Original Article

The coexistence of child undernutrition and maternal overweight: prevalence, hypotheses, and programme and policy implications

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Abstract

The purpose of this paper is to document the prevalence of the phenomenon of the coexistence of a stunted child and an overweight mother (SCOWT) in the same household in low- and middle-income countries. We also explore whether this phenomenon is associated with a country's level of economic development and urbanization and highlight policy directions for public nutrition. Data from 36 Demographic and Health Surveys (DHS) were used (23 in Africa, 8 in Latin America, and 5 in Asia). Stunting was defined as height-for-age < –2 SD of the reference population and maternal overweight as a body mass index (BMI) of >25 kg m^{-2}. World Bank and United Nations figures were used for gross national product per capita (an indicator of economic development) and for level of urbanization respectively. Descriptive statistics were derived, and multivariate linear regression analysis was used to model the association between economic development, urbanization and the prevalence of SCOWT. The prevalence of SCOWT is generally below 10%, except in four countries, of which three are in Latin America. Among our sample of countries, SCOWT is generally more prevalent in Latin America than in Africa, and is near or below 5% in all five countries of Asia. Contrary to our expectations, SCOWT is not necessarily more prevalent in urban than rural areas. We also find that when economic development is controlled for, SCOWT is associated with urbanization only in Latin America. In Africa and Asia, SCOWT is associated with economic development, but not urbanization. The concrete recognition of the SCOWT phenomenon is an important step to delineating more effective and integrated strategies to address problems of over- and undernutrition and dietary quality within countries, regions and households. This gives special importance to designing programmes and policies that will address the food and nutrition needs of each individual, rather than assuming that those needs are addressed by targeting programmes or policies to the household as a whole.

Keywords: DHS (Demographic and Health Surveys), malnutrition, nutrition transition, overweight, stunting, urbanization.

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Rationale

In cruel and ironic contrast to the deprivation associated with poverty, diseases more often associated with excess have also emerged as serious concerns in many developing countries (PAHO, 2000; Popkin, 2002). With increased economic development and urbanization, incomes rise. Consumption of processed foods, including more refined grains and foods with higher content of saturated fat, sugar and salt, also increases. Physical activity is reduced as city-dwellers take more sedentary jobs and firms and households adopt labour-saving technologies (Popkin, 1994; Popkin & Doak, 1998; Doak *et al*., 2000). Dietary excess and poor diet quality may accompany these changes and contribute to a rise in nutrition-related chronic diseases (NRCDs), such as diabetes, obesity and heart disease. These trends appear especially pronounced in the middle-income nations of Latin America and the Near and Middle East (PAHO, 2000; Jackson & Pellett, 2004). These countries now face the worst of two worlds. Millions of infants and young children suffer from undernutrition and poor growth while adults contend with over-nutrition.

This nutrition transition is often conceived of as a national phenomenon, a wave of change in dietary, activity, and body composition patterns that a country goes through on the way to higher levels of economic development (Popkin, 1994). During this transition, symptoms of under- and over-nutrition logically coexist at the population level, with wealthier households exhibiting 'diseases of affluence', including obesity, and poor households exhibiting food insecurity and malnutrition. But recent work indicates under- and over-nutrition can coexist in the same household (Monteiro *et al*., 1997; Doak *et al*., 2000, 2002a).

If nutritional status of individuals were simply randomly determined, this joint occurrence would not be surprising. However, stunting and underweight (or overweight) are biological responses to environmental conditions and choices, including diet quality, energy quantity and morbidity.

Generally these conditions are thought to result from environmental conditions that affect the entire household, with undernutrition particularly reflecting a lack of income and poor diets. Therefore, the joint probability of undernutrition for children and mothers in the same household would not just occur as a simple function of their respective prevalence. An association of poor nutrition among household members is expected.[1] The coexistence of undernutrition and overweight among members of the same household, therefore, suggests a weakening of this association and raises questions about its cause.

One possibility is that with economic development and urbanization, severe poverty declines, removing household income levels and food availability as the most common causes of poor nutrition. Some household members remain undernourished owing to deficiencies of energy and essential nutrients, and others become overweight from excess energy. In this situation, the importance of intra-household resource allocation, food choices, and caring behaviours would increase. A somewhat different possibility is that at higher levels of economic development, energy is sufficient for both children and adults, but micronutrient intakes remain low, leading to stunting in children and overweight in adults.

