

**Looking Beneath the Urban Averages:
The Effects of Household and Neighborhood Poverty
on Health**

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For the foreseeable future, world population growth will be mainly concentrated in the cities and towns of developing countries. According to the United Nations (2000), by the year 2030 the world's population will exceed today's total by 2.06 billion persons, of whom some 1.94 billion will be added to the urban areas of low-income countries. If these are the prospects in view, then researchers concerned with poverty and opportunity must increasingly set their concerns in urban contexts.

What might city life imply for levels of reproductive health, and for health inequalities? Using data from the urban samples of 85 Demographic and Health surveys (DHS), we focus on three indicators of health: the unmet need for modern contraception; attendance of a doctor, nurse, or trained midwife at childbirth; and young children's height for age. The first of these, the unmet need for contraception, is closely linked to the risks of unintended pregnancy; birth attendance is a measure of the risks facing mothers and children at the time of delivery; and height for age is an often-used indicator of the state of child health. Taken together, these measures describe a high-risk period in the lives of women and their children. Our principal objective is to understand how such health measures are affected by urban living standards. To assess the effects, we will consider two dimensions of living standards. One is calculated for the household in which the woman and her children reside, and the other for the sampling cluster in which the household resides. Holding household living standards constant, we investigate the health effects of poverty and affluence in the surrounding neighborhood.

Why are such "neighborhood effects" of interest? Debates on urban poverty in the developing world have often been framed in terms of the living conditions of slum-dwellers. Estimates by UN-HABITAT suggest that some 38 percent of the population of developing-country cities lives in slums, with total slum populations numbering 126 million persons in Africa, 433 million in Asia, and 87 million in Latin America (Herr and Karl 2002; Herr and Mboup 2003). The emphasis on slums has been accentuated by the United Nations' Millennium Declaration, which 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.¹ But there is, as yet, no consensus in the research community on how “slums” are to be defined, and surprisingly little knowledge of the relationship between urban poverty overall and the living standards of slum populations. It is not known, for example, what proportion of the developing-country urban poor live in slums, nor what proportion of slum-dwellers can be counted as poor in terms of income and other socioeconomic criteria. Furthermore, although the spatial concentration of poverty would seem to be of the essence in any definition of slums, current efforts at systematizing slum definitions (using indications of access to safe drinking water, adequate sanitation, electricity, and housing quality) have been focused on households, and have not directly taken into account the concentrations of poverty or affluence in the local neighborhoods that surround households.

In its relative neglect of neighborhood effects, the literature on urban poverty in poor countries stands in sharp contrast to that concerned with the United States and other rich countries, where neighborhood effects have been the subject of intense scholarly interest over the past two decades. These research efforts have been powerfully motivated by the writings of Wilson, Coleman, and colleagues on social interaction, exclusion, and social capital in poor U.S. neighborhoods (Wilson 1987; Coleman 1988; Massey 1990; White 2001; Sampson et al. 2002). A supporting motivation has emerged within the demographic realm, where multi-level analyses hold considerable methodological appeal, neighborhood effects being a leading example of the forces operating outside households that can exert influence on household-level attitudes and behavior. Hence, on both substantive and methodological grounds there would seem ample reason to explore neighborhood effects in the cities of poor countries.

What, then, can account for their neglect? A fundamental barrier to such research is the lack of data on living standards. Because the DHS program gathers no information on household incomes or expenditures as such, measures of poverty based on these survey data are limited to what can be fashioned from a few proxy variables, including ownership of consumer durables and rather crude assessments of the quality of housing. A lively literature has emerged in the past

¹See www.un.org/millenniumgoals for further information on the Millennium Declaration and its associated goals, specific targets, and research programs.

few years about the merits of various statistical techniques that use such indicators. We explore one of the most promising approaches for distilling the proxies into a single living standards index, termed confirmatory factor analysis. In applying this method, we face one difficulty of a methodological nature: the indicators at hand are dichotomous, and standard factor-analytic techniques are inappropriate for such cases. We have developed our own estimation routines to address this problem.²

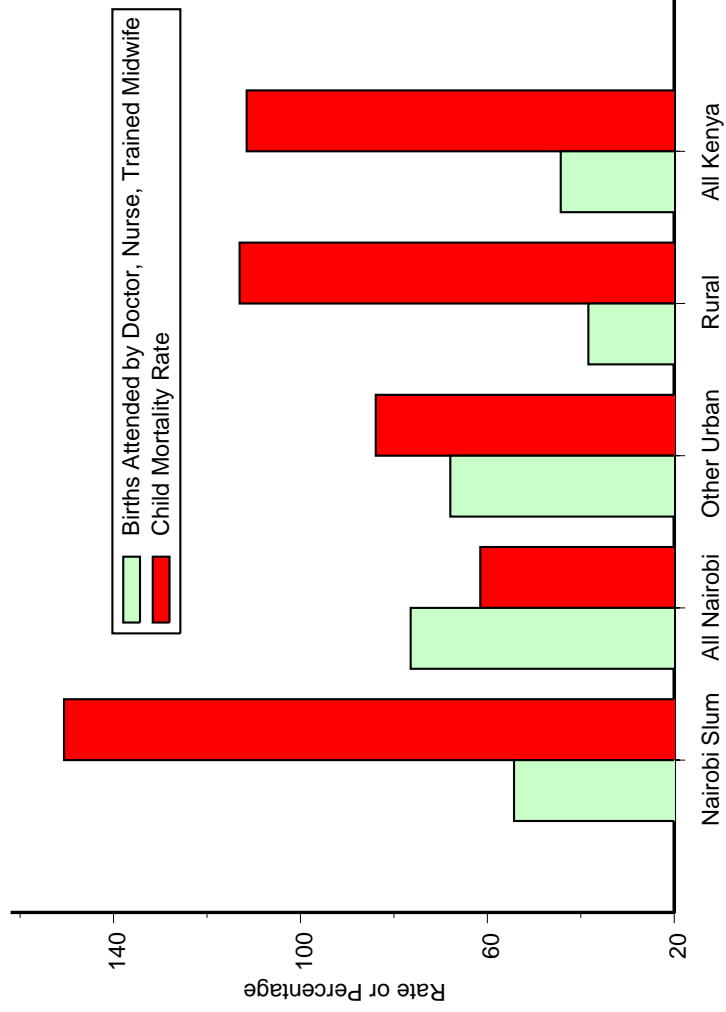
The paper is organized as follows. In Section 1, we briefly sketch the theory of neighborhood effects in relation to health, drawing from the forthcoming report of the National Research Council's Panel on Urban Population Dynamics (2003). We then provide, in Section 2, an overview of the models and statistical issues that must be confronted in distilling defensible measures of living standards from the crude raw materials at hand, and summarize our thinking in an equation system that links urban living standards to health. Section 3 describes the DHS data we shall use, presenting descriptive statistics on the health measures, the basic set of explanatory variables used in the models, and the indicators of household living standards. We then compare living standards and poverty measures for households with summary measures that are calculated at the cluster level, the aim being to understand just how closely household and neighborhood living standards are linked. Section 5 presents multivariate results for the three health measures, with the models based only on household living standards factors shown first, and models with both household and neighborhood factors following. The paper concludes with thoughts on an agenda for further work.

1 Neighborhood Effects: A Review

Figure 1 for Nairobi may help to frame the issues. In the slums of this city, we see rates of child mortality (shown in the dark bars of the figure) that substantially exceed those found elsewhere in Nairobi, and that are high enough even to exceed rural rates of mortality. If urban populations have an advantage in health, as is so often asserted, then it seems that this advantage must be very unequally shared. Of course, such urban disadvantages were once widely apparent in the West: in the nineteenth century, it was not uncommon for mortality rates in urban

²The econometric details are developed in a companion paper available from the authors.

Figure 1 Comparison of birth attendance and child mortality rates ($_{5/0}$) in the Nairobi slums sample with those for all Nairobi, other cities in Kenya, rural areas, and Kenya as a whole. Source: African Population and Health Research Center (2002).



slums to far exceed those of the countryside, in part because the spatial concentration of urban dwellers put them at greater risk of communicable disease. If anything, such urban-rural differences are more striking in today's world, because even in poor countries many cities have managed to provide the basic public health infrastructure needed to combat communicable disease, and city populations are generally better supplied with modern curative health services. Indeed, on average, as the Panel on Urban Population Dynamics (2003) has shown with DHS data, city populations do exhibit lower levels of child mortality than found in the countryside. When one peers beneath the urban averages, however, striking differentials in health are revealed—poor city dwellers often face health risks that are nearly as bad as what is seen in the countryside, and sometimes (as in Nairobi) the risks are decidedly worse. In this respect, the second set of bars displayed in Figure 1, having to do with birth attendance, conveys a sense of what can be seen more generally in developing countries—large health disparities between slum residents and those living elsewhere in the city, but with slum residents being somewhat better shielded from risk than rural dwellers.

