The Impact of Resource Inflows on Child Health: Evidence from South Africa[§]

by

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August 2001

[♣] Pushkar Maitra would like to thank the Faculty Research Grant Scheme, Faculty of Business and Economics, Monash University for research support. Ranjan Ray acknowledges support via a Large Grant from the Australian Research Council.

Abstract

This paper investigates the changes to health care facilities and the nutritional status of Black children during the first 5 years of democratic rule in South Africa. Using panel data on Black households living in KwaZulu-Natal in 1993 and 1998, this study examines the key determinants of child health over this period. Unlike previous studies, this exercise estimates the child health equations using a 3SLS simultaneous equations framework that recognises the endogeneity of the resource variables. It departs from the conventional unitary model in distinguishing between the various resource components, and allowing for their mutual dependence. A key result, with considerable policy appeal, is that the nature of income effect on child health varies sharply between the various resource components. For example, in 1998, female earned income and female pensions have the most beneficial effects on child health. In contrast, male earned income and male pensions impact negatively on child health. The results point to the need to target the resource inflows at particular groups within the household in order to maximise their positive impact on child health. While the immediate context of this study is post apartheid South Africa, the results have implications that extend beyond the frontiers of that country.

JEL Classification:
C21, I12, I31, J13, J16, J18

Keywords:
Anthropometric Status, Z-scores, Stunting,
Wasting, South Africa

1. Introduction

Has the dismantling of apartheid led to improved nutritional status of Black[1] children in South Africa? As that country came out of white minority rule in the early 1990s, there was widespread hope and anticipation that the end of apartheid and the restoration of democratic governance will lead to a rapid advance in the welfare of the dispossessed Black majority. One of the principal components of that welfare is the health of children of Black households. An answer to the above question, that constitutes the principal motivation of this paper, will provide a significant pointer to the evidence on the wider issue of the welfare of Black households in post apartheid South Africa.

Health and nutrition have important effects on learning, on labour productivity and, more seriously, on child survival and mortality. Consequently, the subject of child health, as measured by the child's nutritional status, is at the centre of the wider issue of household welfare in developing countries. Studies using data sets from Asia and Africa consistently show that malnutrition in children raises the risk of death with underweight children contributing to 25% to 50% of childhood mortality. Pelletier (1991) observed a sharp increase in childhood mortality as nutritional status worsens [see World Development Report (1993, Fig. 4.1)]. Malnutrition among children is widespread in developing countries. For example, according to the World Development Report (1993, Table A6), 39% of children in the age group 24 -59 months in Sub-Saharan Africa suffer from stunting.

In an influential article, Waterlow et. al. (1997) established that a child's 'height for age' and 'weight for height' are good indicators of his/her nutritional status. Consequently, this study focuses on these concepts and uses them as dependent variables in the analysis of child health, and of its key determinants in South Africa. While a child's 'height for age' is

[1] During the apartheid era, the South African government delineated four racial groups: Black (or African), Indian (or Asian), Coloured (or Mixed Race) and White (or Caucasian). Our use does not signify acceptance of this terminology or the system of racial naming.

an indicator of her long run nutrition status reflecting the child's past nutritional experience, 'weight for height' is an indicator of short run or current nutritional status. Malnutrition on account of low child 'height for age' causes *stunting*, while a low 'weight for height' is associated with *wasting*. The Z-score method, recommended by WHO (1983), is used to measure a child's 'height for age' and 'weight for height' as follows. The child's height is expressed as a number of standard deviations above or below the corresponding US median for a child of the same age to obtain the Z-score of height for age. The 'weight for height', which is gender and height specific, is a ratio of the child's weight in kilograms to height in centimetres, expressed as a function of a norm which is also based on US measurements. The Z-score for 'weight for height' is, then, calculated as a multiple of its standard deviation similar to the Z-score for 'height for age'. Following Kassouf and Senauer (1996), we define 'severe' and 'moderate' malnutrition as characterised by Z-scores, which are in the intervals (< -3), (-3, -2) respectively.

The primary focus of this paper is on an analysis of the determinants of the child's anthropometric status in South Africa. Of particular importance are the sign and magnitude of the coefficients of the key resource variables in the regression equations on child anthropometric status. Unlike most previous studies, the present analysis recognises the simultaneity and endogeneity of the income/resource variables appearing as regressors in the Z-score equations. Strauss (1990, p 237) argues that "many studies have confused the concepts of production function and reduced form, estimating a hybrid of the two". The use of household income as an exogenous, explanatory variable has been criticised by Thomas, et.al. (1990) as likely to generate simultaneity bias in the OLS estimated equations. The problem of endogeneity arises because the resource inflow variables could be correlated with the unobserved determinants of child anthropometric status leading to inconsistency in the OLS estimates. An additional feature of the present analysis is that it is consistent with the

"collective" model of intra family resource allocation [see Browning and Chiappori (1988), Thomas, et.al. (1999)]. In the spirit of such a framework, this paper distinguishes between the various components of household resources based on the source of the resource, the gender and age group of the resource recipient inside the household. The last distinction is of particular significance in the South African context in view of the tendency of three or more generations to live together as a "household" in that country. A key result of our study is that the various resource components differ widely in the nature and magnitude of their impact on child health.

The plan of the rest of this paper is as follows. Section 2 describes the data and presents the summary evidence on health care facilities and child health in South Africa. The framework for the estimation of the Z-score equations is discussed in Section 3. The results are presented and analysed in Section 4. We end on the concluding note of Section 5.