In terms of programmes and policies, the challenge to public finances and to a public health system that must simultaneously address both the causes of under- and over-nutrition in the population is difficult enough, but the presence of both inside the household complicates the design and implementation of successful interventions.

Purpose of the study

As an exploration of these ideas, this paper examines the particular occurrence of a stunted, or undernourished, child in the same household as an overweight

[1]A one-sided Fisher exact test of significance in these data, for instance, found significant correlations at the 0.10 level or higher between the prevalence of stunted children and underweight mothers in 22 of the 36 countries. In 32 of the countries, a two-sided Fisher exact test found significant associations at the 0.10 level or higher between the prevalence of stunted children and overweight mothers, thus not allowing acceptance of their statistical independence.

(over-nourished) mother. We term this pairing of a stunted child and overweight mother SCOWT. This ecological study does not attempt to explain the household-level determinants of SCOWT, but rather seeks to document its occurrence and explore its association, at the population-level, with similar, national-level factors associated also with the nutrition transition, such as economic development and urbanization.

The paper has 3 main objectives:

- To determine the prevalence of SCOWT in a number of countries in developing regions around the world;
- To explore its association with the factors of economic development and urbanization; and
- To highlight potential explanations and policy directions to address the double burden of under- and over-nutrition.

Some studies have looked at the coexistence of overweight and underweight among any member of the same household (Doak *et al*., 2000, 2002a). Using data from 36 Demographic and Health Surveys (DHS), our study looks at the prevalance of SCOWT. We prefer stunting to underweight or wasting as an indicator of child undernutrition because stunting reflects the cumulative negative impacts on growth of numerous deprivations, including low birthweight (Martorell & Scrimshaw, 1995). On the other hand, underweight is a non-specific indicator of overall malnutrition (WHO, 1995), while wasting usually reflects acute illnesses, severe food shortages, or both (Ruel, 2001).

We also explore the hypothesis that a higher prevalence of SCOWT pairs is associated with higher levels of urbanization and economic development. Both are associated with higher levels of household incomes. As diet, activity, and child care patterns shift with urban living and with higher incomes, we would then expect to see higher levels of adult obesity, which, if not accompanied by similar rates of decline in stunting, would see the emergence of these SCOWT pairs.

Methods

To conduct this analysis we used publicly available data sets from the DHS for 36 countries (23 in Africa, 8 in Latin America, and 5 in Asia). The data cover the period 1991–98. Although predominantly from Africa (64% of the countries), the data do represent all developing-country regions, and so provide at least some indication of the prevalence of this phenomenon around the world.

The DHS are funded by the US Agency for International Development and coordinated by ORC Macro International. All data are nationally representative. Data collection is usually carried out in collaboration with country governments using population sampling frames. These data sets are available from the DHS website (http://www.measuredhs.com).

We chose data sets that had anthropometric data for mothers and their children. We included children 6–60 months old[2] and their non-pregnant mothers aged 18 years or older. If a mother had more than one child in this age group, we selected one of the children randomly for analysis.[3]

For children's nutritional status, we used height-for-age z-scores (HAZ). Stunting was defined as HAZ below –2 SD of the WHO/NCHS/CDC reference standards (WHO, 1979). Using the WHO guidelines, we considered mothers with a body mass index (BMI) of >25 kg m^{-2} as overweight (WHO, 1995).

We used World Bank estimates for gross national product (GNP) per capita (in constant 1995 U.S. dollars) for the same years as the nutritional status data (World Bank, 2000). GNP per capita serves as a proxy for a country's level of economic development. United Nations sources provide estimates of the percentage of the population in urban areas in 5-year intervals. We selected the data for the year closest to the year of the DHS data (UN, 1998).

From these data we calculated the prevalence of stunted children, overweight mothers and of SCOWT

[2]The maximum age of children in 17 of the data sets was 36 months old, and in one data set it was 48 months old.

[3]When a mother had more than one child in the selected age range, we first sequentially assigned a number to each child. We then determined a random number within that sequence for each of these mothers, and selected the child whose sequence number matched the random number assigned to the mother for inclusion in the child–mother pair.

pairs (as a percentage of total child–mother pairs) in each country. Table 1 shows the sample sizes for the mother–child pairs for each country (overall, urban and rural). We also explored the independent association of the level of urbanization and economic development with SCOWT using a multivariate linear regression model, and further examined the data for any differences in urban and rural areas, or between regions.