Our concern in this paper is with urban populations only. Confining attention to the portions of Figure 1 that refer to urban Kenya, we recognize significant differences in health *within* the urban population. These intra-urban inequities have received curiously little attention from researchers, but of course they will be taking on greater weight in all poverty calculations as developing countries continue to urbanize. Because the Nairobi slum populations of Figure 1 exhibit the poorest health in urban Kenya, there is a suggestion that the spatial concentrations of poverty found in these slums may apply health penalties beyond what household poverty alone would apply. But the figure does not distinguish poor households in slums from poor households living elsewhere, and it can give no clear testimony as to the effects of spatially concentrated poverty. There is enough here, however, to justify further exploration.

A Sketch of the Theories

We cannot do justice here to the many pathways by which neighborhood and related contextual effects could exert influence on health. In its forthcoming book, the Panel on Urban Population Dynamics (2003) provides an extensive review of

these theories, with attention to their implications for neighborhood-level poverty (or living standards) and individual demographic behavior in the cities of developing countries. To briefly summarize this panel's lengthy and complex argument—much of which is dependent on empirical examples from the U.S. experience—one expects neighborhoods to matter for several reasons. Where communicable disease is concerned, it has long been recognized that the spatial proximity of diverse urban populations can generate negative *health externalities*. Timæus and Lush (1995) provide an unusually penetrating discussion of these externalities. As we have seen for Nairobi, the externalities associated with environmental contamination and communicable disease could cause the health risks of slum life to rival or exceed those of rural areas, despite the generally easier access to transport and health services enjoyed by city residents (Timæus and Lush 1995; Harpham and Tanner 1995; African Population and Health Research Center 2002).

Less often recognized, but potentially of equal importance, are the *social externalities* that figure into urban life. Individual women and households are connected to others in their neighborhoods through social network ties, and along such social circuits there may flow information about how to recognize and respond to health threats, and where appropriate services can be found. Of course, social network ties will often reach beyond the local neighborhood. It has been argued, however, that the social networks of women and the poor are spatially constricted by comparison with those of men and the more affluent. The relative costs of travel may well be greater for the poor, and women with children and other domestic responsibilities may find their daily routines largely confined to their neighborhoods (McCulloch 2003; Panel on Urban Population Dynamics 2003). Although we are aware of no recent research on social networks and the diffusion of health information in developing country cities, the work of Behrman et al. (2001) and Casterline et al. (2001) document the network effects on contraceptive use in rural and peri-urban African contexts.³

³One of the most influential random interventions in the history of family planning, the Taichung experiment of 1963, found strong evidence of information diffusion along social network lines in this Taiwanese city (Freedman and Takeshita 1969). See National Research Council (2001) for an excellent summary of related findings in several areas of demographic research.

Theories of local reference groups and social comparison are often invoked (if rarely tested) in relation to mental health. The idea is that individuals evaluate their own circumstances by comparing them to what can be observed of the circumstances of others (van den Eeden and Hüttner 1982). When the comparisons are consistently unfavorable, this may bring on feelings of resentment and inequity, and thus produce stresses and anxieties that undermine good mental health. There is reason to think that such mechanisms can affect health more broadly. In the view of Wilkinson (1996: 215),

It is the social feelings which matter, not exposure to a supposedly toxic material environment. The material environment is merely the indelible mark and constant reminder of one's failure, of the atrophy of any sense of having a place in a community, and of one's social exclusion and devaluation as a human being.

Repeated exposure to such social inequities could undermine a poor person's feelings of social confidence, sapping the sense of personal agency and efficacy that stimulates constructive health-seeking behavior.

The role of relative socioeconomic standing, as measured by individual income in relation to the income distribution of the surrounding community or wider social group, is still largely untested, especially for spatial units as small as neighborhoods (Wen et al. 2003). In U.S. research, some evidence has emerged—not always consistently—indicating that inequality at the county, metropolitan area, and state level is linked to poor health at the individual level. Very little is known of this relationship outside the U.S. context. Other social mechanisms with similar effects include those linked to residential segregation (Massey 1996; White 2001) and to local social capital (Aber et al. 1997; Furstenberg 1993; Furstenberg and Hughes 1997; Astone et al. 1999).

Much of this literature has put emphasis on the spatial concentration of poverty, but the effects of spatially concentrated affluence are also drawing attention. Wen et al. (2003: 848) summarize Wilson's work as showing the benefits of economic heterogeneity for urban communities:

In his model, the prevalence of middle/upper-income people positively correlates with the material and social resources necessary to

sustain basic institutions in urban neighborhoods like the family, churches, schools, voluntary organizations, and informal service programs. . . . These institutions are pillars of local social organization that help to nurture neighborhood solidarity and mobilize informal social control.

In their own study, Wen et al. (2003: 856) find that neighborhood affluence exerts a significant positive influence on health net of other covariates, including neighborhood-level poverty, income inequality, aggregated educational attainment, and lagged levels of neighborhood health. However, Pebley and Sastry (2003) can find no separable, significant effect of neighborhood affluence in their Los Angeles study of children's educational test scores, given controls for the median level of neighborhood family income, which is a significant positive influence on these scores.

In addition to these approaches to neighborhood effects, one finds a small literature in demography exploring the links between *local services* and health outcomes, with a particular focus on how services may either provide a substitute for, or alternatively complement, the beneficial effects of mother's education (e.g., Sastry 1996). Relatively poor urban neighborhoods may not be attractive to private-sector suppliers of health services and contraception (although vendors may offer drugs and supplies even in poor neighborhoods). These neighborhoods may also lack the political clout it takes to secure adequate public-sector services. It is not a given that poor neighborhoods will be under-served by the public sector—in some countries these neighborhoods could be targeted for improved service provision. There may well be a connection between local social capital and health services—Gilson (2003) applies the concept of “trust” to explain attitudes toward health care providers and institutions. The trust concept may provide one way of measuring the social dimensions of access to modern medical care.

How Strong is the Evidence?

Empirical studies of these effects in developing country cities are far from being common. For Rio de Janeiro, Brazil, research by Szwarcwald et al. (2002) examines a type of multi-level model, 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 across the set of tracts that constitute larger

neighborhoods. These authors find substantial dispersion in poverty across the tracts of given Rio neighborhoods, and this variation (or inequality) is only weakly associated with the mean neighborhood poverty rate. Furthermore, both the neighborhood mean and its dispersion are positively associated with tract-level infant mortality and adolescent fertility. This finding is suggestive of a link between local socioeconomic inequality and health, if not quite as persuasive as multilevel estimates from models with both individual and areal characteristics.

As a number of researchers have noted (e.g., Timæus and Lush 1995; Szwarcwald et al. 2002; Åberg Yngwe et al. 2003; Wen et al. 2003; Drukker et al. 2003), multilevel studies have often but not invariably found neighborhood levels of poverty, income, and related factors to exert significant influence when individual-level covariates are controlled. Collinearity between the individual and spatially aggregated measures can make it difficult to distinguish the individual and neighborhood effects. Ginther et al. (2000), using longitudinal data with a rich set of individual, family, and neighborhood variables, caution that neighborhood measures often lose their significance as more family and individual-level covariates are taken into consideration. Longitudinal studies of these relationships are rare, and randomized intervention studies are rarer still.

But What Is an Urban Neighborhood?

The geographical units for which aggregated data are available—in the U.S., these are census tracts, block groups, and the like—have boundaries that need not correspond closely, or indeed correspond at all, with the sociological boundaries of neighborhoods as determined by patterns of social interaction, contagion, and comparison. Furthermore, as noted above, it may be that social networks exert important influences on individual and family behavior, and these network contacts are not necessarily confined to the space of local neighborhoods.

In an early, memorable, and still provocative piece, Wellman and Leighton (1979) make a point of emphasizing the lack of overlap between social interactions taking place in neighborhoods and those taking place in individual social networks. In their view, social networks encompass and extend well beyond the neighborhood, place-based connections. Writing on health and reference group effects, Wen et al. (2003: 845) acknowledge that, “It is not clear what spatial level is

appropriate to examine this relationship.” For Sweden, Åberg Yngwe et al. (2003) explore an approach whereby socially-defined reference groups are constituted on the basis of social class, age, and region, rather than in terms of local geography.

