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Health effects of health policies in Burkina Faso

by

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Abstract

In this paper I explore the possible effects of health policies in Burkina Faso on the health status of its population. Relations between health indicators for mothers and their young children and their determinants are estimated using data from a recent Demographic and Health Survey. Of the determinants, general education, the supply of safe water and sanitation, and the provision of health care can be influenced by health policies. In absence of price data the estimated equations include proximity indicators for health care facilities, for which three specifications are tried, but the results show only modest to low influence of these indicators. According to the estimations, better living standards have a positive impact on the nutritional status of mother and child, and reduce the prevalence of illness among children. Education of the mother positively influences her nutritional status and that of her young children, but does not seem to affect their illness frequency. Safe drinking water is positively related to the nutritional status of mothers and children, but its effect on illness of children is unclear. Toilet facilities do not seem to have any impact at all. Also a positive effect of health care on health is hard to establish, and health status is positively correlated to a few types of facilities only. Effects of private health facilities seem more pronounced than those of public ones, but may be biased due to selectivity. Of all vaccinations, only those against measles reduce the illness frequency of young children.

Section 1
Introduction[1]

Good health is considered an important determinant of economic development, contributing to the labor power of adults and the physical and intellectual growth of children. Actual health status in most African countries, including Burkina Faso, is rather low, even compared to other low-income countries. For example, in Burkina Faso of each 1000 newborn children in 1999 210 will probably die before the age of five and in Sub-Saharan Africa on average 161. These mortality rates are considerably higher than the average of 116 per 1000 for all low-income countries, while in high-income countries it has been reduced to a mere 6. For adults the probability to die between the ages of 15 and 60 is 53.6% in Burkina Faso and 47.6 % for Sub-Saharan Africa as a whole, significantly higher than the average of 27.3% for all low-income countries and of 9.4% for high-income countries (World Bank, 2001).

Individuals can to a large extent influence their own health through their consumption of food, hygiene and health care. Still, ample scope exists for the promotion of good health by government activities, which can be distinguished in four broad policy areas. First, the dissemination of health knowledge through education or information campaigns. Second, the prevention of communicable diseases by for example vaccinations and reduction of non-human disease carriers. Third, the supply of health infrastructure such as networks for safe drinking water and sanitation. Fourth, the education of health experts such as physicians and nurses and the supply of health care facilities.

In this paper, I investigate the health determinants in Burkina Faso, using the available information of the Demographic and Health Survey (DHS) of 1993 (INSD, 1994), to find evidence of to what extent the health status of the population is affected by policies in these four areas. Advantages of the Demographic and Health Surveys are that they are available for many developing countries, that the data are widely accessible, and that they include some objective health indicators and often also information on the supply of health care. Disadvantages are that, despite its name, a DHS does not contain much information on health of adults, while economic data on incomes and prices are almost absent. Still, relevant data are available on the health status of young children and their mothers, and on the drinking water source and the toilet type, while features of the house and the types of household items owned can approximate living standard. Though no complete information is available on the user costs of health care, the distance to the different types of health care facilities can be used to take at least the travel costs to health care into account.

A large literature exists on determinants of health, but to my knowledge this is the first study for Burkina Faso. Of course, many results found in studies for other countries are also relevant to Burkina Faso, and earlier examples for neighboring countries include Thomas, Lavy and Strauss (1996) for Cote d'Ivoire, and Asenso-Okyere, Asante, and Nubé (1997) and Lavy, Strauss, Thomas and de Vreyer (1996) for Ghana. However, since the organization of health care is rather country specific, results for other countries on the effectiveness of health care can not be applied to Burkina Faso without further study. This paper includes the availability of health care facilities explicitly in its investigation of health determinants in

[1] The paper is prepared for a workshop of the Human Resource Development project of the SADAOC research program, to be held in December 2001 at Lomé, Togo.

Burkina Faso. The DHS 1993 seems to be the only recent survey containing information covering all four health policy areas, including health care supply[2].

