The Unraveling of the Urban Health Advantage: The Case of South Africa

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1. Introduction

The prevailing wisdom of health scholars has long been that urban residents enjoy better health than rural people. This can be attributed to a variety of advantages, including better access to health infrastructure, improved sanitation, higher incomes, healthier populations due to migrant selection, and better access to health knowledge and information. (Panel on Urban Dynamics, 2003) As a result, policy makers have often focused health outreach and investment towards improving the lot of rural populations. However, in recent years, scholars have questioned the reality of urban advantage in some developing countries, emphasizing the vast inequality in services and environments experienced by urban residents (Brockerhoff and Brennan 1998, Montgomery 2009). This question is particularly salient in the African context. In the last three decades, Africa has gone from having urbanization rates between 10% and 30% in the 1970s, to 30 to 60% in 2005. (Zlotnik 2006). This rapid urbanization is characteristic of the developing world more widely, but it differs from previous patterns of urbanization in several important ways. The most critical difference is that the majority of the urbanization presently occurring in Africa is happening in the absence of industrialization and economic growth. (Tienda et. al. 2006, Montgomery et. al. 2003) Whereas urban migrants were previously drawn to the cities by the 'pull factors' such as the prospect of employment and improved wages in the urban economy, today's migrants are equally likely to be fleeing 'push factors' like civil conflict, natural disaster, or the decrease in demand for rural labor. While the 'pull factors' certainly still loom large in the minds of young urban migrants, the bigger picture shows that urbanization in Africa is largely occurring without corresponding increases in per capita incomes. (Tienda et. al. 2006, Cohen 2004, Montgomery et. al. 2003)

In light of this deviation from earlier patterns, its appropriate that scholars re-examine the 'urban health advantage' and test its persistence. Recent studies in developing country contexts have found that although the average health of urban residents is higher than the average of their rural counterparts, such averages obscure the disadvantages suffered by the poorest urban residents, who may have health outcomes equal to or worse than rural residents (Fotso 2007, Van De Poel, O'Donnel & Doorslaer 2007). In addition, the swift pace of urbanization in the developing world raises concerns that cash strapped and decentralizing governments are unable to expand health infrastructure adequately to keep pace with urban population growth-potentially leading to deterioration of health for urban residents. South Africa makes a particularly interesting case study for policy makers to examine the resilience of urban advantage, as it has both a high relatively urbanization rate and a stable government that has focused on improving and expanding urban infrastructure coverage in recent years. The remainder of this paper uses two nationally representative datasets from South Africa to first examine the persistence of urban advantage 15 years after apartheid ended. I find that a strong urban advantage seen in the initial survey has disappeared by 2008, largely due to improvements in rural children's health. I also find that although the early urban advantage is explained by differences in household socioeconomic status, the gains in rural children's health are not driven by differential improvements in household SES. Rural households have had similar gains in education to their urban counterparts, and most surprisingly, they have had much lower gains in household wealth. Secondarily, I test whether differential migration or improvements in household sanitation or community health infrastructure are potential explanatory factors. I find no evidence for selective migration of children, nor do I find that household infrastructure influences child health outcomes once household wealth is accounted for. Although community health infrastructure has expanded in the period examined here, improved access to local

hospitals and clinics does not seem to influence children's weight or height for age. Access to regional hospitals has a positive and significant effect on children's weight for age, but as large regional hospitals are disproportionately located in urban areas, this does not explain the relative gains of rural children over urban children.

2. Data and Outcomes

The analysis takes advantage of two nationally representative cross sectional household surveys from South Africa conducted 15 years apart. The first, the Project for Statistics on Living Standards and Development (PSLSD) was conducted in 1993/94 at the close of the apartheid government. This survey measured health and economic indicators in 8809 households across South Africa, and included adult and child modules administered to 43, 687 people. Most importantly for this comparison, all resident children under the age of six were physically weighed and measured, giving us direct information on their relative health status for age. In addition, a community survey was administered in each of the statistical areas in order to document the local infrastructure and services accessible to the surveyed households. The second cross section of data comes from a new nationally representative data set from South Africa- The National Income Dynamics Study (NIDS). This comprehensive survey of over 7000 households combines individual level and household level questionnaires along with direct anthropometric measurements of adults and children. It also contains specific information on residence in urban formal and informal settlements as well as formal rural areas and tribal holdings. Collectively, this information allows direct evaluation of the health, socioeconomic profile, and place of residence for the 31,170 adults and children surveyed.

Together, these surveys provide two comparable snapshots of South African households taken 15 years apart. Further, the fifteen years covered by these two surveys have been ones of enormous social and economic change in South Africa, and although the end of apartheid meant that racial inequality was no longer dictated by law, the legacy of racial discrimination is still very much evident. As such, its would be disingenuous to compare all South African children and households as similar, and this analysis restricts itself only to the majority racial group- Black South Africans. It is further restricted to analyzing health outcomes for children under the age of six. This is due to the fact that the earlier survey only took measurements for children who were under school age, and so we have direct measurements only for young children. Ultimately, I am able to analyze 3662 children and their households in 1993, and compare them to 1856 children and their households in 2008.

3. Empirical Strategy

The empirical framework is a simple multiple cross sectional comparison in two parts. In part one of the analysis, urban and rural children in 1993 are compared across five health outcomes based on direct anthropometric measurements of the children (rather than caregiver reports). The five are standardized measures (zscores) of *height for age* (HAZ) and *weight for age* (WAZ), as well as body mass index (BMI), *stunting* (more than 2 standard deviations below mean height for age) and *wasting* (more than two standard deviations below mean weight for age). I also use ordinary least squares to unpack the some of the socioeconomic components of urban advantage in the 1993 sample. I then use the same five measures and examine urban and rural children in the 2008 sample to observe whether the urban health advantage still exists and I

find that it does not, but that this is largely due to large health gains made by rural children.[1] In the 2008 sample, I am able to additionally examine the health differences between formal and informal urban residency in comparison with rural residency.