2. Data and Descriptive Statistics

The study is based on two data sets. The first data set is from the South Africa Integrated Household Survey (SIHS) conducted in 1993, jointly by the World Bank and the South Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town, as a part of the Living Standard Measurement study (LSMS) in a number of developing countries. This data will henceforth be referred to as the SIHS data. The survey was conducted in the nine months preceding the historic 1994 elections. The main instrument used in this survey was a comprehensive household questionnaire covering a wide range of topics including demography, household services and expenditures, remittances and marital maintenance, land access and use, employment and income, health status and anthropometry. The SIHS is the first survey that covers the entire South African population, including those

in the predominantly Black "homelands".[2] The complete sample consists of approximately 9000 households drawn randomly from 360 clusters. For our analysis we only include in our sample children less than 60 months old at the time of the survey. The data set used in estimation therefore consists of 3358 children in the age group 0 – 5 years (born between 1988 and 1993) of whom 1660 (49.43%) are girls and the rest are boys. Of the children included in the sample, 86.54% are Black, 5.72% are Coloured, 2.41% are Indian and 5.33 are White. Note that the sample is not representative of the (current) population distribution of South Africa. The questionnaire and summary statistics are contained in SALDRU (1994).

Households in the SIHS data set that resided in the KwaZulu-Natal province were re-interviewed in 1998 for the KwaZulu-Natal Income Dynamics Study (KIDS).[3] The KIDS data constitutes the second data set used in our study. KwaZulu-Natal is the home of a fifth of the population of South Africa and was formed by combining the former Zulu Homeland and province of Natal. More than 84% of the original sample of Black households from the SIHS data set residing in KwaZulu-Natal in 1993 were successfully reinterviewed in 1998. In comparison with panel data sets available elsewhere, for example, Peru (Lima) and Indonesia, given the length of time between the SALDRU and the KIDS data sets and, considering the mobility of the South African population in the post apartheid period, a resurvey rate of 84% appears quite satisfactory. Though the households in KwaZulu-Natal that appear in SIHS constitute a panel with respect to the subsequent KIDS data, this is not

[2] During the apartheid era the White government forced Black South Africans into "homelands" which were desolate regions incapable of sustaining a livelihood based on agriculture thereby creating a massive pool of unemployed Black workers who were employed in the mines and in the White owned agricultural farms. The migrant workers were forced to live away from their families, remitting home cash and goods to support their families. This was known as the "oscillatory migrant labour system". These "homeland" regions were semi-autonomous but were dependent on funds from the South African government for infrastructure development. Naturally the apartheid era was characterised by severe disparities between the homeland and the Non homeland regions of South Africa.

[3] The KIDS data set is the outcome of a collaborative project between researchers at the University of Natal, the University of Wisconsin-Madison and the International Food Policy Research Institute. Details of the KIDS data set have been described by its principal authors in May, Carter, Haddad and Maluccio (2000).

true of the children living in these households. Because of data availability, we restrict our analysis to children in the age group 0 – 5 years (maximum age is 60 months). So the 1993 sample includes children born between 1988 and 1993 and the 1998 sample includes children born between 1993 and 1998. While we are unable to exploit the panel nature of the household level data for the purpose of this study, we do however control for household fixed effects in our estimation.

Tables 1 – 3 provide summary evidence on the health care facilities that were available in South Africa in 1993. Though the dismantling of apartheid began somewhat earlier, these figures reflect the huge disparity in the health care facilities between the homeland and non-homeland provinces in favour of the latter. As the t values of the difference between the sample means confirm, the disparity is particularly striking in case of Pharmacy (Tables 1, 3), Doctor and Pharmacist (Table 2) and Clinic, Family Planning Facilities (Table 3). The figures, also, reveal huge disparities in health care facilities between the homeland provinces themselves. Venda does relatively quite well in respect of several health care indicators – for example, with regard to the availability of hospital and dispensary, it enjoyed sample means that were higher than in Natal, which was one of the most favoured provinces in the country. Table 4 provides evidence on the changing picture of health care facilities in KwaZulu-Natal province between 1993 and 1998 under democratic governance. Clearly, in most cases where comparable figures are available, we see a marked improvement in health care facilities. There has been a many fold increase in the availability of Dispensary, Pharmacy and Maternity Clinic.

Tables 5 and 6 present the summary evidence on child health, as measured by the Z-scores, in South Africa in 1993. While Table 5 reports the mean Z-scores, Table 6 presents the overall picture on the degree of child malnourishment for the whole country. Tables 5 and 6 agree that stunting is a more serious problem than wasting in South Africa. Black children

are more malnourished than the others, while the same can be said of rural vis-à-vis urban children and boys vis-à-vis girls. The superior health care facilities available in the non homeland provinces vis-à-vis the homeland are reflected in the generally lower mean Z-scores in the latter compared to the former. Note, also, the wide variation in the mean Z-scores between the children residing in the homelands which is consistent with the variation in their health care facilities, noted earlier.

Tables 7 and 8 provide information on movements over 1993 – 1998 in the mean Z-scores of children living in the panel of households in KwaZulu-Natal. The overall picture is one of marked improvement in the nutritional status of Black children in KwaZulu-Natal during this post apartheid period. Some of these improvements could, however, be more apparent than real, reflecting differences in reporting and recording procedures between 1993 and 1998. The Kernel density estimates of the Z-scores for the Black children residing in KwaZulu-Natal in 1993 and 1998, presented in Figure 1 (height to age Z-score) and Figure 2 (weight to height Z-score), interestingly show that the distributions are not particularly different over the two years. What is interesting is that for the distribution of the height to age Z-score (Figure 1), the mass is slightly to the right in 1998 compared to 1993 and that the distribution of the weight to height Z-score (Figure 2) is more concentrated in 1998 compared to 1993.

