Public Health Nutrition: 9(2), 187–193 DOI: 10.1079/PHN2005835

Does living in an urban environment confer advantages for childhood nutritional status? Analysis of disparities in nutritional status by wealth and residence in Angola, Central African Republic and Senegal

Gina Kennedy[1,]*, Guy Nantel[1], Inge D Brouwer[2] and Frans J Kok[2]
[1]Nutrition Planning, Assessment and Evaluation Service, Food and Nutrition Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, I-00 100 Rome, Italy: [2]Division of Human Nutrition, Wageningen University, Wageningen, The Netherlands

Submitted 5 January 2005: Accepted 14 June 2005

Abstract

Objective: The purpose of this paper is to examine the relationship between childhood undernutrition and poverty in urban and rural areas.
Design: Anthropometric and socio-economic data from Multiple Indicator Cluster Surveys in Angola-Secured Territory (Angola ST), Central African Republic and Senegal were used in this analysis. The population considered in this study is children 0–59 months, whose records include complete anthropometric data on height, weight, age, gender, socio-economic level and urban or rural area of residence. In addition to simple urban/rural comparisons, the population was stratified using a wealth index based on living conditions and asset ownership to compare the prevalence, mean *Z*-score and odds ratios for stunting and wasting.
Results: In all cases, when using a simple urban/rural comparison, the prevalence of stunting was significantly higher in rural areas. However, when the urban and rural populations were stratified using a measure of wealth, the differences in prevalence of stunting and underweight in urban and rural areas of Angola ST, Central African Republic and Senegal disappeared. Poor children in these urban areas were just as likely to be stunted or underweight as poor children living in rural areas. The odds ratio of stunting in the poorest compared with the richest quintile was 3.4, 3.2 and 1.5 in Angola ST, Senegal and Central African Republic, respectively.
Conclusions: This paper demonstrates that simple urban/rural comparisons mask wide disparities in subgroups according to wealth. There is a strong relationship between poverty and chronic undernutrition in both urban and rural areas; this relationship does not change simply by living in an urban environment. However, urban and rural living conditions and lifestyles differ, and it is important to consider these differences when designing programmes and policies to address undernutrition.

Keywords
Child undernutrition
Sub-Saharan Africa
Urbanisation
Poverty

Attention to urban areas is warranted given the forecast that, by 2015, the majority of the world's population (53.6%), including nearly half (45.1%) of the population of Africa, will live in urban areas[1]. In sub-Saharan Africa the urban population is expected to double, rising from 209 million to 440 million in 20 years[2]. When using most definitions of wealth, urban areas have a larger proportion of wealthy residents than do rural areas; however, urban poverty seems to be increasing. Part of this is due to widespread migration from rural to urban areas. Nef[3] argues that 'hyperurbanization' or 'overurbanization' occurs more as a result of poverty than affluence, with megacities and their surrounding sprawl becoming associated more with conditions of deprivation than prosperity. Sachs *et al.*[4] cite abject rural poverty as fuel for rural–urban migration.

When simple comparisons of urban and rural populations are made, conditions in urban areas are habitually reported as superior to those in rural areas. It is true that wealth is more concentrated in urban areas and poverty in rural areas; however, there is evidence that urban poverty is growing. Already, the current population of many urban agglomerates overwhelms existing infrastructure for basic service provision. A recent study by the International Food Policy Research Institute notes an increase in the absolute numbers of urban poor, as well as an increase in the share of the urban poor in overall poverty[5]. Increasing urbanisation and the growth of urban poverty signal the

*Corresponding author: Email gina.kennedy@fao.org

need for greater research into the outcomes of poverty in urban compared with rural environments. The principal rationale for the present analysis is to explore whether living in an urban environment confers advantages for child growth if an absolute measure of wealth across urban and rural areas is considered.