Strauss and Thomas (1995) provide a recent overview of the empirical literature on health demand by households and its determinants. In their overview, they first of all discuss the measurement problems for health indicators, and in particular the possible, positive relationship in survey data between self-reported health status and education or use of health care, which leads to biased estimates. This relation may also hold for a narrowly defined health indicator as number of days too ill for normal activities, though people in the higher income groups, generally better educated and using more health care, now have higher opportunity costs of illness. Schultz and Tansel (1992) report for instance a positive influence of primary education on days ill or inactive in survey data for Cote d'Ivoire and Ghana, but this effect is not found at higher education levels, except for women in Ghana with secondary or higher education. Anthropometric indicators of nutritional status are supposed to be less biased in this respect, and can also be used as health indicators.

Main determinants of child health found in the literature are household characteristics such as living standard and parental education, especially that of the mother. Positive effects of education are in particular reported for child mortality and anthropometry. Available evidence also indicates that the mother's education has its largest effect during the child's first years (Thomas, Strauss and Enriques, 1990; Sahn and Alderman, 1997). Very young children seem to depend more on the quality of the mother's care, while older children are more affected by the general household living standard. Other, possibly unobserved, household factors may however, confound the positive effect of parental education. For instance, Thomas and Strauss (1991) argue that not education itself but rather access to information from newspapers and television benefits child health. On the effect of education on adult health considerable less studies exist than those concerning children, but several report a positive effect of own education also. For instance, a positive effect on BMI is found in survey data for Cote d'Ivoire (Thomas, Lavy and Strauss, 1992), though this effect largely disappears after controlling for household resources.

With respect to the household living standard, child mortality and height is in the literature found to be positively affected by household resources, while in for example Cote d'Ivoire and Ghana also adult BMI is positively related to household expenditure level (Thomas, Lavy and Strauss, 1992; Nubé, Asenso-Okyere and van den Boom, 1998). The possible endogeneity of household living standard is an important technical concern in empirical work, since household decisions on income, expenditures and health are typically taken jointly, while better health can promote labor earnings, and thus income and expenditures. Furthermore, living standard indicators may show serious collinearity with variables that may influence health more directly, such as availability of safe water, sanitation and waste disposal and the proximity to health care facilities.

Community health infrastructure for health care, safe water and sanitation are another main category of health determinants mentioned in the literature. Unfortunately, it is difficult to draw general conclusions on their impact on health outcomes. For instance, Thomas, Lavy and Strauss (1996) report positive effects of some health services and the availability of drugs on child height and weight in Cote d'Ivoire, but they also show negative effects of other indicators, which are not easily explained. Lavy, Strauss, Thomas and de Vreyer (1996) report similar results for Ghana. The unobserved quality of health care facilities may play a

[2] Neither the more recent DHS 1998-99 for Burkina Faso, nor the Priority Survey of 1995 contain data on availability of health care facilities.

role in these mixed results, since it is often only partially or not at all measured. Several estimates of the impact of safe water and sanitation exist in the literature, showing a lowering impact on child mortality and diarrhea incidence. Again, a possible endogeneity of community resources may be a concern if health infrastructure is targeted to areas with more severe health problems or if people move intentionally to areas with better health infrastructure.

With respect to technical aspects in the literature on health determinants, much attention is paid to the treatment of possible endogeneity of explanatory variables (Jones, 2000). Many studies apply either an Instrumental Variables approach or a Fixed Effects approach to take possible endogeneity explicitly into account, but both methods have problems. It is often not simple to find appropriate instrumental variables, that can be assumed not to be correlated to the error term in the main relation and at the same time show sufficiently large correlation with the possibly endogenous variable. If either of these requirements is not satisfied, estimation results will still be biased and may even get worse. Fixed effect methods try to eliminate unobserved heterogeneity, but through taking differences or introducing dummy variables significant correlation with the explanatory variables becomes much harder to establish. Next to possible endogeneity, selectivity of the sample may also pose technical problems. Pitt (1997) and Lee, Rosenzweig and Pitt (1997) have explicitly corrected for a possible bias due to selective fertility and child mortality, but they found this bias to be small.