In parts two and three of the analysis, I explore the socioeconomic correlates of urban advantage and find that parental characteristics and household wealth account for the urban advantage in 1993. I then try to identify potential reasons that rural children have made large health gains in the relative absence of economic growth while children in urban households have made only very small gains despite a twenty five percent increase in average household income. In this section I focus on the two most commonly used health outcomes- height for age, which is generally understood as an indicator of chronic malnutrition, and weight for age, which is a measure of acute malnutrition.

4. Empirical Results

4.1 Changes in the Urban Advantage

The primary question posed in this paper is whether the urban advantage in children's health has persisted in South Africa despite rapid urban growth. Table One compares the mean scores of black children under six years of age across urban and rural areas. In 1993, there is a clear urban advantage. It is also worth noting that the HAZ and WAZ scores are standardized to the 2000 U.S. reference population, and South African children score consistently below the mean of American children of the same age.[2] However, there is a significant advantage to living in an urban area. Urban children are taller and heavier for their age compared to rural children of the same age group. This is particularly salient in the measures of height for age, where urban

[1] I conducted parallel analyses of obesity, disability, and caregiver reported health status. Results are not presented here but followed the same patterns as the presented five and are available on request.

[2] To what degree the American children are a reasonable reference for world growth standards is a lively debate- which I will not take up here. However, I have performed the same analysis using the WHO reference population as well and found that the conclusions are robust to the use of different standard populations.

children are nearly a quarter of an order of magnitude taller. As low HAZ is a reflection of chronic malnourishment, it appears that urban children have enjoyed a consistent advantage over their rural counterparts. The weight for age advantage is slightly smaller in magnitude but, similarly, is highly statistically significant. Correspondingly, urban children have slightly lower BMI, since they have great height advantage, but not as great a weight advantage over rural children. The two measures of acute malnutrition, stunting and wasting are above 20 percent in both categories. The degree of stunting and wasting here is probably exaggerated due to the differences between the American reference population and the South African children. However, we are primarily concerned with the differences between urban and rural children, and here we see a urban advantage in stunting of 6 percentage points. Incidence of wasting does not differ between urban and rural children.

The second panel of Table One presents the same comparison 15 years later, in 2008. The first thing worth noting is that time has been good to South African children. All the children, regardless of rural or urban status, have improved in height and weight compared to the previous generation. Rural children's weight scores have improved by roughly eight tenths of a standard deviation, nearly an entire order of magnitude. Urban children have similarly improved in weight scores by seven tenths of a standard deviation. Rural children have similarly large improvements in height for age, gaining .53 of a standard deviation in height for age. Urban children's height gains have been considerably more modest, gaining .24 of a standard deviation. Acute malnutrition is also much improved. Stunting has gone down considerably and levels of wasting are less than half of what they were in 1993. What is more remarkable is that the urban advantage has gone away completely. By 2008, urban children have are not statistically significantly different than rural children across any of the indicators.

[Table One about here]

Figure one further illustrates these changes decomposed by age and gender. The charts on the left hand side are from the 1993 population, the right hand side are for the 2008 population. The charts show a clear urban rural gap in HAZ scores in 1993 which was particularly pronounced for boys, and which appears to be increasing as children age. By 2008, the urban and rural children are not significantly different at any age. The WAZ scores are closer across both boys and girls, but a consistent urban advantage is identifiable in 1993 and no clear advantage can be seen by 2008. However, the WAZ charts for girls do start to diverge at older ages, suggesting that urban life may confer weight advantages at older ages for girls.[3]

Collectively, everyone appears to have improved, but rural children have made much greater strides than urban children. This fact bears further investigation since we might expect urban children to actually be better positioned to benefit from the policy change and economic growth that have characterized post-apartheid South Africa. One potential explanation for this pattern is that urban children have both improved and regressed simultaneously. That is, some urban children have gotten better off, but rapid urbanization means that many urban children are living in informal townships and slums with poor infrastructure and health facilities. Consequently on average, urban children have not made as much progress as rural children. Tables 2 and 3 explore this question by looking at children's health indicators across different kinds of urban and rural environments. In the 1993 sample, urban households were classified into 'metropolitan' and 'urban', where urban signifies households that are in smaller urban or

[3] NIDS collected height and weight data on children up to age 15, and an comparison of older girls does find an urban advantage in weight, however, there is a concern about selection bias among school age children in the sample, namely that many older children either were not around to be measured because of schooling or refused to be measured. As such, the evidence is only suggestive.

peri-urban areas.[4] The differences between children in metropolitan and urban households are not substantively or statistically different from each other.

[Table 2 about here]

By 2008 (Table 3) there is clearer evidence of a wide division in child welfare within the urban category. In the NIDS survey, households in informal urban areas (i.e. informal townships) were classified separately from households in metropolitan areas and formal townships. You can see that the vast majority of children in the sample live either in a formal urban area or in a rural area controlled by tribal authorities.

