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Individual and collective resources and health in Morocco

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Research Paper No. 2008/21

Individual and Collective Resources and Health in Morocco

Marie-Claude Martin*

March 2008

Abstract

The interaction between available individual and collective resources in the determination of health is largely ignored in the literature on the relationship between poverty and health in developing countries. We analyse the role public resources play in the perception that rural women in Morocco have of their health. These resources are taken to contribute directly and indirectly to the improvement of individual health by, on the one hand, providing a health-promoting environment and, on the other, improving the individual's ability to produce health. The empirical results of multilevel models confirm the expected associations between socioeconomic status, individual vulnerability factors and health. Furthermore, the random part of the model suggests that variation in state of health is also associated with the presence of collective resources. However, the higher the level of women's individual wealth, the less the characteristics of the community in which they live seem to be associated with their health, and the less the potential vulnerability factors seem to constrain their ability to maintain or improve health. Our results suggest that collective investments derived from various areas of activity will be more favourable to improving health, insofar as they are adapted to the initial capacity of women to benefit from them.

Keywords: health, poverty, rural, women, Morocco

JEL classification: H75, I19, I32

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Introduction

Poverty-reduction policies are considered to help improve the health status of poor populations. Indeed, individual level of income is thought to be associated with the capacity to adopt and choose a lifestyle and environment favourable to health; it is generally accepted that a decent level of income provides the protection necessary to maintain and produce an adequate level of health. However, on a more aggregate level, matters are different. For example, the relationship between the public resources available at the municipal or regional level and the health of the individuals in the municipality or region is not as well understood and is the subject of some debate. Some questions therefore seem to be in order: Can the protective effect on health provided by an individual's income be reproduced instead (or in addition) by the level of collective resources? Can the individual's capacity to produce health be increased or constrained by the presence or absence of appropriate collective resources given the level of individual resources? If yes, under which conditions?

In the literature, these questions tend not to be dealt with or are at best raised only indirectly. Several studies do measure the importance of place ('neighbourhood effect') (Macintyre et al., 2002; Macintyre et al., 1993) by introducing measures of composition, that is measures that reflect the distribution and concentration of individual characteristics in a given environment. Very often these include such measures as level of poverty or income inequality, employment levels, or racial profile. (Pickett and Pearl, 2001; Wilkinson et al., 1998; Kawachi et al., 1999; Kennedy et al., 1996; Townsend et al., 1988; Marmot et al., 1991; Deaton, 1999, 2001a, 2001b). Less often, policy variables that reflect the level and type of social and economic services and infrastructures offered in a community or a region (Lynch, 2000) are introduced directly. Studies of developing countries are even rarer and are generally limited to analysing the effects of infrastructures directly related to the risk of disease transmission, especially those involving potable water, sanitation and, to some extent, electricity and health services (Wang, 2003; Thomas et al., 1996; Lavy et al., 1996; Rosenzweig and Wolpin, 1982; van der Klaauw and Wang, 2004; Shi, 2000).

In developing countries, some communities, regions and segments of the population are particularly disadvantaged in terms of access to public resources, and the uneven availability of such resources may contribute to the development of health disparities. It may also act as a modifying factor with respect to the (accepted) associations between health and socioeconomic status as measured, for example, by income and education. It therefore seems worthwhile to consider the interactions between available collective and individual resources and capabilities in the production of health.

In exploring these questions of the contribution of public resources to women's capacity to produce better health and of the potential interactions between collective and individual resources and vulnerability factors, this article makes use of the theoretical proposals and analytic tools favoured by the human development approach (UNDP, 1990; Ranis and Stewart, 2000), social epidemiology and determinants of health (Frenk et al., 1994), health-production models (Grossman, 1972, 2000), and Sen's body of theoretical work on capabilities (1987). The capability approach provides a unique perspective since it recognizes the importance of considering the freedom that individuals have to convert public and private resources and instrumental capabilities such as education, into health and other benefits. It makes the distinction between access to resources and the freedom and the capacity to use them to achieve a set of

functionings. The production approach derived from Grossman's perspective (1972) enables us in addition to explore and formalize questions of productivity, technical effectiveness and interdependence between the two types of resources considered as inputs in the production of health.

Resources and health

There are deemed to be two pathways by which collective resources (public services and infrastructure) are associated with health status. The first is indirect: Access to and use of the resources make it possible to increase the productivity of individual health-production factors, particularly the level of education and income. The second pathway is direct: Collective resources, which are associated with a community's level of social and economic development, create a 'health-promoting' environment. In Morocco, for example, a project to improve access to water is reported to have yielded direct health benefits by significantly reducing the prevalence of diarrheal diseases among children less than five years of age.[1] It also had indirect and certainly longer-term benefits by considerably increasing school registration and retention rates for girls (Klees et al., 1999).

We have adopted a production approach in order to estimate the capacity of women at given levels of vulnerability to produce health with both their own resources and the collective ones available to them.