The rest of the paper is set up as follows. The next section discusses the empirical model, section three discusses the empirical findings on model variables and their relations, and section four concludes.

Section 2
The model

To explore the specification of empirical relations concerning health, the standard individual utility maximization model is extended with an explicit incorporation of health, health production and the occurrence of health events.

$$\max_{x_i^o \geq 0, x_i^h \geq 0, h_i} u_i(x_i^o; h_i)$$

subject to

$$p^h x_i^h + p^o x_i^o \leq m_i(h_i) + \mu_i$$

$$h_i = h_i(h_{i,-1}, e_i, x_i^h, x_i^o)$$

$$e_i = e_i(h_{i,-1}, x_i^h, x_i^o)$$

The utility function $u_i(.)$ now depends explicitly on health status h_i, and illness is assumed to reduce well-being and utility from consumption. Commodities are distinguished in two groups, health inputs x^h and other commodities x^o, with corresponding prices p^h and p^o. Health inputs can influence the health status but no utility is directly derived from their consumption. Other commodities give utility as usual and may also influence the current or future health status as side effect. Next to a utility effect of health, the model also includes a productivity effect of health. Illness may reduce labor productivity and thus earned income $m_i(.)$, which depends explicitly on the health status. Other income is fixed by assumption. The health status itself depends on the status in the preceding period and the occurrence of health events e_i such as illnesses or injuries during the period, as well as on consumption of health inputs and other commodities. The way these factors affect the individual's health status will depend on his or her knowledge on health and this relation is specific for the individual. The occurrence of health events is in principle a stochastic process, which is influenced by the previous health status and the consumption of health inputs and other commodities. Though in the model formulas for health status and health event occurrence all health inputs are included, illness prevention is typically effective in the latter and illness treatments in the former.

The observed health status of an individual is in an economic sense considered as demand for health. The introduction of the dependence of income on health in the model is comparable to the dependence of income on consumption in the efficiency wage theory, and implies unfortunately that standard duality results do not apply anymore. However, without explicit analytical justification, we will assume that an individual's demand for health (d^h) depends on income and prices, as well as on characteristics of the individual (z_i), her household (z_f) and her community (z_c), including her health knowledge, her previous health status and her health environment:

$$d_i^h = f(p^h, p^o, \mu_i; z_i, z_f, z_c)$$

To investigate the determinants of health, including those possibly affected by policies, empirical estimations are made of health demand as well as of illness probability. The illness

probability (the $e_i(.)$ function) is a technical relation and is estimated in a structural form. In contrast, the demand for health is a derived relation and estimated in a reduced form.

The data of a Demographic and Health survey do not allow estimation of health demand or illness probability exactly according to the theoretical considerations, if only because they do not include the necessary price and income information. Fortunately, sufficient information seems available that allows for an empirical investigation of the relations between health indicators and several main determinants, as shown in Table 1. This selection of DHS variables uses all information available in the survey and covers all mentioned health demand variables[3], though sometimes only to a limited extent.

Table 1. Correspondence between health variables and DHS variables

Health variable	Variable in Demographic and Health Survey
Health status	Body Mass Index of mothers of young children, Height for Age of young children, Weight for Height of young children, Illness frequency of young children
Health knowledge	Years of education of mother
Health input demand	Vaccinations
Health infrastructure	Source of drinking water, Toilet facility
Health care prices	Distance and travel time to health care facilities
Living standard	Main floor material, Number of types of household items

Three health indicators refer to nutritional status: the Body Mass Index (BMI) of mothers of young children, and the Height for Age and Weight for Height indicators of young children. These data are available for the youngest three children below the age of five and their mother. The mother's BMI and the Weight for Height indicator both indicate the short-term nutritional status, whereas the Height for Age indicator refers to the long-term nutritional status. The nutritional indicators for children are given as z-scores, as relative deviation from the median of an international standard distribution. Illness frequency refers to the share of children with diarrhea, fever or cough in the two weeks before the survey interview. These data are also used to estimate illness probability.