[Table 3 about here]

In keeping with what urbanization scholars have hypothesized (Montgomery et al 2003, Fotso 2007, Van De Poel, O'Donnel & Doorslaer 2007) you can see a much larger spread within the urban category than you do in the 1993 data. Children living in urban informal areas have weight for age scores of -.26, which look very similar to most rural children's average z-scores of -.21. In contrast, children in urban formal areas have significant advantage over both the tribal authority and urban informal residents with an average weight for age z-score of -.12. Although there is evidence of significant variation within the urban experience, there is also considerable variation within the rural category. Much like urban children in informal areas are disadvantaged, an almost identical proportion of children living in formal rural areas are highly

[4] Unfortunately, the details of the classification scheme are not clarified, so its hard to know exactly what 'urban' but not 'metropolitan' really signifies in terms of access to services and living environment.

disadvantaged compared to rural children living in tribal authority areas.[5] Children in rural formal areas are 5 percentage points more likely to be stunted and 7 percentage points more likely to be wasted. In addition their weight for age z-scores are significantly lower than the other rural children or the urban children. Urbanization scholars are likely correct in their assertion that the variation in urban children's welfare is increasing, but based on this data, it seems that there is still at least as large a variation among rural children as well. So growing variation in urban living conditions does not fully explain why we find greater average increases in rural welfare than in urban welfare.[6]

4.2 Urban Advantage and SES

There are a fair number of good reasons to expect urban children to have better health than rural children. They are, on average, living in wealthier households, have better educated parents and likely have access to better urban infrastructure such as clean water, electricity and local clinics and hospitals. Tables 4 and 5 present OLS regressions of the socioeconomic characteristics of households on HAZ and WAZ respectively to see what factors explain the urban advantage in both samples. In both tables, columns 1-3 report the regression results for the 1993 PSLSD sample and columns 4-6 report the results for the 2008 NIDS sample.

[Table 4]

The first column of Tables 4 and 5 presents the base model, controlling additionally only for age and gender of the child. Column two explores the hypothesis that urban children are

[5] Note to Sharon/readers- the classification system used in NIDS came from the ZA census classification, and its not entirely clear how they defined these categories. I hope to ultimately get better information from the census office to clarify for the readers (and myself) how these categories really differ)- until then, I dare not make too much of these tables.

healthier due to living with adults who are more educated and better able to make informed decisions regarding the child's health. In keeping with previous research, we find here that the more educated the child's mother, the higher the child's height and weight z-scores. The same is true for the mother's age at the child's birth. The coefficient on the 'urban residence' covariate goes down but does not lose statistical significance when you include these characteristics, suggesting that differences in parental age and education together are a significant contributor to the urban advantage but do not explain it away entirely. Column 3 then adds in several measures of household wealth, including the log of monthly household expenditure and its square, as well as a measure of how many assets a household possessed at the time of interview (from a list of 11 commonly held household assets, such as radio, stove, refrigerator, TV etc). For both height and weight scores the household wealth variables are statistically significant, Further, controlling for them eliminates the significance of urban residence effect. From this evidence, it would seem that the primary driver of urban health advantage in 1993 was the relative wealth enjoyed by urban households compared to rural ones.

[Table 5]

Columns 4-6 in Tables 4 and 5 repeat the same regression analyses for the 2008 sample. As cited previously, by 2008 there is no remaining urban health advantage, even without controlling for parental or household wealth characteristics. In columns 5 and 6, I find that although they continue to be significant predictors of childhood health, there is no change in non-significance of the urban effect.

Given the above evidence, the most obvious explanation for rural children rapidly closing the health gap is that rural households caught up with urban households along key

socioeconomic variables between 1993 and 2008. However, a comparison of household characteristics over time in both rural and urban households shows that this has not been the case in South Africa.

[Table 6]

The two panels of table six compare the changes in the average rural households to changes in urban households over the 15 years. Since the end of apartheid, both urban and rural black households have fewer children, and on average household adults have about a year more education completed than they did in 1993. However, the most striking aspect of the table is per capita income.[7] In rural households, once inflation has been adjusted for, there has been almost no change in household income. Per capita household income increased from 647 rand per person to 662 rand per person, roughly a 2% increase in income. In contrast, urban households enjoyed a 24% increase in average per capita household income over the period, moving from 1115 rand per person to 1380 rand per person. If, as Tables 4 and 5 suggest, wealth is a primary driver of childhood health, how did rural children make great strides in health while their urban counterparts enjoyed all the growth in household wealth?

4.3 Testing Explanations for the Urban Rural Paradox

There are several potential explanations for why rural children may have closed the gap in the absence of economic growth. One of the motivations for these research questions is the observation that cities are growing rapidly in sub Saharan Africa. Consequently, one potential explanation is that the dissolution of the urban health advantage is a result of urban migration.

[7] 1993 incomes are adjusted to 2008 Rand using CPI. Analysis was repeated using household per capita expenditure rather than income, but findings did not differ based on the measure of household wealth. In addition, households in the top one percent for earnings were dropped from the analysis.

Focusing analysis on children under school age alleviates some of the common concerns that urban health advantages are attributable to selection of healthier migrants into the urban labor force or school system. Children are generally not in the labor force in South Africa, and preschool-age children are unlikely to move to educational opportunities. However, there is a possibility of reverse selection. That is, if rural families know that there is better health care available in urban areas, they could plausibly send sicker or weaker children to the city in search of the health care advantages. If this were to occur on a mass scale, it could artificially depress the health outcomes of urban children and increase those of rural children. I am able to partially explore this possibility in the NIDS data using caregivers reports on birth weights, head circumference at birth and attended births for all children under six years old. This allows me to examine whether there is migrant selection in effect because am able to compare at children who migrated to urban areas at birth- i.e. *before* they migrated – to see if they exhibit signs of poorer health compared to non-migrant children. I find no difference in average birth weights or head circumference for children who migrate from rural to urban areas. Further, children who migrate from rural to urban areas are no more or less likely to have been born in a hospital or clinic or to have had an attended birth. [8] Consequently, it is unlikely that the migration of more unhealthy children from rural to urban areas is behind these puzzling results.

While the evidence explored so far suggests that household wealth and parental education are significant factors in childhood health, its entirely plausible that increases in household wealth are not the only pathway to improving children's health status. In the absence of dramatic changes in household wealth, improved infrastructure and improved access to health services could play an important role in boosting improving children's health. Particularly, as in the South African case, when health care is supposed to be available to expectant mothers and

[8] Results not shown, but available on request.

young children free of charge. Tables 7 and 8 explore the influence of household infrastructure, such as running water and connectivity, as well as community health infrastructure, such as the availability of clinics and hospitals.