The model

The model is formulated such that the production of individual health, $\boldsymbol{H}_{ij}$, depends on a vector of independent variables of individual and family resources—education (I_{ij}) and a measure of wealth (Y_{ij})—and on the availability of collective resources in a given region j along with other population attributes ($\mathbf{z}_j$). The production of health also depends on initial conditions, represented by a vector of independent individual-vulnerability variables $\boldsymbol{A}_{ij}$, which affect the capacity of women to convert their own resources into health. The collective resources vector ($\mathbf{z}_j$) affects health production by increasing the productivity of individual resources, for example, through the introduction of a technological advance. For a given quantity of individual resources, the presence of collective resources thus increases the production of health. An individual's 'production technology' may then be written as: $H_{ij} = A_{ij} f_{ij}(I_{ij}(z_j), Y_{ij}(z_j))$; where f_{ij} may have a different functional for for each woman i.

The model thus points out the relative contributions of individual and collective characteristics and resources in the production of women's health, given individual vulnerability factors, and considers that the effectiveness of collective resources will depend on how well they fit with individual characteristics.

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1 The findings by Esrey (1996) for Morocco also suggest that access to a better source of potable water would improve health when combined with better health infrastructures.

The variables in the model

The variable of interest in the model, $\boldsymbol{H}_{ij}$, is health status as perceived by Moroccan women. Because of their vulnerability factors ($\boldsymbol{A}_{ij}$)—age,[2] number of children and diagnosed morbidity—which may affect the productivity of other inputs,[3] women do not all have the same ability to be healthy and to transform their resources into health.

Individual and family resources are captured by the socioeconomic status of women and households; the two measures used are education (I_{ij}) and their standard of living (Y_{ij}). The inclusion of more than one measure of individual socioeconomic status allows for a more robust estimation of the relationship between collective (or purely contextual) resources and health status (Pickett and Pearl, 2001).

Being educated is instrumental to achieve a given level of health. The higher the level of education, the better an individual can adopt or change to a healthy lifestyle, understand the risks associated with different behaviours, assimilate information of a medical nature, and follow prescriptions properly (Strauss and Thomas, 1995; Caldwell, 1979). As a direct input, education is a measure of knowledge, power and control (of lifestyle, fertility, etc.). Education is also an indirect input: It measures the capacity to seek out and use an optimal combination of inputs and resources conducive to health (Drèze and Sen, 1989) and to lower the price associated with investment in health through greater productivity (Leibowitz, 2004).

The second dimension of socioeconomic status, standard of living, captures the financial capacity to obtain goods and services that may be used to ensure, maintain or enhance a healthy environment, adequate nutrition, the seeking of care, etc. (Sastry, 1996; Strauss and Thomas, 1995; Case, 2002). It is generally accepted that there is a gradient between health and income, at least for women in developing countries and particularly in a middle-income country like Morocco (Gwatkin et al., 2000). Standard of living, like education, is also considered an indirect input in health production, since it affects access to and use of the various collective resources available.

We have selected a measure that reflects long-term wealth, as determined by household possessions, rather than one that captures seasonal or annual income and so may vary over a short span of time. The choice of such a measure is also warranted by the issue of endogeneity: A measure of possessions or wealth may be considered exogenous and thus not to vary as a function of women's health except in the event of a catastrophe in which a household would have to dispose of its assets to finance emergency care.[4]

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2 In a pure production model, age is a variable that affects the depreciation rate of the stock of health (Grossman, 1972).

3 These initial conditions are the equivalent of the initial stock of health in production models. Several studies deal especially with estimation problems associated with heterogeneity in initial health (individual fragility) (Rosenzweig and Schultz, 1983; Lee et al., 1997).

4 However, introducing a morbidity variable into the model allows one to at least partially control for endogeneity.

Table 1. Characteristics of sample and variables

Dependent variable: health status (HS)		
Good (n=551; 21.1%)	Fair (n=1434; 55%)	Poor (n=623; 23.9%)
Independent variables		
Variables (distribution)	Reference category (frequency)	Contrast category (frequency)
Women (n=2608)		
Age (Mean = 32.5; SD= 9.0)	Reference: 21 and + (n=2338; 89.6%)	15-20 years (n=270; 10.4%)
Children Mean = 4.2 ; SD = 3.2	Reference: 1 and + (n=2306; 88.4%)	No children (n = 302; 11.6%)
Education (literate or not)	Reference: No (n=2371; 90.9%)	Yes (n=237; 9.1%)
Reported morbidity	Reference: None (n=2014; 77.2%)	At least 1 (n=594; 22.8%)
Households (n=2170)		
Standard of Living (SoL)	Reference: Lowest (n= 790; 36.4%)	Low: (n=877; 40.4%) Middle: (n=336; 15.5%) High: (n=117; 5.4%) Highest: (n=50; 2.3%)
Communes (n=94)		
Primary schools per 100,000 inhabitants (Mean = 118; SD =64)	Reference: More than 150 schools (n=23; 24.5%)	From 86 to 150: (n=40; 42.6%) Fewer than 86: (n=31; 33%)
Health centres and dispensaries per 100,000 inhabitants (Mean = 12.5; SD=9.6)	Reference: More than 17 dispensaries (n = 19; 20.2%)	From 8 to 17: (n=44; 46.8%) Fewer than 8: (n=31; 33%)
Level of development	Reference: High (n=29; 30.9%)	Low (n=65; 69.1%)
Provinces (n=44)		
Poverty incidence (Mean=19.6; SD = 13.6)	Reference: Low (n=16; 36.3%)	High: (n=28; 63.7%)

Source: see text.