Childhood nutritional status is a good outcome indicator, closely tied to poverty and reflective of the overall level of deprivation and inequalities in development[6–8]. Stunting, a reflection of low height-for-age, commonly referred to as chronic undernutrition, is the indicator of choice for analysing the relationship between undernutrition and poverty. It reflects poor linear growth caused by sustained food deprivation, repeated illness or both. Stunting is considered a barometer of the population's ability to meet basic needs, such as food, health care and housing[6]. Underweight, measured using weight-for-age, is also included in the present analysis in keeping with the decision to use this as the indicator to measure progress towards the Millennium Development Goal (MDG) of eradicating extreme poverty and hunger.

The consequences of poor nutritional status during childhood impact on both immediate and long-term prospects for well-being. Childhood undernutrition is implicated in over half of all child mortality[9]. When children are stunted, their immune systems are generally weakened and they are more susceptible to episodes of diarrhoeal illness and other infections. There is evidence that severe stunting decreases cognitive ability and school performance[10]. There is also evidence to suggest that children who are malnourished in early life have decreased work capacity in adolescence compared with children whose early childhood nutritional status was normal[11].

When prevalence rates of underweight and stunting in urban and rural areas are compared, the urban population always appears better off. However, these comparisons mask the heterogeneity of the urban population and do not take into account the disparities in wealth within urban populations. Using an absolute measure of wealth, the present paper considers the prevalence of stunting and underweight and mean height-for-age and weight-for-age *Z*-scores in urban and rural areas to determine if there is a significant advantage or disadvantage associated with residence.

Methods and subjects

Survey data

Data used for this analysis were obtained from household-level Multiple Indicator Cluster Surveys (MICS). MICS are supported by the United Nations Children's Fund (UNICEF) for the purpose of monitoring and evaluating indicators of children's well being. More information on the justification and goals of the surveys can be found at http://www.childinfo.org/MICS2/Gj99306m.htm. Although designed prior to the Millennium declaration, many of the indicators collected in MICS will help monitor progress in achievement of the MDGs. Geographic representation of West, Central and Southern Africa and, within these regions, the availability and quality of anthropometric data on children under the age of 5 years and information on household socio-economic status were the main criteria used to select the MICS datasets analysed herein. Three countries with high-quality anthropometric data, adequate sample sizes in urban and rural areas and measures of wealth were used for the present analysis. The countries selected were Angola, Central African Republic and Senegal.

UNICEF has prepared extensive documentation in English, French and Spanish for use in preparing and conducting the surveys to ensure accurate and representative data collection. Technical manuals provide guidelines for preparing for the survey, designing the questionnaire, designing and selecting the sample, training survey enumerators, training survey supervisors, techniques for taking anthropometric measurements, and data entry and data analysis. In addition, standardised questionnaire modules are available for adaptation in each country as appropriate.

The MICS manual recommends the use of a probabilistic, self-weighting sample design[12]. Ideally, the adherence of countries to these guidelines should be assessed via reports describing the survey methodology and procedures used in data collection. Senegal was the only country in the present analysis for which a detailed report of methodology was available. The Senegal sample used the most recent census data to divide the country into 800 sample districts, from which 250 primary units were chosen using probability proportional to size. Within each primary unit, all households were listed and 26 randomly chosen to be interviewed[13]. In the case of Angola, a note of caution regarding the sample is included with the dataset. The survey estimates are not representative of Angola as a whole, but are limited in their interpretation to Angola-Secured Territory (Angola ST) due to insecurity in rural zones, which limited the survey primarily to urban areas and rural areas considered to be secure. It is estimated that the sample represents only about 65% of the population[14].

Women aged 15–49 years are the primary survey respondents. For the questions on children under the age of 5 years, which are used in the present analysis, the primary caregiver, most commonly the mother, is asked to answer the questions concerning child health, feeding and care practices.