The health knowledge of the mother is approximated by her years of education, assuming implicitly that formal education has taught her on health topics and has made health information in general more accessible and acceptable to her.

Health input demand concerns vaccinations of young children. This demand is assumed to be endogenous for the household, and will be used only in the structural form estimation of illness probability of children, but not in reduced form estimations of health demand. Of course, health status of children may depend on their vaccination status, but the latter is assumed, like other health inputs, to be determined by health knowledge, health care prices and livings standard of the household.

The probability of occurrence of health events is related to the health infrastructure used by the household, such as the source of drinking water and the toilet facility. A better quality of drinking water source or toilet facility is thought to reduce health hazards. The different categories used in the survey data for these facilities are ordered according to presumed hygienic level, as shown in Table 2 from low to high. In the ordering of the

[3] Another health indicator that can be derived from the DHS data, the share of children that died before reaching the age of five, has not been included in the research.

drinking water sources it is assumed that surface water is least safe, while water in wells can be protected somewhat from contamination, especially private wells. A piped water system can supply safe water, but tap water quality is in practice not always safe, as many travelers have experienced. In rural areas without piped water system, tap water concerns water from a household reservoir fed with rain or ground water, which may not be completely safe also. Water from public taps may be fetched some time before its actual use in which time the hygienic quality may deteriorate. The same argument applies to water from tanks. Bottled water is a safe drinking water source, but the number of households reporting this as their main source of drinking water was too small to justify a separate category.

The drinking water source and toilet facility used are not completely exogenous to the household, since it is the water source or toilet facility chosen by the household from the options available in their neighborhood, depending on infrastructure such as a well, a piped water system or a sewerage system. Unfortunately, information on these options is not directly available, only on the main water source and main toilet type in the community as reported by a community spokesman. However, this information considered unreliable since a comparison showed several discrepancies between this information and that reported by the households. Moreover, data at cluster level shows that in almost all urban clusters tap water is available, while in almost all rural clusters a public well is present, but no tap water. An cluster indicator of available water infrastructure derived household data would thus become almost an urban-rural dummy variable.

Table 2. Health infrastructure ordered by hygienic level

Level	Types of drinking water sources	Level	Types of toilet facilities
1	Spring, river, stream, pond, lake, dam, rain	1	No facility, bush
2	Public well	2	Traditional pit toilet
3	Well in residence	3	Ventilated improved pit latrine
4	Public tap, tanker truck	4	Shared flush toilet
5	Tap in residence, bottled water	5	Own flush toilet

The costs of using health care facilities are not known in the DHS, but in the 1993 survey for Burkina Faso information on access to health facilities is included in the community questionnaire data. This information has for our analysis been linked to the individual data for women in the age group 15-49. Access to health facilities is measured by distance and travel time to 11 types of health facilities. For the econometric analysis, proximity indicators to health facilities and services are constructed, which range from zero to one. Distant facilities are indicated by (almost) zero, since their influence of the health status will be negligible, while nearby facilities have an indicator of (almost) one. The proximity indicators represent the travel costs to the health facilities, and several assumptions are possible on how these costs correspond to distance and travel time. The three used functional forms are shown in the Table 3, which have been specified to have only few parameters, while taking (almost) the value one for zero distance and to become infinitesimal small for large distances.

Table 3. Alternative proximity indicators for health care facilities

Type	Formula	Comment
Proportional	1 – distance / 100	Travel costs are assumed to increase proportional with distance
Inverse	1 / (1 + .max(distance – , 0))	Travel costs are assumed to increase more than proportional above a certain threshold
Logistic	1 / (1 + exp (.distance – 5))	Differences in travel costs at small or large distances count less[4]

Health policy in Burkina Faso during the survey period aimed at organizing public health facilities in four types of increasing quality level, covering in order primary health posts, basic health facilities, district medical centers and hospitals. Other types of public facilities such as for mother and childcare were to be merged in this structure. Besides the public facilities, private health care facilities exist in Burkina Faso such as clinics, practices and pharmacies. In the analysis, the public and private facilities are grouped according to their quality level as shown in Table 4.

