducing the number of cases in some of the calculations.

From the correlation matrix (not shown here) the following relationships were identified:

- 3.1 The total mortality rate and life expectancy at birth vary closely together (Pearson correlation  $-0,9282$ ), as is to be expected, given the similar age-structure of the Coloured population in different districts.
- 3.2 From the correlation matrix, it is clear that the simple correlation between the measures of mortality and life-expectancy on the one hand and the housing variables on the other is insignificant. Income and poverty, however, seem to be closely related to the mortality measures used, though not as closely to life expectancy.
- 3.3 While child mortality increases with persons per doctor, other measures of mortality do not show any significant relationship with this variable. Surprisingly, life expectancy at age 1 is strongly positively correlated with persons per doctor. An intervening variable (such as urbanization) may be responsible for this, and so not too much should be read into the correlation. (This is indeed confirmed by the regressions, discussed later.)
- 3.4 Fertility rates in urban parts of districts and for the full districts (though not rural parts of districts) vary positively with mortality and negatively with life expectancy at birth, though there is no significant relationship with life expectancy at age 1.
- 3.5 Urbanization's effect on mortality does not emerge clearly from the correlation matrix. While higher levels of urbanization seem to go with lower infant and child mortality, they also, paradoxically, go with lower life expectancy at age 1. As urban income levels are generally higher than rural incomes, it would be interesting to find out whether urbanization indeed has a positive effect on health condi-

tions when other variables (such as income) are held constant.<sup>3)</sup>

#### 4. REGRESSION RESULTS

Standardising for the effect of other variables on mortality/life expectancy can be done by means of multiple regression. The effect of any single variable on the value of the dependent variable (mortality or life expectancy) is derived from the regression equation, the effect of all other explanatory variables being held constant.

Mortality and life expectancy are assumed to be affected by all groups of variables. Specifically, it is postulated that mortality rates and life expectancy are all functions of income, housing conditions, fertility, persons per doctor, the proportion of households headed by women, the Coloured population size of a district, the level of urbanization, education, and the male dependency burden. Which particular variables from these main groups of variables are more significant is not clear; we started with the estimating equations shown below, and then tested for a better fit by substituting alternative measures of some variables which could, on a priori grounds, be expected to affect the results.

The basic equations were:

$$\begin{aligned} \text{Dependent variable} = & a + b_1\text{INC} + b_2\text{ROOMS} + b_3\text{SHACKS} + b_4\text{FERT} \\ & + b_5\text{CPOP} + b_6\text{CURB} + b_7\text{MDEP} + b_8^{\text{LIT}} + b_9\text{PPDOC} + \\ & b_{10}\text{FEMHH} \end{aligned}$$

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3) From the matrix, it is not possible to determine causation, i.e. whether increasing urbanization causes lower infant mortality, or whether it is the increased income and educational attainment that go with urbanization that are also responsible for lower infant mortality rates. However, the regression results throw some light on this.

Ordinary least-square regressions (OLS) were used to estimate the equations shown above. Thereafter, by a process of backward regression, non-significant variables were discarded one by one, thereby reducing the coefficient of determination ( $R^2$ ), while the coefficient of determination adjusted for degrees of freedom ( $\bar{R}^2$ ) first rose until the "best basic" regression was reached, and thereafter decreased once the drop in the coefficient of determination was no longer compensated for by the increased degrees of freedom. Next, alternative specifications of some of the variables were investigated in those cases where, on a priori grounds, the possibility of a better fit could be expected. (For instance, female education may better explain infant mortality than all adult education does; similarly, the percentage of families in poverty may be a better explanatory variable than median family income.) Where a better fit was found, the results are shown in table 1.

The regressions shown in the table summarise the main findings with regard to Coloured health conditions as reflected in life expectancy at birth and at age one (after the effects of infant mortality have been excluded), as well as in infant and child mortality. Aggregation of the nature of the district data used here raises problems similar to those experienced when data are averaged, viz. that the variability of the data is reduced and the experience of certain smaller segments of the population, which may differ from aggregate trends, is not fully reflected.