With 36 countries, using both rural and urban observations, we had a total of 72 observations for use in the regression model that examines the association of the prevalence of SCOWT with economic development and urbanization. The relatively small number of observations means we must be careful in interpreting results because of the lower statistical power.

Dummy variables were used to represent categorical variables for geographic regions (Asia, Africa and

Table 1. Sample sizes for prevalence calculations (Mother–child pairs, DHS data)

Country	Year of survey	Urban sample	Rural sample	Total
Africa				
Benin	96	415	782	1197
Burkina Faso	92	369	1228	1597
Cameroon	97	320	788	1108
Central African Republic	94	570	848	1418
Comoros	96	129	377	506
Cote d'Ivoire	94	762	1311	2073
Egypt	95	1840	1969	3809
Ghana	93	353	680	1033
Kenya	98	347	1490	1837
Madagascar	97	342	1258	1600
Malawi	92	179	1463	1642
Mali	95	634	1356	1990
Morocco	92	956	1296	2252
Mozambique	97	489	1161	1650
Namibia	92	434	891	1325
Niger	98	367	799	1166
Senegal	92	686	829	1515
Tanzania	96	586	2331	2917
Tchad	96	500	1719	2219
Togo	98	533	1467	2000
Uganda	95	289	2230	2519
Zambia	96	1238	1777	3015
Zimbabwe	94	377	1030	1407
Asia				
Bangladesh	96	224	1513	1737
Kazakhstan	95	222	277	499
Kyrgyz Republic	97	163	524	687
Nepal	96	162	2101	2263
Uzbekistan	96	203	509	712
Latin America				
Bolivia	98	2098	1243	3341
Brazil	96	1957	528	2485
Colombia	95	1883	918	2801
Dominican Republic	91	1243	805	2048
Guatemala	95	1433	2586	4019
Haiti	95	472	937	1409
Nicaragua	96	2219	1744	3963
Peru	96	5536	3086	8622

DHS, Demographic and Health Surveys.

Latin America) and urban–rural areas. The model incorporated them as separate variables and also as interactions with other variables. The limited number of observations made it difficult to test the regression model for interactions with both urban–rural and regional dummy variables simultaneously, so we tested the urban–rural and regional interactions separately.

Consequently, we explored interactions of all the main effects with first the urban dummy and then the regional dummies, using a joint *F*-test to determine whether there were any significant differences of the main effects as a group in urban versus rural areas, or by region. We considered coefficients with *P*-values < 0.10 significant with regard to main effects and *F*-tests with *P*-values < 0.10 significant for groups of interactions. The interactions of the main effects with the urban dummy revealed no significant differences. The interactions with regional dummies (Africa and Latin America, with Asia as the reference) revealed significant differences only for Latin America. The final, more parsimonious model, then, excludes interactions with the urban dummy variable, and includes only the interactions with the Latin American regional dummy variable. Squaring the urbanization and the GNP per capita variables allows for flexibility to account for possible non-linear relationships.

We used SPSS for descriptive statistics and STATA for regression.

Results

Prevalence

Overweight mothers are widespread in the countries studied (Table 2), as documented by others (Doak *et al*., 2000; PAHO, 2000), with the highest prevalence generally found in Latin America. With the exception of Haiti, where 12% of mothers are overweight, all other countries have high prevalence, ranging from about 30–50%. Almost half of all mothers in Bolivia (47%) are overweight. The range of overweight mothers across African and Asian countries is particularly large. Among African countries in our sample, the percentage of overweight mothers ranges from a low of 4% in Madagascar to a high of 55% in Egypt. In Asia, we had data from only five countries, three of which were countries of the former Soviet Union (FSU). The percentages of overweight mothers in FSU countries, all of which are more than 15%, are markedly different from the figures for Bangladesh (4%) and Nepal (2%), where overweight mothers are practically non-existent. Overweight is more prevalent in urban areas in all countries except Kazakhstan (data not shown).

At the same time, childhood stunting remains a serious problem in these countries as well, even in urban areas and even in countries with a high prevalence of overweight mothers (Table 2). For instance, in Egypt and Bolivia, the countries with the highest prevalence of overweight mothers, more than one quarter of children 6–60 months old are stunted. Close to or more than half of pre-schoolers are stunted in many southern African countries and in Nepal and Bangladesh. The prevalence of stunting is consistently higher in rural than in urban areas (data not shown).