Even the spatial aspect is problematic. Coulton et al. (1997) and Sastry et al. (2002) emphasize the complexities entailed in delineating geographic boundaries for urban neighborhoods. Coulton et al. (1997) asked residents of Cleveland to depict their local neighborhoods in maps, and found that the perceived boundaries often differed substantially from the perimeters of census-based units. There was substantial variance across residents in the spatial extent of their perceived neighborhoods. Despite this variation, when averages of socioeconomic measures (e.g., poverty rates, crime rates, non-marital fertility) were calculated for the perceived neighborhoods and then compared to figures for the census tracts, the socioeconomic profiles did not differ a great deal. The composition of administratively-defined geographic units was similar to that of the units sketched out by local residents.

In this paper, as in so much of the literature on neighborhood effects, definitions of neighborhood are forced upon us by the nature of the available data. DHS surveys collect data within sampling clusters, and in what follows, speaking loosely, we will describe these clusters as “neighborhoods.” The extent to which DHS sampling clusters represent neighborhoods is, of course, open to debate. In the cities of developing countries, such sampling clusters can be as small as a single multi-unit apartment building, or they can extend more broadly, though they would seldom be as broad in spatial terms as rural sampling clusters. (It may be that the logistics of survey-taking—the need for interviewers to conduct a given number of interviews per workday—imply that urban clusters will generally be compact, especially in high residential density areas.) Unfortunately, the spatial perimeters of DHS sampling clusters are not documented in any accessible format, and it would be a substantial undertaking to retrieve the relevant maps even for recently fielded surveys. Further substantial effort would be needed to determine the nature of social interactions that take place within and outside these spatial perimeters.

For many reasons, then, it is well beyond the scope of this paper to identify precisely the routes through which neighborhoods can influence health. Data far more detailed than those collected in the DHS would be required. In making a

preliminary survey of the data that are available, we will offer interpretations of our findings that stress one or another of the mechanisms described above, and, in closing, will outline priorities for future research.

2 Statistical Overview

The specifications to be explored here take the form of equation systems in which a given health variable, denoted by Y , is the main object of interest. As discussed above, in our application Y will represent one of three measures of health: the unmet need for modern contraception; attendance of a doctor, nurse, or trained midwife at childbirth; and children’s height for age. The first two of these are binary variables.

For the unmet need and birth attendance models, we write the main structural equation in latent variable form as

$$Y^* = W'\theta + f\delta + \epsilon \quad (1)$$

with the observed dependent variable $Y = 1$ if $Y^* \geq 0$ and $Y = 0$ otherwise. For the children’s height variable, which is continuously distributed, we can take Y as being equivalent to Y^* . 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—more in a moment on when this will be a tenable interpretation. Another unobservable, ϵ , serves as the disturbance term of this structural equation.

We model the factor $f = X'\gamma + u$, the value of f being determined by a set of exogenous variables X and a disturbance u . Although f is not itself observed, its presence is signalled in the behavior of a set $\{Z_k\}$ 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,

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

In this set of equations, the β_k parameters show how the unobserved factor f takes expression through the indicators.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 health equation (1) and equations (2) for the indicators.

In setting out the problem in this way, we follow an approach advocated by several researchers (notably Sahn and Stifel 2000; McDade and Adair 2001; Tandon et al. 2002; Ferguson et al. 2003). Filmer and Pritchett (1999, 2001) offer an alternative based on the method of principal components. Although useful and very easy to apply, this method is best viewed as an atheoretical data-reduction device whose main virtue is simplicity.⁵ The principal components method does not cleanly separate the determinants of living standards from the indicators of living standards, and in any case, it is not readily generalized to structural, multiple-equation models (Montgomery et al. 2000).

For this paper, we will take a two-step approach to estimating the system. Assuming all disturbances to be normally-distributed, the parameters α , β and γ of the indicator equations (2) are estimated by the method of maximum likelihood, using routines that we have written for this purpose.⁶ An estimate $\hat{f} = E[f|X, Z]$ of the factor is derived from these equations alone. (The calculation involves quadrature, as explained in our companion paper.) The predicted \hat{f} is then inserted into the structural equation (1) just as if it were another observed covariate.

⁴Note 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.

⁵For an empirical comparison of principal components and factor analysis, see Hewett and Montgomery (2001).

⁶As will become clear in a moment, it is more accurate to describe the estimation method as “quasi-maximum likelihood,” because the estimating equations do not take cross-household, within-neighborhood correlations into account.

Note that the full system (1) and (2) can be viewed as a constrained version of a largish multivariate probit system. To see how estimation techniques for such binary indicator models differ from those for models with continuously-valued indicators, compare Lawley and Maxwell (1962), Bollen (1989), and Jöreskog (2000, 2002). The maximization problem does presents some numerical difficulties, and it appears that maximum likelihood methods have been used less often in problems such as these than minimum-distance estimation.

Conventional statistical methods are applied to estimate the parameters θ and δ of the structural model of health.⁷

It is important to take note of a key point: we assume that the disturbance terms $\{\epsilon, u, v_1, \dots, v_K\}$ are mutually independent. The principal worry is that the ϵ disturbance of the health equation might be correlated with u or one of the v_k disturbances. A correlation involving ϵ could arise if the propensity to own a given consumer durable (for the k -th durable, this propensity involves both u and the disturbance v_k) is somehow linked to the disturbance term ϵ of the main health equation. When the indicator equations (2) are estimated separately, as in our approach, then the estimator $\hat{\gamma}$ is consistent for γ , and the $X'\hat{\gamma}$ component of \hat{f} is (in the limit) free of contamination from any association with the health equation disturbance.⁸ One could let $\hat{f} = X'\hat{\gamma}$ and proceed without concern for inconsistency in the parameter estimators. However, when \hat{f} is formed by conditioning not only on X , but also on the indicators Z , then an association of \hat{f} with ϵ could persist even in the limit. When there is a reason to be concerned about this sort of bias, the procedure used to generate \hat{f} clearly must be adjusted. Lacking any compelling reason for suspecting correlation, however, we have not made the adjustments here.

Modelling 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 health equation? How are the X variables, posited to be determinants of living standards, to be distinguished from the $\{Z_k\}$ variables that serve as indicators of living standards? Montgomery et al. (2000) review the issues with reference to models of fertility, mortality, and children's schooling, and here we touch on several points made in the earlier paper.

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

⁷As 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.

⁸This assumes independence among $\{u, v_1, \dots, v_K\}$. The X variables themselves are taken to be fully exogenous.

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 on which data are gathered. Using these indicators, we construct what McDade and Adair (2001) have termed a “relative affluence” measure of living standards. Producer durables—in a rural sample these would include ownership of livestock and land—are deliberately excluded from the $\{Z_k\}$ set, 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 that is drawn from household production.

By this logic, if producer durable variables were available for the urban samples with which we are concerned, we should include them among the X covariates. Unfortunately, as of this writing the DHS survey program has not collected data on urban producer durables as such.⁹ To be sure, some publicly-provided services can also be viewed as enabling factors, or inputs, into consumption—notably, the provision of electricity—and we have therefore included electricity in the X living standards determinants. Although city size may be only a distant proxy for other factors determining consumption—among them, access to multiple urban income-earning possibilities and heterogeneous factor markets—we include city size with the other X variables.

It is perhaps not unreasonable to liken adult education to a producer durable, education being a type of long-lasting trait that produces over time a stream of incomes and consumption; on these grounds we include the education (and age) of the household head 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). 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 health equations as well as in the set of X variables that act as determinants of living

⁹Over the past year, however, the DHS has been experimenting with new urban-sensitive questions on housing ownership and security of tenure in a handful of surveys.

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 the education of the household head as a determinant of living standards and the education of the woman and her spouse as determinants of health.¹⁰

Living Standards at the Neighborhood Level

Evidently there are many issues to confront in specifying living standards models at the individual and household level; yet further issues must be confronted in any effort to define neighborhood (cluster) living standards. Our approach is very simple. With estimates \hat{f}_{ic} in hand for household i in cluster c , we construct a cluster-level measure for household i by averaging \hat{f}_{jc} over all households $j \neq i$ that reside in the cluster, that is,

$$\hat{f}_i^c = \frac{1}{n_c} \sum_{j \neq i} \hat{f}_{jc},$$

with n_c being the number of households in the cluster, less one. (As will be seen, in our descriptive work we also construct measures of the proportion of cluster households falling into the lowest and highest quartiles of the urban distribution of living standards.) This approach at least has the virtue of simplicity, though its other virtues may not be immediately apparent.