The main results are the following:

- Persons per doctor among all races do not seem to have any statistically significant effect on any of these indicators of health conditions;
- Education similarly has little effect on health - even female education, which is normally presumed to affect especially infant mortality rates;
- Housing conditions do not appear to have any influence on health (see further discussion below, however);
- Urbanization has a significant negative effect on health. This becomes

TABLE 1  
REGRESSION RESULTS

	Life expect- tancy at birth (years)	Life expect- tancy at age 1 (years)	Infant mortality (0-1 years) (per 1000)	Child mortality (1-4 years) (per 1000)
CONSTANT	47,98272	57,47685	-49,82	15,73
COLOURED POPULATION	0,000016707 (1,30)	0,000015085 (1,50)	-	-
MEDIAN ANNUAL FAMILY INCOME	0,01033*** (4,73)	0,00544*** (3,18)	-	-0,020631*** (-4,85)
PERCENTAGE OF FAMILY EARNINGS LESS THAN R1 000 p.a.	-	-	2,38*** (5,95)	-
INCIDENCE OF INFORMAL HOUSING (TOTAL) (UNITS PER 1000 POPULATION)	0,05625 (1,56)	0,04061 (1,44)	-	-0,084873 (-1,52)
GENERAL FERTILITY RATE (BIRTHS PER 1000 WOMEN AGED 15-49)	-0,04987*** (-5,56)	-0,03003*** (-4,26)	0,46301*** (4,88)	0,038696*** (2,67)
URBANISATION LEVEL OF COLOURED POPULATION IN DISTRICT	-0,09145*** (3,23)	-0,09007*** (-4,05)	0,55015* (1,97)	0,14401*** (3,31)
ADULT LITERACY RATE	-	-	-	-0,09659 (1,14)
MALE DEPENDENCY BURDEN (DEPENDENTS PER 1000 WORKING-AGE MEN)	0,06947*** (4,59)	0,04961*** (4,18)	-0,49673*** (-3,24)	-0,028499 (-1,21)
PERSONS PER DOCTOR	-	-	-	-
PERCENTAGE OF FAMILIES WITHOUT A MALE HEAD	-0,26265*** (-2,66)	-0,25353*** (-3,27)	-	0,40799*** (2,74)
R <sup>2</sup>	0,4188	0,42077	0,39713	0,45089
R <sup>2</sup>	0,38311	0,38521	0,37736	0,41717
SEE	4,76764	3,74097	51,95	7,2022
n	122	122	127	122
F	11,73515	11,83058	20,09116	13,37261

\* - denotes significance at 10% level

\*\* - denotes significance at 5% level

\*\*\* - denotes significance at 1% level

t-values in parentheses

clearer from the regressions than from the original data as the higher income levels normally found with higher levels of urbanization could be held statistically constant;

- Female-headed households also correlates negatively with health conditions;
- Fertility shows a strong negative influence on health ;
- Median family income in a district is strongly associated in most cases with better health conditions, while the percentage of families in poverty better explains infant mortality;
- Male dependency burden shows an unexpected, yet statistically strong, positive correlation with better health conditions.

The equations shown account for roughly forty per cent of the variation in health conditions among Coloureds, which is fairly high for cross-sectional analyses of this nature. This is especially good if it is considered that the unit of observation, the district, is extremely open and that cross-border flows reduce the clarity of most relationships.

There are a number of surprising results:

4.1 Doctors, education, housing:

In particular, one would have thought that persons per doctor, educational level and housing conditions would all effect the health conditions faced by the Coloured population, and would therefore also be statistically linked to life expectancy and infant and child mortality. The fact that this was not found to be so, does not indicate no such association, but places the spotlight to a greater extent on some of the other variables which were found to be highly significant.