Overweight mothers and stunted children, of course, do not necessarily occur in the same household. The prevalence of SCOWT is generally below 10%, except for four countries, of which three are in Latin America (Bolivia, Guatemala and Peru). Egypt is the other country with a markedly high prevalence of SCOWT (14%), especially when compared to most other African countries. The levels of SCOWT vary across countries, highlighting the fact that SCOWT results from a combination of the country's level of stunting and overweight. In Latin America, for example, Bolivia has the highest rate of overweight mothers in the region, at 47%, and Guatemala has the highest level of stunting, at 51%. These two countries have the highest prevalence of SCOWT in the region and rank second and third after Egypt among our sample of 36 countries.

Surprisingly, SCOWT is not always more prevalent in urban than in rural areas (Figs 1–3). In Latin America, except in Haiti, SCOWT is actually higher in rural areas. The explanation for this appears to be that in Haiti the prevalence of overweight mothers is high in both urban and rural areas, while stunting continues to be a significant problem mostly in rural areas. In

Table 2. Descriptive statistics

Country	Year of survey	Percentage of children stunted	Percentage of mothers overweight	Percentage of children in stunted child–overweight mother pairs	Percentage Urbanized	GNP per capita (1995 US Dollars)
Africa						
Benin	96	27.1	10.8	2.0	38.4	371
Burkina Faso	92	35.2	8.3	1.9	13.6	241
Cameroon	97	35.1	21.3	5.4	44.7	588
Central African Republic	94	38.8	7.0	2.5	39.1	317
Comoros	96	36.3	20.3	5.5	30.4	424
Cote d'Ivoire	94	27.4	14.2	2.7	43.4	641
Egypt	95	28.3	55.2	14.0	44.6	1027
Ghana	93	27.8	13.4	2.2	33.9	372
Kenya	98	35.1	12.4	2.6	28.6	330
Madagascar	97	57.6	3.7	1.4	26.4	229
Malawi	92	54.6	9.6	4.6	11.8	158
Mali	95	34.5	10.4	2.1	26.8	249
Morocco	92	21.3	34.4	5.2	48.2	1247
Mozambique	97	39.5	12.3	2.5	33.8	162
Namibia	92	30.6	21.1	3.7	31.0	2186
Niger	98	43.4	14.0	3.3	18.2	212
Senegal	92	24.2	19.6	2.2	40.4	541
Tanzania	96	47.8	13.8	4.8	24.2	171
Tchad	96	45.3	5.2	1.8	22.2	212
Togo	98	25.1	12.4	2.0	30.7	327
Uganda	95	43.1	8.9	3.1	12.5	297
Zambia	96	46.1	13.1	4.3	43.0	377
Zimbabwe	94	24.6	23.8	4.3	31.8	632
Asia						
Bangladesh	96	54.7	4.2	1.3	18.3	334
Kazakhstan	95	16.9	24.1	2.6	59.6	1237
Kyrgyz Republic	97	28.8	18.5	4.4	38.8	817
Nepal	96	53.2	1.8	0.6	10.3	215
Uzbekistan	96	33.2	15.2	5.5	41.1	969
Latin America						
Bolivia	98	26.0	46.7	11.0	60.5	937
Brazil	96	9.6	35.4	2.7	78.4	4428
Colombia	95	14.0	40.7	5.0	72.6	2321
Dominican Republic	91	9.3	37.8	2.2	58.3	1293
Guatemala	95	51.3	34.3	13.4	38.9	1452
Haiti	95	33.7	11.8	2.0	31.8	366
Nicaragua	96	24.6	40.2	8.2	62.1	364
Peru	96	25.8	45.2	9.8	70.9	2445

GNP, gross national product.

Asia the prevalence of SCOWT is higher in the rural areas of 3 of 5 countries, although prevalence are low in general and the urban/rural differences are small. In Africa SCOWT is higher in urban areas in 20 of 23 countries, but again, urban/rural differences are often small. SCOWT primarily occurs in urban areas in Africa because fewer rural women are overweight as compared to urban women, even though stunting levels are generally high in both rural and urban areas.