The standard-of-living measure is based on a factor analysis. A composite index is derived from different measures of possessions (telephone, kitchen range, etc.), housing characteristics (roofing and flooring materials) and the socioeconomic status of the head of household. This type of index is widely used in the literature on the subject (Filmer and Pritchett, 1998; Lindelow, 2004).

Since we are studying the hypothesis of a relationship between the availability of collective resources ($\mathbf{z}_j$) and health, the model uses measures of the availability (rather than use) of public goods and services. The measures are density of primary schools and of health centres per capita. Their proximity (or subsidized access) encourages their use by reducing the costs entailed.

The other collective resources, such as water, electricity and sanitation infrastructures, means of transport, institutions of law and order, are incorporated in a comprehensive measure of the development of the *commune* (the municipality). This indicator captures both the potential of a health-promoting environment (direct pathway) and the opportunities it offers for improving individual health-production capabilities (indirect pathway). Like women's standard of living, the level of development of the commune is a synthetic index based on a factor analysis.

Collective resources are associated with health independently of a commune's compositional characteristics, which are the result of the aggregation of individual

characteristics. The model also estimates the effects of collective characteristics that are not 'purely' contextual. We have introduced two such compositional measures: the incidence of poverty, as measured by the percentage of the population living below the rural poverty line, and a measure of income distribution in the commune.

The data are drawn from three sources: Ministère de la Santé (1999), Royaume du Maroc (1999), and Direction de la Statistique (2000a, 2000b), which lays out the public and private infrastructure for each of Morocco's municipalities. The characteristics of the sample and the distribution of the variables in the model are presented in Table 1.

Calculations

In light of the hierarchical structure of the databases, we have used a multilevel analysis for our empirical calculations for the model (Goldstein, 1995; Snijders and Bosker, 1999; Rice and Jones, 1997). The reconstituted database spans five hierarchically arranged levels: women, households, communes, provinces and regions. However, the model uses a three-level structure: women (*i*), communes (*j*) and regions (*k*). The first two and the last two units of observation were merged, and the structure of the observations was thus preserved.

Given the nature of the dependent variable, we have used an ordered multinomial logistic regression (Fielding, 2002; Fielding et al., 2003) to respect the underlying order in the scale of the women's responses, namely good, fair or poor perceived health.

All the calculations are based on a restricted iterative generalized least squares (RIGLS) procedure and a second-order approximation by penalized quasi-likelihood. The calculations were made using Version 1.1 of MlwiN (including the MULTICAT program for ordered multinomial models). The descriptive analyses were carried out with SPSS for Windows 11.5.

Results

Two series of results are presented here. The first deals with the complete sample and explores the associations between vulnerability, individual and collective resources and the perceived health status of women. The second explores more particularly the question of the interactions between the characteristics of women and those of the communes they live.

Table 2 sets out the results of the ordered multinomial model in five stages. The empty model includes only one random scale parameter with levels 2 and 3 to measure variations in health status between communes and regions. Models 1, 2 and 3 provide estimates of the fixed effects of individual (and household) variables and the presence of morbidity. Model 4 shows the fixed effects of the community variables, and model 5 is the final model. The coefficients, standard deviations and odds ratios are provided for each of the variables. The shaded odds ratios are associated with coefficients significant at a level of $p < 0.05$.

The reference population for all the models is uneducated women over 20 years of age who have children, whose relative standard of living is more than one half standard

