Copyright Permission

Note: Permission of the Publisher has been given to the International Food Policy Research Institute (IFPRI) to post this article to its web site as allowed under the copyright law of the United States (Title 17, United States Code) which governs "fair use" or the making of photocopies or other reproductions of copyrighted material. Photocopy or reproduction is not to be “used for any purpose other than private study, scholarship, or research.”

The correct citation for this article is Menon, Purnima; Ruel, Marie T.; Morris, Saul Sutkover. 2000. **Socio-economic differentials in child stunting are consistently larger in urban than rural areas: analysis of 10 DHS data sets**. *Food and Nutrition Bulletin* 21(3): 282-289.

Reprinted with the permission of UNU Food and Nutrition Bulletin.

Thank you in advance for respecting these conditions. For additional information, contact IFPRI-library@cgiar.org.

Socio-economic differentials in child stunting are consistently larger in urban than in rural areas

Purnima Menon, Marie T. Ruel, and Saul S. Morris

Abstract

Urban–rural comparisons of childhood undernutrition suggest that urban populations are better off than rural populations. However, these comparisons could mask the large differentials that exist between socio-economic groups in urban areas. Data from the Demographic and Health Surveys for 11 countries from three regions were used to test the hypothesis that intra-urban differentials in child stunting are greater than intra-rural differentials, and that the prevalence of stunting among the urban and the rural poor is equally high. A socio-economic status (SES) index based on household assets, housing quality, and availability of services was created separately for rural and urban areas of each country, using principal components analysis. Odds ratios (OR) were computed to estimate the magnitude of differentials in stunting (height-for-age Z scores < –2) between urban and rural areas and between the lowest and highest SES quintiles within areas. The prevalence of stunting was lower in urban than in rural areas for all countries, but rural–urban odds ratios were relatively small (< 3.3). As hypothesized, the gap between low and high SES was markedly larger in urban (median OR, 4) than rural (median OR, 1.8) areas, and differentials were statistically significant (interaction between area and SES in logistic regression) in all but three countries. Within-urban ORs as high as 10 were found in Peru and the Dominican Republic, whereas within-rural ORs were smaller than 3.5, except in Brazil. In most countries, stunting in the poorest urban quintile was almost the same as that among poor rural dwellers. Thus, malnutrition in urban areas continues to be of concern, and effective targeting of nutrition programmes to the poorest segments of the urban population will be critical to their success and cost-effectiveness.

Purnima Menon is affiliated with the Division of Nutritional Sciences, Cornell University, in Ithaca, New York, USA. Marie Ruel and Saul Morris are affiliated with the Food Consumption and Nutrition Division at the International Food Policy Research Institute in Washington, DC.

Introduction

Population growth estimates suggest that the urban population is currently growing about three times faster than the rural population. By the year 2025, it is estimated that over 80% of the developing world will be living in urban areas. Along with such increases in urban population in developing countries come increasing urban poverty and malnutrition. Recently compiled data show that both the absolute numbers of urban poor and the contribution of urban poverty to overall poverty have been increasing over the past two decades [1]. Similar trends are also observed for urban childhood undernutrition. The magnitude of this problem has not been well recognized, despite its potential importance for national policy, given the escalating rates of urbanization and the potential consequences of urban poverty and malnutrition. Most programme and policy analyses intended to support resource allocation decisions continue to rely on simple urban–rural comparisons. The danger of using such comparisons is that they mask the enormous differentials that exist between socio-economic groups in urban areas.

The present paper argues that although socio-economic differentials in malnutrition do exist both in urban and in rural areas, they are of significantly larger magnitude in urban areas. To test this hypothesis, data from the Demographic and Health Surveys (DHS) for 10 countries (2 in Asia, 5 in Latin America, and 4 in Africa) were used. The other hypotheses tested were that intra-urban differentials are also larger than overall urban–rural differentials and that the prevalence of stunting among the urban poor is often as high as that among the rural poor.