[Table 7]

During the time elapsed between the two surveys, the South African government prioritized improvements in community infrastructure, particularly in previously underserved areas and electricity and water supply were expanded substantially. Taking the 1993 sample (Table 7) columns 1 and 4 add measures of whether the household had piped water and was connected to an electricity supply to see if these differences in household infrastructure and sanitation, contribute to the improvements in children's health. For the most part, once household wealth is controlled for, access to piped water does not seem to have a strong association with child height and weight in 1993 or 2008. Having access to household electricity is associated with improved and weight height for age in 1993, although only 26% of the households with children have electricity in 1993. As such, it may be a marker of other types of household advantage. Regardless, by 2008 electricity does not have an association with either measure of child health. (Table 8, columns 1 and 4)

A related potential explanation is that community health infrastructure, rather than household infrastructure, has a direct effect on child health outcomes. This explanation is particularly appealing in the context of urbanization, because there is some evidence that the health infrastructure in sub-Saharan Africa is becoming overwhelmed by population growth and the HIV epidemic. (Case and Paxson 2009). In addition, there has been a concerted effort to expand the number of community health clinics, particularly in rural areas. (Cite- Health systems

trust, ZA DoH) Its possible that urban population growth is outstripping the capacity of urban health clinics to meet need and previously advantaged urban populations are now seeing a reversal of that advantage. Concurrently, rural areas are getting more health care infrastructure installed. Although I can not examine this topic comprehensively, I am able to look at two related measures of access to hospitals and clinics in the 93 and 08 surveys. In the PSLSD survey, a community survey was conducted in conjunction with the household surveys. The survey recorded whether the households in the community had access to 7 kinds of health facilities, including hospitals, dispensaries, pharmacies, clinics, family planning clinics. Columns 2 and 5 in Table 7 control for the existence of any health facility at all, whereas columns 3 and 6 control only for access to hospitals and clinics. The results suggest that the existence of a hospital in your community has a substantively and statistically significant effect on childhood weight for age, but clinics and other types of facilities have minimal impact on weight for age, and no statistically significant impact on height for age.

Unfortunately, the 2008 survey does not include a corresponding community survey which could be directly compared to the 1993 reports on access to local health facilities. However, the South African Institute for Race Relations publishes an annual report including the number of regional hospitals, district hospitals, clinics and mobile health centers in each district council or municipality. Using this information, I am able to determine the per capita availability of health facilities for the district councils in which the NIDS survey households reside. Adding this information to the regressions in 2008 does not provide any strong evidence that improved access to district hospitals or clinics corresponds to improved height and weight for South African children. However, having a higher number of regional hospitals per capita in your district council does correspond to improved child weight, even after household income and infrastructure are controlled for. Together, Tables 7 and 8 provide only weak evidence that

differences in access to health facilities could explain the paradox of the disappearing urban health advantage. Even if rural children are enjoying expanded access to health facilities, the evidence that that access significantly improves health outcomes independent of economic growth is weak. Only large regional hospitals seem to have an effect on childhood weight for age, and the establishment of large regional hospitals in rural areas has not been part of the expansion health care in South Africa.

5. Conclusions

This analysis ultimately paints a mixed picture of the trajectory of urban health advantage. The urban advantage in early childhood health has undoubtedly disappeared in South Africa. Fortunately, this is largely due to rural children making significant gains rather than urban children sliding backwards. However, given the relative improvements in household socioeconomic status, urban children have gained far less than we might have expected them to, where rural children have gained more than we might expect. This paradox does not appear to be attributable to changes in household infrastructure or changes in demographics from migration. It also does not appear that access to health facilities is associated with improved child health outcomes, so expansion of clinics to more rural areas is an unlikely explanation. However, the existence of health facilities certainly does not predict access to health care. Those facilities must also be open, staffed with medical professionals and providing affordable care. I have not been able to evaluate the quality of medical care here, only the existence of clinics and hospitals. Further research into the substantive differences the quality of health care between rural and urban areas, particularly in terms of staffing levels, transport costs, and user fees might help illuminate why rural children are enjoying health gains that urban children are not. However, regardless of the immediate causes, the findings in this paper suggest that policy makers in South

Africa and other rapidly urbanizing developing countries may want to focus more directly on the health of the expanding numbers of urban poor.

References

Brockerhoff, M. (1990) "Rural to Urban Migration and Child Survival in Senegal" *Demography* 27:601-616.

Brockerhoff, M. and E. Brennan. (1998) "The Poverty of Cities in the Developing World." *Population and Development Review* 24:75-114.

Brokerhoff, M. and Brennan, E. (1998) "The Poverty of Cities in Developing Countries" *Population and Development Review* 24(1), 75-114
burg, Wits University Press)

Case, A and C. Paxson. (2009) "The Impact of the AIDS Pandemic on Health Services in Africa: Evidence from the Demographic and Health Surveys" Forthcoming in *Demography.* Available at http://www.princeton.edu/~accase/papers.html

Cohen, B. (2004) "Urban Growth in Developing Countries: A Review of Current Trends and a Caution Regarding Existing Forecasts." *World Development* 32:23-51.

Collinson, M, Lurie, M, Kahn, K. Wolff, B, Johnson, A. and S. Tollman. (2006) " Health Consequences of Migration:Evidence from South Africa's Rural Northeast (Agincourt)" in *Africa On The Move: African Migration and Urbanization in Comparative Perspective,* eds. Tienda, M. Findley S. Tollman S. and E. Preston-Whyte (Johannesburg, Wits University Press)

Fotso, J. (2007) "Urban Rural Differentials in Child Malnutrition: Trends and Socioeconomic Correlates in sub-Saharan Africa" *Health and Place* 13, 205-223.
Montgomery, M. (2009) "Urban Poverty and Health in Developing Countries," *Population Bulletin* 64, no 2.