We are exploring two alternative approaches that are better-justified in econometric terms. In one of these, a cluster-level living standards factor f_c is introduced along with the household-level factor f , and modelled in terms of cluster-level variables. This two-factor approach can be implemented in much the same way as the one-factor approach, although estimation entails far greater computational difficulties given the number of indicators and the typical number of households per cluster seen in the DHS data we use. An alternative, not quite as well-justified but perhaps acceptable as a compromise, is to enter the cluster-level variables as indicators (or determinants) of a single household-level living standards factor.

¹⁰In most of our samples, there is sufficient variation in headship for this strategy to produce distinct education variables in the indicator and health equations.

3 Data and Model Specification

The data drawn upon in this analysis come from 85 surveys fielded in Phases 2 through 4 of the Demographic and Health Survey (DHS) program.¹¹ The survey dates range from 1990 through 2001, and in all some 50 countries in 6 developing regions are represented.

Health Measures

Regional summaries of the distributions for the health variables—unmet need for modern contraception, attendance by a physician, nurse, or trained midwife at delivery, and children’s height for age—are presented in Table 1. Here and elsewhere in the paper, we use such regional summaries and averages to set the results in context. It should be remembered that the DHS surveys are not strictly representative of any developing region, since in no region have all countries, or even all large countries, participated in the DHS program. Another point to note is that several countries have fielded multiple DHS surveys.

The first column of Table 1 shows the percentages of women who have an unmet need for contraception. An unmet need can be said to exist when a woman who is not currently using contraception expresses a desire to prevent or delay further births (Casterline and Sinding 2000; Westoff and Pebley 1981; Westoff and Bankole 1995). Among those women who report that they wish to stop childbearing altogether or delay the next birth—excluding those not at risk of conception (i.e., those not in union, pregnant, or amenorrheic)—a woman with an “unmet need” is one who uses no modern contraception.

The second health measure in Table 1 is generated from the DHS maternity histories for all births that occurred in the three years before the survey date. For each such birth, information is gathered on who assisted at the delivery of the child, with the possibilities including a doctor, nurse, trained midwife, other midwife, traditional birth attendant, and a relative. This analysis will focus on the women who have had either a doctor, a nurse, or a trained midwife attend each of their deliveries in the last three years. The variable is coded with a “0” if one birth was

¹¹One survey, for Yemen, provides data on durables and their determinants, but not on the health variables.

Table 1 Mean Values of Urban Unmet Need, Birth Attendance by a Doctor, Nurse or Trained Midwife, and Children’s Height for Age, by Region

Region	Unmet Need^a	All Recent Births Attended^b	Height for Age^c
North Africa	20.8	64.4	-.715
Sub-Saharan Africa	48.4	60.2	-1.112
Southeast Asia ^d	21.7	65.2	
South Central Asia	23.4	63.2	-1.241
West Asia	17.4	83.8	-.577
Latin America	22.8	70.4	-.885
TOTAL	35.3	64.5	-1.032

^a Expressed in percentages of women at risk of unmet need.

^b Figures shown are percentages of women with births in the last 3 years whose deliveries were attended by a doctor, nurse, or trained midwife.

^c Expressed in standard deviations from an international reference median, with -1.0 being one standard deviation below that median.

^d No DHS surveys in this region has collected information on children’s height for age.

attended but another was not—hence, in the case of multiple births in the three years before the survey, it measures consistent attendance .

The DHS also collects information on the height and weight of each child born in the three or five years before the survey date.¹² A child’s height for age is thought to be a good proxy measure of health status, reflecting both nutrition and disease history (Montgomery et al. 1997). We will focus on height for age among children who are 3 to 36 months of age, the lower age cut-off being chosen to minimize the problems of measurement error that are thought to plague estimates for the youngest children. Height-for-age is standardized by age and sex and is expressed in terms of standard deviations from the median of an international reference population.

¹²In the DHS, although the choice of three to five years is country-specific, most DHS surveys include health information for children born in the last five years.

Explanatory Variables

A small set of variables from the DHS is included to serve as socioeconomic controls. Descriptive statistics for these variables are presented in a companion paper available from the authors; here we discuss the rationale for including the variables and our approach to coding them. The woman's age is coded in the conventional five-year age groups. The urban context is indicated by a pair of dummy variables for residence in the country's capital or another large city (defined by the DHS as a city with at least 1 million population), and residence in a smaller city (one in the range of 50,000 to 1 million residents). The omitted category for residence is towns, that is, urban places with fewer than 50,000 residents.

To devise a consistent classification of educational attainment is difficult. The educational experiences of women and their husbands vary a great deal over the range of regions and countries covered in this analysis. For example, over 80 percent of woman have completed secondary schooling or more in Kazakhstan and Uzbekistan, whereas only 8 percent and 1 percent have done so in Mali and Burkina Faso, respectively. Clearly no single classification scheme can be imposed upon all countries.

We have chosen to define educational attainment for women and their husbands according to the distribution of attainment within each country. This approach yields three distinct coding schemes, as shown in Table 2. Our aim was to devise a measure with a sizable baseline (omitted) category, with 8 percent of the urban sample taken to be the minimum acceptable size for this category. In the great majority of DHS surveys, the base comprises those with no education or at most incomplete primary school education. For a small minority of surveys, however, mainly from the former Soviet republics, this grouping yielded too small a base category, and the base was expanded to include those who completed primary school or attended, but did not complete, secondary school.

Living Standards Indicators

The set of living standards indicators $\{Z_k\}$ includes the consumer durables and housing items shown in Table 3. These indicators are available in almost all DHS surveys, although some countries lack one or two of them. Some surveys include additional consumer items, e.g., possession of soap or a cooking stove, but

Table 2 Coding of educational attainment for multivariate analyses

Number of surveys	No Education	Incomplete		Completed		Higher
		Primary	Secondary	Primary	Secondary	
64	Base ^a		Group 2		Group 3	Group 3
13	Base ^a		Group 2		Group 3	Group 4
7		Base ^a			Group 2	Group 3

^a The base group, which serves as the omitted category in the multivariate models, is defined so as to include no less than 8 percent of the urban sample.

Table 3 Percentages of urban households with living standards indicators, by region.^a

	North Africa	Sub- Saharan Africa	Southeast Asia	South, Central Asia	West Asia	Latin Amer- ica
Consumer Durables						
Car	17.4	12.9	12.7	24.6	28.3	16.3
Television	92.6	37.4	62.6	69.9	95.8	79.0
Refrigerator	79.4	23.9	37.2	67.9	91.9	51.8
Radio	83.9	76.6	77.2	57.4	72.6	84.6
Bicycle	17.6	21.0	48.9	31.7	10.8	27.4
Motorcycle	10.3	12.6	30.5	12.9	0.1	8.9
Housing Quality						
Sleeping rooms	67.3	47.7	64.8	52.4	64.9	46.2
Finished flooring	94.7	76.9	75.8	47.3	79.7	77.2

^a Unweighted means, based on households with a woman eligible for the unmet need analysis, using surveys that gathered data on the indicator.

we exclude such measures in the interest of achieving reasonable cross-country comparability.

4 Household and Neighborhood Living Standards

Table 4 summarizes the estimated $\hat{\beta}_k$ factor loadings produced by the confirmatory factor models. As can be seen in the table, the coefficients are almost always positive and statistically significant. Table 5 presents a summary of the effects of the X covariates. These effects are very much in line with expectations. The provision of electricity is positively associated with living standards, as would be anticipated given its role as a key input. The education of the household head is also strongly and positively associated with living standards, and, consistent with age profiles of productivity, we find that living standards increase with the head's age up to about age 60, and decrease thereafter. City size variables show weaker effects overall, but usually indicate that living standards are higher in small and large cities relative to the levels found in towns, the smallest urban areas. Evidently there is good statistical support for the notion that the proxy variables

Table 4 Summary of Confirmatory Factor Loadings ($\hat{\beta}_k$) for Consumer Durables and Housing Quality^a

Item	Estimated	Positive and Sig-nificant	Negative and Sig-nificant
Consumer Durables			
Television	71	69	1
Refrigerator	76	75	0
Radio	83	82	0
Bicycle	79	75	4
Motorcycle	57	54	1
Measures of Housing Quality			
Sleeping rooms	67	65	2
Finished flooring	78	77	0

^a The β parameter for ownership of a car is not estimated, but rather normalized to unity.