3. Estimation Framework

Let us consider the static model of the household, where household welfare W depends on the utility of each member $n(=1,\ldots,N)$, so that the household welfare function can be written as:

$$W = W\left(\{U_n\}_{n=1}^{N}\right) \tag{1}$$

Each individual's utility function U_n depends on the commodity consumption of all household members X_{in}, where $i = 1,\ldots,G$, goods, the consumption of leisure by each member of the household $\{L_n\}_{n=1}^{N}$ and also a vector of H home produced goods $q_{1n},\ldots,q_{Hn},(n = 1,\ldots,N)$, for example, health, education and nutrition of each household member. This paper focuses on one particular element of *q*, namely, the health of children as measured by their anthropometric status. In addition, household utility is assumed to depend on a set of household specific characteristics l_h so that each individual's utility can be written as $U_n = U_n(X_1,\ldots,X_G,L,q;l_h,e)$, where *e* denotes unobserved heterogeneity. The individual utility functions can be aggregated to obtain the household welfare function. The household therefore maximises the welfare function given by equation (1), subject to the household budget constraint and a production function for each element of *q*. The household budget constraint can be written as:

$$\mathrm{p'X} = \sum_{\mathrm{n}} \mathrm{I_n} \tag{2}$$

where *p* denotes the price vector and I_n denotes the household resources accruing to individual $n(=1,\ldots,N)$. The production function for each component of *q* can be specified as:

$$q = q(k, l_n, l_h, l_c, J) \tag{3}$$

where *k* denote inputs (that might either be purchased in the market or might be non-marketable), a set of observed individual, household and community characteristics (l_n, l_h, l_c) and a set of unobservables (J). For example, child health is produced by a set of inputs (time spent in child care, nutrient intakes, preventive and curative health care usage, sanitation practices), individual characteristics (age, sex, innate healthiness), a set of

household characteristics (parental education, household income, household structure) and community characteristics (availability of health care facilities).

Maximising equation (1) subject to the constraints in equation (2) and (3) we get a demand function for each element of the commodity vector, leisure and each element of q. The determinants of child health will therefore consist of child, household and community characteristics and also individual resource holdings within the household. The child's anthropometric status, measured by the Z-score, can therefore be written as

$$Z_n = f_n(l_n, l_h, l_c, I_h; e) \tag{4}$$

where I_h denotes total household resources and

$$I_h \equiv U_h + E_h + P_h + R_h \tag{5}$$

where U, E, P, R denote, respectively, unearned income, earned income, pensions, and private transfers/remittances. In the context of South Africa, R is a significant component of total household resources, I.

OLS estimation of (4) will suffer from, principally, two problems: (i) As already noted, it ignores the endogeneity of household income, I_h, which is jointly determined with child health, Z_s, and other household outcomes. Further, it is quite likely that household resources or at least some of the components of household resources are correlated with the unobserved determinants of child health. OLS estimates will therefore be inconsistent. (ii) It ignores the distinction between the various components of income (U, E, P, R) by assuming that these income flows are pooled in the achievement of household outcomes, such as child health, as the unitary model does. Equation (4) also ignores the distinction between resource inflows based on the gender of the recipient by assuming that men and women pool their resources in achieving the desired child health outcome.

This paper overcomes these restrictive features by adopting a simultaneous equation framework that treats the resource inflows as jointly endogenous with the Z-scores.

Moreover, we follow our earlier exercise [Maitra and Ray (2000)] in distinguishing between the resource inflows based on the source of the resource and gender of the recipient.

Denoting *m*, *f* for male and female, respectively, we extend (4) and write the child health equation as follows:

$$Z_n = f_n\left(\lambda_n, \lambda_h, \lambda_c, U_{mh}, U_{fh}, \underline{E_{mh}}, \underline{E_{fh}}, \underline{P_{mh}}, \underline{P_{fh}}, \underline{R_{mh}}, \underline{R_{fh}}; \beta\right) + \varepsilon_n \qquad (6)$$

where n denotes the child, *h* denotes the household that the child comes from, the ls are the predetermined exogenous, vector of determinants, e_n is the stochastic error term, b the parameter vector, and the other variables are as defined before. The endogenous resource variables appearing on the right hand side of equation (6) have been underlined. The estimation procedure involved 3SLS estimation of the set of seven simultaneous equations consisting of the 6 resource equations and the child health equation given by (6). Earned income and pensions are allowed to depend on one another, besides unearned income and the other household characteristics. Remittances received by males and females within the household are assumed to depend on both the earned income and social pensions received by the different members of the household, in addition to unearned income and other household characteristics. Note, therefore, that the estimation not only recognised the joint endogeneity and mutual dependence of the resource variables and child health but, also, allowed mutual feedback between the seven equations via a non-diagonal covariance matrix of the errors. While the specification of the endogenous resource variables has been described in our earlier exercise [see Maitra and Ray (2000)], we extend that framework here by allowing earned income and pensions to depend on one another. This follows evidence that suggests [see Bertrand, Miller and Mullainathan (2000)] that public pensions in South Africa have a detrimental effect on labour force participation. To the best of our knowledge, there are no papers that examine the relationship between the different components of household

resources and child health as attempted here. The papers that are closest to the spirit of the present paper are due to Duflo (2000a, 2000b). However, those papers examine the effects of the social pension program in South Africa on child health and are not concerned with the other forms of resource flows into the household. In particular these papers do not account for private remittances, which has been shown to be of significant importance in the South African context (Maitra and Ray (1999)).