Montgomery, M., Stren, R., Cohen, B., and Reed, H. (2003) *Cities Transformed: Demographic Change and Its Implications in the Developing World*, Washington, D.C: National Academies Press.

Montgomery, Mark. R (2009) "Urban Poverty and Health in Developing Countries," *Population Bulletin* 64, no 2.

Panel on Urban Population Dynamics, *Cities Transformed: Demographic Change and its Implications in the Developing World*, ed. Mark.R. Montgomery et al.(Washington DC, National Academies Press, 2003)

Posel, D. (2006) "Moving On: Patterns of Labor Migration in Post-Apartheid South Africa" in *Africa On The Move:African Migration and Urbanization in Comparative Perspective,* eds. Tienda, M. Findley S. Tollman S. and E. Preston-Whyte (Johannesburg, Wits University Press)

.

Tienda, M. Findley S. Tollman S. and E. Preston-Whyte (2006) *Africa On The Move: African Migration and Urbanization in Comparative Perspective*, (Johannesburg, Wits University Press)

Van de Poel, E. O'Donnel, O. and Doorslaer, E. (2007) "Are Urban Children Really Healthier? Evidence from 47 Developing Countries" *Social Science and Medicine* 65, 1986-2003

Van de Poel, E. O'Donnel, O. and E. Doorslaer (2007) "What Explains the Rural-Urban gap in Infant Mortality:Household or Community Characteristics" *Demography* 46: (825-850)

Zlotnik, H. (2006) "The Dimensions of Migration in Africa" in *Africa On The Move:African Migration and Urbanization in Comparative Perspective*, eds. Tienda, M. Findley S. Tollman S. and E. Preston-Whyte (Johannesburg, Wits University Press)

Table 1:

PSLSD-1993 Child Health Indicators (0-6)				NIDS- 2008 Child Health Indicators (0-6)			
	Rural	Urban	Pval diff		Rural	Urban	Pval diff
HAZ	-1.193755	-0.9678951	**	HAZ	-0.6816682	-0.7082365	
WAZ	-1.064404	-0.945473	**	WAZ	-0.2394014	-0.2305235	
BMI	16.16812	15.93664	***	BMI	16.61279	16.75069	
Prob. Stunted	0.2721374	0.2145631	***	Prob. Stunted	0.158545	0.1573034	
Prob. Wasted	0.2649962	0.2607004		Prob. Wasted	0.10299	0.1248025	
N(%)	2634 (72)	1028 (28)		N (%)	2466 (66)	1208 (33)	
*** 1%, **5% * 10%				*** 1%, **5% * 10%			

Table 2:

PSLSD- 1993 Child Health Indicators (0-6)			
	Rural	Urban	Metro
HAZ	-1.193755	-1.004442	-0.9267542
WAZ	-1.064404	-0.9347249	-0.9540573
BMI	16.16812	15.89129	15.90001
Prob. Stunted	0.2721374	0.2021467	0.2270916
Prob. Wasted	0.2649962	0.2473118	0.2678571
N (%)	2634 (72)	565(15)	463 (13)

Table 3:

NIDS- 2008 Child Health Indicators (0-6)				
	Rural Formal	Tribal Authority Areas	Urban Informal	Urban Formal
HAZ	-0.9049057	-0.6539045	-0.7203563	-0.7030405
WAZ	-0.4204233	-0.2172509	-0.2616696	-0.1208436
BMI	16.38037	16.65501	16.79181	16.58557
Prob. Stunted	0.2060606	0.1540881	0.1518219	0.1885246
Prob. Wasted	0.1646342	0.0970432	0.1373737	0.0839695
N (%)	272 (7)	2194 (60)	265 (6)	943 (26)

Table 4:

	HAZ in 1993 (PSLSD 0-6)				HAZ in 2008 (NIDS 0-6)		
	(1)	(2)	(3)		(4)	(5)	(6)
urban	0.221***	0.162***	0.0213	urban	0.108	0.0621	0.0779
	(0.0576)	(0.0588)	(0.0607)		(0.105)	(0.108)	(0.116)
agey	-0.464***	-0.458***	-0.456***	agey	-0.429***	-0.434***	-0.437***
	(0.0507)	(0.0507)	(0.0503)		(0.120)	(0.120)	(0.118)
agey2	0.0737***	0.0732***	0.0723***	agey2	0.0732***	0.0738***	0.0741***
	(0.00958)	(0.00959)	(0.00953)		(0.0199)	(0.0199)	(0.0198)
male	-0.188***	-0.191***	-0.191***	male	-0.0359	-0.0344	-0.0537
	(0.0484)	(0.0482)	(0.0479)		(0.0978)	(0.0969)	(0.0926)
mom's education		0.0289***	0.00929	mom's education		0.0332**	0.0361**
		(0.00798)	(0.00835)			(0.0155)	(0.0155)
mom age at birth		0.00999**	0.00600	mom age at birth		0.00947	0.00980
		(0.00472)	(0.00473)			(0.00807)	(0.00790)
log hh expenditure			0.242	log hh expenditure			-3.589***
			(0.548)				(1.136)
log hh expenditure ^2			-0.00367	log hh expenditure ^2			0.221***
			(0.0354)				(0.0700)
Pval for joint exp vars			*0.0002(***)*	*Pval for joint exp vars*			*.0069(***)*
assets			0.0662***	assets			0.0161
			(0.0183)				(0.0180)
Constant	-0.591***	-1.045***	-2.603	Constant	-0.325*	-0.865***	13.38***
	(0.0645)	(0.155)	(2.124)		(0.168)	(0.323)	(4.489)
Observations	3650	3650	3649	Observations	1806	1806	1806
F test	0	0	0.057	R-squared	0.017	0.022	0.041
R-squared	0.035	0.039	0	F test	0.00581	0.00212	4.46e-05