It should be mentioned that the quality of the data regarding education was

particularly poor, since published data were available only on the level of economic regions. Estimation of district data therefore does not account for all the variability which is likely to be present in the data pertaining to different districts within the same economic region. Furthermore, it is very likely that education is not particularly important in isolation, but that its positive influence on health, if it does exist, only operates in symbiosis with other favourable conditions, such as the presence of certain medical facilities.

With regard to housing, one must conclude either that housing has little effect on health, or that the data used was subject to irregularities, or (what in my opinion is most likely) that the positive effect of housing provision on health only operates above a certain threshold level of housing availability. If the latter is true, that would imply that raising the level of housing would not have a positive effect on health unless it was raised enough above this threshold level. As there were virtually no Coloured communities of substantial size that experienced such adequate housing provision in 1970, the statistical effect of housing on health would not be apparent from the data.

One factor which could account for the lack of significance of persons per doctor for Coloured health could be that Coloured mortality in 1970 was mainly the result of inadequate preventative measures, whereas doctors in South Africa perform mostly curative services.<sup>4)</sup> There were no data available at district level to measure the input of preventative health services, however.

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4) This fact was pointed out to me by Johann Eloff of the Institute of Development Studies at the Rand Afrikaans University, who found a similar situation in the health services of Venda.

#### 4.2 Urbanization:

A further seemingly surprising result is the negative effect of urbanization on Coloured health. This relationship has been identified in previous studies in South Africa, although urbanization usually has a positive effect on health in international studies of a similar nature. This may have something to do with the conditions of urban life in South Africa (other than the nature or adequacy of housing structures or income), which seem to be less conducive to good health than rural conditions. It may indicate that the provision of such urban amenities as clean water and sanitation, regarded as basic needs, may require greater priority in public policy.<sup>5)</sup>

Evidence exists that, in Britain in the late eighteenth century, wage differentials between urban and rural areas partly came about to compensate for the "urban disamenities", including substantially higher infant and overall mortality rates, in the urban areas. There are even those who argue that urban living conditions actually deteriorated over a period of time during and after the Industrial Revolution, but Williamson opposes this view.<sup>6)</sup>

The higher mortality rates experienced by Coloured people in the urban areas (defined to include rural towns) compared to those living on farms contrasts with the situation experienced in other developing countries<sup>7)</sup> and suggests that urban disamenities similar to those experience in Britain

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5) Using a dummy variable for metropolitan regions does not improve the estimating equations. This may indicate that cities do not experience conditions different from those in other towns.

6) See Williamson, Jeffrey G., "Urban Disamenities, Dark Satanic Mills, and the British Standard of Living Debate", The Journal of Economic History, vol. 41, no. 1, March 1981; see also the debate between Pollard and Williamson in the December 1981 issue of the same journal.

7) See United Nations, Levels and Trends of Mortality since 1970, New York, United Nations, 1982, pp. 108, 110, 136-8, 163-9.

and most other industrial countries during their Industrial Revolutions<sup>8)</sup> have arisen in South Africa, at least in the case of the Coloured group.

This also suggests that the farming community, generally paying low cash wages, appears to have provided far better health conditions for their Coloured workers in 1970, whether that be by their own efforts or because poor sanitary and social conditions are less detrimental to health in environments of low population density, such as on farms.

It is even conceptually possible to calculate the rise in income which, ceteris paribus, would have been necessary to compensate, in terms of health conditions, for farm families moving to town, simply by using the regression equations.<sup>9)</sup> The results suggest that:

- in order to maintain the same life expectancy at birth, farm families would have had to be able to improve their median income by R885 in moving to a town or city;
- for life expectancy at age 1 to have been on a par in town and on farms, median family income in town would have had to be a full R1 655 per annum higher;
- for child mortality rates to have been similar, R408 more in annual median family income would have had to be earned in towns or cities; and
- for infant mortality rates to be similar, R698 more would have had to accrue to median families in urban areas. (The last was estimated from an equation not shown here; it could, alternatively, be formulated in terms of the regression equation shown, in which case the proportion

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8) With regard to the differences between the earlier experience of today's industrial countries and the now developing countries, the World Bank states: "Interestingly, the contrast between rural and urban health status in today's developing countries is opposite to that which prevailed in the advanced nations when they were becoming industrialized." (World Bank, The Assault on World Poverty - Problems of Rural Development, Education, and Health, Baltimore, John Hopkins, 1975, p. 351.)

