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Urban Poverty and Early Childhood Mortality: A Case Study of Household and Neighborhoods in Urban Egypt

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Abstract

This paper investigates the effects of living standards and relative poverty on infant and child mortality in the urban areas of Egypt, with a special focus on Greater Cairo. To measure living standards, we apply a multiple-indicator, multiple-cause (MIMIC) factor-analytic model to a set of proxy variables collected in the 2003 Interim Demographic and Health Survey for Egypt, and extract an estimate of the relative standard of living for each household. Using this estimate, we find that living standards exert substantial influence on early childhood chances of survival. Moreover, there is evidence that *household* living standards make a difference to child survival, much more than that of *neighborhood*.

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According to United Nations (2003) forecasts, by the year 2030 the world's population will exceed today's total by some 2 billion persons. Of these, some 1.9 billion are expected to reside in the cities and towns of Africa, Asia and Latin America. Cairo, the largest city of the Middle East, with an estimated year 2003 population of 10.8 million is projected to grow to 13.1 million by 2015. Other large Middle East cities are also expecting significant growth: for example, Beirut is anticipated to house 2.2 million people in 2015, and Amman some 1.5 million. Urban growth will pose daunting challenges to the effective management of health services, infrastructure, and public amenities, especially for the urban poor.

Despite decades of attention to developing-country poverty, surprisingly few data sets give health and mortality researchers much purchase on the concept of living standards. Although exceptions exist—notably the World Bank's Living Standards Measurement Surveys—surveys with detailed information on children's health and survival chances have not often gathered comparably detailed data on household incomes and consumption expenditures. Researchers interested in household poverty and children's health and survival have often been forced to make use of a grab-bag of proxy indicators for living standards.

The past decade has seen a lively debate in the literature on the merits of the alternative statistical techniques for measuring living standards. that use such proxies. We explore one of the more promising approaches for distilling the proxies into a living standards index, termed MIMIC models, which are a variant of confirmatory-factor analysis. The MIMIC approach requires that variables serving as *indicators* of living standards be distinguished from those serving as *determinants* of living standards. In this way the method brings a helpful theoretical structure to the estimation of living standards indices and imposes a measure of discipline on the empirical results.

We will draw upon data recently collected in the 2003 Egypt Interim Demographic and Health Survey (EIDHS), which provides detailed information on child health, nutrition, and mortality, and includes a large supplementary sample of slum-dwellers in Greater Cairo. We focus on two measure of early childhood chances of survival: (1) infant mortality; and (2) child mortality. To understand the effects of living standards on mortality and health outcomes, the MIMIC approach is applied to the urban households of the EIDHS, and used to develop urban-specific rankings of living standards. We then explore whether relative living standards for households make a difference to their children's chances of survival. We also investigate whether living standards in the neighborhood affect child mortality, taking neighborhood to be represented by the sampling cluster in which the household resides.

The paper is organized into four sections. Section 1 sketches the theory of neighborhood effects and reviews related empirical evidence. Section 2 provides an overview of models and statistical issues in measuring living standards. This section also compares living standards and poverty measures for households with summary measures that are calculated at the sampling cluster level. The aim here is to understand how closely household and neighborhood living standards are linked. The EIDHS data and specification of the infant and child mortality models are presented in Section 3. The multivariate results for the mortality measures are also included in this section, with a comparison of models based only on household living standards factors with those based on both household and neighborhood factors. The paper concludes with thoughts on an agenda for further work.

HOUSEHOLD AND NEIGHBORHOOD EFFECTS: AN EMPIRICAL AND THEORETICAL REVIEW

Neighborhood and related contextual effects could influence health and other demographic outcomes through multiple pathways. Substantial research effort has been given to theories of social epidemiology, which emphasize how local reference groups, local behavioral models, and other forms of social comparison and information exchange can hindering (or encouraging) appropriate health-seeking behavior. The recent Panel on Urban Population Dynamics (2003) volume provides an extensive review of the theory, with attention to the implications for neighborhood poverty (or living standards) and individual demographic behavior in the cities of developing countries. Montgomery and Hewett (2004) briefly summarize this panel's argument and review more recent research concerned with neighborhood effects on health. Among others, Sastry (1996) has explored the links between *local services* and demographic outcomes, another mechanism by which neighborhood characteristics can make a difference.

In the United States and other high-income countries, where most people live in cities, there is extensive research and programmatic interest in the effects of household and neighborhood living standards on demographic outcomes. This research has been stimulated by the writings of Wilson, Coleman, and research on social interaction, exclusion, and social capital in poor U.S. neighborhoods ((Wilson 1987; Coleman 1988; Massey 1990; White 2001; Sampson et al. 2002)). Yet very few researchers have empirically explored the neighborhood effects in the cities of developing countries. Montgomery and Hewett (2004) investigates whether, in a set of 85 developing-country cities, the health of women and children is affected by both household and neighborhood standards of living. Their analysis shows that both household and neighborhood standard of living can make a substantively important difference to health. Szwarcwald et al. (2002) examines a type of multilevel model in Brazil, in which infant mortality and adolescent fertility rates at the census-tract level are posited to depend on the proportion poor and the dispersion of poverty rates in the larger geographic areas within which tracts are nested. The authors find that higher levels of infant mortality and adolescent fertility at the tract level are associated with higher mean poverty rates in the larger areas.