Table 5 Summary of $\hat{\gamma}$, the Effects of Determinants X on the Living Standards Factor

Item	Estimated	Positive and Sig-nificant	Negative and Sig-nificant
Basic Demographic Variables			
Head is male	85	74	11
Head's age	85	85	0
Head's age, squared ^a	85	0	85
Head's Education			
Completed primary or incomplete secondary	76	76	0
Completed secondary or higher	60	60	0
Completed secondary	19	19	0
Higher	20	20	0
Head's education unknown	12	12	0
Other			
Household has electricity	61	61	0
Residence in small city	71	60	11
Residence in capital city	82	74	7

^a The living standards factor is estimated to increase with head's age up to an age of 59.7 years, this being the average "turning point" among all estimated models.

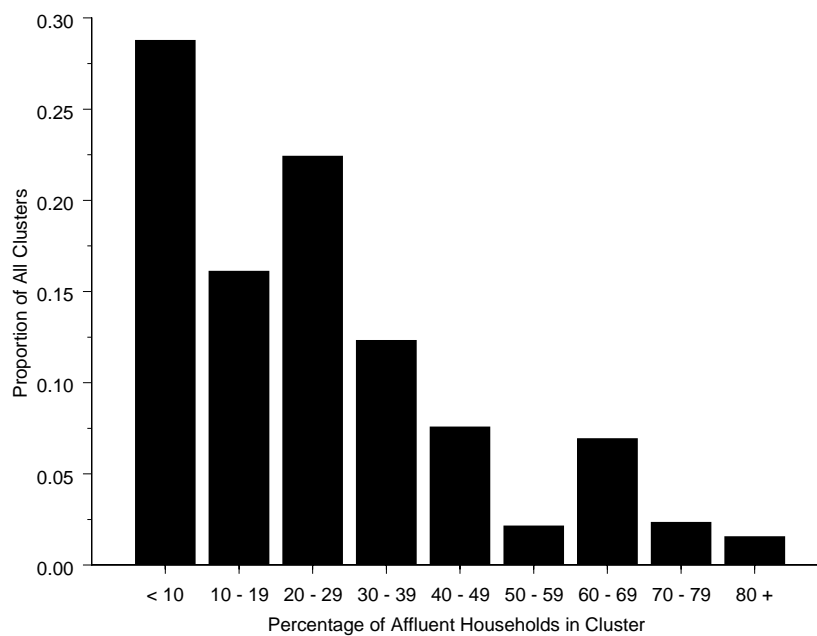
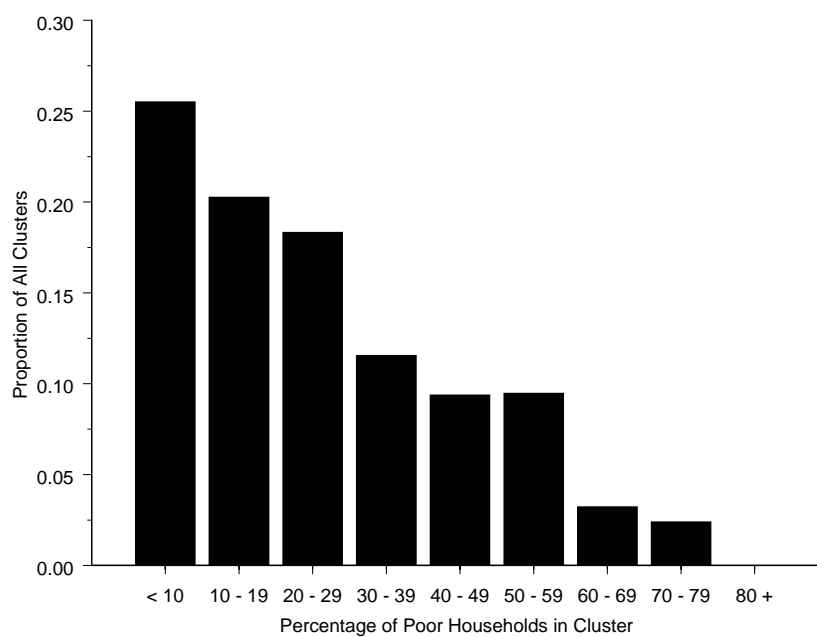
collected in the DHS surveys are interpretable as indicators of the household’s otherwise unobservable standard of living.

We now examine the relationship between living standards indices estimated at the household level, and aggregated indices computed for the other households residing in the sampling cluster. Recall that the approach is to estimate confirmatory factor scores \hat{f}_{ic} for each household i in urban sampling cluster c in a given Demographic and Health Survey dataset. The sampling cluster averages are computed by separating out the score for each household i and calculating a mean for the other households in the cluster. We also examine the proportion of households in the cluster that fall into the lowest quartile of urban factor scores overall and the proportion falling in the uppermost quartile, again without reference to the i -th household. These proportions are described in what follows as the cluster proportions “poor” and “affluent,” with poverty and affluence being defined in relative terms.

In considering the DHS sampling clusters, we might ask first whether there is evidence that relative poverty and affluence are indeed spatially concentrated. It is reasonable to expect that if 25 percent of urban households overall are poor, in examining a set of sampling clusters we are likely to find some clusters with very high concentrations of poverty and others with very few poor households. Likewise, we might well expect to observe a high spatial concentration of affluence.

Although these are reasonable expectations, the DHS results provide something less than resounding support for them. We see a greater degree of heterogeneity in cluster composition than might have been anticipated. We document this heterogeneity in several ways. Consider first, for Ghana, Figure 2, which presents the distributions of DHS sampling clusters by the cluster proportion of poverty (in the upper figure) and the cluster proportion of relative affluence (lower figure). Out of all Ghanaian urban clusters, in about 25 percent of clusters we find fewer than 10 percent of households being poor. Likewise, out of all these clusters, in about 28 percent of them fewer than 10 percent of households are relatively affluent (that is, in the upper quartile of all urban households). These two left-most bars are suggestive of some spatial concentration of poverty and affluence. However, as we consider the full range of the distributions, we see less evidence of extreme spatial concentration. In Ghana—and across our full sample of surveys—

Figure 2 Distribution of sampling clusters by percentages of poor and better-off households. Results for Ghana (1998–99).



we simply do not find very many clusters that are more than half poor or more than half affluent.¹³

Figures 3 and 4, which refer to all surveys in our analysis, may further clarify the situation. In the first of these figures, we characterize the neighbors of poor households. If poor households were indeed generally surrounded by other poor households—as in the images of slums and shantytowns that are invoked in so many discussions of urban poverty—then we would expect to find that their neighbors are predominantly poor. As the figure shows, this is far from being the case. In Latin America, the average poor household lives in a neighborhood in which about 44 percent of its neighbors are poor. This is well above the percentage of poor in the urban population as a whole (25 percent by our definition of poverty), but it leaves substantial room for neighbors who are in the 25th–75th percentiles of the living standards distribution (in Latin America, this “middle” group accounts for about 45 percent of a poor household’s neighbors) and even for neighbors who are affluent, those who are in the top-most quartile of the urban distribution. A poor Latin American household has, on average, about 1 neighbor in 10 who is affluent.

Figure 4 depicts the neighbors of these affluent households. Again, as expected, relatively more of these neighbors are themselves affluent than in the urban population at large but the spatial concentration of affluence is less evident than might have been anticipated. Likewise, the affluent households have more poor neighbors (the poor make up about 20 percent of neighbors) than would be suggested by images of extreme social–spatial polarization that appear in the literature. Evidently, there is substantial heterogeneity in the composition of urban neighborhoods.

In summary, having taken the estimated factor score to be a measure of the standard of living, and having examined the internal composition of clusters in this dimension, we find some support for the hypothesis of spatial concentration

¹³By construction, of course, only one-quarter of urban households in any survey are relatively poor, and only one-quarter are relatively affluent. The definition of poverty and affluence in terms of quartiles places some constraints on distributions like those seen in the figure. A complicating factor is that DHS sampling clusters vary in population size. In an extreme case, a relatively small number of very large clusters could house most of the urban poor or the urban affluent. A more refined analysis than we can undertake here would take such complications into account.

Figure 3 Who are the neighbors of the urban poor?