4. Results

Since the interest of this paper is on child health, we do not report the 3SLS estimates of the six income equations – these are available on request. Table 9 presents the 3SLS estimates of both measures of child health (the height to age Z-score and the weight to height Z-score), based on the 1993 SIHS data for the whole country.

Both sets of estimated results agree that, ceteris paribus, girls enjoy superior anthropometric status to boys, and that a child's health status deteriorates with increasing age in relation to the US median child. The results, also, agree that the estimated coefficients of the eight resource variables differ so widely as to deny any basis for the idea of income pooling underlying the unitary model. Unearned female income and earned female income significantly increase the height to age Z-score as does remittances received by males. We also conducted gender specific regressions, which show that the female income coefficients are higher in size and significance for girls relative to boys.[4] On the other hand, with the exception of remittances received by males, none of the other resource variables have a significant impact on the weight to height Z-score. Note the somewhat surprising result that an increase in male remittances received has a negative and significant impact on the weight

[4] These gender specific regressions are not presented because of space constraints. They are available on request.

to height Z-score. It therefore appears that remittances received by males have fundamentally different impacts on the long and the short-term health status of the children. The household compositional variables have strong impact on the Z-scores. There is some evidence of "quality-quantity trade off" in child health – an increase in the number of children in the household worsens the short-term health status of children though the long-term health status of the children improves. It could be that the more the number of children, the better parents become at bringing up children, which is reflected in improvements in the long term health status of the children. In the short run, however, the resource constraints inside the household and the consequent sibling rivalry dominate, resulting in a worsening of health status. Conditioning for other variables, especially the various income components, the Race of the household does not have a significant impact on child health. There are two minor exceptions. First, relative to the reference category of children belonging to Black households, the height to age Z-scores are higher for children belonging to Indian households (though it might be noted that the effect is weak, being significant at the 10% level of significance) while the weight to height Z-scores are lower for children belonging to Coloured Households. The community variables do not, in most cases, have the expected positive impact on child health. This is, possibly, due to the fact that improved health care provisions do not, necessarily, imply increased usage of these facilities in the absence of social awareness and public knowledge. Campaigns at increasing such awareness are important in translating increase in health care facilities into improved child health. It is, also, worth noting that, contrary to their treatment here, community variables such as health care are not predetermined but should be considered endogenous, along with the income variables. Communities or clusters, which have a record of inferior public health, might attract extra funds for setting up health care facilities [see Rosenzweig and Wolpin (1986) for an explanation].

Table 10 presents the 3SLS estimates of the Z-scores for 'height for age' of Black children in KwaZulu-Natal in 1993 and 1998. These are from separate regressions on the SIHS (1993) and KIDS (1998) data sets, respectively. The corresponding estimates for 'weight for height' are available upon request. Table 10 not only controls for region of residence and Race, among other variables, but, also, allows an examination of changes over 1993 – 1998 in the estimated coefficients of comparable variables, especially of the coefficients of the resource variables. While the gender effect on child health strengthens, the effect of child age weakens over this period. The income coefficients, which reverse signs in some cases between 1993 and 1998 are, generally, much stronger in size and significance in 1998 than in 1993. In both years, earned income and pensions received by the female have positive impact on child health, with the impact strengthening over 1993 – 1998. This is, clearly, a result with considerable policy significance. Duflo (2000b) uses the SIHS 1993 data and shows that social pensions received by the grand mother have significant effects on the anthropometric status of grand daughters. In contrast, earned income and pension received by the male have an adverse impact on child health. The estimated coefficient of transfers received by the female, which is statistically significant in both years, underwent a dramatic sign reversal from a positive magnitude (0.024) in 1993 to an equally negative magnitude (-0.024) in 1998. While any attempted explanation for this must be ad hoc and tentative, it suggests that transfers received by females in 1998 are being directed by the sender (usually a male) at non child health oriented items, similar to earned male income and male pensions. Both the data sets agree that there is no evidence to justify the income pooling assumption underlying the unitary model. Of the other variables, the health care coefficients continue to register statistical insignificance. They reiterate the need, as noted earlier, to increase social awareness through public education so as to encourage greater use of the health care facilities.

The KIDS data set has additional information on asset ownership – whether a particular asset is owned by a man or a woman or jointly within the household. This information can be used to test the collective model of household decision making against the unitary model. Bargaining models suggest that women with more assets, income or education have greater bargaining power .This is because they have more options outside the household and therefore their threat point within the household is higher. The share of assets owned by the woman – females' share of durables, females' share of gifts at marriage, females share of financial assets and total *lobola* (bride price) and *umbondo* (dowry) paid - are included as additional explanatory variables in the regressions using the KIDS data set. The estimated coefficients presented in Table 10 do not provide much evidence in favour of bargaining power since none of the share of asset variables, with the sole exception of females share of financial assets, has a significant effect on the height to age Z-score. Even in this case the effect is negative. It could be that the share itself is not truly exogenous and is in part determined by past decision making within the household. This is clearly a matter that merits further research.

5. Conclusion

The end of apartheid and the restoration of democratic governance in South Africa have provided an opportunity to improve the welfare of the Black households who suffered under decades of White minority rule. A key component of that welfare is the health of Black children or, more precisely, their nutritional status. In order to devise effective policies that improve child health in post apartheid South Africa, it is important to identify the key determinants of child nutrition in that country. That has been the principal motivation of this paper. Though the immediate context of this study is post apartheid South Africa, the results have wider application that extends much beyond South Africa. The paper, also, investigates

whether the health care facilities, child health and its determinants have changed during the first 5 years of democratic rule in post apartheid South Africa.