Table 2. Ordered multinomial model of self-rated health

	Empty model			Model 1			Model 2			Model 3			Model 4			Model 5		
Responses	coef	se	cum P	coef	se	cum P	coef	se	cum P	coef	se	cum P	coeff	se	cum P	coef	se	cum P
HS_g	-1,52	0,20	0,18	-2,15	0,22	0,10	-1,34	0,19	0,21	-1,96	0,21	0,12	-1,1	0,26	0,25	-1,69	0,23	0,16
HS_f	1,29	0,20	0,78	0,83	0,22	0,70	1,55	0,19	0,82	1,01	0,21	0,73	1,11	0,26	0,75	1,35	0,23	0,79
Variables	coef	se	OR	coef	se	OR	coef	se	OR	coef	se	OR	coeff	se	OR	coef	se	OR
Age=20 years (ref:>20)				0,96	0,15	**2,61**				0,87	0,15	**2,39**				0,86	0,15	**2,36**
0 children (ref: 1 child or +)				0,95	0,14	**2,59**				0,88	0,14	**2,41**				0,88	0,14	**2,41**
Educated (ref: uneducated)				0,58	0,15	**1,79**				0,56	0,15	**1,75**				0,56	0,15	**1,75**
Standard of living (ref: NdV = μ-0.5 et)																		
NdV = μ + 3sd				0,85	0,31	**2,34**				0,91	0,31	**2,48**				0,95	0,31	**2,59**
μ+1.5sd <NdV< μ+3sd				0,67	0,21	**1,95**				0,67	0,21	**1,95**				0,69	0,22	**1,99**
μ+0.5sd=NdV= μ+1.5sd				0,57	0,14	**1,77**				0,55	0,14	**1,73**				0,56	0,14	**1,75**
μ-0.5sd <NdV< μ+0.5sd				0,25	0,1	**1,28**				0,27	0,1	**1,31**				0,29	0,1	**1,34**
1 morbidity (ref: none)							-1,01	0,1	**0,36**	-0,89	0,10	**0,41**				-0,87	0,10	**0,42**
Density of schools (ref: D= 150 schools per 100 000 inhabitants)																		
86 < D < 150													-0,3	0,18	0,74	-0,23	0,17	0,79
D = 86													-0,41	0,19	**0,66**	-0,39	0,17	**0,68**
Development index low (ref=high)													-0,22	0,13	0,80	-0,19	0,13	0,83
Incidence of poverty high (ref=low)													-0,2	0,15	0,82			
Variances																		
Level 2	0,21	0,06		0,19	0,05		0,2	0,05		0,16	0,05		0,19	0,05		0,15	0,05	
Level 3	0,46	0,21		0,49	0,22		0,38	0,17		0,41	0,18		0,42	0,19		0,34	0,16	
Like	4757.2			4160.7						3939.7			4752.6			3927.8		
ICC																		
ICC communes	0,05									0,04						0,04		
ICC regions	0,12									0,11						0,09		
Explained variance																0,12		
Unexplained variance																0,88		

Source: author's calculations.

deviation below the mean, and who have no reported morbidity. The reference population lives in communes with more than 150 primary schools per 100,000 inhabitants and more than 17 primary healthcare facilities per 100,000 inhabitants. The incidence of poverty in these communes is under 30 per cent, and the level of development is higher than the mean.

According to the results of the empty model, the median proportion of women reporting they are in good health is 18 per cent. Prevalence varies significantly between communes and between regions, thus warranting the three-level analysis.

Models 1 to 3 confirm the expected associations between the individual variables and perception of health. The vulnerability factors—age, number of children and reported morbidity—are strongly associated with the perception women have of their state of health. Controlling for the three vulnerability factors and education, which is also associated with the perception of good health, a strong relationship emerges between health and standard of living. The women high on the scale of the composite standard of living index (mean + three standard deviations) report they are in good health more frequently (OR: 2.48; 95 per cent CI: 1.35 to 4.56) than the other groups.[5]

Models 4 and 5 suggest that the density of primary schools is significantly associated with a perception of good health. Communes with a very low school density, fewer than 86 schools per 100,000 inhabitants, seem to differ from the high-density reference communes. No model, though, shows an association between perception of health and density of health centres and dispensaries or the other communal variables, such as the communal development index, incidence of poverty or inequality of income. We will discuss this result in more depth later.

The random part of the multinomial model confirms that a not insignificant part of the variation in health in rural Morocco is associated with characteristics other than individuals ones. The intraclass correlation coefficients are 0.05 and 0.12 for the communes and regions respectively. Given the structure of the estimation model, these coefficients must be interpreted cautiously, but they may suggest that 5 per cent and 12 per cent of the variance in health status stems from the variation between communes and regions.

The final multinomial model gives us correlation coefficients of 4 per cent and 9 per cent respectively, with the proportion of explained variance at 12 per cent. The unexplained proportion is 88 per cent, of which 73 per cent comes from individual characteristics. It is not surprising that this should be the case, since it is primarily individual factors, such as genetics, that are the most important source of heterogeneity in health (Wagstaff et al., 2001). Such factors often go unobserved in this type of analysis.

Interactions between individual and collective resources

In the second set of calculations, we explore the hypothesis that the characteristics of the communes in which the women live are not only associated with their health but

[5] OR: odds ratio; and CI: confidence interval.

also that the association varies to some extent with the level of the individual resources the women have at their disposal and their own capacity to use the available resources to achieve a desirable level of health. In other words, there are interactions between characteristics of the individual and those of the collectivity, especially access to public resources. For example, the poorest women may derive relatively greater benefit from the available collective resources than the wealthiest women if the resources are such that the poor can use and understand them. However, if the collective resources are too specialized or obviously too expensive, it is the more educated or wealthier women who will derive relatively greater benefit from them. To test this hypothesis, we disaggregated the total sample, breaking it down into four sub-samples defined by the composite standard-of-living index. We then ran the calculations for the complete sample, adding the interaction terms associated with the key variables tested with the sub-samples.