Other researchers have noted that using global statistics to characterize poverty and childhood malnutrition in urban areas may be misleading, because city averages do not capture the large heterogeneity between social classes in urban areas [2]. The magnitude of differentials in childhood malnutrition, morbidity, and mortality between socio-economic

Food and Nutrition Bulletin, vol. 21, no. 3 © 2000, The United Nations University.

groups in urban areas has been documented previously [2–6]. To our knowledge, however, this is the first study that systematically addressed this question by directly comparing the magnitude of such differentials in the prevalence of childhood stunting between urban and rural areas.

Data and methods

DHS data (rounds II and III) were used to test the study hypotheses. The DHS programme is funded by the US Agency for International Development (USAID), coordinated by Macro International, and data collection is usually carried out in collaboration with country governments. Population sampling frames are used for the data collection, which makes all the data sets nationally representative. These data sets are in the public domain and are available from the DHS website (www.macroint.com/dhs). We used the most recent data sets, available as of June 1997, from Bangladesh and Pakistan for Asia; from Tanzania, Ghana, Senegal, and Zambia for Africa; and from Brazil, Colombia, the Dominican Republic, Peru, and Guatemala for Latin America. The two main criteria for the selection of countries were that information on child anthropometry be available in the data set, and that both the urban and the rural samples include at least 500 children 0 to 36 months of age. The latter criterion was important to allow an adequate sample size for the planned disaggregated analysis of socio-economic status (SES)by quintile. Stunting was defined as height-for-age Z score less than –2 standard deviations of the WHO/NCHS/CDC reference standards [7].

Creation of a socio-economic index

The first step in the analysis was to create a socio-economic index for each country and each area (urban and rural), using the type of data available at the household level in the DHS data sets. A valid index of SES should contain variables from different domains, because SES is a multi-dimensional concept [8]. In the DHS data sets, data are available on three main domains of household wealth: characteristics of the dwelling (floor, walls, and roof material), availability of water and sanitation services, and ownership of household durable goods (such as bicycle, television, and radio). Other domains that one might expect to include in a scale of SES are household income and parental education. The DHS data sets do not contain information on household income, and we deliberately avoided including education in this scale, because education has some effects on child health and nutrition that are known to be independent of the effects of SES [9, 10]. For this index to be content valid, therefore, one would expect that at least some variables from all three domains would be included in the final index.

The main purpose of creating the index was to categorize households into SES quintiles and to compare the difference in the prevalence of stunting between the groups of lowest and highest SES. The index was constructed separately for each country and for urban and rural areas within each country, because the characteristics that define wealth were expected to differ between countries as well as between urban and rural areas within a country.

Principal components analysis was used to derive one factor from the selected wealth variables (see table 1 for the list of variables). All variables were categorical and ranked by ascending order (from worst to best). The selection criterion for inclusion of individual variables into the final factor was that factor loadings (defined as the correlation between the variable and the factor) had a value greater than 0.4. (In the case of Ghana, a variable with a factor loading as low as 0.28 was maintained, because no other variables besides drinking water and non-drinking water source loaded strongly with the factor.) We also conducted paired *t* tests to examine whether factor loadings were significantly different between urban and rural areas for the same country. This was done to assess the comparability of the SES indices between urban and rural areas. For each country and area, the newly created variable reflecting the factor scores was then ranked into quintiles to create five SES groups. All further statistical comparisons in stunting prevalence were made between the lowest and the highest SES groups.

Analysis of differentials

We used odds ratios to quantify the magnitude of differentials in stunting prevalence. The overall urban–rural and the lowest SES versus highest SES odds ratios were computed using the formula

$$\frac{p}{(1-p)} \div \frac{q}{(1-q)}$$

where p is the proportion of stunted children in rural areas and q is the proportion of stunted children in urban areas.

Odds ratios were used rather than prevalence rate ratios, because prevalence rate ratios are limited by the fact that there are ceilings on values that prevalence rate ratios can take in situations where the prevalence of the outcome of interest is large even in the lowest-risk group. Odds ratios are not constrained by this statistical artifact and can take any value between zero and infinity [11].