Wealth index variable

The wealth index used in this analysis is based on principle components analysis of household assets. The questions used to establish the wealth index include: household access to electricity, radio or television;

household ownership of bicycle, motorcycle or car; type of material of dwelling floor; number of rooms in the dwelling; main source of drinking water; and type of toilet facility (see Appendix). Principle components analysis was used to derive wealth index quintiles, which are presented as a routine part of the MICS data. A ranking of households by quintiles was used in this paper to represent household wealth. Allocation of the population into quintiles using the wealth index was based on the entire population sampled, in order to derive an absolute rather than a relative measure of poverty across urban and rural areas. As would be expected, post-stratification of the population in each wealth index quintile by urban or rural residence resulted in larger numbers of the urban population in the higher income quintiles and larger numbers of the rural population in the lower income quintiles. As per the recommendations in the MICS survey guide, sample sizes were checked to ensure that each subset analysed included a minimum of 25 observations[15].

Anthropometric measures

The mean *Z*-score and prevalence of stunting and underweight were assessed. The prevalence of stunting and underweight was defined using the cut-off points recommended by the World Health Organization (WHO) of less than minus two standard deviation units (< -2SD) of the National Center for Health Statistics/WHO childhood growth curves. Only children aged 0–59 months were included in the analysis. Measurements flagged for implausible anthropometric findings were discarded. Age distribution of each dataset was assessed according to WHO recommendations of approximately 20% in each 12-month age grouping[16]. The datasets had a range of 15.8–23.6% in each 12-month grouping, with the majority of age groupings between 19 and 21%. The age groupings were also checked for heaping on birth years or even numbers. A perfectly even age distribution would result in 1.66% of the population on each birth month. The range of distribution by month was 0.7–2.8%. While heaping was noted, it was not consistently on birth years (for example, 12, 24 and 36 months) or rounded months, suggesting that these issues were covered during the survey training.

Statistical analyses

The data were cleaned and analysed using SPSS statistical package, version 11.5 for Windows (SPSS Inc., Chicago, IL, USA). The Pearson chi-square test for statistical significance was performed to test the significance of the difference in prevalence of undernutrition stratified by wealth and urban/rural residence. The independent means *t*-test was used to test the difference in mean height-for-age *Z*-score (HAZ) and weight-for-age *Z*-score (WAZ) in different wealth quintiles stratified by residence. Binary logistic regression models with stunting as the dependent variable and residence and wealth as independent variables were designed to provide additional information on the effect of residence on stunting and the strength of this effect when wealth was added to the model.

Results

Table 1 provides descriptive statistics on the case study countries. The largest sample of children measured was in Central African Republic (12 949), followed by Senegal (8319) and Angola ST (5118). Indicators for diarrhoeal and respiratory infections were similar in all three countries. Stunting was highest in Angola ST (45%), followed by Central African Republic (39%) and Senegal (25%).

Prevalence of stunting and underweight by residence and wealth

When simple urban/rural comparisons were made, the prevalence of stunting was significantly greater in rural areas in all three countries (Fig. 1). The prevalence of underweight differed significantly between urban and rural areas in the Central African Republic and Senegal. When stratified by wealth quintile, there were no significant differences in the prevalence of stunting across urban and rural populations within the same quintile, in any of the countries (Table 2). The prevalence of stunting in children of the poorest wealth

Table 1 Descriptive statistics for study countries

Variable	Angola-Secured Territory	Central African Republic	Senegal
Survey year	2001	2000	2000
No. of households	6012	13 991	6383
Urban children in sample (%)	69.4	38.9	34.2
Women aged 15–49 years with no formal education (%)	34.9	54.0	64.1
Households with adequate sanitation (%)	59.4	25.6	40.1
Households with adequate access to safe water (%)	61.6	54.9	64.5
Children <5 years with diarrhoea in past 2 weeks (%)	23.4	25.7	28.3
Children <5 years with acute respiratory infection in past 2 weeks (%)	7.7	10.3	7.1
No. of children included in anthropometric analysis	5118	12 494	8319
Stunted children <5 years (%)	45.2	38.9	25.4
Underweight children <5 years (%)	30.5	24.3	22.7
Wasted children <5 years (%)	6.3	8.9	8.4

https://doi.org/10.1079/PHN2005835 Published online by Cambridge University Press