On the whole, in rural Morocco 21 per cent of women reported that their health status was good. The most affluent did so in a greater proportion than did women with the lowest standard of living; 35 per cent of the former and fewer than 14 per cent of the latter said their health is good, even though the incidence of morbidity for both groups is very similar. The proportion knowing how to read and write differs greatly depending on standard of living; 73 per cent of the wealthiest women are educated as opposed to only 2 per cent of the most disadvantaged ones. The proportion of women under 20 is the same in both groups, but there is a substantial difference between the wealthiest and poorest women in terms of the number who have no children. In addition, fewer than 3 per cent of women from the highest standard-of-living segment but nearly 45 per cent of the poorest women live in the 32 communes considered to have a low level of development. If we further refine the disaggregation of communes in terms of level of development and consider the six least developed of the 32, 93 per cent of their inhabitants fall into the most disadvantaged segment of the population.

Table 3 lays out the results of the ordered multinomial analysis of self-rated health by standard-of-living segment.[6] Morbidity is the only individual variable that presents a significant association with health for all segments. Still, the odds ratios demonstrate a marked spread from 0.85 for the wealthiest segment to 0.41 for the poorest. The odds ratios for the two other vulnerability variables, age and number of children, also display a wide spread: they are more than twice as high for the poorest segments as for the wealthiest ones. The negative effects of age and number of children seem to increase as standard of living falls. Education, meanwhile, is associated with the perception of health for the wealthiest segment.

The results with respect to the effects of communal resources are particularly interesting. Although there is no perfectly linear progression in the odds ratios, the less wealthy segments and the wealthier one still present a contrast. The greater the women's individual wealth, the weaker the association between the setting in which the women live and their health status. For the wealthiest segment, no collective resource is

6 The cross level interactions between standard of living and communal resources are not statistically significant for the sample as a whole, perhaps because of a number of factors, particularly the number of categories, the quality of the standard-of-living indicators and statistical power (Zhao and Bishai, 2003; Kreft, 1996).

Table 3. Multinomial model of self-rated health stratified by standard of living

	Stratum 1 "wealthy"			Stratum 2			Stratum 3			Stratum 4 "poor"			Total population		
Réponses	coef	se	cum P	coef	se	cum P	coef	se	cum P	coeff	se	cum P	coeff	se	cum P
HS_g	0,35	0,06	0,59	-0,45	0,32	0,39	-1,1	0,28	0,25	-1,56	0,24	0,17	-1,07	0,18	0,26
HS_f	0,86	0,06	0,70	2,39	0,35	0,92	2	0,28	0,88	1,69	0,24	0,84	1,93	0,19	0,87
Variables	coef	se	OR	coef	se	OR	coef	se	OR	coeff	se	OR	coeff	se	OR
Age≤20 years (ref:>20)	0,13	0,08	1,14	0,75	0,4	2,12	0,98	0,22	**2,66**	0,75	0,27	**2,12**	0,85	0,15	**2,34**
0 children (ref: 1 child or +)	0,05	0,07	1,05	0,72	0,35	**2,05**	0,98	0,21	**2,66**	0,95	0,26	**2,59**	0,87	0,14	**2,39**
Educated (ref: uneducated)	0,14	0,04	**1,15**	0,28	0,29	1,32	0,57	0,24	**1,77**	0,2	0,47	1,22	0,69	0,14	**1,99**
1 morbidity (ref: none)	-0,16	0,05	**0,85**	-0,96	0,26	**0,38**	-0,92	0,16	**0,40**	-0,88	0,17	**0,41**	-0,88	0,1	**0,41**
Density of schools (ref: D ≥ 150 schools per 100 000 inhabitants)															
86 < D < 150	-0,01	0,07	0,99	-0,73	0,37	**0,48**	-0,46	0,28	0,63	-0,49	0,25	**0,61**	-0,46	0,21	**0,63**
D ≤ 86	-0,07	0,07	0,93	-0,8	0,38	**0,45**	-0,86	0,29	**0,42**	-0,59	0,29	**0,55**	-0,62	0,22	**0,54**
Development index low (ref=high)	-0,14	0,12	0,87	-0,15	0,36	0,86	-0,36	0,22	0,70	-0,33	0,22	0,72	-0,44	0,18	**0,64**
Variance															
Level 2	0,16	0,01		0,46	0,19		0,61	0,15		0,44	0,13		0,47	0,09	
ICC															
ICC communes**	0,05	[]		0,12	[0,16]		0,16	[0,17]		0,12	[0,14]		0,13	[0,15]	

**** The intraclass correlation coefficient in square brackets is the coefficient associated with the empty model (without explanatory variables)**

associated with health; the odds ratios approach unity for each of the communal variables. The more limited the wealth of the individual, the more sensitive the health status becomes to setting and the stronger the relationship between the different collective resources and health. The ratios fall into a range of 0.4 to 0.6 for primary schools.

The presence of public resources, particularly primary schools, would therefore seem to be relatively more strongly associated with the health of poor women than wealthy ones. We should note, though, that this association does not necessarily seem to extend to the poorest segment, evidencing an accessibility problem for those who are most deprived. The level of development of the commune, as presented here, is a composite of several factors, each of which differs in its relative importance in the perception of health depending on the standard of living of the women. For the poorest, electricity and water-purification systems seem to be the most discriminant factors.