9) Williamson, in the study cited above, uses a similar procedure in analysing Britain's historical experience.

of families earning more than R1 000 per annum would have had to increase by 23,1 percentage points for similar infant mortality rates to be experienced in towns and cities as on farms.)

All these calculations depend on the regression equations estimated, of course, and the precise figures given should only serve as orders of magnitude. However, these equations have proved to be rather robust in that most regression coefficients only changed marginally when other variables were entered or discarded. It therefore is not surprising that, despite very large income differentials between districts which are predominantly urban and those with a predominantly farm population, the latter still usually experience considerably better health conditions, at least as far as the Coloured population group is concerned; consider, for instance, the figures shown above against a Coloured national median family income figure of R580 in 1970.

#### 4.3 Broken families:

The strong negative effect of broken families (families without a male household head may be regarded as a good proxy) on health amongst the Coloured population, is the only measure which gives some indication of the effect of community and family life on the meeting of this basic need. Its statistically strong influence points to the need for healthy community life and for social and community work, while it may also indicate that migrant labour amongst Blacks could have similar negative consequences for health, if family ties are affected in the same manner.

#### 4.4 Male dependency burden:

The positive effect of the male dependency burden shown by the equations came as a surprise. The only possible factor known to this author which could account for it is that there seems to have been some underenumeration especially of urban Coloured males aged 15-49 in the 1970 census.<sup>10)</sup>

10) My attention was drawn to this fact by prof. J.L. Sadie.

#### 4.5 Fertility:

The negative relationship found between fertility and health conditions is not surprising. However, though the level of fertility has a negative influence on health, there are those who argue that improvements in health conditions, and in particular lower infant mortality rates, are required before parents would be willing to produce fewer children. Both of these arguments probably contain some element of truth.

The series of birth rates and infant mortality rates published by the Central Statistical Service as part of South African Statistics show, however, that amongst Coloureds, decreases in the birth rate precede decreases in infant mortality. If this were a true picture (which it may not be since it may only reflect changes in the propensity to register births and deaths), it indicates that the direction of causality is mainly from fertility to health, rather than the other way round.

I would argue, however, that it is not only lower fertility which leads to better health conditions (which, perhaps, thereafter also further reduce fertility yet again), but that there is in addition some underlying, unidentified factor which effects both fertility and mortality, though with a different lag. For lack of another term one could perhaps call it "modernisation". Such "modernisation" appears to encompass knowledge and attitudes independent of literacy or higher educational attainments, and operates even when the level of urbanization is held constant. It is, then, a factor which must be investigated further, and its identification could perhaps show that there are other social factors, more fundamental than income, formal education, housing or medical facilities, which play an equally important role in the development process.

## 5. CONCLUSION

The regressions discussed above show that, at least among Coloureds in 1970, the experience in meeting basic health needs in South Africa differs in certain respects from achieving the same end in other developing countries. In particular, the negative effects of urbanization on life expectancy is contrary to most modern experience, while it was also found that providing more doctors, education and housing does not significantly improve health conditions, contrary to initial expectations.

The findings with regard to urbanization may indicate that the urban health environment in South Africa receives relatively less attention than is warranted, given the high mortality levels still experienced in towns and cities.<sup>11)</sup> As there is a considerable housing backlog in urban areas, one may expect this to be an important factor contributing to the negative effects of urbanization on health, but it transpires (from the regressions) that the availability of housing (as measured by number of rooms relative to urban population) does not improve health conditions significantly. This may be because formal housing provision does not always imply better sanitary conditions than, for instance, in squatter areas. Moreover, even in the districts where the housing position is relatively better, one finds that there still was a great deal of overcrowding in 1970. The effect of overcrowding is only likely to diminish once housing conditions improve substantially above some minimum threshold.