Regression model

The regression results from the final preferred model (Table 3) show that in Latin America both

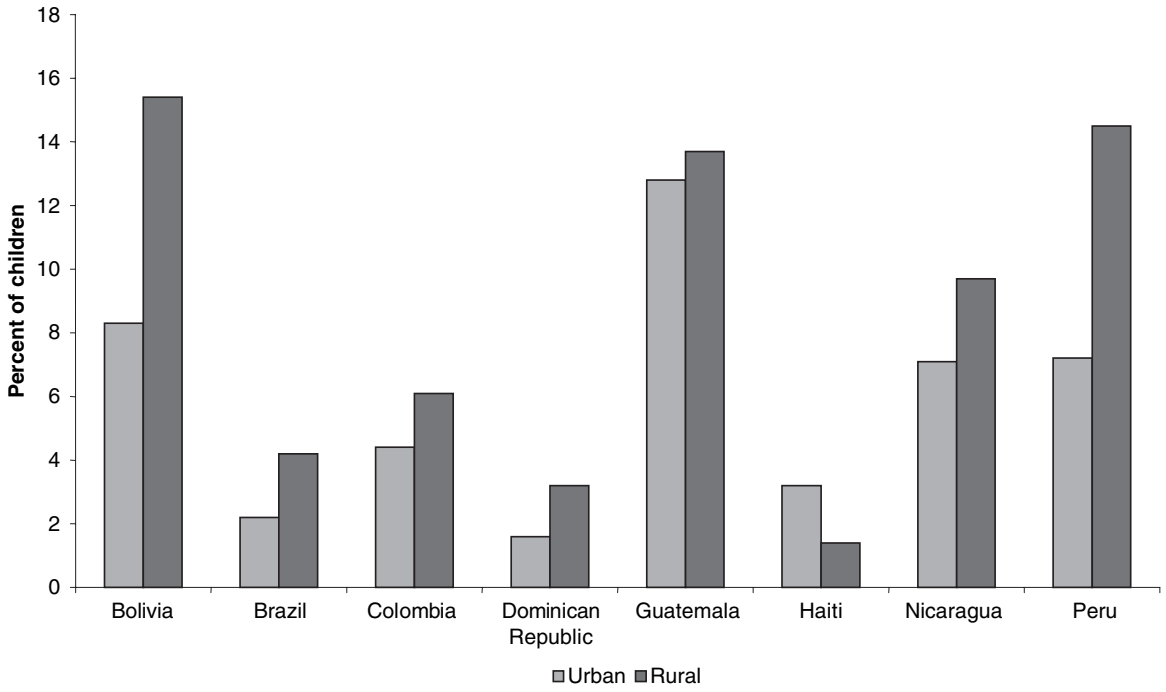

Fig. 1. Percentage of children in stunted child–overweight mother pairs (Demographic and Health Surveys, eight Latin American countries).