Odds ratios for differentials between SES groups within a given area were computed to determine the magnitude of differentials in stunting prevalence between the highest and the lowest SES groups, within

TABLE 1. Results of principal components analysis to create a household socio-economic index (factor loadings and variance explained by the factor), according to country and to rural (R) or urban (U) area

Country	Year	DHS round	Variables used in SES scale (factor loadings)							Variance explained by component (%)
			Drinking water source	Non-drinking water source	Toilet	Floor material	Wall material	Roof material	Durable goods	
Bangladesh (R)	1993	3	—	—	0.72	0.67	0.71	0.59	0.73	47.4
Bangladesh (U)	1993	3	0.71	0.78	0.74	0.84	0.78	0.75	0.72	57.9
Pakistan (R)	1991	2	0.93	0.93	0.48	—	—	—	0.52	56.1
Pakistan (U)	1991	2	0.80	0.83	0.68	—	0.62	0.69	0.67	51.7
Ghana (R)	1993	3	0.96	0.96	—	0.28	—	—	—	64.1
Ghana (U)	1993	3	0.92	0.91	0.53	—	—	—	0.59	57.0
Senegal (R)	1992	2	0.83	0.80	0.51	0.61	—	—	0.64	47.1
Senegal (U)	1992	2	0.87	0.87	0.65	0.45	—	—	—	50.8
Tanzania (R)	1991	2	0.94	0.94	—	0.43	—	—	0.33	51.6
Tanzania (U)	1991	2	0.90	0.89	0.47	0.71	—	—	0.46	51.0
Zambia (R)	1992	2	0.86	0.87	0.53	0.68	—	—	0.53	50.5
Zambia (U)	1992	2	0.92	0.92	0.79	0.54	—	—	0.53	58.0
Brazil (R)	1996	3	—	—	0.63	0.77	0.76	0.70	0.72	51.8
Brazil (U)	1996	3	0.70	0.73	0.59	0.42	—	—	0.59	35.3
Colombia (R)	1995	3	0.84	0.84	0.68	0.61	—	—	0.62	52.3
Colombia (U)	1995	3	0.93	0.93	0.67	0.44	—	—	—	59.2
Dominican Republic (R)	1991	2	0.70	0.70	0.66	0.60	—	0.56	0.66	42.2
Dominican Republic (U)	1991	2	0.78	0.75	0.73	—	0.47	—	0.70	48.3
Guatemala (R)	1997	3	0.53	—	0.73	0.70	—	—	0.82	49.4
Guatemala (U)	1997	3	0.55	—	0.79	0.59	—	—	0.72	45.9
Peru (R)	1992	2	0.88	0.88	0.63	0.55	—	—	0.62	52.8
Peru (U)	1992	2	0.85	0.85	0.77	0.67	—	—	0.65	58.5

urban and within rural areas, respectively. These were calculated by using the following logistic regression model:

$$\text{Stunting} = \beta_0 + \beta_1(\text{area}) + \beta_2(\text{SES}) + \beta_3(\text{area} * \text{SES})$$

where the variables are defined as follows:

Stunting:	1 = stunted	0 = not stunted
Area:	1 = urban	0 = rural
SES:	1 = low SES	0 = high SES

A statistically significant coefficient ($p < .2$) for the interaction term between area and SES indicated that the magnitude of the socio-economic differentials observed was different between urban and rural areas (i.e., that the within-urban and the within-rural odds ratios were significantly different).

Analyses were performed by EPI-Info 6.0 (for unadjusted odds ratios) and SPSS 8.0 (for logistic regression and factor analysis) [12, 13].

Results

The results of the factor analysis clearly indicate that in all countries, our SES scale was a good reflection of its underlying variables (table 1). The factors were generally strong, in that most of them explained more than 50% of the variance of the variables retained in the factor (ranging from 35.3% for urban Brazil to 64.1% for rural Ghana; see table 1). The factors also included variables from the three dimensions of SES hypothesized (water and sanitation, housing quality, and assets) in 18 out of 22 of the models. There was no systematic difference in the number of variables entering the index in rural and urban areas, nor was there any systematic difference in the proportion of the total variance in these variables explained by the model. Within countries, factor loadings appeared to be broadly comparable in urban and rural areas (paired *t* tests; not shown), although there was a clear and statistically significant tendency for the variable TOILET to load more heavily in urban compared to rural areas.