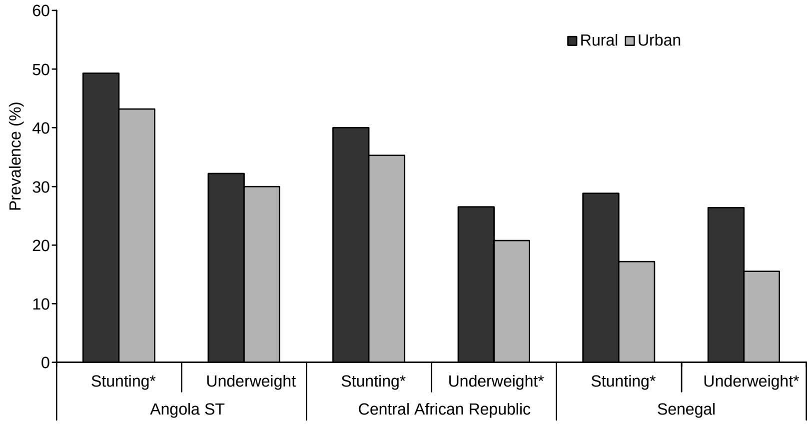

Fig. 1 Simple urban/rural comparison of stunting and underweight prevalence (Angola ST – Angola-Secured Territory). *Significant difference between urban and rural (chi-square test): $P < 0.05$

index quintile in urban and rural areas was 50 and 53% in Angola ST, 44 and 43% in Central African Republic and 27 and 35% in Senegal. Patterns for underweight are similar to those observed for stunting. When the prevalence of underweight children of the same wealth index quintile living in urban and rural areas was compared, the differences were not significant for any of the quintiles in Angola ST, but were significant for three of the quintiles in the Central African Republic and Senegal (Table 2).

Mean Z-scores by urban/rural residence and wealth

Mean *Z*-scores have the advantage of describing the entire population and not just the sub-set falling under −2SD. The well-nourished reference population has a mean Z-score of 0, and the significance of the problem of poor linear and ponderal growth can be partly assessed by the size of negative deviation of the population mean *Z*-score away from 0. Mean *Z*-scores by residence and wealth are presented in Table 3. In all case study countries the mean *Z*-scores were negative, indicating the population has shifted to the left of a normal distribution. Mean HAZ for the poorest quintiles in urban and rural areas was −1.9 and −2.0 in Angola ST, −1.7 and −1.6 in Central African Republic and −1.0 and −1.4 in Senegal; none of these differences were statistically significant. Mean HAZ scores improve markedly for the wealthiest quintile. The mean HAZ scores in urban compared with rural areas for the wealthiest quintile were −1.4 and −1.6 Angola ST, −1.3 and −1.4 in Central African Republic and −0.6 and −0.5 in Senegal. Using mean WAZ there were significant differences only for the second poorest quintile in the Central African Republic and the wealthiest quintile in Senegal. These findings demonstrate not only that differences in the prevalence of malnourished children disappear when wealth is considered, but also that the degree to which the entire population of children is affected is similar across urban and rural environments when wealth is considered.

Logistic regression

The first logistic regression model included residence only and the second model added wealth (Table 4). Residence, as the only variable in the model, was a significant improvement in all countries over the model with no independent variables. When wealth was added to the model, residence lost significance in all countries. The largest inequalities for stunting between wealth