Table 4. Classification of health facilities in DHS Burkina Faso

Level	Typical treatments	Typical staff	Included health facilities
Primary health post	Advice, practical aid	Health agent, midwife	P.S.P, Health worker
Basic health center	Simple treatments	Nurse, midwife, health agent	C.S.P.S., S.M.I., Public health center, Pharmaceutical depot
District medical center	Common treatments	Physician, nurse etc.	C.M.A., Private practice, Pharmacy
Hospital	Specialized treatments, inpatient facilities	Specialists, nurses etc.	Public hospital, Private clinic

Finally, the indicators of the household living standard are only approximate.[5] The survey includes questions on the quality of the house and ownership of household items, which combined may yield an indication of the wealth of households in low-income countries. They refer to the main floor material of the house, the use of electricity, and the ownership of a radio, television or refrigerator, a bicycle, motorcycle or car. Two indicators are derived, one for the floor material and one for household items. The floor material indicator classifies the survey categories according to quality level as shown in Table 5.

Table 5. Types of main floor material, Burkina Faso, 1993, classified to quality

1	Earth, sand
2	Dung
3	Cement
4	Parquet, polished wood, vinyl, asphalt strips, ceramic tiles, carpet, other

[4] The value of 5 has been chosen because the logistic function 1/(1+exp(x)) covers almost its complete range [0,1] for values of x between –5 and +5.

[5] Sahn and Stifel (2000) follow a totally different approach in estimating living standards by using factor analysis to derive an asset index from DHS data for several African countries.

The indicator of household items is the number of types of household items, where the use of electricity is considered to be an ‘item’ also. It indicates the different types of household items that a household owns, not the actual number of items since a household may have several bicycles or radios.

Section 3
Empirical findings

In this section a description is given of the variables included in the analysis, their bi-variate relation with the health indicators, and the results of multi-variate econometric analysis. All data refer to the sub-sample of women with at least one child below the age of five, for which the used health indicators are available. While the whole sample of women aged 15-49 has size 6354, the sub-sample of mothers of young children for which health data are known covers 3318 women, a little more than half of the total. The figures presented are at least representative for mothers of young children, their children and the households they live in, but not necessarily for all women of age 15 to 50. By selecting only women with young children in the sub-sample, women with more children may be over-represented, since they have a larger probability of having a young child at the time of the survey.

The sub-sample appears to contain relatively more women in rural areas. Where the survey sample has 57 percent women in rural areas, the sub-sample shows 64 percent of mothers with young children living in rural areas. When the sub-sample is compared to the total sample with respect to the features discussed in this section, it appears that for rural areas the results are quite similar. The data presented here for rural areas can thus be considered representative for the whole rural survey sample also, and hence for the rural areas of Burkina Faso. In urban areas, some clear differences emerge: mothers of young children have less education, lower quality health infrastructure, live somewhat further from health facilities and have a lower living standard than the women of age 15 to 50 who did not have a young child at the time of the survey.

3.1 Description of the model variables

Body Mass Index

About one out of seven mothers of young children was undernourished (BMI below 18.5) at the time of the survey in 1993, while the Body Mass Index for another quarter of the mothers was just sufficient (between 18.5 and 20), see Table 6. In urban areas, the nutritional status of the mothers is slightly more favorable with only one out of ten mothers being undernourished.