Figure 1 shows that the prevalence of stunting was consistently higher in rural areas than in urban areas for all countries and regions. Figures 2 and 3 also show that, irrespective of area of residence, the prevalence of stunting among children from groups of lower SES was consistently higher than among children from groups of higher SES. Table 2 summarizes these results

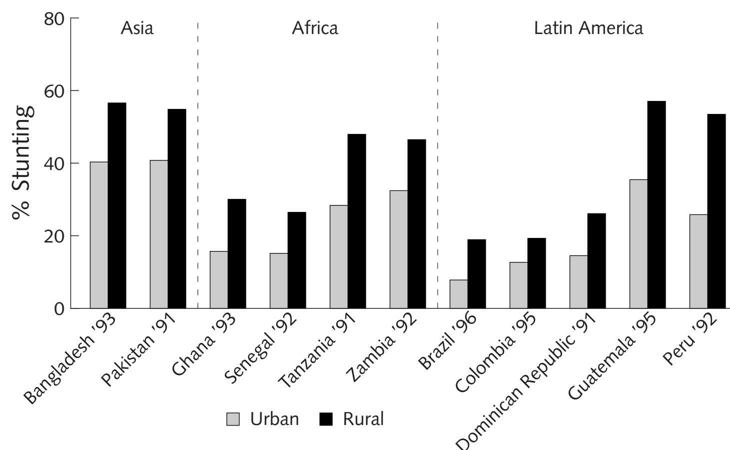

FIG. 1. Prevalence of stunting according to urban or rural residence

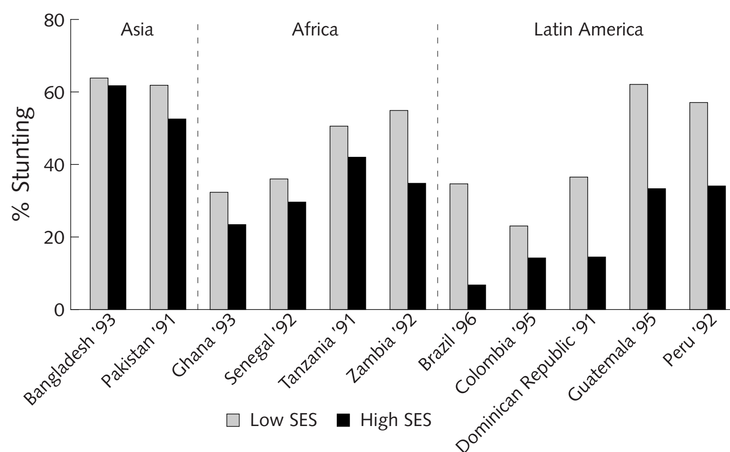

FIG. 2. Prevalence of stunting in rural areas according to SES

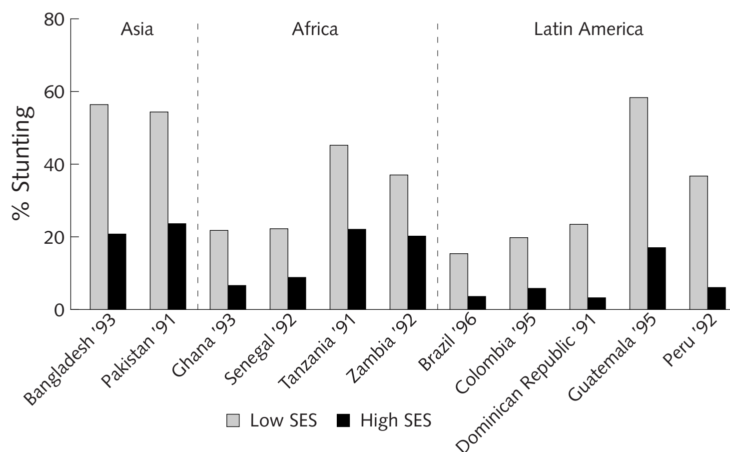

FIG. 3. Prevalence of stunting in urban areas according to SES

by presenting the odds ratios and their 95% confidence intervals for these different comparisons. First, all odds ratios of urban–rural differentials were statistically significant, ranging from 1.3 for Tanzania to 3.3 for Peru. Thus, in the countries studied, the odds of stunting were between 1.3 and 3.3 times higher for rural than for urban children.