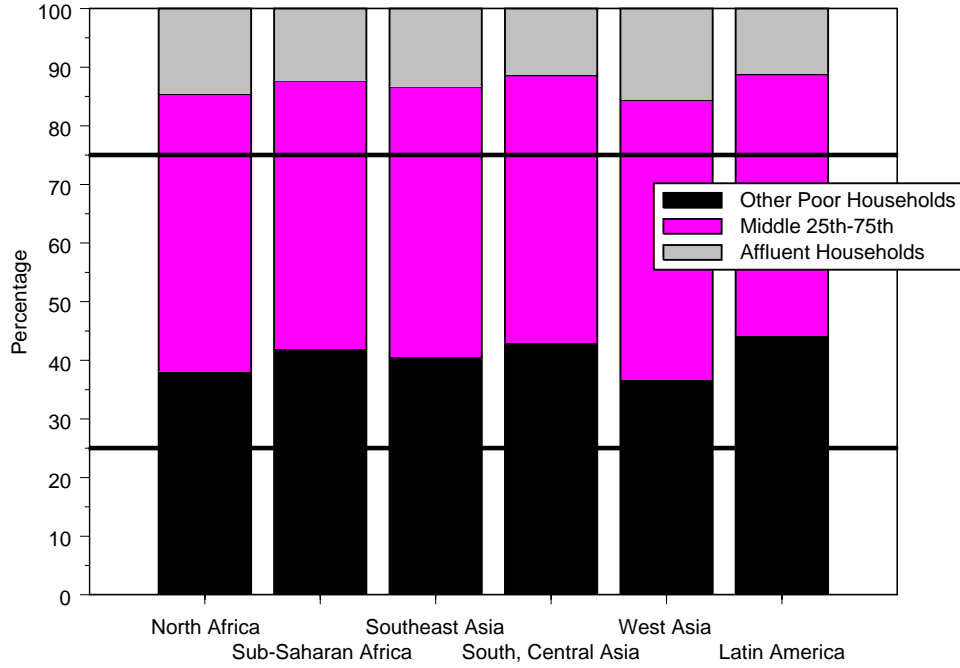
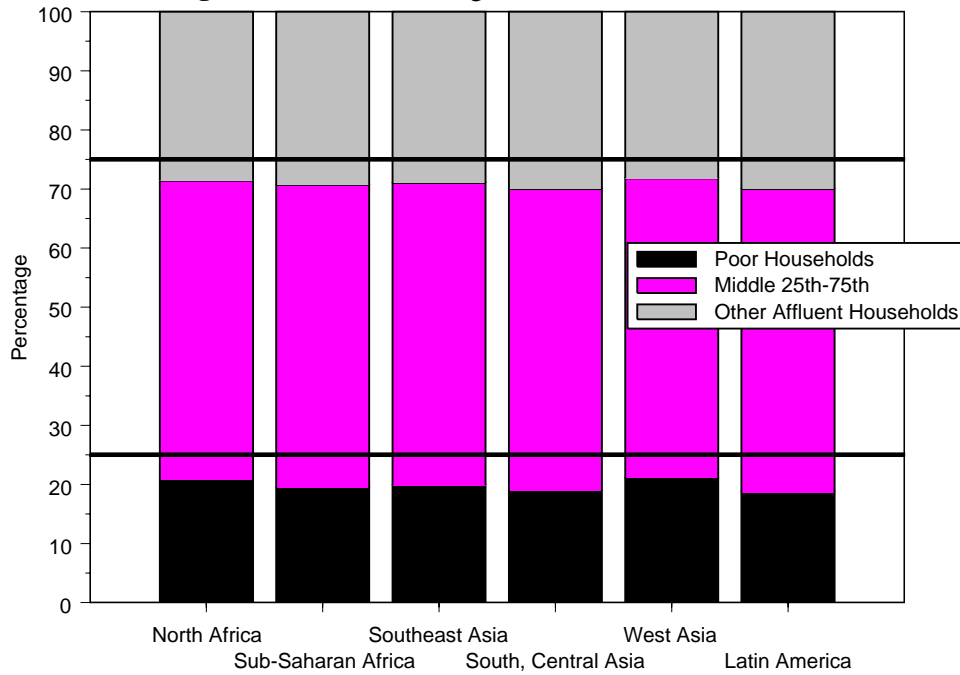


Figure 4 Who are the neighbors of the urban affluent?



of poverty and affluence, but not as much support as we had expected to find. Two cautions are in order. First, there can be no presumption that households inhabiting the same local space will interact, or even serve as relevant points of comparison. The Latin American literature is especially instructive on the non-spatial forms of exclusion and segregation (e.g., Caldeira 1999, 2000). Second, as we have already noted, sampling clusters are not the same thing as neighborhoods, and little if anything is known of their correspondence in DHS sampling designs.¹⁴ Factor scores for individual households are clearly associated with cluster-level averages and proportions, but with considerable residual variance. This implies that there may be sufficient independent variation in the individual and cluster measures to estimate models including both kinds of scores.

5 Unmet Need, Birth Attendance, and Height for Age

In the multivariate empirical work reported below, we began by examining measures of the lower and upper quartiles of the factor score distributions, focusing on the households that we have termed relatively poor and relatively affluent and on the corresponding cluster proportions. To date, however, we have not uncovered empirical evidence suggesting that these measures add insight beyond what can be gleaned from models with individual factor scores and cluster mean scores. (Pebley and Sastry (2003) also found it difficult to isolate poverty and affluence effects from the effect of neighborhood medians in their study of Los Angeles neighborhoods.) Although further work needs to be done on specifications involving relative poverty and affluence, the models to which we now turn are specified in simpler terms.

The models of unmet need and birth attendance are based on probit regressions for the i -th household in sampling cluster c , which can be expressed as

$$\Pr \left(Y_{ic} = 1 | W_{ic}, \hat{f}_{ic}, \hat{f}_i^c \right) = \Phi \left(W_{ic}'\theta + \hat{f}_{ic}\delta + \hat{f}_i^c\delta_c \right),$$

where Φ is the standard normal cumulative distribution function, W_{ic} denotes the set of explanatory variables measured at the household level, \hat{f}_{ic} is the estimated

¹⁴Fred Arnold and colleagues at the DHS have examined the case of Mumbai, India, where maps of survey enumeration areas can be overlaid on the maps of urban slum communities that have been drawn up by Indian planners and social scientists. Arnold reports seeing many discrepancies between these two types of spatial units (personal communication). It is not yet known whether what is true for Mumbai is true more generally.

factor score for the household, and \hat{f}_i^c is the average of these scores over all except the i -th household in the cluster. The model of children’s height for age is a simple regression model; the explanatory variables include those used for unmet need and birth attendance, and for this model we add indicators of the child’s sex, age, and the square of age (recall that these are children no more than 36 months old).

To distill the great number of coefficient estimates into a few readily interpretable quantities, we summarize them in the following way. For each health outcome variable, we limit discussion to the estimated effects of the household and cluster factor scores, making comments only in passing on the estimates for other explanatory variables. We describe how often the factor score coefficients attain statistical significance and how often they are both significant and of the expected sign. Robust standard errors are employed throughout.

We then illustrate the size of the living standards effect in two ways. Consider the unmet need analysis. To summarize the effects of living standards, we calculate the predicted probability that woman i has an unmet need given her W_{ic} covariates and given a factor score \hat{f}_{ic} that we fix at the value for the 25th percentile of the urban factor score distribution (i.e., the distribution across all urban households in the survey in question). We construct another predicted probability using the same W_{ic} covariates but with the factor score now set to the value corresponding to the 75th percentile of the score distribution. (The 25th and 75 percentile points are chosen to be suggestive of a relatively poor and a relatively better off urban household.) We average the predictions $P_{i,25}$ and $P_{i,75}$ over the urban estimation sample used in the survey, thereby obtaining two averages P_{25} and P_{75} . The difference between these, $P_{25} - P_{75}$, is one illustration of the size of the factor score’s effect in a given DHS sample. We term this the “absolute difference” in the predicted probabilities of unmet need. In the tables to follow, the absolute difference is expressed in terms of percentage points. A second illustrative device is constructed by dividing the absolute difference by the average level of unmet need in the survey’s urban sample, giving $(P_{25} - P_{75})/\bar{P}$. We describe this second measure as the “difference relative to the mean.” It may convey a sense of the proportional effect of the factor score, and we report these relative differences in terms of percentages.

A similar approach is taken in describing the effects of the cluster-level factor score means, although in this case, the 25th and 75th percentile points are taken

from the distribution of cluster mean scores *across clusters*. Because cluster means *are* means, they tend to have more concentrated distributions than the individual household scores, and we take this into account in choosing values to represent relatively poor and relatively better off clusters.