Table 2 Prevalence of stunting and underweight by residence and wealth

		Angola-Secured Territory		Central African Republic		Senegal	
	Wealth index (quintile)	Urban	Rural	Urban	Rural	Urban	Rural
Stunting	1 (poorest)	49.5 (200)	52.8 (735)	44.2 (328)	42.9 (2571)	27.0 (37)	34.7 (1779)
	2	51.0 (478)	49.7 (465)	35.9 (555)	38.4 (2093)	24.5 (143)	30.1 (1938)
	3	46.4 (754)	50.6 (320)	38.3 (766)	41.0 (1941)	21.7 (457)	24.3 (1684)
	4	46.1 (900)	39.0 (205)	34.6 (1373)	36.1 (856)	17.0 (835)	20.8 (501)
	5 (least poor)	33.3 (1016)	24.4 (45)	32.6 (1610)	33.4 (401)	13.2 (854)	14.3 (91)
Underweight	1 (poorest)	38.5 (200)	34.0 (735)	25.6 (328)	31.0 (2571)*	16.2 (37)	31.6 (1779)*
	2	36.2 (478)	32.9 (465)	20.7 (555)	25.9 (2093)*	20.3 (143)	27.3 (1938)
	3	34.2 (754)	31.6 (320)	23.0 (766)	23.9 (1941)	21.0 (457)	22.7 (1684)
	4	30.3 (900)	28.3 (205)	21.6 (1373)	23.4 (856)	16.2 (835)	18.6 (501)
	5 (least poor)	21.9 (1016)	22.2 (45)	18.0 (1610)	19.7 (401)	11.1 (854)	18.7 (91)

Data are expressed as % (*n*).
* Significant difference between urban and rural: $P < 0.05$.

https://doi.org/10.1079/PHN2005835 Published online by Cambridge University Press

Table 3 Mean height-for-age *Z*-score (HAZ) and weight-for-age *Z*-score (WAZ) by residence and wealth

	Wealth index (quintile)	Angola-Secured Territory Urban	Angola-Secured Territory Rural	Central African Republic Urban	Central African Republic Rural	Senegal Urban	Senegal Rural
Mean HAZ	1 (poorest)	−1.92	−2.04	−1.67	−1.64	−1.02	−1.38
	2	−1.98	−1.95	−1.34	−1.45	−1.15	−1.20
	3	−1.85	−1.88	−1.49	−1.57	−0.85	−1.01
	4	−1.72	−1.68	−1.39	−1.35	−0.77	−0.90
	5 (least poor)	−1.35	−1.57	−1.28	−1.35	−0.55	−0.52
	Total	−1.69	−1.93*	−1.38	−1.53*	−0.73	−1.16*
Mean WAZ	1 (poorest)	−1.63	−1.49	−1.10	−1.21	−1.02	−1.34
	2	−1.54	−1.48	−0.94	−1.07*	−1.03	−1.23
	3	−1.42	−1.38	−1.02	−1.07	−0.94	−1.06
	4	−1.32	−1.27	−0.96	−0.96	−0.84	−0.91
	5 (least poor)	−1.07	−1.29	−0.90	−0.97	−0.67	−0.96*
	Total	−1.32	−1.44*	−0.95	−1.10*	−0.81	−1.19*

* Significant difference between urban and rural: $P < 0.05$.

quintiles were in Angola ST and Senegal, where children in the poorest compared with the wealthiest quintile had an odds ratio (OR) of 3.5 (95% confidence interval (CI): 1.7–6.9) and 3.2 (95% CI: 1.8–5.8), respectively. For underweight, the differences were greatest between the 1st and 5th wealth quintiles in Central African Republic (OR = 1.8, 95% CI: 1.4–2.4) and Senegal (OR = 2.0, 95% CI: 1.2–3.4). As would be expected, the odds of being stunted or underweight compared with the wealthiest quintile decreased with successively increasing wealth quintiles.

Discussion

The finding that the overall prevalence of undernutrition is higher in rural than in urban areas has been documented by others[17,18]. New evidence is brought forward in the present paper to indicate that when an absolute measure of wealth is considered, the prevalence and degree of childhood undernutrition are the same in urban and rural areas. Consistently, in Angola ST, the Central African Republic and Senegal, there are no significant differences in the prevalence of stunted urban children compared with rural children of the same wealth index quintile. For children in the poorest families, simply living in an urban environment does not appear to confer any particular advantage in terms of linear growth. Interestingly, this finding also holds true for children in wealthier households, where, regardless of urban or rural residence, prevalence of undernutrition was similar.