Within urban and rural areas, all odds ratios for differences between groups of different SES were statistically significant, except for the within-rural differences in Ghana and Senegal. The magnitude of the odds ratios for SES differences in rural areas ranged from 1.4 for Senegal and Tanzania to 7.5 for Brazil, with a median of 1.8. There was some tendency, although it was not entirely consistent, towards higher within-rural odds ratios in Latin America than in Africa and Asia (the four highest odds ratios were found in Latin American countries). In urban areas, the median odds ratio for SES differentials was more than twice as large as the median odds ratio in rural areas (4 vs 1.8); the values ranged from 2.4 in urban Zambia up to 10.2 in urban areas of the Dominican Republic. Again, the magnitude of the odds ratios in urban areas tended to be larger in Latin America than in Africa and Asia, but the pattern was not totally consistent. For each country except Brazil, the within-urban odds ratios were larger than the within-rural odds ratios. Estimates of the coefficients of the interaction term between area and SES revealed that for all but three countries, the within-urban odds ratios were statistically significantly greater than the within-rural odds ratios ($p < .10$ in all cases). The countries for which differences were not statistically significant were Brazil, Ghana, and Zambia ($p > 0.2$; Table 2). Note also that at the national level, the within-urban odds ratios were systematically greater than the overall urban–rural odds ratios.

Figure 4 provides a graphical illustration of the results described above. Each box represents one country. The vertical line forming the left side of the box shows the difference in the prevalence of stunting between groups of low and high SES in rural areas; the line forming the right side of the box shows the corresponding difference in urban areas. The line forming the top of the box shows the difference between rural and urban groups of low SES, and the bottom line shows the difference between rural and urban groups of high SES. In an ideal situation, the box would be slim, with no distortion, indicating no difference in the prevalence of stunting between urban and rural areas or between groups of low and high SES. Figure 4 indicates that this is far from being the case. It shows that the data for most countries form a clearly trapezoidal shape, thus highlighting the marked differences in stunting between groups of different SES, especially in urban areas. The figure also demonstrates that in most countries, the gap between the rural and the urban poor is small (top line), in spite of the fact that the prevalence of stunting is always somewhat higher among the rural poor.

Figure 4 and all previous analyses focused on the extreme quintiles of the socio-economic index scale. Figures 5 and 6 are presented, however, to highlight the fact that differences in the prevalence of stunting in the countries studied generally showed a dose-response relationship. This was true for both urban and rural areas, although differences according to SES were clearly more pronounced in urban areas.

Discussion

Our analyses clearly show that across the developing world, there are large socio-economic differentials

TABLE 2. Odds ratios for stunting in rural compared with urban areas, overall and according to SES within rural and within urban areas