Models with Household Factors Only

Tables 6 to 8 summarize the results from models using the household factor scores together with the set of socioeconomic controls. There is an impressive consistency in the findings across health measures. First, the factor scores are generally statistically significant, and in the expected direction, for each of the health equations. As can be seen in the second columns of these tables, the household score is negative and significant in 64 of the 84 DHS surveys in the unmet need analysis (Table 6), is positive and significant in some 63 of the 76 surveys where birth attendance is examined (Table 7), and is positive and significant in 49 of 73 surveys for children's height for age (Table 8). The proportions of significant findings are strikingly similar to those for mother's education, as can be seen in the notes to these tables.

The substantive implications of the household scores are summarized in the remaining columns of these tables. We first focus on the absolute effect, comparing predicted values for households at the 25th percentile of the score distribution (the "relatively poor" households) with those at the 75th percentile (the "relatively affluent"), and then examine the effects relative to the mean of each dependent variable. The estimated effects are reported for all surveys, and separately for the surveys in which a statistically significant coefficient was found. For the unmet need analyses (Table 6), we see that the average difference in the unmet need percentage implied by this comparison is 7.4 percentage points in the full sample (see the "Total" row) and 8.7 percentage points in the sample with significant results. Comparing the regions, the largest absolute effects are found in sub-Saharan Africa and Latin America. When these absolute effects are translated into relative terms (last two columns of the table), we see that an absolute difference of 6.3 points in the Latin American results is equivalent to 31.1 percent of the mean level of unmet need. The relative effects of the household factor for the other regions are generally smaller than this, but are still of considerable substantive importance.

Table 6 Summary of Estimates of Unmet Need using Confirmatory Factor Scores

Region	Factor Score Negative and Significant ^a	Effect of Household Factor Score:			
		Absolute Difference ^b	Difference Relative to Mean ^c	All	Significant
North Africa	3 of 4	4.0	4.9	18.9%	22.0%
Sub-Saharan Africa	31 of 42	9.5	11.5	22.9	28.1
Southeast Asia	5 of 6	4.5	5.7	17.3	24.8
South Central Asia	6 of 12	5.2	7.1	22.7	26.6
West Asia	3 of 4	3.9	4.8	22.5	28.0
Latin America	16 of 16	6.3	6.3	31.1	31.1
TOTAL	64 of 84	7.4	8.7	23.8	28.1

^a This column may be compared with results for women's education and the education of the spouse or partner. Women's education exerts a negative and significant influence on unmet need in 2 of 4 surveys for North Africa, 28 of 42 in sub-Saharan Africa, 3 of 6 in Southeast Asia, 4 of 12 in South Central Asia, 3 of 4 in West Asia, and 10 of 16 in Latin America. Spouse's education is negative and significant far less often: in none of the surveys from North Africa, Southeast Asia, and South Central Asia, in 16 of 39 surveys from sub-Saharan Africa, 1 of 4 surveys in West Asia, and 4 of 16 surveys in Latin America.

^b Expressed in percentage points. The difference is between predicted unmet need among households at the 25th percentile of the urban household factor score distribution and unmet need among households at the 75th percentile.

^c Expressed in percentages of mean unmet need in the urban samples.

Table 7 Summary of Estimates of Birth Attendance by a Doctor, Nurse, or Trained Midwife, using Confirmatory Factor Scores

Region	Factor Score Positive and Signifi- cant ^a	Effect of Household Factor Score:			
		Absolute Difference ^b	Difference Relative to Mean ^c	All	Significant
North Africa	4 of 4	7.1	7.1	11.6%	11.6%
Sub-Saharan Africa	31 of 39	10.7	12.9	18.7	20.2
Southeast Asia	4 of 5	10.8	14.3	14.9	19.5
South, Central Asia	8 of 8	18.8	18.8	47.6	47.6
West Asia	3 of 4	4.4	5.3	7.6	9.4
Latin America	13 of 16	7.9	9.4	13.8	16.4
TOTAL	63 of 76	10.4	12.3	19.5	21.8

The surveys for Ethiopia 1999, Niger 1998 and Philippines 1998 did not collect birth attendance data. Models for Armenia 2000, Jordan 1997, Kazakhstan 1995, Kazakhstan 1999, Kyrgyz Republic 1997 and Uzbekistan 1996 could not be estimated due to near-universal birth attendance.

^a This column may be compared with results for women's education. Women's education exerts a positive and significant influence on birth attendance in 4 of 4 surveys for North Africa, 24 of 39 in sub-Saharan Africa, 4 of 5 in Southeast Asia, 8 of 8 in South and Central Asia, 4 of 4 in West Asia, and 14 of 16 in Latin America. Husband's education is positive and significant in 3 of 4 surveys from North Africa, 10 of 36 from sub-Saharan Africa, 3 of 5 from Southeast Asia, 3 of 8 in South Central Asia, 2 of 4 in West Asia, and 6 of 16 in Latin America.

^b Expressed in percentage points. The difference is between predicted birth attendance by a professional among households at the 75th percentile of the urban household factor score distribution and birth attendance by a professional among households at the 25th percentile.

^c Expressed in percentages of women with all births attended by a trained nurse or doctor in the urban samples.

Table 8 Summary of Estimates of Children's Height for Age using Confirmatory Factor Scores

Region	Factor Score Positive and Significant ^a	Effect of Household Factor Score:			
		Absolute Difference ^b	Significant	All	Significant
					Difference Relative to Mean ^c
North Africa	1 of 3	.123	.252	19.7%	45.2%
Sub-Saharan Africa	25 of 39	.322	.398	29.7	36.1
South, Central Asia	5 of 11	.212	.322	23.2	20.9
West Asia	3 of 5	.211	.224	42.7	49.5
Latin America	15 of 15	.328	.328	42.6	42.6
TOTAL	49 of 73	.291	.355	31.8	37.6

^a This column may be compared with results for women's education. Women's education exerts a positive and significant influence on children's height for age in 1 of 3 surveys for North Africa, 11 of 39 in sub-Saharan Africa, 6 of 11 in South and Central Asia, 3 of 5 in West Asia, and 12 of 15 in Latin America. Husband's education is positive and significant in 1 of 3 North African surveys, 3 of 37 surveys in sub-Saharan Africa, 2 of 11 in South Central Asia, 2 of 5 in West Asia, and 5 of 15 in Latin America.

^b Expressed in standard deviations, the units in which height for age is itself expressed. The difference is between predicted child's height among households at the 75th percentile of the urban household factor score distribution and predicted height among households at the 25th percentile.

^c Expressed in percentages of mean height for age in the urban samples.

Much the same story emerges from the analyses of birth attendance and children's height for age, which are summarized in Tables 7 and 8. The estimated influence of the household living standards factor on birth attendance is large in terms of the percentage point differences between relatively poor and affluent households, and these absolute differences imply differences relative to mean attendance that range from 7.6 percent in West Asia to 47.6 percent for the significant cases of South and Central Asia. In the height for age models (Table 8), where absolute effects are expressed in terms of standard deviations from the reference median, the implied difference between an affluent and a poor household is on the order of .291 standard deviations of children's height. These differences are quite large in relative terms, especially in Latin America. Clearly, even within an urban sectors that are generally better supplied with transport options and health services, a household's standard of living can make a considerable difference to its health.

Models with Both Household and Cluster Factor Scores

To weigh the evidence for "neighborhood effects," we now add the cluster means of the household factor scores to the model, retaining all covariates and the household's own factor score. The results are summarized in Tables 9–11. We first describe the number of surveys in which a significant effect is found for the cluster variable, and also re-check the significance of the household scores to see if the empirical association between the household and cluster scores, documented in the preceding section, makes it difficult to identify their separate effects. We then proceed to describe the influence of the cluster scores, comparing predicted values at the 25th percentile of the cluster score distribution (the "relatively poor" clusters) with those at the 75th percentile ("relatively affluent" clusters).

In general, the cluster-level factors are not statistically significant as often as the individual household factors were, and in fact the significance of the household factors is rather little affected by the inclusion of the cluster measures. (Each table includes a column indicating how often the household factors are significant; as can be seen, in relatively few cases does the inclusion of a cluster-level average remove statistical significance from the household factor.) For unmet need, the cluster mean score is significant in 16 of the 84 surveys examined; it is significant in 53 of the 76 cases for birth attendance; and in 22 of 73 cases for children's height

for age. Although smaller in the typical case, the absolute effects of the cluster scores still exert a reasonably strong influence on the three measures of health, with the effects being most striking in the case of birth attendance. When the absolute effects are translated into relative terms, they are seen to be of substantive importance.