Methodologically, this study has two features that distinguish it from most previous studies on child health. First, the study recognises the endogeneity of the resource variables in the estimated child health equation by adopting a simultaneous equations estimation framework that jointly estimates the resource inflow and child health equations. Second, we depart from the conventional unitary model and adopt the "collective approach" that distinguishes between the various resource components, based on the source, the gender and age group of the recipient

The empirical results provide support to the 3SLS estimation procedure adopted here by rejecting the hypothesis of diagonal covariance matrix of the errors in the simultaneous equation system that underlines traditional single equation methods. The income coefficients in the estimated child health equations vary between themselves, thus, rejecting the assumption of income pooling underlining the conventional unitary model. Perhaps, as a result of the departures from the conventional methodology, the resource variables generally register much greater statistical significance in their impact on child health than most previous studies. No less noteworthy is the result that the size and significance of the impact of the resourcee variables on child health has increased over the 5 years, 1993-98.

The results show that, while both child health and health care facilities have improved over the period, there is no reason to believe that the latter have contributed to the former. This is a result with considerable policy significance for it suggests that simply increasing the provision of health care does not necessarily imply increased use of such facilities. The latter requires a public campaign aimed at increasing social awareness to ensure effective use of the health care facilities. Much of the improvement in child nutrition in Black households during 1993 – 1998 is due to income gains rather than the increased provision of health care. The

rejection of income pooling is, also, of policy significance since it underlines the need to distinguish between the various income components in identifying the key variables that improve child health. The results, especially the ones on the 1998 KIDS data set, suggest the need to target the female income earner and the female pensioners for the income gains in order to maximise the beneficial impact of income on child health.

The Black households in KwaZulu-Natal, that were interviewed in 1993 and reinterviewed in 1998, constitute a panel. This is, however, not true of the children, aged 0 – 5 years, living in such households. Note that the Z-scores are not available for the older children. Consequently, the number of children whose health data is available in both 1993 and 1998 is a small proportion of the total number of children (0 – 5 years) involved in both the data sets. Hence, we were not able to exploit the panel nature of the household level data for the purpose of this study. It is important to include the health data of all children, aged 0 – 5 years, in the original sample, in the subsequent data sets. The results of this study suggest that there are some interesting dynamics at work in the child health variables (ie., Z-scores) in post apartheid South Africa. Such dynamics require, for their study, the availability of panel data on child health, similar to the household level panel data that currently exists.

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Table 1: Proportion of Clusters with the Specific Facility in 1993/94

	Hospital	Dispensary	Pharmacy	Maternity Clinic	Clinic	Family Planning Clinic
Mean for Whole Sample	0.11	0.17	0.16	0.13	0.40	0.38
Non Homelands						
Cape	0.11	0.27	0.20	0.04	0.42	0.40
Natal	0.22	0.30	0.52	0.17	0.61	0.65
Transvaal	0.12	0.17	0.29	0.11	0.39	0.35
Orange Free	0.30	0.25	0.25	0.20	0.65	0.65
Homelands						
KwaZulu	0.02	0.06	0.02	0.13	0.45	0.38
Kangwane	0.17	0.67	0.00	0.50	0.83	0.83
Qwa-Qwa	0.00	0.00	0.00	0.00	0.33	0.33
Gazankul	0.00	0.00	0.00	0.00	0.00	0.00
Lebowa	0.10	0.10	0.00	0.20	0.35	0.20
Kwandebe	0.00	0.00	0.00	0.00	0.00	0.00
TranskeiI	0.00	0.03	0.03	0.13	0.25	0.22
Bophutha	0.05	0.05	0.05	0.10	0.24	0.29
Venda	0.40	0.40	0.00	0.40	0.40	0.20
Ciskei	0.25	0.50	0.00	0.50	0.63	0.63
Rural	0.06	0.11	0.05	0.14	0.36	0.30
Urban	0.22	0.32	0.23	0.18	0.66	0.66
Metro	0.11	0.18	0.33	0.07	0.28	0.28
t –value of Difference in Means between Non Homeland and Homeland Provinces	1.762*	1.647*	5.773***	-1.892*	0.899	1.761*

Note: * indicates statistical significance at 10%, ** at 5% and *** at 1%.

Table 2: Proportion of Clusters with the Specific Personnel in 1993/94

	Doctor	Nurse	Pharmacist	Mid Wife	Family Planning Worker	Health Worker	Traditional Healer
Mean for Whole Sample	0.32	0.44	0.16	0.30	0.36	0.32	0.23
Non Homelands							
Cape	0.38	0.40	0.22	0.29	0.38	0.35	0.09
Natal	0.65	0.61	0.57	0.35	0.65	0.65	0.35
Transvaal	0.41	0.46	0.28	0.33	0.35	0.29	0.22
Orange Free	0.30	0.50	0.15	0.25	0.50	0.40	0.15
Homelands							
KwaZulu	0.28	0.49	0.02	0.23	0.23	0.17	0.17
Kangwane	0.67	0.83	0.17	1.00	0.83	0.83	0.50
Qwa-qwa	0.00	0.33	0.00	0.33	0.67	0.67	0.00
Gazankul	0.11	0.22	0.00	0.11	0.11	0.22	0.11
Lebowa	0.10	0.35	0.00	0.15	0.30	0.25	0.55
Kwandebe	0.25	0.50	0.00	0.25	0.25	0.25	0.50
Transkei	0.00	0.22	0.00	0.28	0.22	0.19	0.25
Bophutha	0.24	0.38	0.00	0.33	0.29	0.33	0.19
Venda	0.40	0.60	0.00	0.40	0.20	0.00	0.00
Ciskei	0.38	0.63	0.00	0.63	0.63	0.63	0.88
Rural	0.19	0.36	0.04	0.25	0.26	0.24	0.29
Urban	0.44	0.60	0.21	0.41	0.59	0.52	0.18
Metro	0.48	0.45	0.35	0.32	0.35	0.31	0.17
t –value of Difference in Means between Non Homeland and Homeland Provinces	2.828**	-0.031	5.456***	0.320	1.734*	1.598	-2.356**

Note: * indicates statistical significance at 10%, ** at 5% and *** at 1%.