Country	Year	Sample size		Urban vs rural, overall		Rural low vs high SES		Urban low vs high SES		p [a]
		Urban	Rural	OR	95% CI	OR	95% CI	OR	95% CI	
Bangladesh	1993	447	4,328	1.9	1.6–2.3	1.8	1.6–2.2	5.0	2.6–9.6	.056
Pakistan	1991	1,382	2,653	1.8	1.5–2.0	1.5	1.1–1.9	3.8	2.6–5.7	.000
Ghana	1993	520	1,297	2.4	1.8–3.1	1.6	0.6–3.8	4.0	1.5–10.6	.277
Senegal	1992	1,423	2,380	2.5	2.1–3.0	1.4	1.0–1.8	3.0	1.7–5.2	.015
Tanzania	1991	1,227	4,720	1.3	1.2–1.5	1.4	1.2–1.7	2.9	1.9–4.7	.032
Zambia	1992	2,290	2,566	1.8	1.6–2.0	2.3	1.8–3.0	2.4	1.7–3.4	.863
Brazil	1996	2,903	912	2.9	2.3–3.5	7.5	3.3–16.8	4.8	2.8–8.5	.426
Colombia	1995	2,776	1,631	1.6	1.4–2.0	1.8	1.2–2.9	4.0	2.3–6.9	.037
Dominican Republic	1991	1,689	1,194	2.2	1.8–2.7	3.5	2.2–5.5	10.2	4.6–22.3	.018
Guatemala	1995	2,505	5,262	2.4	2.2–2.6	3.3	2.7–4.0	6.9	5.2–9.3	.000
Peru	1992	—	2,709	3.3	3.0–3.8	2.6	2.0–3.3	9.9	6.8–14.5	.000

a. All p values refer to the statistical significance of the interaction term between area (urban or rural) and SES in a logistic regression model that included both of these factors as main variables and the interaction term between the two.

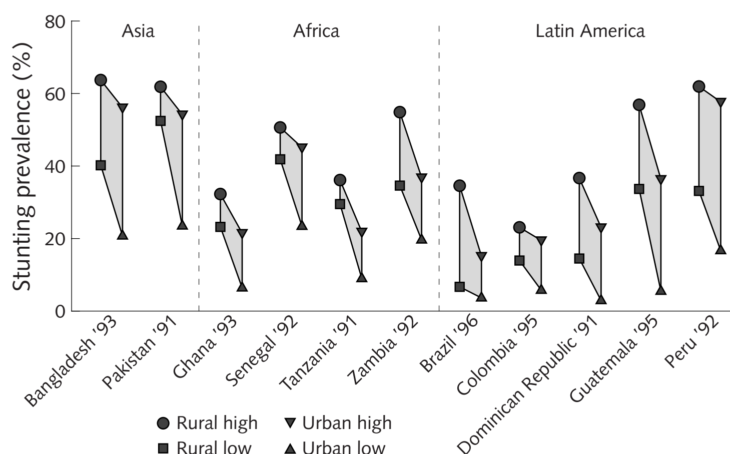

FIG. 4. Summary of prevalences of stunting in urban and rural areas according to SES

in stunting among 0- to 36-month-old children, that these differentials are commonly greater in urban than in rural areas, and that the most disadvantaged urban children have rates of stunting that are on average only slightly lower than those of the most disadvantaged rural children. These conclusions are drawn from large, nationally representative data sets from 11 different countries on three continents. Data collection procedures were similar in all cases, and identical analytic methods were applied.

Many previous studies have addressed socio-economic differentials in the nutritional status of children in either rural [14–16] or urban [5, 17] areas. However, the magnitude of socio-economic differentials in urban and rural children has seldom been compared. Ricci and Becker [18] found that in Metro Cebu, Philippines, household socio-economic characteristics were important determinants of stunting in children aged 12 to 29 months in both rural and urban areas, and that the effect of these factors on the risk of stunting was detectable earlier in rural than in urban *barangays*. However, because the regression models for the two strata used different sets of socio-economic indicators, it is difficult to compare the importance of SES across the two strata. In Mozambique, Garrett and Ruel [19] found that household expenditures, parental education, and crowding were similarly associated with the children's height-for-age Z scores in both rural and urban areas. The use of well water, however, was strongly associated with lower height-for-age Z scores only in urban areas. In both studies, the variables used as proxies for SES were not equally common in rural and urban areas, making it difficult to judge whether the *relative* differentials between the more and less disadvantaged were of similar magnitudes in rural and urban areas.