How does the general pattern of findings square with the theories of neighborhood effects that were outlined earlier? The three pathways of influence that have been mentioned in the literature involve: health externalities associated with communicable disease; social externalities stemming from localized patterns of interaction, information flow, and the like; and the effects of local service provision.

We had expected to find the clearest expression of neighborhood effects in the children's height analyses, because here is where one would think health externalities and the risks of contagion in poor neighborhoods would be most apparent. There are numerous significant and relatively large effects seen in height for age (Table 11), especially in Latin America, but on the whole the cluster measure attains significance in under one-third of all surveys. It may be that cluster mean values of living standards scores are too many steps removed from the epidemiological mechanisms that produce within-neighborhood contagion. Direct measures of health in the cluster (e.g., percentages of children with recent fevers or diarrhea) might better isolate this particular pathway of influence. Also, note that the models do not include access to piped water and improved sanitation, and these measures of services need to be examined before any strong conclusions can be drawn.

We found the results for cluster effect on birth attendance to be surprisingly strong. We do not think that contagion effects in the narrow epidemiological sense can be involved here. But neighborhood patterns of social interaction and information exchange could make a substantial difference in the extent to which city residents assess the risks of childbirth, feel comfortable with modern medical professionals, and are motivated to pay for their services. (Household abilities to pay are indicated in the strong effects of the household-level factor scores.) These are examples touching on the social epidemiology of health and health-seeking behavior. Our results for urban communities may thus parallel what Pebley et al. (1996) found for rural Guatemalan villages: strong associations among community resi-

dents in birth attendance that appear to stem from shared norms about appropriate care in childbirth.

There may be other explanations for the patterns we have found. As we noted earlier, relatively poor urban neighborhoods may not be well equipped with private-sector health services, and even public-sector clinics and hospitals may be located elsewhere if governments make little effort to target services to the poor. These possible pathways cannot be examined in great depth with DHS data, but we have not yet exploited all of the DHS measures available. For example, many DHS surveys have fielded community modules even in urban areas, and these may shed light on the local availability of health services.

Table 9 Summary of Estimates of Unmet Need using Household and Cluster Average Factor Scores

Region	Cluster Negative and Significant	Score Negative and Significant	Household Score Negative and Significant	Effects of Mean Cluster Score:			
				Absolute Difference ^a		Difference Relative to Mean ^b	
				All	Significant	All	Significant
North Africa	2 of 4	3 of 4	2.1	2.9	10.1%	13.2%	
Sub-Saharan Africa	5 of 42	24 of 42	2.0	8.1	4.3	23.9	
Southeast Asia	0 of 6	5 of 6	0.3	—	4.0	—	
South, Central Asia	2 of 12	7 of 12	1.5	3.0	6.1	18.6	
West Asia	3 of 4	3 of 4	3.4	4.9	19.4	28.1	
Latin America	4 of 16	14 of 16	1.8	5.8	7.8	22.3	
TOTAL	16 of 84	56 of 84	1.8	5.6	5.6	22.3	

^a Expressed in percentage points. The difference is between predicted unmet need among households at the 25th percentile of the distribution of urban cluster means across clusters and unmet need among households at the 75th percentile of this distribution.

^b Expressed in percentages of mean unmet need in the urban samples.

Table 10 Summary of Estimates of Birth Attendance by a Doctor, Nurse, or Trained Midwife, using Household and Cluster Average Factor Scores

Region	Cluster Positive and Significant	Score	Household Score Positive and Significant	Effects of Mean Cluster Score:			
				Absolute Difference ^a	Difference Relative to Mean ^b		
					All	Significant	All
North Africa	3 of 4		4 of 4	8.9	11.0	13.6%	16.2%
Sub-Saharan Africa	23 of 39		16 of 39	7.6	11.3	14.8	21.6
Southeast Asia	4 of 5		4 of 5	8.1	9.4	10.8	12.7
South, Central Asia	6 of 8		7 of 8	7.8	8.1	19.4	19.6
West Asia	3 of 4		3 of 4	3.2	3.2	4.4	3.6
Latin America	14 of 16		11 of 16	7.5	8.2	12.5	13.8
TOTAL	53 of 76		45 of 76	7.5	9.5	13.9	17.3

^a Expressed in percentage points. The difference is between predicted birth attendance among households at the 75th percentile of the distribution of urban cluster means across clusters and birth attendance among households at the 25th percentile of this distribution.

^b Expressed in percentages of women with all births attended by a doctor, nurse, or trained midwife in the urban samples. The surveys for Ethiopia 1999, Niger 1998 and Philippines 1998 did not collect birth attendance data. Models for Armenia 2000, Jordan 1997, Kazakhstan 1995, Kazakhstan 1999, Kyrgyz Republic 1997 and Uzbekistan 1996 could not be estimated due to near-universal birth attendance by a trained professional.

Table 11 Summary of Estimates of Height for Age using Household and Cluster Average Factor Scores

Region	Cluster Positive and Significant	Score	Household Score Positive and Significant	Effects of Mean Cluster Score:			
				Absolute Difference ^a		Difference Relative to Mean ^b	
				All	Significant	All	Significant
North Africa	3 of 3		1 of 3	.174	.174	25.4%	25.4%
Sub-Saharan Africa	5 of 39		22 of 39	.107	.253	11.3	25.8
South, Central Asia	2 of 11		5 of 11	.151	.145	17.0	9.1
West Asia	2 of 5		3 of 5	.104	.181	21.7	39.7
Latin America	10 of 15		14 of 15	.182	.244	24.9	35.0
TOTAL	22 of 73		45 of 73	.132	.222	16.3	29.7

^a Expressed in percentage points. The difference is between predicted height for age among households at the 75th percentile of the distribution of urban cluster means across clusters and unmet need among households at the 25th percentile of this distribution.

^b Expressed in percentages of mean height for age in the urban samples.

6 Conclusions

This paper can be read as a progress report on a far-from-completed research agenda. We have found strong evidence that household living standards, as measured by confirmatory factor scores, exert substantial influence on the unmet need for modern contraception, birth attendance, and children’s height for age. The effects are generally statistically significant (not always, to be sure, but the fraction significant is strikingly similar to that for women’s education) and these effects are clearly of substantive importance. Our measures of living standards at the level of the cluster attained statistical significance less often, but when they were significant, these cluster effects were also found to be of substantive importance. To judge from our results, there is sufficient reason to believe that both dimensions of living standards can be important influences on health in the cities and towns of developing countries. It seems that the health of poor households can depend not only on their own circumstances, but also on the socioeconomic composition of their neighborhoods.

As our descriptive analyses have shown, the neighborhoods of poor households often contain considerable percentages of non-poor households, and even appreciable percentages of the affluent, with some 1 in 10 of a poor household’s neighbors typically being in the upper quartile of the urban distribution. This neighborhood heterogeneity in living standards has not been much remarked upon in demographic analyses of developing-country cities. To the extent that such heterogeneity brings social, economic, and political resources within the reach of the poor, it may suggest greater potential for neighborhood-based interventions than some might have thought. Perhaps there is more to the idea of “bridging” social capital than popular images of uniformly poor slums would indicate.

As we think about the meaning of the empirical results, it is worth remembering just how crude some of the key measures are. The concept of a living standard is measured only imperfectly by a few simple indicators $\{Z_k\}$ and determinants X . The concept of neighborhood is also very imperfectly measured by the use of DHS sampling clusters. We hope that the mismatches between neighborhood, a social construct, and sampling clusters, a statistical device, are not so great as to threaten the conclusions of this research—but we know of no direct evidence on this point. The notion of living standards at the neighborhood level is measured through sim-

ple averages of the household-level factors, and as we have noted, more could be done to strengthen this aspect of the econometric models.

Our conceptualization of neighborhood composition is also simplistic—more attention could be paid to their social composition, as reflected in the percentages of local residents who are educated, for example (Coleman 1988; Kaufman et al. 2002; Kravdal 2003). Theories of social and environmental interaction and externalities (Panel on Urban Population Dynamics 2003) indicate a need for the collection of social network and spatial data that will undoubtedly lie outside the responsibilities of the DHS program, and which will require new sorts of surveys to be fielded in the cities of developing countries. Much could be learned, we believe, through application to these cities of the conceptual and measurement tools being applied to poor urban communities in the United States. We would like to think that when relatively strong results emerge from models with rather weak measures, as they have here, more tightly-focused investigations might well turn up even stronger findings. But for the moment that is speculation.

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