Defining neighborhoods and slums

The geographical units in which surveys are fielded have boundaries that need not correspond closely, or indeed at all, with the sociological boundaries of neighborhoods as determined by patterns of social interaction, contagion, and social comparison.[1] In this paper, as in most of the literature on neighborhood effects, the definitions of neighborhood are forced upon us by the nature of the available data. Demographic and Health Surveys collect data within sampling clusters, and we will refer to these clusters as "neighborhoods" (See Montgomery and Hewett (2004) for a discussion on the extent to which DHS sampling clusters represent neighborhoods.)

The United Nations Millennium Declaration has singled out slum neighborhoods of developing countries as especially deserving of attention.[2]. However, no consensus has yet been reached among researcher as to how "slum neighborhoods" are to be defined. Very little knowledge exists of the relationship between urban poverty overall and the living standards of slum populations. For instance, the proportion of the developing-country urban poor who live in slums is not known; neither is the proportion of slum dwellers who are poor in terms of income or other socioeconomic criteria (Montgomery and Hewett 2004).

In Cairo, slums are typically defined as unauthorized settlements on areas which were not intended for housing and residence purposes, such as the unplanned areas (which lack basic services and adequate sanitation facilities) that have emerged in agriculture zones, government areas, and unsettled areas in the absence of planning and in violation of existing laws. Although there is broad

[1]See Wellman and Leighton (1979) for a discussion on the lack of overlap between social interactions taking place in neighborhoods and those taking place in individual social networks.

[2]The United Nations Millennium Declaration specifies a target of achieving by 2020 "significant improvement in the lives of at least 100 million slum dwellers" under the broader goal of ensuring environmental sustainability (See www.un.org/millenniumgoals for further information on the Millennium Declaration and its associated goals, specific targets, and research programs.)

agreement on the main characteristics of slums, there does not exist a clear boundaries of slums areas in Cairo. Three main lists have been compiled of slum communities within urban Greater Cairo.[3] These lists were developed by the Ministry of Health and Population, the Ministry of Local Communities, and the Central Agency for Public Mobilization and Statistics (CAPMAS).

The EIDHS Greater Cairo slum sampling frame drew upon the CAPMAS list of slums, mainly to be consistent with the non-slums sampling frame which was also obtained from the CAPMAS. An area was included in the CAPMAS slum list if it was unplanned, the majority of its building were constructed without permits, streets were unstructured, and it lacked basic services—including health, education, and sanitation facilities. In other words the main definition of Egyptian slums, in the DHS sample as well as in much previous research and government reports, is based on the legal characteristics of these places. In what follows, we will carefully examine the associations between neighborhood living standards as measured through the MIMIC approach and the formal designation of slums adopted by CAPMAS.

Statistical approach: The MIMIC model

It may be useful to preview our MIMIC approach by situating it among the various strategies that have been applied to the problem of measuring living standards with collections of proxy variables. Figure 1 presents one scheme for doing so, in which we distinguish highly-structured and less-structured approaches, and also draw a distinction between approaches that are statistically-based and those that rely solely on the judgment of the investigator. In separating determinants from indicators, the MIMIC approach brings more structure to bear on the problem than do the comparatively unstructured principal components or simple factor-analytic methods. But judgment-based approaches, in which detailed knowledge of local conditions is applied to form weights for each consumer durable or indicator, are also highly structured and they also bring outside information to bear on the problem of defining living standards.

The specifications to be explored here take the form of equation systems in which a given mortality variable, denoted by Y, is the main object of interest. As discussed above, in our application Y will represent one of two measures of early child mortality. For the infant and child mortality models, we write the main structural equation in latent variable form as

$$Y^* = W'\theta + f\delta + \varepsilon \qquad (1)$$

[3] Greater Cairo includes the three governorates of Cairo, Giza, and Kalyubia.

Figure 1 Classifying the approaches to measuring living standards

	Non-Statistical Approaches	*Statistical Approaches*
Loosely Structured	Counts of all durables owned	Principal components or factor analysis of durables alone
Tightly Structured	Judgment-based weighted indexes of durables	MIMIC specifications

with the observed dependent variable $Y = 1$ if $Y^* \geq 0$ and $Y = 0$ otherwise. The determinants of Y^* include a vector of explanatory variables W and an unobservable factor f that we will take to represent the household's standard of living. Another unobservable, ε, serves as the disturbance term of this structural equation.