*** p<0.01, ** p<0.05,

Robust standard errors in parentheses, clustered at household level

All currency values in 2008 Rand

Table 5:

	WAZ in 1993 (PSLSD 0-6)				WAZ in 2008 (NIDS 0-6)		
	(1)	(2)	(3)		(4)	(5)	(6)
urban	0.115*	0.0418	-0.0660	urban	1.75e-05	-0.0560	-0.0224
	(0.0647)	(0.0667)	(0.0698)		(0.0850)	(0.0858)	(0.106)
agey	-0.438***	-0.431***	-0.430***	agey	-0.188**	-0.188**	-0.121
	(0.0584)	(0.0584)	(0.0581)		(0.0893)	(0.0894)	(0.108)
agey2	0.0691***	0.0687***	0.0681***	agey2	0.0190	0.0197	0.0142
	(0.0107)	(0.0107)	(0.0107)		(0.0159)	(0.0159)	(0.0195)
male	-0.0860*	-0.0903*	-0.0908*	male	-0.135*	-0.132*	-0.190**
	(0.0518)	(0.0518)	(0.0516)		(0.0728)	(0.0725)	(0.0918)
mom's education		0.0368***	0.0222**	mom's education		0.0419***	0.0255
		(0.00855)	(0.00893)			(0.0119)	(0.0158)
mom age at birth		0.00933*	0.00628	mom age at birth		0.00954*	0.00499
		(0.00539)	(0.00541)			(0.00548)	(0.00697)
log hh expenditure			-0.0867	log hh expenditure			-1.957**
			(0.777)				(0.887)
log hh expenditure ^2			0.0136	log hh expenditure ^2			0.128**
			(0.0504)				(0.0563)
Pval for joint exp vars			*0.0664(*)*	*Pval for joint exp vars*			*0.0574*
assets			0.0544***	assets			0.0110
			(0.0207)				(0.0192)
Constant	-0.542***	-1.029***	-1.116	Constant	0.151	-0.476**	6.992**
	(0.0762)	(0.177)	(3.011)		(0.120)	(0.234)	(3.468)
Observations	3662	3662	3661	Observations	1856	1856	1856
F test	0	0	0	R-squared	0.011	0.019	0.0278
R-squared	0.022	0.028	0.037	F test	0.00123	2.81e-05	0.019

*** p<0.01, ** p<0.05, * p<(

Robust standard errors in parentheses, clustered at household level

All currency values in 2008 Rand

Table 6:

Rural Household Comparison Over Time			Urban Household Comparison Over Time		
	1993	2008		1993	2008
Per Capita HH Income*	646.99	662.36	Per Capita HH Income	1115.24	1380.68
HH Size	5.10	4.75	HH Size	4.25	3.51
Adult Education	5.96	6.84	Adult Education	7.54	8.78
HH Age	26.52	30.20	Mean HH Age	29.42	30.11
Num. adults	2.99	2.92	Num. adults	2.90	2.38
Num Kids	2.11	1.83	Num Kids	1.35	1.13
Prob. Female headed	0.34	0.52	Prob. Female headed	0.34	0.47

* income figures adjusted to 2008 rand

*** In both 1993 and 2008 datasets, all urban/rural differences shown here are statistically significant with a pvalue<.01, with the exception of the 'number of household adults' in 1993 (urban rural difference is significant with a pvalue<.10), and probability of female headed household', which is not significantly different between urban and rural households in 1993.

Table 7:

1993 (PSLSD 0-6) HAZ and WAZ

	HAZ			WAZ		
	(1)	(2)	(3)	(4)	(5)	(6)
	Household Infrastructure	*Any Health Facility*	*Clinics and Hospitals*	*Household Infrastructure*	*Any Health Facility*	*Clinics and Hospitals*
urban	-0.0248	0.0202	0.0262	-0.0613	-0.0719	-0.0833
	(0.0696)	(0.0728)	(0.0728)	(0.0804)	(0.0845)	(0.0847)
agey	-0.449***	-0.474***	-0.476***	-0.427***	-0.439***	-0.435***
	(0.0502)	(0.0527)	(0.0527)	(0.0581)	(0.0613)	(0.0611)
agey2	0.0711***	0.0782***	0.0787***	0.0674***	0.0711***	0.0703***
	(0.00951)	(0.0100)	(0.01000)	(0.0107)	(0.0112)	(0.0112)
male	-0.188***	-0.230***	-0.230***	-0.0866*	-0.147***	-0.147***
	(0.0478)	(0.0507)	(0.0507)	(0.0517)	(0.0549)	(0.0549)
mom_ed	0.00962	0.0105	0.0106	0.0222**	0.0227**	0.0225**
	(0.00836)	(0.00899)	(0.00899)	(0.00895)	(0.00963)	(0.00961)
momagebirth	0.00702	0.0108**	0.0107**	0.00666	0.0102*	0.0104*
	(0.00473)	(0.00497)	(0.00496)	(0.00544)	(0.00578)	(0.00577)
loghhexp08	0.258	0.0918	0.104	0.00944	0.0794	0.0659
	(0.548)	(0.567)	(0.569)	(0.782)	(0.818)	(0.813)
loghhexp08_2	-0.00462	0.00590	0.00495	0.00754	0.00148	0.00252
	(0.0354)	(0.0366)	(0.0367)	(0.0506)	(0.0531)	(0.0527)
Pval for joint sig of exp vars	*0.0001(***)*	*0.0005(***)*	*0.3788*	*.0601(*)*	*0.2043*	*0.187*
assets	0.0477**	0.0513**	0.0541**	0.0425*	0.0351	0.0293
	(0.0203)	(0.0217)	(0.0217)	(0.0225)	(0.0242)	(0.0241)
piped water	0.0194	0.0264	0.0337	-0.0481	-0.0678	-0.0836
	(0.0609)	(0.0656)	(0.0659)	(0.0696)	(0.0743)	(0.0739)
connected	0.156**	0.0817	0.0831	0.111	0.172**	0.169*
	(0.0747)	(0.0808)	(0.0809)	(0.0814)	(0.0873)	(0.0871)
hospital			-0.148			0.324**
			(0.115)			(0.138)
clinic_healthpost			-0.0114			0.0271
			(0.0612)			(0.0695)
localfacility		-0.0308			0.120*	
		(0.0570)			(0.0650)	
Pval for joint sig of hosp/clinic			*0.0006(***)*			*.0281(**)*
Constant	-2.690	-2.126	-2.174	-1.483	-1.739	-1.663
	(2.121)	(2.202)	(2.207)	(3.028)	(3.170)	(3.149)
Observations	3200	3200	3200	3209	3209	3209
F test	0	0	0	0	0	0
R-squared	0.059	0.062	0.063	0.037	0.040	0.042