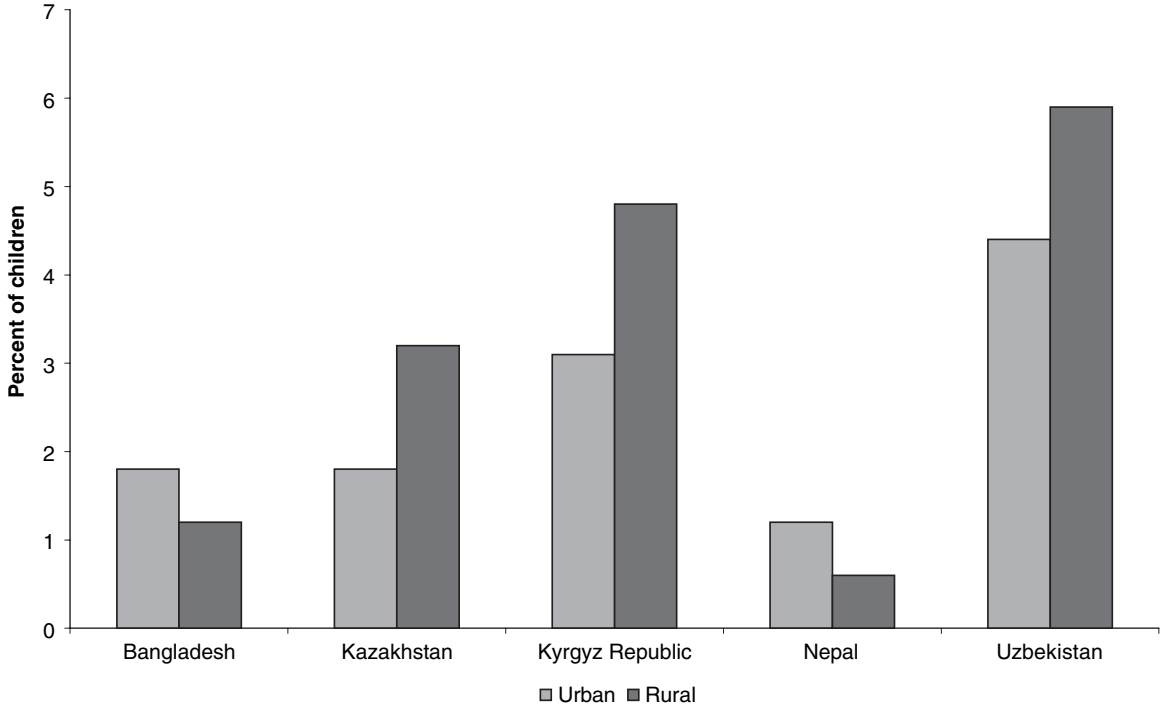

Fig. 2. Percentage of children in stunted child–overweight mother pairs (Demographic and Health Surveys, five Asian countries).

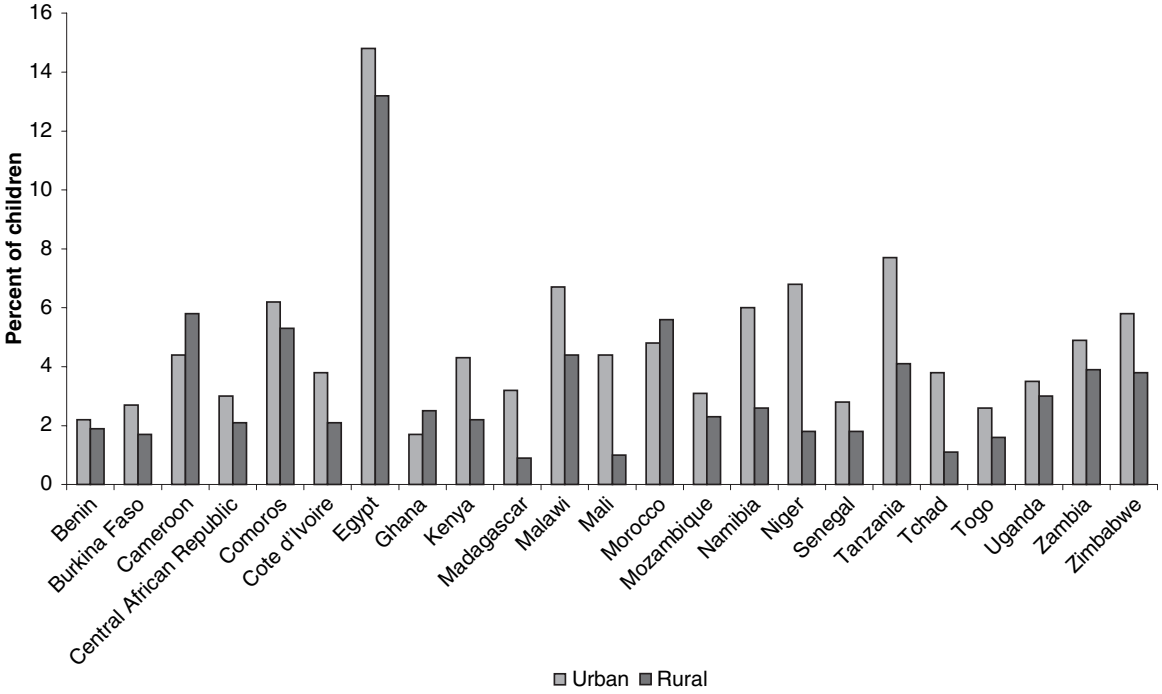

Fig. 3. Percentage of children in stunted child–overweight mother pairs (Demographic and Health Surveys, 23 African countries).

urbanization and economic development are significantly and positively associated with the prevalence of SCOWT. Economic development is also positively associated with SCOWT in Africa and Asia, although urbanization is not. In Latin America SCOWT increases with economic development at a slightly increasing rate (the combined effect of the squared and un-squared terms). SCOWT also increases with economic development in Africa and Asia, but at a declining rate, although the overall association is larger.

Based on these results, in this model, the Latin American interactions with the urbanization and economic development variables are significantly different from those of the African and Asian countries ($P = 0.03$ in a joint F–test of interactions of the urbanization variables with the Latin American dummy variable, and $P = 0.08$ in a joint F–test of interactions of the economic development variables with the Latin American dummy variable). Of course, we must treat the results with some caution owing to the relatively low number of observations in this country-level sample.