We posit a model of the factor f such that $f = X'\gamma + u$, the value of f being determined by a set of exogenous variables X and a disturbance u. Although f is not itself observed, its probable level is signaled through the values taken by $\{Z_k\}$, a set of K indicator variables. These are binary indicators in our application, and it is conventional to represent them in terms of latent propensities Z_k^*, with $Z_k = 1$ when $Z_k^* \geq 0$ and $Z_k = 0$ otherwise. We write each such propensity as $Z_k^* = \alpha_k + \beta_k f + v_k$, and, upon substituting for f, obtain K latent indicator equations,

$$\begin{aligned} Z_1^* &= \alpha_1 + X'\gamma + u + v_1 \\ Z_2^* &= \alpha_2 + \beta_2 \cdot X'\gamma + \beta_2 u + v_2 \\ &\vdots \\ Z_K^* &= \alpha_K + \beta_K \cdot X'\gamma + \beta_K u + v_K. \end{aligned} \tag{2}$$

In this set of equations, the β_k parameters show how the unobserved factor f takes expression through each indicator.[4] Whether f is actually interpretable as a living standards index depends on the signs that are exhibited by these parameters.

The full equation system thus comprises the child mortality equation (1) and equations (2) for the living standards indicators. In setting out the model in this way, with latent factors embedded in structural equations, we follow an approach that has been recommended by several researchers (notably Sahn and Stifel 2000;

[4]Note that no β_1 coefficient appears in the first of the indicator equations: It has been normalized to unity. Further normalizations are also required. In latent variables models such as these, the sizes of the variances σ_u^2 and $\sigma_{v_k}^2$ are not identifiable. For the indicator equations, we apply the normalization rule $\beta_k^2 \sigma_u^2 + \sigma_{v_k}^2 = 1$ so that the variance of $\beta_k u + v_k$ equals unity in each equation.

McDade and Adair 2001; Tandon et al. 2002; Ferguson et al. 2003). Filmer and Pritchett (1999, 2001) have developed an alternative approach based on the method of principal components. Although useful in descriptive analyses and very easy to apply, this method is perhaps best viewed as a data-reduction procedure whose main virtue is the ease with which the researcher can collapse multiple indicators into a single index. The principal components approach is otherwise rather limited—it does not cleanly separate the determinants of living standards from the indicators of living standards, and it lacks a firm theoretical and statistical foundation. As a result, the method is not readily generalizable to structural, multiple-equation models such as ours (Montgomery et al. 2000; Montgomery and Hewett 2004).

For this paper, we will take a two-step approach to estimating the full equation system. Assuming that the disturbances are normally distributed, we estimate the parameters α, β, and γ of the indicator equations (2) by the method of maximum likelihood, using routines that we have written for this purpose. An estimate $\hat{f} = \mathrm{E}[f|X, Z]$ of the factor is derived from these indicator equations alone. The predicted $\hat{f}$ is then inserted into the structural equation (1) just as if it were another observed covariate. Conventional statistical methods are applied to estimate the parameters θ and δ of the structural model.[5]

Modeling the living standards factor

With the living standards factor specified as $f = X'\gamma + u$, how should the X variables of this equation be chosen and what relation, if any, should they bear to the W variables that enter the main mortality equation? How are the X variables, posited as determinants of living standards, to be distinguished from the $\{Z_k\}$ variables that serve as indicators of living standards? In Table 1 we present our classification scheme and give descriptive statistics on the indicators and determinants.

As Montgomery et al. (2000) note, there is little consensus in the literature about how best to define and model the living standards measures found in surveys such as those fielded by the DHS program, which lack data on consumption expenditures and incomes. With proper consumption data lacking, we think it reasonable to define the set of living standards indicators $\{Z_k\}$ in terms of the consumer durables and housing-quality items for which data are gathered. Us-

[5] As in other two-step models with "generated regressors," the standard errors of the estimators $\hat{\theta}$ and $\hat{\delta}$ should be corrected for the use of an estimated $\hat{f}$ in the second step. We employ robust standard errors, which should adequately address this and other sources of heteroskedasticity. See Montgomery and Hewett (2004) for a fuller account of statistical issues and estimation techniques.

Table 1 Mean values of household living standards variables, urban sample (N = 8462).

Proportion of Households Owning Indicator	
Car, Van, or Truck	0.098
Bicycle or Motorcycle	0.143
Radio with Cassette	0.889
Television	0.954
Satellite Dish	0.081
Telephone	0.584
Mobile Phone	0.234
Video	0.223
Computer	0.089
Electric Fan	0.929
Air Conditioner	0.044
Refrigerator	0.903
Freezer	0.043
Gas or Electric Stove	0.786
Automatic Clothes Washer	0.278
Other Clothes Washer	0.800
Water Heater	0.594
Adequate Living Space[a]	0.530
Good Flooring[b]	0.129
Mean Values of Determinants	
Owns Dwelling	0.514
Feels Little Risk of Eviction[c]	0.959
Owns Land	0.045
Owns Animals	0.118
Has Sewing Machine	0.097
Proportion of Adults with Primary Schooling	0.162
Proportion with Secondary Schooling	0.473
Proportion with Higher Schooling	0.171
Head's Age (years)	45.862
Head is a Man	0.874
Household Lives in Cairo	0.356
Lives in Alexandria	0.070
Lives in Giza	0.106
Lives in Kalyubia	0.144

[a] Household defined to have adequate living space if the number of persons per room is less than the (weighted) median value for all urban households of about 1.25 persons per room.