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses

Table 8:

2008 (NIDS 0-6) HAZ and WAZ

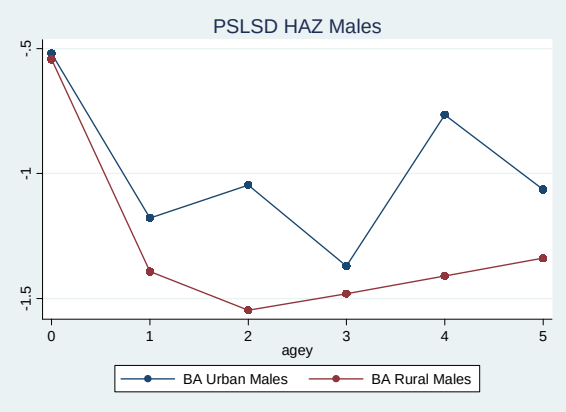
	HAZ			WAZ		
	(1)	(2)	(3)	(4)	(5)	(6)
	Household Infrastructure	*Any Health Facility*	*Clinics and Hospitals*	*Household Infrastructure*	*Any Health Facility*	*Clinics and Hospitals*
urban	0.104	0.164	0.195	-0.0482	-0.0682	-0.0165
	(0.125)	(0.118)	(0.119)	(0.124)	(0.134)	(0.139)
age	-0.472***	-0.475***	-0.478***	-0.120	-0.120	-0.123
	(0.122)	(0.121)	(0.121)	(0.111)	(0.110)	(0.110)
age2	0.0835***	0.0838***	0.0840***	0.0146	0.0146	0.0149
	(0.0202)	(0.0201)	(0.0202)	(0.0200)	(0.0200)	(0.0199)
male	-0.0352	-0.0326	-0.0354	-0.200**	-0.201**	-0.200**
	(0.0959)	(0.0958)	(0.0957)	(0.0959)	(0.0957)	(0.0956)
mom_ed	0.0358**	0.0370**	0.0350**	0.0191	0.0188	0.0187
	(0.0162)	(0.0159)	(0.0160)	(0.0167)	(0.0167)	(0.0166)
momagebirth	0.00585	0.00545	0.00503	0.00317	0.00339	0.00335
	(0.00816)	(0.00828)	(0.00825)	(0.00730)	(0.00727)	(0.00725)
loghhexp	-3.681***	-3.582***	-3.615***	-1.694*	-1.730*	-1.702*
	(1.193)	(1.211)	(1.220)	(0.928)	(0.921)	(0.912)
loghhexp2	0.227***	0.222***	0.224***	0.113*	0.115**	0.114**
	(0.0732)	(0.0745)	(0.0747)	(0.0585)	(0.0582)	(0.0577)
Pval for joint sig of exp vars	*.0084***	*.0114***	*.0109***	*.0949**	*.0283***	*.0866***
assets	0.00773		0.00545	0.00539	0.00610	0.00502
	(0.0198)		(0.0197)	(0.0228)	(0.0225)	(0.0227)
piped water	0.145	0.139	0.131	0.0379	0.0402	0.0106
	(0.133)	(0.133)	(0.134)	(0.126)	(0.126)	(0.126)
connected	-0.122	-0.119	-0.131	-0.0121	-0.00987	0.0156
	(0.137)	(0.129)	(0.138)	(0.141)	(0.142)	(0.145)
reghosp_pc			0.198			0.645**
			(0.279)			(0.269)
disthosp_pc			-0.158			-0.244
			(0.175)			(0.186)
clinic_pc			0.0476			0.0336
			(0.0307)			(0.0336)
Pval for joint sig of hosp/clinic			*0.3674*			*0.1061*
facilities_pc		0.0157			-0.00546	
		(0.0102)			(0.0118)	
Constant	13.83***	13.23***	13.28***	6.010	6.217*	5.828
	(4.729)	(4.810)	(4.877)	(3.661)	(3.627)	(3.591)
Observations	1679	1679	1679	1731	1731	1731
F test	2.64e-05	1.10e-06	5.29e-06	0.118	0.016	0.0527
R-squared	0.045	0.047	0.048	0.015	0.153	0.019

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses, clustered at household level

Source for per capita health facilties- South African Insitute for Race Relations South Africa Survey 2008/2009