Our analyses suggest, moreover, that the results obtained regarding the respective contributions of individual and communal factors on health status by standard-of-living segment are similar to those that can be obtained when the sample is stratified on the basis of education. Since education is an instrumental capability to being healthy, we redid the previous analyses and obtained similar results. It is interesting to note that the income effect seems stronger for educated women, although the progression up the four income levels is not constant or significant. This result tends to support our hypotheses that the more educated women are, the more effectively income is used, allowing for better health production. Education thus interacts with resources and the vulnerability factors in the production function. Nonetheless, the association with standard of living is not negligible for uneducated women; to some extent, income seems to be a substitute for education for them.

No communal characteristics are apparently associated with the perception of health by educated women. For uneducated women, there is an association with both school density and level of development. It would seem that, in health production, the type of collective resources available might make up for these women's lack of formal education.

Discussion

With the specifications and form of the model we have adopted, empirical calculation does not allow us to explicitly determine the extent of the direct and indirect contributions of collective resources to the improvement of health. However, it does allow us to calculate the total 'effects' and their relative importance in explaining variations in state of health. Our results suggest that the presence and number of primary schools enhance their accessibility and use by reducing the relative cost they entail (proximity). The results suggest too that primary schools may respond appropriately to women's educational needs, help increase their general and specific level of education and consequently increase their effectiveness with regard to health production, or that the schools' proximity may allow women to allocate more time to other income-generating pursuits. The presence of such resources may also have a leverage effect, attracting other investments to the commune and increasing the potential for and diversity of jobs and sources of individual income. School density thus also seems to have an indirect effect on the perception of health by Moroccan women.

As for interactions between individual and collective resources, the results of the stratified analyses suggest that the quantity and diversity of available collective resources (particularly primary schools, but to some degree the level of development of the commune as well) affect the capacity to produce health, most especially for the most deprived or least educated women. The 'production technology' differs according to the characteristics of the women. For the poorest, availability and accessibility are critical and have to make up for the lack of individual resources, for the wealthiest, more specialized services and resources, which demand a minimal income or education level, will allow them to improve their state of health at the margin. One may thus suggest that the profile of the target population will determine whether the nature and quality of services are associated with population health.

This observation also contributes to explain at least partially why we found no association between health infrastructure and health status, as reported previously. It is an indication of a lack of access or a lack of quality of the services provided and it is central to the capability approach where no matter what the level of resources are, the capacity and the freedom to use them are non-existent. We should note though that this result could also be explained by the type of infrastructures considered and by using self-rated health rather than an indicator of ill health.

Although interactions between collective and individual resources do not seem to be significantly associated with health in the model with the total sample, our results do at least support the hypothesis of the additive effects of individual characteristics and certain contextual ones. The results suggest that the characteristics of each different segment of the population must be considered before one may conclude that there are no contextual effects associated with the presence of collective resources. Even in a relatively homogeneous population (like that of rural women), public investments may well affect the most deprived and the best off differentially. One can only imagine what may be overlooked with aggregate national- and international-level data.

The results also suggest that when we take into account the diversity among women and control for vulnerability factors (age and number of children) and initial state of health (presence of morbidity), standard of living remains an important determinant of health. Indeed, the results confirm the presence of a gradient, even within a population that is, by and large, as relatively homogeneous as that of rural women.

The results show too that income is more closely associated with the health status of the most educated women, suggesting that being educated may increase the effectiveness of individual health production. All things being equal, at equivalent income levels, one dirham would thus 'produce' more health for an educated woman than for an uneducated one.

It seems then that there are interactions between individual resources and vulnerability factors similar to the interactions between primary schools and individual resources. The results suggest, in fact, that experienced morbidity, age and number of children do not seem to affect the most and least affluent women in the same way. Income level and education apparently provide protection against individual risk factors.

Conclusion

These results suggest that any intervention that jointly tackles individual, family, communal, or regional mediators of women's socioeconomic status is likely to help improve their health. The results validate the proposition that individual resources contributes to improve health status and that individuals' freedoms to convert these resources into health depend on their vulnerability factors. Accessing collective resources, particularly the number of primary schools in our example, may also reinforce these capabilities. Any type of intervention that gives rise to greater individual and collective 'wealth' and capabilities may potentially make the environment more conducive to the production of health for individuals and the population. The results show, however, that, in choosing types of investments, consideration must be given not only to the health objectives but also to the initial conditions, that is, socioeconomic status and population vulnerability factors. The expected social benefits of public investments and collective resources will be that much greater if the capacity of individuals to access them—especially their capacity to internalize the return—is taken into account.

Our results also suggest that public resources from different spheres of activity may create positive externalities with respect to health since they can increase the capacity of individuals and populations to be healthy. It therefore seems important to consider and include health benefits in calculating the expected returns of public investments in areas of activity other than health, most notably education. Nor must we ignore the possibility that investments that seem to yield individual returns may also create positive externalities benefiting the whole community. For example, Alderman et al. (2003) have shown that educating women affects the health not only of their own children but of the children in their 'neighbourhood' as well. There are important implications here for national and international policies designed to achieve, for example, the Millennium Development Goals. The argument thus exists to treat these goals as inter-connected rather than 'silos', each left to the relevant sectoral specialists and tackled with 'targeted' policies.