Table 3: Average Number of Health Facilities per 10000 Residents in Each Cluster in 1993/94

	Hospital	Dispensary	Pharmacy	Maternity Clinic	Clinic	Family Planning
Mean for Whole Sample	1.54	2.30	3.92	1.52	4.72	4.17
Non Homelands						
Cape	0.77	3.60	3.60	0.67	6.64	6.03
Natal	3.66	3.66	10.55	2.75	8.06	8.06
Transvaal	2.45	2.64	7.57	1.20	4.83	4.39
Orange Free	1.39	2.15	2.15	1.39	3.69	2.92
Homelands						
KwaZulu	0.33	0.82	0.00	2.00	3.57	2.67
Kangwane	1.41	6.01	0.00	6.01	8.05	8.05
Qwa-qwa	0.00	0.00	0.00	0.00	0.01	0.01
Gazankul	3.30	0.00	0.00	0.00	0.00	0.00
Lebowa	1.15	1.15	0.00	2.42	3.76	2.42
Kwandebe	0.00	0.00	0.00	0.00	0.00	0.00
Transkei	0.00	0.00	0.00	0.00	0.00	0.00
Venda	0.78	0.78	0.00	0.78	0.78	0.30
Ciskei	0.00	0.88	0.00	2.57	2.57	2.57
Rural	0.97	1.44	0.69	1.96	4.42	2.98
Urban	1.93	3.39	5.66	1.43	7.89	7.70
Metro	2.04	2.62	7.03	0.97	2.56	2.95
t –value of Difference in Means between Non Homeland and Homeland Provinces	1.643	2.227**	4.024***	-1.121	2.188**	2.485**

Note: * indicates statistical significance at 10%, ** at 5% and *** at 1%.

Table 4: Proportion of Clusters in KwaZulu-Natal with the Specific Personnel/Facility

	1993	1998
Hospital	0.80	
Public Hospital		0.73
Private Hospital		0.35
Dispensary	0.13	0.78
Pharmacy	0.17	0.72
Maternity Clinic	0.13	0.67
Clinic	0.49	0.90
Family Planning Clinic	0.45	0.86
Doctor	0.40	
Private Doctor		0.57
Nurse	0.55	
Pharmacist	0.19	
Mid Wife	0.28	
Family Planning Worker	0.36	0.30
Health Worker	0.32	
Traditional Healer	0.24	0.91

Notes: Sample consists of Panel Households From KwaZulu-Natal

Table 5: Summary Statistics: SIHS 1993 Data (National Sample)

	Count	HAZ	WHZ
All Children	3358	-1.06	0.25
Girls	1660	-0.92	0.40
Boys	1698	-1.20	0.10
Black Children	2906	-1.15	0.27
Coloured Children	192	-1.09	0.00
Indian Children	81	-0.24	0.08
White Children	179	0.10	0.26
Rural	2058	-1.22	0.33
Urban	683	-0.88	0.19
Metro	617	-0.73	0.04
Non Homelands			
Cape	249	-1.27	0.38
Natal	153	-0.53	0.23
Transvaal	683	-0.71	0.09
Orange Free	149	-0.69	-0.08
Homelands			
KwaZulu	612	-1.33	0.55
Kangwane	58	-0.91	0.21
Qwa-Qwa	16	-1.30	-0.36
Gazankul	120	-1.10	0.13
Lebowa	369	-1.27	-0.04
Kwandebe	64	-0.60	0.44
Transkei	537	-1.32	0.75
Bophutha	199	-0.93	-0.53
Venda	83	-1.48	0.31
Ciskei	66	-0.47	-0.49

Notes: HAZ: Height to Age Z-score, WHZ: Weight to Height Z-score

Table 6: Percentage of Children by Z-Score categories (SIHS 1993, National Sample)

Z-Score Interval	Degree of Malnutrition	Category				
		All	Black	Coloured	Indian	White
Height for Age (HAZ)						
< -3	Severe	11.76	12.84	6.25	3.70	3.91
(-3, -2)	Moderate	14.86	15.76	16.15	3.71	3.91
(-2, -1)	Mild	27.37	28.18	33.33	16.05	12.85
> -1	Normal	46.01	43.22	44.27	76.54	79.33
Weight for Height (WHZ)						
< -3	Severe	3.81	4.27	1.04	2.47*	-
(-3, -2)	Moderate	5.60	5.74	4.17	6.17	4.47
(-2, -1)	Mild	13.34	13.25	15.62	17.29	10.61
> -1	Normal	77.25	76.74	79.17	74.07	84.92

Notes: *: Sample Size is very small

Table 7: Change is Child Anthropometric Status, 1993 – 1998

	1993			1998		
	Count	**HAZ**	**WHZ**	**Count**	**HAZ**	**WHZ**
All Children	838	-1.16	0.43	727	-0.79	0.93
Girls	422	-1.16	0.50	359	-0.61	0.96
Boys	416	-1.16	0.36	368	-0.96	0.91
Black Children	753	-1.25	0.46	700	-0.78	0.96
Indian Children	85	-0.34	0.12	27	-1.13	0.18