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11) Relative to urban conditions, rural health in South Africa (outside the homelands) may have received greater attention than in other developing countries. Whereas most developing countries show an urban bias in health provision (as in the provision of other services), South Africa may have had a rural bias; the urban environment relative to the rural environment is far less healthy, at least as far as the Coloured population is concerned. (For the Black rural population, concentrated in the homelands, this may not be the case.)

The statistically insignificant effect of persons per doctor on health as measured here may be due to access: a greater number of doctors relative to population does not guarantee Coloured people greater access to doctors than before. Moreover, if doctors provide mainly curative services, and high mortality rates among Coloureds are mainly the result of inadequate preventative services, it is unlikely that there would be any significant relationship between persons per doctor and Coloured health.

With regard to education, the educational data used here were not very adequate, which may partly be responsible for the relative insignificance of the education variable. Another possibility is that the formal education system does not improve the specific knowledge of basic hygiene among Coloureds in South Africa, which may be more important than general education in reducing deficiencies in health. If so, community work is indicated.

The strongly negative effect of broken families on Coloured health also points to the need for further community and other social work.

Finally, it is significant that income (measured by median family income in a district) shows such a positive influence on health, especially when controlling for the negative effects of urbanization. From a basic needs perspective one would have expected the percentage of families earning less than certain poverty lines to be more important, yet this does not appear to be so. This could be the result of the factor referred to before, viz. "modernisation", which appears to reflect general income levels rather than the income of the poor.

## APPENDIX

### Variables used in the study

#### INCOME AND POVERTY

INC	Mean Coloured family income in district
POV1	Percentage of Coloured families earning less than R150 per annum
POV2	Percentage of Coloured families earning less than R450 per annum
POV3	Percentage of Coloured families earning less than R1 000 per annum

#### HOUSING AND SQUATTING

ROOMS	Rooms (formal housing) available per 1 000 Coloured population
ROOMS (URB)	Urban rooms (formal housing) available per 1 000 Coloured population
ROOMS (RUR)	Rural rooms (formal housing) available per 1 000 Coloured population
SHACKS	Number of housing units other than houses or flats occupied by Coloureds per 1 000 Coloured population
SHACKS (URB)	Number of urban housing units other than houses or flats occupied by Coloureds per 1 000 Coloured urban population
SHACKS (RUR)	Number of rural housing units other than houses or flats occupied by Coloureds per 1 000 Coloured rural population

#### FERTILITY

FERT	Coloured general fertility rate (births per 1 000 women in fertile age group 15 - 44, average 1968-72)
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## MORTALITY AND LIFE EXPECTANCY

LIFEX0	Life expectancy of Coloureds at birth
LIFEX1	Life expectancy of Coloureds at age one
TOTMORT	Coloured crude mortality rate average 1968-72
INFMORT	Coloured infant (below one year) mortality rate average 1968-72
CHMORT	Coloured child (1-4 years of age) mortality rate average 1968-72

## POPULATION, URBANIZATION AND DEPENDENCY BURDEN

CPOP	Total Coloured population size in district
CURB	Coloured urbanization level in district, assigning all inhabitants of towns and cities to the category "urban"
MDEP	Male dependency burden (dependents 0-14 years per 1 000 working-age males)

## EDUCATION

LIT	Literacy rate (defined as people having reached std. 3-level of education) amongst population 10 years and older expressed in per cent
PREDOC	Percentage of Coloured population 15 years and older who have passed std. 6
HIEDUC	Percentage of Coloured population 15 years and older who have passed std. 8
FLIT	Female literacy rate amongst Coloured population 10 years and older expressed in per cent
FPREDOC	Percentage of Coloured female population 15 years and older who have passed std. 6
FHIEDUC	Percentage of Coloured female population 15 years and older who have passed std. 8

PERSONS PER DOCTOR

PPDGC Persons of all races per doctor, 1972

FEMALE-HEADED HOUSEHOLDS

FEMHH Percentage of households without father present (e.g. mother and children)