[b] Household has flooring covered with parquet or polished wood, ceramic or marble tiles, or wall-to-wall carpeting.

[c] Household either owns its own dwelling, or reports no or very little risk of eviction.

ing these indicators, we construct what McDade and Adair (2001) have termed a "relative affluence" measure of living standards. Access to electricity is now all but universal in urban Egypt, so this determinant can be excluded from our statistical analysis. So few urban households in Egypt own dishwashers that it was necessary to exclude this indicator as well.

Producer durables are deliberately excluded from the $\{Z_k\}$ set of indicators, because while they may help determine final consumption, producer durables are not themselves measures of that consumption. They are a means to an end, or, to put it differently, producer durables are better viewed as inputs in household production functions, rather than as measures of the consumption drawn from household production. By this logic, producer durable variables should be included among the X covariates—we have included of a house or land, ownership of animals, and possession of a sewing machine. We have also made use of a variable measuring security of housing tenure, as expressed in household perceptions of the likelihood of eviction risk. (To judge from the responses, relatively few urban Egyptian households feel themselves to be at risk of eviction, a situation quite unlike what is seen in other urban areas of the developing world.) Although city size may be only a distant proxy for the many other factors that determine consumption—among them, access to multiple income-earning possibilities and heterogeneous labor and product markets—we include dummy variables for Cairo, Alexandria, and Kalyubia to account for such effects, relegating other urban towns and small cities to the omitted (reference) category.

It is not unreasonable to liken adult education to a producer durable, education being a type of long-lasting trait that produces a lifetime stream of income and consumption; on these grounds we include the age of the household head and measures of adult educational attainment for all adults in the household in our specification of the X determinants. In doing so, we are mindful of the "dual roles" played by education in demographic behavior (Montgomery et al. 2000; Montgomery and Hewett 2004). Education is both a determinant of living standards and a conceptually separable influence on behavior via its links to social confidence, to the ability to process information, and to the breadth and nature of individual social networks. In short, education measures belong with the W variables of the mortality equations as well as in the set of X variables that act as determinants of living standards. Model identification is not threatened by variables that are common to both X and W, but we hope to strengthen the empirical basis for estimation by using a summary measure of education for adults in the living standards model (the proportions of all adults in the household having various levels of completed education) and a more detailed specification, involving levels of the mother's and her husband's education, in the children's mortality models. The sex and age of the household head is also included among the determinants of living standards.

Estimates of urban living standards

Table 2 summarizes the estimated $\hat{\beta}_k$ factor loadings on the indicators of living standards, and also presents the $\hat{\gamma}$ estimates on the determinants. As can be seen in the table, the $\hat{\beta}_k$ coefficients are always positive and statistically significant. This is encouraging, in that it supports the interpretation of the factor as an expression of the household's standard of living. The table also presents a summary of $\hat{\gamma}$, the effects of the X determinants. These effects are very much in line with expectations. The adult education variables are strongly and positively associated with living standards in urban areas; and, consistent with age profiles of productivity, we find that urban living standards increase with the head's age up to about age 57, and decrease thereafter.

Among the producer durables, ownership of a home and land are positively associated with living standards, but ownership of animals is negatively associated. Other producer durables—possession of a handcart and sewing machine—are positively and significantly associated with living standards in both urban and rural settings. Interestingly, although some 95 percent of urban Egyptian households believe themselves to be at little risk of eviction from their homes, this variable is positively associated with living standards. The city-specific dummy variables suggest that with other things held equal, living standards are generally higher in Cairo (and weakly so in Alexandria) by comparison with Egypt's towns and secondary cities. On the whole, the results presented in Table 2 provide good statistical support for the proposition that the proxy variables collected in the Egyptian DHS can be interpreted as indicators of the household's standard of living.

To make use of the estimated factor scores derived from this model, we convert the scores into percentile form, giving each household a ranking that accords with its relative position in the distribution of all urban scores. (Sampling weights are used to correctly characterize the full urban distribution.) We label this percentile the household's "Relative" standard of living, with the reference group being composed of all other urban households.

What does the slum designation mean?