Table 3. Regression results. Dependent variable (continuous): prevalence of SCOWT

	Coefficient (SE)	*P*-value
Level of urbanization	–0.054 (0.16)	0.74
Urbanization squared	–0.0009 (0.0025)	0.73
GNP per capita	0.012* (0.0048)	0.01
GNP per capita squared	–3.99e–06* (2.04e–06)	0.06
Africa dummy	3.05* (1.24)	0.02
Latin America dummy	–26.94* (15.86)	0.10
Interactions with Latin American dummy		
Level of urbanization	1.53* (0.68)	0.03
Urbanization squared	–0.014* (0.007)	0.06
GNP per capita	–0.012* (0.005)	0.03
GNP per capita squared	4.13e–06* (2.10e–06)	0.05
Adjusted R-squared	0.28	

SCOWT, the coexistence of a stunted child and an overweight mother; SE, standard error; GNP, gross national product; *Significant at $P < 0.10$.

The coefficients on the Africa regional dummy and the Latin America regional dummy refer to differences between these regions and Asia, respectively, as Asia is the omitted regional dummy variable. Interactions with the Latin America dummy represent differences with Asia and Africa, the omitted regional interactions. Numbers in parentheses are standard errors.

Discussion and implications for policy

The objective of this paper is to document the prevalence of SCOWT in developing countries, especially those facing the nutrition transition, at the population level and explore SCOWT's association with global trends of economic development and urbanization, as expressed in each country. From previous research on the coexistence of under- and overweight individuals in the same household (Doak *et al*., 2000; 2002a, 2002b), we expected SCOWT to emerge as part of a nutrition transition associated with increasing urbanization. However, we find that although economic development is associated with SCOWT in all three regions, urbanization is associated with SCOWT only in Latin America. The regression analysis also supports the findings from descriptive analysis that the association of SCOWT with urbanization and economic development does not differ between rural and urban areas.

As an ecological study, it does not empirically investigate the household-level determinants of SCOWT. For example, despite our finding that SCOWT is associated with higher levels of GDP per capita at the population level, it could still be the poorest households within those countries that tend to have SCOWT. Still, the existence of SCOWT and its association with economic development does encourage thinking about its causes and implications for policy, which can lead to some interesting hypotheses for future research to test.

First, we note that SCOWT is one expression of a dissociation of intra-familial nutritional status. In line with results and hypotheses here, Monteiro *et al*. (1997) have previously noted economic development as a reason for a lessening of the strength of these intra-familial associations. They argue that in less developed countries, undernutrition is highly dependent on food availability, so a high degree of intra-familial association of nutritional status (say, underweight with underweight) should exist. In more developed countries like Brazil, where the problems of low incomes and lack of food are relatively less widespread, undernutrition would be associated with specific diseases or individual characteristics. Less intra-familial association would be present.

One potential explanation for SCOWT may then lie in the process of economic development and change itself. At low levels of economic development and urbanization, constraints on nutrition of adults and children could continue to be primarily economic. They thus manifest themselves at the household level as a lack of food and income affecting all members. As incomes rise and countries become increasingly urban, work and dietary patterns change, and prevalence of overweight increases. Generally speaking, household income is no longer the primary constraint to food security, and household caloric availability, a common measure of food security, is no longer the primary constraint to good nutrition. Intra-household factors, including care and resource allocation decisions, rather than factors affecting the entire household, and individual diets, activity, and disease patterns become relatively more important, and contribute to the rise of SCOWT.

In addition, household members may not experience the changes in physical activity and diet that accompany economic development and the nutrition transition uniformly, leading to different individual outcome (Popkin & Doak, 1998; Doak *et al*., 2002a). Differences in how infants and small children and adults experience the nutrition transition seem quite likely. For example, the prevalence of SCOWT in developing countries, especially in countries with historically high rates of childhood stunting, may be due to children continuing to experience stunting, while their stunted mothers are increasingly obese as a result of increased food and energy availability that accompany higher incomes.