In the present study, this difficulty was overcome by using compound indices of SES that were able to divide the population into five equal-sized groups in both the rural and urban areas, thereby ensuring that in each case the upper quintile of SES was compared with the lower quintile. This approach aimed only to rank these households relative to other households *in the same residential stratum.* There was no implication that households in the lowest SES quintile in urban areas of a given country experienced similar economic

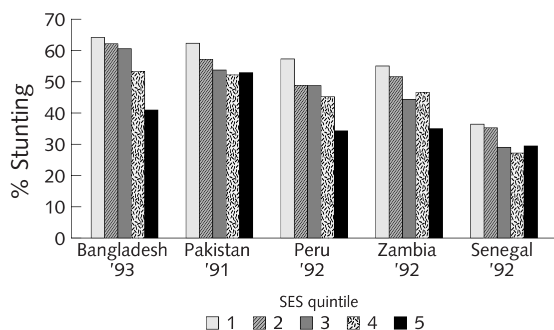

FIG. 5. Prevalence of stunting in rural areas according to SES quintile

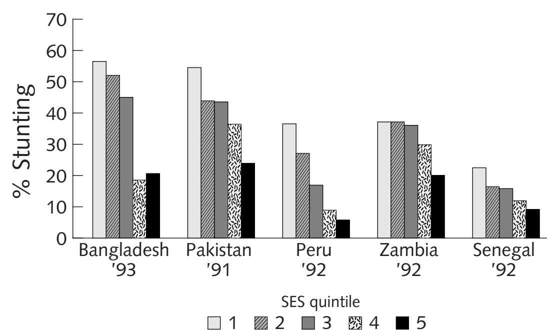

FIG. 6. Prevalence of stunting in urban areas according to SES quintile

conditions to households in the lowest quintile in rural areas of the same country. For this reason, it is not possible to strictly compare the rural poor with the urban poor; it is possible only to compare the size of the differentials between the first and the fifth quintiles within rural and urban areas.

Krieger and collaborators [20] have suggested that, ideally, valid measures of SES should include variables that reflect both household resources, such as assets, income, and education, and prestige- or rank-based characteristics, such as social class. Although our SES index does not contain measures of social rank, we believe that the area-specific indices created for each country in this study are valid indicators of the socio-economic position of these households within area and country, particularly for the purpose that they were designed to serve. We also believe that variables that reflect household resources are more likely to be associated with health and nutrition outcomes than variables that reflect social rank. The content validity of our indices [8] is clearly demonstrated by the fact that in virtually all countries, the three domains that we had set out to include in an SES index were in fact included in the final factor that made up the index. These domains were ownership of durable goods, construction of the dwelling, and access to water and sanitation. As mentioned earlier, the domain of parental education was purposely left out, and data on income are not available in the DHS surveys.

Our study showed that the risk of stunting may be up to 10 times higher for urban children of low SES than for urban children of high SES. The fact that such strong socio-economic gradients are consistently found in urban areas of developing countries implies that reliance on global average statistics to allocate resources between rural and urban areas could be dangerously misleading, a point originally made by Basta in 1977 [2]. We have previously shown that the “average” urban child is consistently less likely to suffer from stunting than the “average” rural child [21], yet in virtually every case studied in the present analysis, there was a distinct group of highly vulnerable urban children who should be high on the list of national priorities for nutrition-oriented interventions. We were unable to determine from these data whether intra-city or inter-city differences are likely to account for most of the overall within-urban sector differences observed. Previous research, however, suggests that even within neighbourhoods of the same city, there is a great deal of variation in attained nutritional status [22]. Targeting the nutritionally vulnerable in urban areas, therefore, may require imaginative and far-reaching programmes to respond to the growing numbers of urban poor and undernourished.

Policy implications

Our research is part of an increasing body of research on the conditions in which poor urban dwellers live and on the deleterious effects of these conditions on health and disease outcomes [23]. It demonstrates an urgent need for programme and policy attention to ameliorate the nutritional situation of the urban poor. Health and nutrition interventions, in conjunction with poverty reduction measures, are priorities for the urban poor as much as they are for the rural poor.

Acknowledgements

We wish to acknowledge the ideas and comments contributed by Dr. Jean-Pierre Habicht of Cornell University and Lawrence Haddad of the International Food Policy Research Institute (IFPRI). Funding for this research was provided by the Food Consumption and Nutrition Division of IFPRI and the USAID/University partnerships grants.