In what follows, households falling into the lowest quartile of the urban factor scores will be termed "relatively poor" and those in the uppermost quartile termed

Table 2 Estimates of the indicator and determinants coefficients of the MIMIC living standards model, urban Egyptian households

	Coefficient	*Z value*
Coefficients $\hat{\beta}_k$ *of the Indicators*		
Bicycle or Motorcycle[a]	0.191	6.803
Radio	1.105	30.693
Television	1.398	33.698
Satellite	1.129	29.523
Telephone	2.052	42.021
Mobile Phone	1.182	32.744
Video	1.392	38.144
Computer	1.773	41.640
Electric Fan	1.282	35.127
Air Conditioner	1.178	28.255
Refrigerator	1.597	39.383
Freezer	1.227	33.150
Gas or Electric Stove	0.822	29.039
Automatic Clothes Washer	1.571	39.955
Other Clothes Washer	0.393	18.368
Water Heater	1.578	39.731
Adequate Living Space	1.778	42.159
Good Flooring	0.953	27.695
Coefficients $\hat{\gamma}$ *of the Determinants*		
Own Dwelling	0.032	7.331
Little Risk of Eviction	0.346	25.796
Owns Land	0.238	21.896
Owns Animals	−0.103	−14.696
Has Sewing Machine	0.288	30.201
Proportion of Adults with Primary Schooling	0.103	16.678
Proportion of Adults with Secondary Schooling	0.425	38.103
Proportion of Adults with Higher Schooling	0.846	40.905
Head's Age[b]	0.055	31.353
Head's Age, Squared	-0.48^{-3}	−29.253
Head is a Man	0.240	25.766
Household lives in Cairo	0.105	19.166
Lives in Alexandria	0.046	5.123
Lives in Giza	0.115	15.115
Lives in Kalyubia	−0.066	−9.206
ρ	0.227	21.014

NOTE: For specification of variables, see Table 1 and text.

[a] The β coefficient on ownership of a car, van, or truck has been normalized to unity.

[b] According to the age coefficient estimates, the positive effect of head's age on household living standards rises to a peak at age 57 and then declines.

Table 3 Average household percentiles, proportions relatively poor and proportions affluent by cluster, slum and nonslum clusters

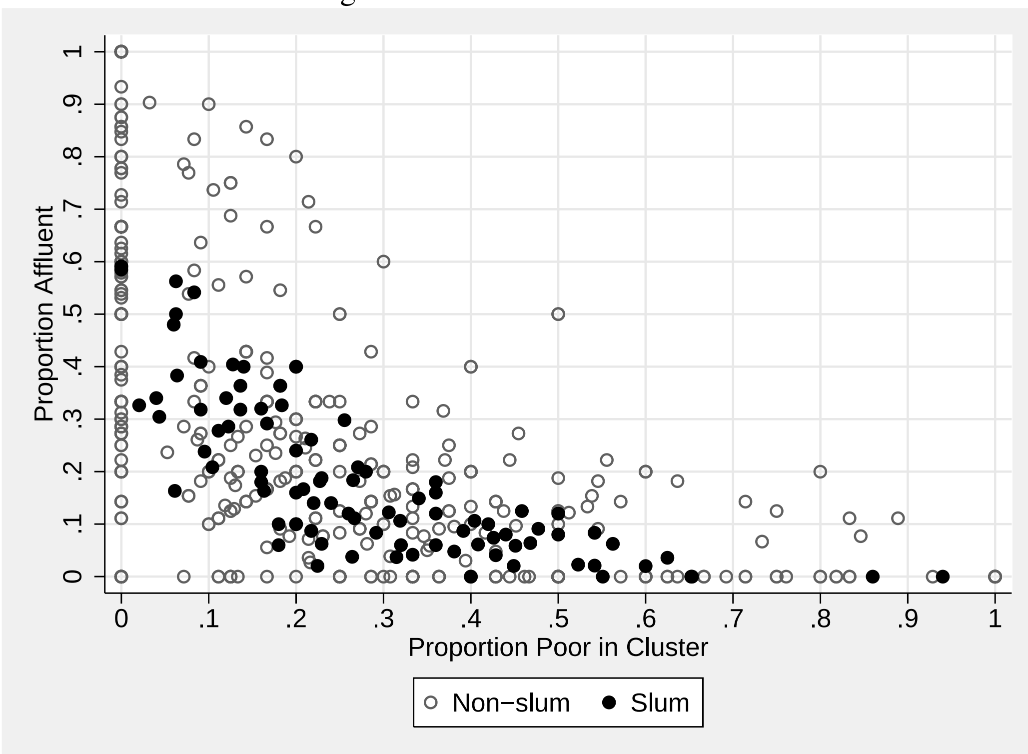
	Slum	Nonslum
Average Household Score in Percentiles	46.4	54.3
Average Proportion of Poor Households	28.0	23.4
Average Proportion of Affluent Households	18.6	31.5

"relatively affluent." To classify the neighborhoods (i.e., sampling clusters) in which households live, we take simple averages of the "Relative" variable across households residing in the cluster, and also compute the cluster proportions poor and affluent.