An alternative but related explanation could revolve around dietary quality, and provide a common determinant for the coexistence of under- and over-nutrition in the same household. Overall increases in income may lead to increases in overall energy availability, but dietary quality – the micronutrient content of the diet and its composition in terms of percentage of energy from saturated fats or refined sugars – may remain poor. Dietary quality may then become the key nutritional constraint for both adults and children. Low dietary quality in children usually results in inadequate micronutrient intake, which in turn causes micronutrient deficien-

cies and poor growth, health, and developmental outcomes. In adults, low quality diets may also result in micronutrient deficiencies but increase the risks of obesity because of the excessive amounts of energy, saturated fats, and refined sugars that these diets often contain.[4]

Further investigation is important to assess the causes and the appropriate policy responses. More specifically, an overweight mother in the household indicates that income is apparently enough for her to acquire sufficient energy to be overweight. She may not be eating 'well' – that is, her diet may not be of high quality in terms of micronutrient content and percentage of energy from saturated fat or refined sugars – but she is certainly eating 'enough' in terms of energy. But does undernutrition in her child indicate a deficit in energy or micronutrients? In both cases, broadly speaking, improvements in feeding practices are called for. But in the case of an energy deficit, the most appropriate response would be changes in intra-household resource allocations, with more food for the child. In the case of micronutrient deficits, the quality of the diet, with better, and not necessarily more, food should be improved.

Policy and programme challenges

The coexistence of a stunted child and an overweight mother poses a challenge for policy makers and programmers in developing and rapidly urbanizing countries. The prevalence of SCOWT highlights the fact that overweight as well as stunting continue to be problems in many developing countries, in both urban and rural areas. It also shows that SCOWT particularly increases the complexity of designing and targeting nutrition and food-security interventions in Latin America. With increased economic development, SCOWT will probably emerge as a complicating factor in Asia and Africa as well.

Policy makers and programmers can no longer assume that households with malnourished children are simply in need of 'more food.' They must tune their antipoverty and food and nutrition programmes to a more complex reality. They must emphasize overall dietary quality, not simply quantity, or 'more food', and creatively tailor policies and programmes to deal with the conflicting demands of deprivation and dietary excess not only in the population but also in the same household.

In higher-income and more urbanized developing countries policy makers may need to emphasize changes in individual dietary and activity patterns. They should also continue to stress the importance of child care and feeding behaviours during infancy and early childhood, not only general household access to food. This analysis reinforces Uauy & Kain (2002)'s concern that programmers must be careful when implementing feeding programmes for children in countries in the 'advanced stages of the transition' because lack of food may not be the primary constraint to good nutrition. It also casts doubt on the widespread use of child nutritional status as an indicator of household-level food insecurity, especially in countries in transition. In lower-income and less urbanized developing countries, however, policy makers may in fact need to pay continued attention to policies and programmes to increase household food availability and access, as household incomes are so low as to provide a constraint to energy intake for all members of the household.

Lessons from Brazil, China and Finland

To deal with the challenges of the nutrition transition, experiences in Brazil, China and Finland suggest a number of elements of successful programmes to improve diets and activity levels (Coitinho *et al*., 2002; Matsudo *et al*., 2002; Puska *et al*., 2002; Zhai *et al*., 2002). Lessons from these programmes suggest that interventions must:

[4]Along these lines, some research notes the existence of an association between obesity and stunting in children in countries undergoing a nutrition transition (Popkin *et al*., 1996; Hoffman *et al.*, 2000; Florencio *et al.*, 2001). Some of the stunted children in the SCOWT pairs could have been overweight or obese, but the percentage of stunted children who are overweight (defined as WHZ above +2 SD) in our sample is small, generally less than 5%.

• involve a wide range of community actors, including health services and schools, homemakers' organizations and community leaders, and encourage community ownership;
• build capacity among these community organizations;
• convey research-based messages on diet change, supported by health information and nutrition counselling;
• include the food industry as allies, and enact appropriate regulations, especially regarding labelling; and
• support appropriate amounts of physical exercise.

Although these programmes encourage healthier eating, and so are applicable to both undernourished (food insecure) and overweight individuals, we have few examples of successful public nutrition programmes that directly address the other part of the problem – undernutrition – at the same time. China's development of a diet-quality index and food guide pagoda that includes concepts of moderation is one of the few examples to provide a conceptual basis for policy making that takes both deficiency and overconsumption into account (Stookey *et al*., 2000).

Few policies or programmes fully embrace the fact that they must simultaneously address over- and undernutrition. In general, it seems that even in transition countries policy makers will still have to pursue policies to improve income and health and hygiene behaviours. They must still ensure access to good health care, sanitation, and water for all. At the same time, they must develop strategies that respond to the differential needs of individuals within the household, and not affect just the household as a whole. The concrete recognition of this paradox could be an important step to delineating more effective and integrated strategies to do exactly that.

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