Table 8: Changes in the Percentage of Children by Z-Score Categories, 1993-98

Z-Score Interval	Degree of Malnutrition	1993			1998		
		All	Black	Indian	All	Black	Indian*
Height for Age (HAZ)							
< -3	Severe	14.68	15.94	3.53	11.97	11.57	22.22
(-3, -2)	Moderate	12.29	13.14	4.71	13.34	13.14	18.52
(-2, -1)	Mild	25.18	25.63	21.17	22.28	22.86	7.41
> -1	Normal	47.85	45.29	70.59	52.41	52.43	51.85
Weight for Height (WHZ)							
< -3	Severe	4.42	4.65	2.35	2.06	2.00	3.70
(-3, -2)	Moderate	5.37	5.31	5.89	2.07	1.71	11.11
(-2, -1)	Mild	10.62	9.69	18.82	6.74	6.43	14.82
> -1	Normal	79.59	80.35	72.94	89.13	89.86	70.37

Notes: *: Sample Size is very small

Table 9: 3SLS Regression Results for HAZ and WHZ, SIHS 1993

Variable	HAZ		WHZ	
	Coefficient	t-value	Coefficient	t-value
Gender of Child (1 = boy, 0 = girl)	-0.346**	-4.197	-0.286**	-3.566
Age in Months	-0.016**	-6.689	-0.021**	-9.099
Unearned Male Income	-0.001	-0.843	0.001	1.618
Unearned Female Income	0.013**	2.168	0.003	0.527
Earned Male Income	-0.001	-0.790	0.000	-0.200
Earned Female Income	0.003**	3.363	-0.001	-0.620
Male Pensions Received	0.002	0.552	-0.005	-1.569
Female Pensions Received	0.001	0.298	0.005	1.475
Transfers Received by Males	0.072**	2.637	-0.053**	-1.988
Transfers Received by Females	0.001	0.125	0.010	1.131
Number of Children	0.060**	2.326	-0.085**	-3.420
Number of Adults	-0.067**	-2.239	0.061**	2.095
Number of Elderly	-0.384**	-2.777	-0.009	-0.065
Gender of Household Head (1=male, 0= female)	0.205	0.712	0.459*	1.639
Age of Household Head	-0.001	-0.047	-0.009	-0.449
$(\text{Age of Household Head})^2$	0.000	0.024	0.000	0.665
Educhd1	-0.018	-0.120	0.036	0.251
Educhd2	-0.010	-0.049	0.134	0.691
Educhd3	0.125	0.528	0.007	0.029
Rural	-0.032	-0.172	0.159	0.874
Coloured	0.017	0.035	-1.354**	-2.849
Indian	0.748*	1.733	-0.370	-0.895
White	0.439	0.928	-0.122	-0.267
Number of Doctors	-0.106	-0.782	0.292**	2.211
Number of Nurses	-0.053	-0.330	-0.154	-0.988
Number of Pharmacists	-0.227	-0.804	-0.361	-1.318
Number of Midwives	0.143	0.855	0.000	-0.002
Number of Family Planning Workers	0.320*	1.780	0.021	0.121
Number of Hospital Workers	-0.112	-0.777	0.014	0.099
Number of Traditional Healers	-0.147	-1.330	-0.030	-0.274
Number of Hospitals	0.227	1.301	0.362**	2.123
Number of Dispensaries	-0.374*	-1.851	0.047	0.238
Number of Pharmacies	-0.006	-0.043	0.013	0.099
Number of Maternity Clinics	-0.061	-0.361	0.216	1.311
Number of Clinics	0.014	0.099	-0.036	-0.259
Number of Family Planning Clinics	-0.114	-0.652	0.119	0.701
Constant	-0.690	-1.096	0.687	1.120

Notes: (i) Regressions Control for Pre 1994 province of residence.
(ii) Educhd1 = 1, if highest education of household head is primary school, 0, otherwise.
(iii) Educhd2 = 1, if highest education of household head is more than primary school, but less than secondary school, 0, otherwise.
(iv) Educhd3 = 1, if highest education of household head is secondary school or higher, 0, otherwise.
(v) *: Significant at 10% significance level; **: Significant at 5% significance level