We generate several graphs showing how the designated slum clusters compare with other clusters in their proportions poor and affluent, and also in terms of the average percentiles. The differences between the slum and non-slum clusters, although perceptible, are not especially striking. Figure 2 depicts the proportions poor and affluent in all urban clusters, with the clusters termed "slums" shown in the dark circles. Were the slum clusters almost uniformly poor (in relative terms), they would all be found grouped in the lower right portion of the figure. It can be seen at a glance that on average these slum clusters do contain lower proportions of affluent households, as would be expected, but it is not obvious that they contain much greater proportions of poor households. Table 3 quantifies things by providing the mean values for slum and nonslum clusters (calculated with sample weights) for the average living standards percentiles of all households in the cluster, and the proportions of relative poor and affluent households. There are differences apparent, to be sure, and these are in the expected direction, but the differences are not as large as we would have anticipated. At least in terms of our consumption-based measure of living standards, then, the slum–nonslum differences are small enough that they cast some doubt on the value of the slum designation.

We have undertaken further empirical exploration of the slum–nonslum differences, and also examined the extent of heterogeneity evident within both types of clusters. An important question is whether cluster averages and proportions are well predicted by the poverty status of individual households, and, reversing the direction of inquiry, whether cluster characteristics are good predictors of the poverty status of households. The results (details not reported here) show considerable heterogeneity in the poverty composition of clusters, and document

Figure 2 Proportions of relatively poor and affluent households by cluster, slum and nonslum clusters. Weighted means.



positive but surprisingly low correlations between individual household poverty and proportions poor in the cluster apart from that household. Likewise, the negative but modest correlations are found between individual household poverty and the proportion nonpoor in the cluster.

EARLY CHILDHOOD MORTALITY: DATA AND MODEL SPECIFICATION

In the following we focus on two aspects of early childhood mortality: (1) infant mortality or the probability of dying during the first year of life; and (2) child mortality or the probability of dying between the first and the fifth birthday. Each of these variables is measured by a binary indicator, which takes the value 1 if the child died before his first(fifth) birthday in the infant (child) mortality models.

The infant and child mortality models are based on probit regressions for the i-th child in household h in sampling cluster c, which can be expressed as follows:

$$\Pr\left(Y_{ihc}=1|W_{ihc},\hat{f}_{hc},\hat{f}_{h}^{c}\right)=\Phi\left(W_{ihc}^{\prime}\theta+\hat{f}_{hc}\delta+\hat{f}_{h}^{c}\delta_{c}\right),$$

where Φ is the standard normal cumulative distribution function, W_{ic} denotes the set of explanatory variables, most of which are measured at the household level, $\hat{f}_{hc}$ is the estimated living standards percentile for the household, and $\hat{f}_{h}^{c}$ is the average of these percentiles over all except the h-th household in the cluster. The same set of explanatory variables is included in all the regression models, and robust standard errors are employed throughout.

A small set of socioeconomic controls in addition to the living standards measures is included in the mortality models. We need to control for a number of biomaternal characteristics, to adequately test the household and neighborhood effect on infant and child mortality. Infant mortality, specifically, tend to be higher among children born to younger or older mothers. We include two dummy variables to measure mother's age at child birth: under age 20 and above age 35 (age 20-35 is the omitted category). Also, the effect of high birth order is measured by a dummy variable that takes the value 1 if the child birth order is four or higher. The educational attainment of the mother is summarized in three dummy variables: the first indicates whether the mother has some or completed primary education; the second indicates whether mother has some or completed secondary schooling, and the third variable indicates whether the mother has some or completed higher education. Similarly for the husband's education level. Residence in a large city or the country's capital is represented in a dummy variable for residence in Greater Cairo. The slum context is represented by a dummy variable for residing in a slum neighborhood, according to the CAPMAS criteria for defining slums. Descriptive statistics for these variables and early childhood mortality measures are presented in Table 4.

Regression Results: Models with Household and Cluster Factor Scores

Table 5 and 6 present the regression results of the infant and child mortality models. (Note that the mortality models are estimated only for children whose mothers are usual residents of the household.) Each model is estimated first using only the set of socioeconomic controls, and then re-estimated adding each of the household factor scores, the cluster factor scores, and the slum dummy. These sets of consecutive models are estimated in order to weigh the evidence for "neighborhood effects" and determine whether separate household and cluster effects can be discerned, as well as to examine whether the legal definition of slums effectively identifies poor neighborhoods.

The tables reveal a clear consistency in the findings across models.

Table 4 Descriptive Statistics for Mortality and Socioeconomic Controls. Data on Children of Age 0–5

Variable	All Urban Non-Slums	Greater Cairo Slums
Child & Biomaternal Characteristics		
Infant Mortality	56%	58%
Child (age 1-5) Mortality	11%	11%
Male	53%	52%
Birth Order: 4th or higher	24%	22%
Mother's Age at Birth of Child <20	12%	16%
Mother's Age at Birth of Child >35	8%	6%
Mother's Education		
Primary Education	15%	19%
Secondary Education	46%	44%
High Education	13%	7%
Husband's Education		
Primary Education	20%	23%
Secondary Education	44%	47%
High Education	19%	10%
Household & Neighborhood Variables		
Greater Cairo	25%	100%

The male coefficient is positive and significant in the child mortality models but not in the infant mortality ones. Thus parents gender bias towards boys appears to affect the children's survival chances after age 1. High birth order does not have a significant effect on either infant or child mortality. Children of mothers below age 20 have higher probability of dying before age 5–than those of older mothers. Furthermore, the survival chances during infancy and childhood significantly increase with the mother's and her husband's education level.