While still convincing, the results for underweight do not show as consistent a relationship with wealth. The significant differences in prevalence of underweight observed in two quintiles in Central African Republic and Senegal may be an effect of small sample size. Another explanation may be that weight-for-age is a less sensitive to wealth than height-for-age. This explanation is plausible as stunting is more reflective of long-term deprivation, while underweight can occur as a result of short-term illness or temporary crisis.

Being poor increases the risk of stunting 3.5-fold in Angola ST, 3-fold in Senegal and 1.5-fold in Central African Republic. The odds for stunting between the two extreme wealth quintiles (1 and 5) are similar, although of a slightly smaller magnitude than findings of other studies, where ORs calculated separately for urban and rural areas using a relative rather than absolute measure of wealth ranged from 1.4 to 10[17]. Zere and McIntyre[19] also found significant differences in stunting and underweight by socio-economic status both across and within urban and rural areas.

The finding that residence is less significant than a composite measure of wealth, which in addition to ownership of household assets includes sanitation, water and housing, is similar to the conclusions drawn by Smith *et al.*[18], who found no differences in the nature of socio-economic determinants for stunting and wasting across urban and rural areas. Urban residence itself is not an important determinant of nutritional status, but is reflective of a number of more favourable conditions, supporting better child growth.

Table 4 Logistic regression models

		Variable	Angola-Secured Territory	Central African Republic	Senegal
Stunting	Model 1	Residence (urban:rural)	0.78 (0.70–0.88)*	0.82 (0.76–0.88)*	0.51 (0.45–0.58)*
	Model 2	Residence	1.54 (0.77–3.08)	0.96 (0.76–1.22)	0.92 (0.49–1.70)
		Wealth 1:5	3.46 (1.73–6.93)*	1.50 (1.20–1.87)*	3.19 (1.76–5.78)*
		Wealth 2:5	3.05 (1.51–6.17)*	1.24 (0.99–1.55)	2.58 (1.42–4.68)
		Wealth 3:5	3.17 (1.55–6.47)*	1.38 (1.10–1.73)*	1.93 (1.06–3.50)*
		Wealth 4:5	1.98 (0.95–4.13)	1.13 (0.88–1.45)	1.57 (0.84–2.94)
Underweight	Model 1	Residence (urban:rural)	0.90 (0.79–1.02)	0.73 (0.67–0.79)*	0.51 (0.45–0.58)*
	Model 2	Residence	1.14 (0.99–1.32)	0.90 (0.68–1.18)	0.55 (0.31–0.96)
		Wealth 1:5	2.11 (1.68–2.64)*	1.83 (1.42–2.38)*	2.01 (1.18–3.44)*
		Wealth 2:5	1.99 (1.62–2.45)*	1.42 (1.09–1.86)*	1.64 (0.96–2.80)
		Wealth 3:5	1.85 (1.52–2.25)*	1.28 (0.98–1.67)	1.28 (0.75–2.19)
		Wealth 4:5	1.55 (1.27–1.88)*	1.24 (0.93–1.67)	0.99 (0.56–1.76)

Data are expressed as odds ratio (95% confidence interval).
* Significant at $P < 0.05$.

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Some of the most important underlying causal factors for child undernutrition are diet, burden of disease and caring practices. Diets in urban areas often contain a larger proportion of dietary energy derived from fat and sugar than in rural areas and are increasingly reliant on processed products[20]. This could explain part of the difference in the level of significance between rates of underweight when simple urban/rural comparisons are made. Urban diets may be more adequate in terms of meeting energy requirements, but do not necessarily contain more micronutrients, particularly in the lower-income groups. Lack of adequate micronutrient intake has been shown to be a factor in stunting prevalence[21].