Variable	1993		Variable	1998	
	Coefficient	t-value		Coefficient	t-value
Gender of Child (1 = boy, 0 = girl)	-0.092	-0.534	Gender of Child (1 = boy, 0 = girl)	-0.389*	-1.863
Age in Months	-0.023**	-4.008	Age in Months	-0.010	-1.426
Unearned Male Income	-0.021**	-2.348	Unearned Male Income	-0.001	-0.780
Unearned Female Income	0.005	1.037	Unearned Female Income	-0.009	-1.489
Earned Male Income	0.004	1.529	Earned Male Income	-0.006**	-2.598
Earned Female Income	0.001	0.437	Earned Female Income	0.012**	4.072
Male Pensions	0.001	0.131	Male Pensions	-0.035**	-2.411
Female Pensions	0.013**	2.120	Female Pensions	0.044**	2.873
Transfers Received by Males	0.006	0.210	Transfers Received by Males	-0.009	-0.355
Transfers Received by Females	0.024**	2.882	Transfers Received by Females	-0.022**	-2.679
Gender of Household Head (1=male, 0=female)	-0.592	-1.356	Gender of Household Head (1=male, 0=female)	1.173**	2.082
Age of Household Head	-0.011	-0.255	Age of Household Head	0.037	0.602
(Age of Household Head^2)	0.000	0.312	(Age of Household Head)^2	0.000	-0.648
Educhd1	-0.050	-0.243	Educhd1	-0.181	-0.678
Educhd2	-0.560	-1.518	Educhd2	0.120	0.313
Educhd3	-1.348*	-1.665	Educhd3	0.490	0.390
Number of Children	0.127**	2.786	Number of Children	-0.038	-0.742
Number of Adults	-0.052	-0.907	Number of Male Adults	0.178*	1.863
Number of Elderly Old People	-0.452*	-1.724	Number of Female Adults	-0.032	-0.395
Number of Doctors	-0.492**	-1.964	Number of Male Elderly	1.478**	2.043
Number of Nurses	0.272	0.877	Number of Female Elderly	-1.306**	-2.018
Number of Pharmacists	1.096	1.454	Total Umbondo Paid	0.000	-1.447
Number of Midwives	-0.312	-0.691	Total Lobola Paid	0.000	1.042
Number of Family Planning Workers	-0.037	-0.081	Males' Share of Durables	0.450	1.096
Number of Hospital Workers	0.537	1.580	Females' Share of Durables	-0.465	-0.992
Number of Traditional Healers	-0.382*	-1.743	Males' Share of Gifts at Marriage	0.315	0.336
Number of Hospitals	2.734**	2.631	Females' Share of Gifts at Marriage	-0.572	-1.071
Number of Dispensaries	-0.648	-1.256	Males' Share of Financial Assets	1.624	1.378
Number. Of Pharmacies	-0.871	-0.637	Females' Share of Financial Assets	-1.906**	-2.447
Number of Maternity Clinics	-0.057	-0.158	Number of Public Hospitals	0.074	0.257
Number of Clinics	0.138	0.320	Number of Private Hospitals	-0.419	-1.564
Number of Family Planning Clinics	-0.404	-0.802	Number of Dispensaries	-0.526	-1.488
Constant	-0.489	-0.388	Number of Pharmacies	0.009	0.101
			Number of Maternity Clinics	0.260	0.551
			Number of Clinics	0.126	0.579
			Number of Family Planning Clinics	0.294	0.522
			Number of Healers	0.011	0.442
			Number of Private Doctors	-0.126	-1.015
			Number of Family Planning Workers	-0.198	-0.953
			Constant	-2.302	-1.143

Notes: (i) Educhd1 = 1, if highest education of household head is primary school, 0, otherwise.
(ii) Educhd2 = 1, if highest education of household head is more than primary school, but less than secondary school, 0, otherwise.
(iii) Educhd3 = 1, if highest education of household head is secondary school or higher, 0, otherwise.
(iv) *: Significant at 10% significance level; **: Significant at 5% significance level

Figure 1: Kernel Density Estimates of Height to Age Z-score – Black Children Residing in KwaZulu Natal Province

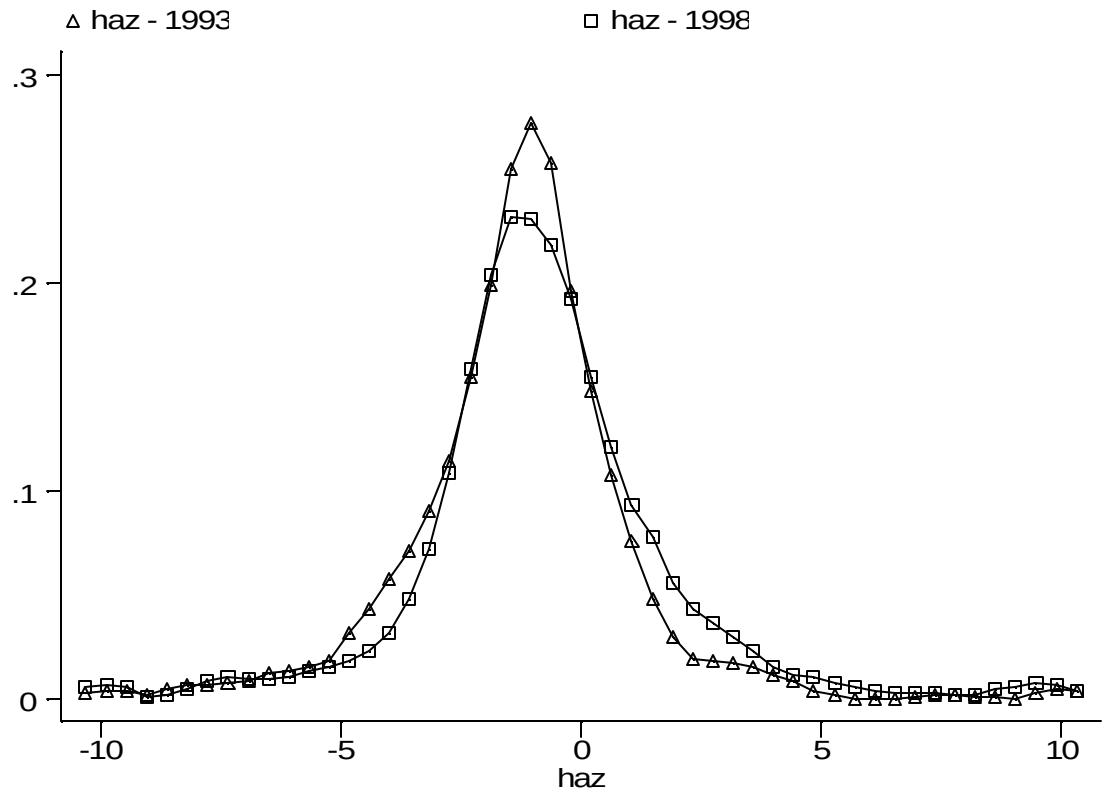

Figure 2: Kernel Density Estimates of Weight to Height Z-score – Black Children Residing in KwaZulu Natal Province