As for the living standards variables, which indicate the household's relative position in relation to other urban households, we find that the household's relative standing exerts a highly significant and positive influence in the infant and child mortality equations. However, the cluster-level averages show no significant effects. (Note that the significance and the magnitude of the household living standards coefficients is only trivially affected by the inclusion of the cluster measures.) Finally, adding the CAPMAS slum dummy to the model does not reveal any additional significant effects. To sum up, adding the household factor scores substantially increases the models' explanatory power; and with all other variables in the specification, no additional contribution is made by either the cluster-level averages of living standards or the slum variable .

Table 5 Estimates of Infant Mortality Models. (Z scores calculated using robust standard errors).

	Model 1		Model 2		Model 3		Model 4	
Variables	Coef.	Z-scores	Coef.	Z-scores	Coef.	Z-scores	Coef.	Z-scores
Child & Biomaternal Characteristics								
Male	0.062	0.973	0.081	1.275	0.082	1.281	0.082	1.278
Birth Order: 4th or higher	0.087	0.994	0.093	1.063	0.09	1.028	0.091	1.036
Mother's Age at Birth of Child <20	0.680***	7.187	0.704***	7.461	0.702***	7.39	0.704***	7.408
Mother's Age at Birth of Child >30	-0.525***	-3.698	-0.570***	-4.12	-0.572***	-4.136	-0.573***	-4.134
Mother's Education (No Education Omitted)								
Primary Education	0.05	0.533	-0.009	-0.095	-0.008	-0.081	-0.007	-0.078
Secondary Education	-0.858***	-8.623	-0.994***	-9.402	-0.992***	-9.4	-0.992***	-9.4
High Education	-1.144***	-6.479	-1.389***	-7.5	-1.381***	-7.463	-1.381***	-7.466
Husband's Education (No Education Omitted)								
Primary Education	-0.325***	-3.443	-0.361***	-3.764	-0.362***	-3.793	-0.363***	-3.785
Secondary Education	-0.671***	-6.849	-0.763***	-7.565	-0.765***	-7.632	-0.767***	-7.617
High Education	-0.422**	-2.665	-0.584***	-3.628	-0.581***	-3.598	-0.582***	-3.597
Household & Neighborhood Variables								
Greater Cairo	-0.05	-0.682	-0.084	-1.15	-0.082	-1.132	-0.108	-0.929
Household Relative Living Standards			0.007***	4.936	0.008***	4.99	0.008***	4.978
Cluster Averages					-0.001	-0.514	-0.001	-0.447
Designated Slum							0.031	0.268
Constant	0.876***	8.132	0.731***	6.8	0.776***	5.652	0.770***	5.532
N	1963		1963		1963		1963	
Log Likelihood	-1054.85		-1040.652		-1040.508		-1040.467	
Chi-square	524.385		517.449		521.532		521.737	

Table 6 Estimates of Child Mortality Models. (Z scores calculated using robust standard errors).

	Model 1		Model 2		Model 3		Model 4	
Variables	Coef.	Z-scores	Coef.	Z-scores	Coef.	Z-scores	Coef.	Z-scores
Child & Biomaternal Characteristics								
Male	0.168**	2.654	0.167**	2.628	0.167**	2.625	0.167**	2.628
Birth Order: 4th or higher	0.112	1.474	0.149	1.926	0.149	1.924	0.149	1.935
Mother's Age at Birth of Child <20	0.599***	7.427	0.628***	7.674	0.628***	7.649	0.629***	7.691
Mother's Age at Birth of Child >35	-0.625***	-3.909	-0.682***	-4.216	-0.683***	-4.212	-0.683***	-4.212
Mother's Education (No Education Omitted)								
Primary Education	0.022	0.246	-0.003	-0.036	-0.004	-0.038	-0.004	-0.039
Secondary Education	-0.545***	-6.281	-0.683***	-7.112	-0.683***	-7.086	-0.684***	-7.089
High Education	-0.569***	-3.498	-0.817***	-4.561	-0.818***	-4.538	-0.818***	-4.536
Husband's Education (No Education Omitted)								
Primary Education	-0.327***	-3.691	-0.366***	-4.078	-0.366***	-4.087	-0.366***	-4.086
Secondary Education	-0.621***	-7.370	-0.706***	-8.141	-0.705***	-8.149	-0.706***	-8.170
High Education	-0.499***	-3.434	-0.662***	-4.483	-0.663***	-4.455	-0.663***	-4.461
Household & Neighborhood Variables								
Greater Cairo	-0.071	-1.059	-0.113	-1.647	-0.114	-1.627	-0.122	-1.266
Household Relative Living Standards			0.007***	4.918	0.007***	4.659	0.007***	4.666
Cluster Averages					0.000	0.048	0.000	0.064
Designated Slum							0.009	0.101
Constant	-0.704***	-6.748	-0.830***	-7.862	-0.834***	-6.796	-0.835***	-6.855
N	3789		3789		3787		3787	
Log Likelihood	-1109.902		-1095.723		-1095.632		-1095.628	
Chi-square	255.014		261.186		266.31		274.195	

Conclusions and Policy Recommendations

This paper examines the role of household and neighborhood poverty as determinants of early children mortality in urban Egypt. It has been conventional to think of the urban poor as slum-dwellers, and this view provides a rationale for geographic targeting of health investments in Egypt and elsewhere. However, this paper highlights that when slum communities are closely inspected they are often found to be more heterogeneous than the conventional view would indicate.