Throughout his writings, Amartya Sen has emphasized at length the fact that a healthy population is not necessarily a wealthy one and that the level of economic development is a necessary but not sufficient condition for improving the community's health. There are a whole series of intervening factors. Of these, the way in which a society creates and distributes its resources, freedoms and social opportunities would seem to help explain its health status and inform us about the health disparities and inequalities in the society (Sen, 2002). Our results suggest that better access to individual as well as to certain types of collective resources contributes to the maintenance and creation of individual and social capabilities to produce and maintain a decent health status.

References

Alderman, H., J. Hentschel and R. Sabates (2003) 'With the help of one's neighbours: externalities in the production of nutrition in Peru'. *Social Science and Medicine*, 56: 2019-31.

Caldwell, J. C. (1979) 'Education as a factor in mortality decline: an examination of Nigerian data'. *Population Studies*, 33(3): 395-413.

Case, A. (2002) 'Health, income, and economic development'. *Annual World Bank Conference on Development Economics, 2001/2002*, Washington DC: World Bank, 221-41.

Deaton, A. (1999) 'Inequalities in income and inequalities in health'. *National Bureau of Economic Research, Working Paper* 7141. Cambridge, MA: NBER.

Deaton, A. (2001a) *Relative deprivation, inequality, and mortality*. Princeton University: Research Program in Development Studies and Centre for Health and Wellbeing.

Deaton, A. (2001b) 'Health inequality, and economic development'. *CMH Working Paper Series WG1:3.* The Commission on Macroeconomics and Health, Geneva: WHO.

Direction de la Statistique, Royaume du Maroc (2000a) *Enquête nationale sur le niveau de vie des ménages 1998/1999: Premiers résultats*. (ENNVM) [National Survey of Household Standard of Living]. Rabat.

Direction de la Statistique, Royaume du Maroc (2000b) 'La Base de données communales 2000' [Commune Database], *Annuaire Statistique du Maroc 2000*. Rabat, Maroc.

Drèze, J., and A. K. Sen (1989) *Hunger and public action*. UNU-WIDER Studies in Development Economics. Oxford: Clarendon Press.

Esrey, S. A. (1996) 'Water, waste, and well-being: a multicountry study'. *American Journal of Epidemiology*, 143(6), 608-23.

Fielding, A. (2002) 'Ordered category responses and random effects in multilevel and other complex structures: scored and generalized linear models'. In S. P. Reise and N. Duan (eds) *Multilevel Modeling: Methodological Advances, Issues, and Applications*. Mahwah, NJ: Erlbaum.

Fielding, A., M. Yang and H. Goldstein (2003) 'Multilevel ordinal models for examination grades'. *Statistical Modelling*, 3(2), 127-53.

Filmer, D., and L. Pritchett (1998) 'Estimating wealth effects without expenditure data- or tears: an application to educational enrollments in states of India'. *World Bank Policy Research Working Paper 1994.* Washington, DC: Development Economics Research Group (DECRG), World Bank.

Frenk J, J. L. Bobadilla, C. Stern, T. Frejka and R. Lozano (1994) 'Elements for a theory of the health transition'. In: L. C. Chen, A. Kleinman and N. C. Ware (eds) *Health and social change in international perspective*. Harvard Series on population and international health, Harvard: Harvard University Press.

Goldstein, H. (1995) *Multilevel statistical models*. London: Edward Arnold.

Grossman, M. (1972) 'The demand for health: A theoretical and empirical investigation'. *National Bureau of Economic Research, Occasional paper* 11. Cambridge, MA: NBER.

Grossman, M., (2000) 'The human capital model'. In: A. J. Culyer and J. P. Newhouse (eds) *Handbook of Health Economics*, vol. 1A: 347-408. Amsterdam: Elsevier.

Gwatkin, D. R., S. Rustein, K. Johnson, R. P. Pande and A. Wagstaff (2000) *Socio-economic differences in health, nutrition, and population in Morocco*. HNP/Poverty Thematic Group of the World Bank. Washington DC.

Kawachi, I., R G. Wilkinson and B. P. Kennedy (1999) 'Introduction'. In: I. Kawachi, B. P. Kennedy and R. G. Wilkinson (eds) *The society and population health reader: income inequality and health*. New York: The New Press.

Kennedy, B. P., I. Kawachi and D. Prothrow-Stith (1996) 'Income distribution and mortality: cross-sectional ecological study of the Robin Hood Index in the United States'. *British Medical Journal*, 312: 1004-7. And erratum: *British Medical Journal, 1996*, 312: 1253.

Klees, R., J. Godinho and M. Lawson-Doe (1999) *Health, sanitation and hygiene in rural water supply and sanitation projects and other World Bank-financed projects*. Washington: World Bank, ECA Regional Studies Program.