Figure 1: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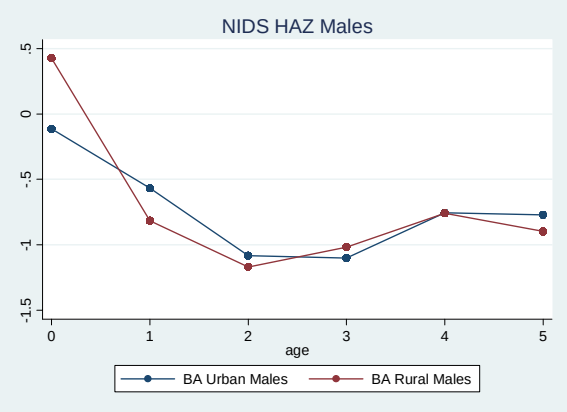
BA Urban Males
BA Rural Males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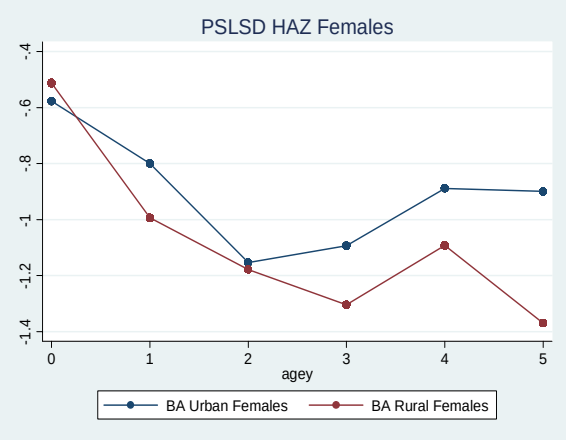
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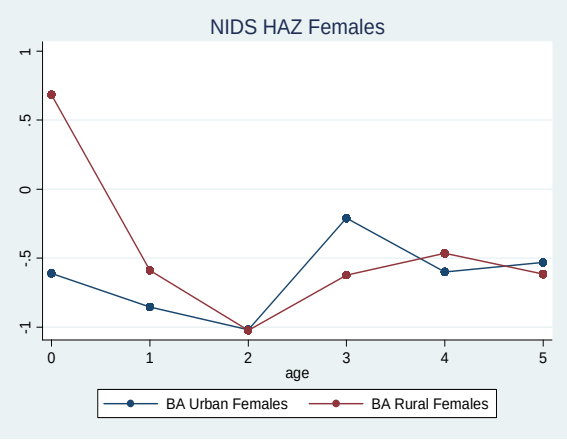
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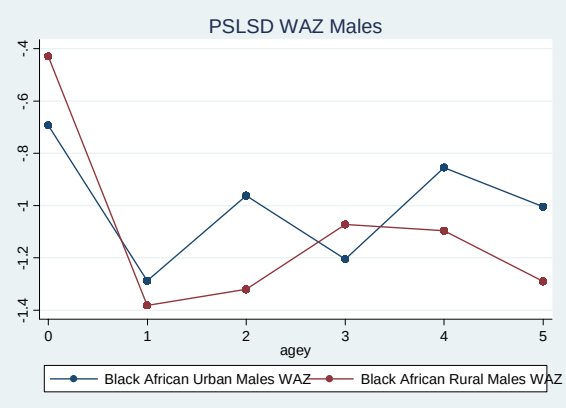
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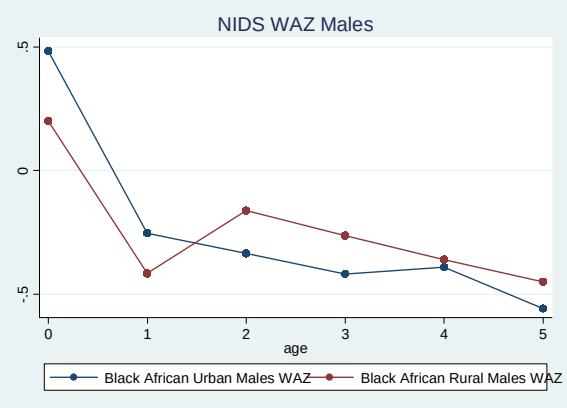
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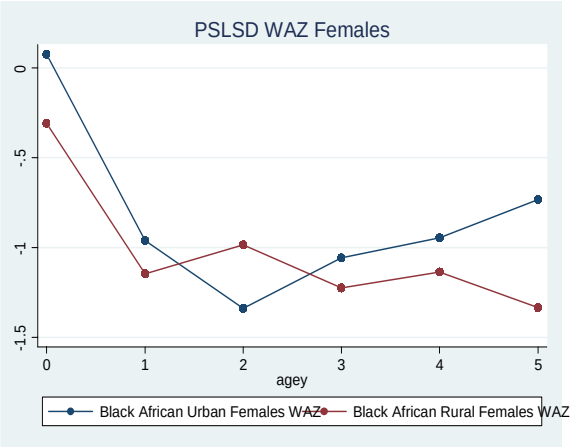
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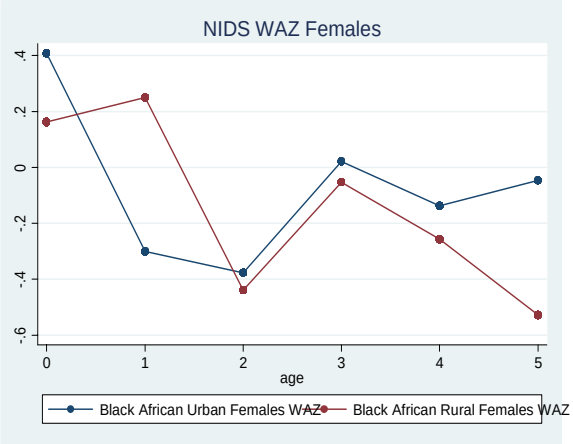
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Black African Urban Females WAZ
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