We have found strong evidence that household living standards, as measured by MIMIC factor scores converted to percentiles, exert substantial influence on children's survival chances in urban Egypt. However, measures of living standards at the level of the cluster attained no additional significance in models of child mortality. In other words, the results show that early childhood mortality of poor households in urban Egypt mostly depends on their own standards of living, and not necessarily on the economic composition of their neighborhoods. With household and neighborhood living standards controlled in this way, knowing that an area has been designated as a slum (by the CAPMAS definition) does not bring any further insight into the prospects for children's survival chances. Indeed, the slum–nonslum differences are small enough that they cast some doubt on the value of the slum designation for the design of policies. There is good reason to supplement such official slum designations with other classifications of families, such as the one produced by the MIMIC approach of this paper.

Policymakers should pay special attention to the heterogeneity that exists within many urban slums, which could have profound implications for the effectiveness of targeting government health investments on a spatial basis. In mixed slum communities, a considerable portion of the benefits from public health investments could be captured by the better-off families. The possibility of such "leakages" needs to be factored into decisions about the placement of investments. Where children's health is concerned, "slums" as defined in the Egyptian context may not provide an appropriate geographic basis for the targeting of health investments.

REFERENCES

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94(supplement):S95–S120.

Ferguson, B. D., Tandon, A., Gakidou, E., and Murray, C. J. L. (2003). Estimating permanent income using indicator variables. Global Programme on Evidence for Health Policy Discussion Paper no. 42. World Health Organization, Geneva.

Filmer, D. and Pritchett, L. (1999). The effect of household wealth on educational attainment: Evidence from 35 countries. *Population and Development Review*, 25(1):85–120.

Filmer, D. and Pritchett, L. (2001). Estimating wealth effects without expenditure data—or tears: An application to educational enrollments in states of India. *Demography*, 38(1):115–132.

Massey, D. S. (1990). American apartheid: Segregation and the making of the underclass. *American Journal of Sociology*, 96(2):329–357.

McDade, T. W. and Adair, L. S. (2001). Defining the 'urban' in urbanization and health: A factor analysis approach. *Social Science and Medicine*, 53(1):55–70.

Montgomery, M. R., Gragnolati, M., Burke, K. A., and Paredes, E. (2000). Measuring living standards with proxy variables. *Demography*, 37(2):155–174.

Montgomery, M. R. and Hewett, P. C. (2004). Urban poverty and health in developing countries: Household and neighborhood effects. Policy Research Division Working Paper no. 184, New York: Population Council.

Panel on Urban Population Dynamics (2003). *Cities Transformed: Demographic Change and Its Implications in the Developing World*. National Academies Press, Washington, DC. Montgomery, M. R., Stren, R., Cohen, B., and Reed, H., editors.

Sahn, D. E. and Stifel, D. C. (2000). Poverty comparisons over time and across countries in Africa. *World Development*, 28(12):2123–2155.

Sampson, R. J., Morenoff, J. D., and Gannon-Rowley, T. (2002). Assessing 'neighborhood effects': Social processes and new directions in research. *Annual Review of Sociology*, 28:443–478.

Sastry, N. (1996). Community characteristics, individual and household attributes, and child survival in Brazil. *Demography*, 33(2):211–229.

Szwarcwald, C. L., de Andrade, C. L. T., and Bastos, F. I. (2002). Income inequality, residential poverty clustering and infant mortality: A study in Rio de Janeiro, Brazil. *Social Science and Medicine*, 55(12):2083–2092.

Tandon, A., Gakidou, E., Murray, C. J. L., and Ferguson, B. (2002). Cross-population comparability and PPPs: Using micro-data on indicators of consumer durables. Evidence and Information for Policy Cluster draft paper. World Health Organization, Geneva.

Wellman, B. and Leighton, B. (1979). Networks, neighborhoods, and communities: Approaches to the study of the community question. *Urban Affairs Quarterly*, 14(3):363–390.

White, M. J. (2001). Residential concentration/segregation, demographic effects of. In Smelser, N. J. and Baltes, P. B., editors, *International Encyclopedia of the Social and Behavioral Sciences*, volume 19, pages 13250–13254. Elsevier Science, Oxford.

Wilson, W. J. (1987). *The Truly Disadvantaged: The Inner City, the Underclass and Public Policy*. University of Chicago Press, Chicago, IL.