Kreft, I. G. G., (1996) 'Are multilevel techniques necessary? An overview, including simulation studies'. Retrieved March 2005 from California State University website.

Lavy, V., J. Strauss, D. Thomas and P. de Vreyer (1996) 'Quality of health care, survival and health outcomes in Ghana'. *Journal of Health Economics*, 15: 333-57.

Lee, L-F., M. R. Rosenzweig and M. M. Pitt (1997) 'The effects of improved nutrition, sanitation, and water quality on child health in high-mortality populations'. *Journal of Econometrics*, 77: 209-235.

Leibowitz, A. A. (2004) 'The demand for health and health concerns after 30 years'. *Journal of Health Economics*, 23: 663-71.

Lindelow, M. (2004) 'Sometimes more equal than others. How health inequalities depend on the choice of welfare indicator'. *World Bank Policy Research Working Paper* 3329. Washington DC: World Bank.

Lynch, J. W. (2000) 'Income inequality and health: expanding the debate'. *Social Science and Medicine*, 21: 1001-5.

Macintyre, S., A. Ellaway and S. Cummins (2002) 'Place effects on health: How can we conceptualise, operationalise and measure them?' *Social Science and Medicine*, 55: 125-39.

Macintyre, S., S. McIver and A. Sooman (1993) 'Area, class and health: should we be focusing on people or places?'. *Journal of Social Policy*, 22: 213-34.

Marmot, M. G., G. Davey-Smith, S. Stansfield, C. Patel, F. North and J. Head (1991) 'Health inequalities among British civil servants: the Whitehall II study'. *Lancet*, 337: 1387-93.

Ministère de la Santé, Royaume du Maroc (1999) *Enquête nationale sur la santé de la mère et de l'enfant (ENSME) 1997*, [Survey of Mother and Child Health], Ministère de la Santé, direction de la planification et des ressources financières, service des études et de l'information sanitaire et PAPCHILD.

Pickett, K. E. and M. Pearl (2001) 'Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review'. *Journal of Epidemiology and Community Health*, 55: 111-22.

Ranis, G., and F. Stewart (2000) 'Strategies for success in human development', *QEH Working Paper Series*, (32), Oxford: Queen Elizabeth House.

Rice, N., and A. Jones (1997) 'Multilevel models and health economics'. *Health Economics*, 6: 561-75.

Rosenzweig, M. R., and K. I. Wolpin (1982) 'Governmental interventions and household behavior in a developing country', *Journal of Development Economics*, 10: 209-25.

Rosenzweig, M. R. and T. P. Schultz (1983) 'Estimating a household production function: Heterogeneity, the demand for health inputs, and their effects on birth weight'. *Journal of Political Economy*, 91(51): 723-46.

Sastry, N. (1996) 'Community characteristics, individual and household attributes, and child survival in Brazil'. *Demography*, 33(2): 211-29.

Sen, A. (1987) *Commodities and Capabilities*. New Delhi: Oxford University Press.

Sen, A. (2002) 'Why health equity?' *Health Economics*, 11: 659-66.

Shi, A. (2000) *How access to urban potable water and sewerage connections affects child mortality*. Development Research Group. Washington, DC: World Bank. Online at: http://www.worldbank.org. (15.2.2008)

Snijders, T. A. B., and R. J. Bosker (1999) *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage.

Strauss, J. and D. Thomas (1995) 'Human resources: Empirical modeling of household and family decisions'. In: J. Behrman, and T. N. Srinivasan (eds) *Handbook of Development Economics*, vol 3A. Amsterdam: Elsevier.

Thomas, D., V. Lavy and J. Strauss (1996) 'Public policy and anthropometric outcomes in the Côte d'Ivoire'. *Journal of Public Economics*, 61: 155-92.

Townsend, P., N. Davidson and M. Whitehead (1988) *Inequalities in health*. London: Penguin.

United Nations Developent Programme (UNDP) (1990) *Human development report 1990: Concept and measurement of human development*. New York: Oxford University Press.

van der Klaauw, B. and L. Wang (2004) 'Child mortality in rural India'. *World Bank Policy Research Working Paper* 3281. Washington DC: World Bank.

Wagstaff, A., P. Paci and H. Joshi (2001) 'Causes of inequality in health: Who you are? Where you live? Or who your parents were?' *World Bank Working Paper* 2713. Washington, DC: World Bank.

Wang, L. (2003) 'Determinants of child mortality in LDCs: Empirical findings from demographic and health surveys'. *Health Policy*, 65: 277-99.

Wilkinson, R. G., I. Kawachi and B. Kennedy (1998) 'Mortality, the social environment, crime and violence'. In: I. Kawachi, B. P. Kennedy, and R. G. Wilkinson (eds) 1999 *The society and population health reader: Income inequality and health*. New York: The New Press.

Zhao, F. and D. Bishai (2003) *The interaction of community factors and individual characteristics on child height in China*. Research report. World Bank and Johns Hopkins University. Available online at: http://paa2004.princeton.edu/abstract Viewer.asp?submissionId=42185 (15.2.2008).