References

1. Haddad L, Ruel MT, Garrett JL. Are urban poverty and undernutrition growing? Some newly assembled evidence. World Dev 1999;27:1891–1904.
2. Basta SS. Nutrition and health in low-income urban areas of the third world. Ecol Food Nutr 1977;6:113–24.
3. Bradley D, Stephens C, Harpham T, Cairncross S. A review of environmental health impacts in developing country cities. Washington, DC: World Bank, 1992.
4. Maxwell DG, Levin CE, Armar-Klemesu M, Ruel MT, Morris SS, Ahiadeke C. Urban livelihoods, food and nutrition security in greater Accra. Research Report. Washington, DC: International Food Policy Research Institute (in press).
5. Timaeus IM, Lush L. Intra-urban differentials in child health. Health Trans Rev 1995;5:163–90.
6. Bicego G, Ahmad OB. Infant and child mortality. Calverton, Md, USA: Macro International, 1996.
7. World Health Organization. Measurement of nutritional impact. Geneva: WHO, 1979.
8. Carmines EG, Zeller RA. Reliability and validity assessment. Sage University Series on Quantitative Applications in the Social Sciences. Series No. 07-017. Newbury Park, Calif, USA: Sage, 1979.
9. Behrman JR, Wolfe BL. How does mother’s schooling affect family health, nutrition, medical care usage and household sanitation? J Econometrics 1987;36:185–204.

10. Ruel MT, Levin CE, Armar-Klemesu M, Maxwell DG, Morris SS. Good care practices mitigate the negative effects of poverty and low maternal schooling on children's nutritional status: evidence from Accra. World Dev 1999;27:1993–2009.
11. Davies HTO, Crombie IK, Tavakoli M. When can odds ratios mislead? BMJ 1998;316:989–91.
12. SPSS. Statistical Package for the Social Sciences, Version 8.0. Chicago, Ill, USA: 1998.
13. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, Dicker RC, Sullivan K, Fagan RF, Arner TG. Epi Info, Version 6: a word processing, database, and statistics program for public health on IBM-compatible microcomputers. Atlanta, Ga, USA: Centers for Disease Control and Prevention, 1996.
14. Arroyave G, Guzman MA, Flores M. Socioeconomic level of the family and nutrition in the rural area of Central America and Panama. Arch Latinoam Nutr 1976;26:47–73.
15. Bhuiya A, Zimicki S, D'Souza S. Socioeconomic differentials in child nutrition and morbidity in a rural area of Bangladesh. J Trop Pediatr 1986;32:17–23.
16. Lindtjorn B, Alemu T, Bjorvatn B. Dietary pattern and state of nutrition among children in drought-prone areas of southern Ethiopia. Ann Trop Paediatr 1993;13:21–32.
17. Monteiro CA, de Freitas IC, Baratho RM. Health, nutrition and the social classes: the empirical link evident in a large urban center, Brazil. Rev Saude Pub 1989; 23:422–8.
18. Ricci JA, Becker S. Risk factors for wasting and stunting among children in Metro Cebu, Philippines. Am J Clin Nutr 1996;63:966–75.
19. Garrett JL, Ruel MT. Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. World Dev 1999; 27:1955–75.
20. Krieger N, Williams DR, Moss NE. Measuring social class in U.S. public health research: concepts, methodologies and guidelines. Annu Rev Public Health 1997;18:341–78.
21. Ruel MT, Garrett JL, Morris SS, Maxwell D, Oshaug A, Engle P, Menon P, Slack A, Haddad L. Urban challenges to food and nutrition security: a review of the literature. Food Consumption and Nutrition Division Discussion Paper No. 51. Washington, DC: International Food Policy Research Institute, 1998.
22. Morris SS, Levin C, Armar-Klemesu M, Maxwell D, Ruel MT. Does geographic targeting of nutrition interventions make sense in cities? Evidence from Abidjan and Accra. World Dev 1999;27:2011-9.
23. Ruel MT, Haddad L, Garrett JL. Some urban facts of life: implications for research and policy. World Dev 1999;27:1917–38.