Price and income are the two most influential factors on food purchases[22]. Urban residents are obliged to purchase the majority of the food consumed within the household. An advantage that persons in rural areas have over urban counterparts is the availability and access to wild or non-cultivated foods, including seasonal fruits and green leaves, which are good sources of essential micronutrients. Reliance on a cash-based economy may constrain the ability of the urban poor to diversify their diet. Research from Bangladesh has shown a negative correlation between malnutrition in urban areas and food expenditure on non-grain products: as urban populations spent more on food items other than rice, the prevalence of underweight in children decreased[23]. One of the reasons cited for this was the increased micronutrient density of non-rice food purchases. The feasibility of the urban poor to diversify their diets and the issue of micronutrient intake among poor urban populations are two areas deserving much more attention.

When rural and urban areas are compared, the prevalence of infection among children younger than 5 years is generally higher in rural areas[24–26]. More research is needed to determine whether there are significant differences in prevalence of disease across wealth income quintiles. Caring practices, such as timing and quality of complementary feeding and health-seeking behaviour, are generally more appropriate in urban settings, although indicators for breast-feeding are generally not as good in urban areas[18]. These behaviours need to be explored beyond simple urban/rural comparisons.

Conclusions

Undernutrition is a fundamental problem for developing countries and improving the nutritional status of children in sub-Saharan Africa is vital for the achievement of the MDGs in this region. The present paper has demonstrated that the prevalence of undernutrition is similar for same-level socio-economic groups in urban and rural areas. As urban populations continue to expand, attention will increasingly need to focus on the urban environment. When decisions are made using aggregated urban and rural figures, discrepancies between socio-economic groups may be masked. Better documentation and monitoring of trends in undernutrition stratified by socio-economic status is needed.

Acknowledgements

We would like to thank Cutberto Garza, Seán Kennedy, Prakash Shetty, Ruth Charrondiere and MarieClaude Dop for valuable comments on earlier versions of the manuscript.

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Appendix – Details of the wealth index

The wealth index score for each household is calculated at UNICEF Headquarters in New York based on methodology developed by Filmer and Pritchet. In consultation with the World Bank, a core set of seven questions related to household ownership of assets and housing characteristics were included in the MICS. The sets of questions recommended are presented in Table A1; these question sets can be modified appropriately for the context of each country. The datasets analysed herein contained the sets of questions on assets and housing characteristics shown in this table.

Table A2 shows mean wealth index regression factor scores by wealth index quintile.

Reference

1 Filmer D, Pritchett L. *Estimating Wealth Effects Without Expenditure Data – Or Tears: An Application to Educational Enrolments in States of India*. World Bank Policy Research Working Paper No. 1994. Washington, DC: World Bank, 1998.

Table A1 List of questions used to derive wealth index*

Core variables in wealth index	Angola-Secured Territory	Central African Republic	Senegal
Main material of dwelling floor	✓	✓	✓
Number of rooms in dwelling	✓	✓	✓
Main source of drinking water	✓	✓	✓
Type of toilet facility used	✓	✓	✓
Household has: electricity, radio, television, refrigerator	✓ plus radio cassette, video, fan	✓ plus cart, iron, heater	✓ plus telephone, stove, sewing machine, air conditioning, land with a house, farm land
Member of household owns: bicycle, motorcycle, car	✓ plus hand cart, horse	✓	✓ plus tractor, plough
Main cooking fuel used by household	✓	✓	✓

* MICS guidelines on creating the wealth index indicate that additional household variables can be used to provide a more powerful index.

Table A2 Mean wealth index regression factor scores by wealth index quintile

	Wealth index quintile				
	1 (poorest)	2	3	4	5 (least poor)
Angola-Secured Territory	−0.77863	−0.61311	−0.37729	0.06227	1.62442
Central African Republic	−0.71233	−0.51564	−0.18683	0.42034	2.14457
Senegal	−0.86914	−0.72966	−0.28642	0.87110	1.82758

https://doi.org/10.1079/PHN2005835 Published online by Cambridge University Press