Table 6. Body Mass Index of mothers with young children, Burkina Faso, 1993 (in percent)

	Rural	Urban	Country
Below 18.5	15.4	9.7	14.4
18.5 – 20	24.5	18.4	23.6
20 – 25	55.1	53.0	54.7
25 – 30	3.9	14.8	5.6
Above 30	1.2	4.0	1.6

Source: DHS 1993 Burkina Faso

Height for Age, Weight for Height

One third of the young children in the survey is chronically undernourished, indicated by a height for age under the cut-off point (-2SD) of twice the standard deviation below the median of the international reference population used in the DHS (see Table 7). Again, in urban areas the situation is slightly better with one out of five children chronically undernourished. A clearly smaller part of the young children suffered from acute undernourishment (weight for height below –2SD) at the time of the survey: 13.2 percent for the country as a whole and 9.7 percent in urban areas.

Table 7. Nutritional status of young children, Burkina Faso, 1993 (in percent)

	Rural	Urban	Country
Height for Age			
Below –3 SD	14.4	5.9	13.0
Between –3 and –2 SD	21.5	13.9	20.3
Weight for Height			
Below –3 SD	3.1	1.2	2.8
Between –3 and –2 SD	10.7	8.5	10.4

Source: DHS 1993 Burkina Faso

Illness frequency

About 44 percent of the young children showed illness symptoms (diarrhea, fever or cough) in the two weeks before the survey interview, both in rural as in urban areas, as shown in Table 8. Fever was the most common illness symptom. It is also more frequent in rural areas than in urban, while for the other two symptoms (cough and diarrhea) differences between rural and urban areas are small.

Table 8. Illness frequency of young children, Burkina Faso, 1993 (in percent)

	Rural	Urban	Country
Ill	44.7	43.6	44.4
Diarrhea	17.6	16.7	17.3
Fever	31.1	25.0	29.1
Cough	27.2	26.0	26.8

Source: DHS 1993 Burkina Faso

Education

Women with young children in Burkina Faso have very little education, see Table 9. In rural areas most have no (formal) education at all, few have followed some years of basic education, and very few have more than 6 years of education. The situation in the urban areas is somewhat better, but still more than 60 percent of the mothers have no education at all, while only one out of six has more than 6 years of education. Both in rural and urban areas ample scope exists to increase the level of education of women.

Table 9. Education of mothers of young children and health indicators, Burkina Faso, 1993

Years of Education	Population share in percent		Mean of health indicators			
	Rural	Urban	BMI	HfA	WfH	Illness
None	92.3	61.0	20.96	-1.31	-0.41	52.1
1 – 3	2.5	7.2	21.66	-0.98	-0.57	46.2
4 – 6	4.3	16.1	22.60	-0.84	-0.49	53.6
7 – 9	0.6	6.6	23.25	-0.56	-0.41	52.4
10 – 12	0.3	5.5	22.79	-0.23	-0.57	54.8
13 or more	0.1	3.6	25.05	0.19	-0.49	52.0

BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height, Illness = Illness frequency (%)
Source: DHS 1993 Burkina Faso

The mother's mean BMI increases roughly with her years of education, as shown in the table, and the same holds for the long-run nutritional status of her children. This supports the idea that a better educated woman has more health knowledge and knows better to sustain a good health for herself and her children. However, the short-run nutritional status of her children and their illness frequency seem hardly related to her educational level.

Vaccination

The vaccination scheme for young children in Burkina Faso comprised at the time of the survey a BCG vaccination against tuberculosis, three vaccinations against DPT (diphtheria, pertussis, tetanus) and polio, and finally a vaccination against measles. The World Health Organization recommends that these eight vaccinations be given during the first year of life. According to DHS data, practice in Burkina Faso falls somewhat short of this goal. In urban areas, children receive their vaccinations typically in the first 18 months of their life, while children in rural areas receive vaccinations up to the age of 3. Also coverage among children of age 3 and 4, who hardly receive vaccinations anymore, is not complete (see Table 10). In urban areas, 71 percent of these children is fully vaccinated, but 13 percent have received only half or less than the recommended vaccinations. In rural areas, the vaccination level is even lower. Half of the children of age 3 or 4 are fully vaccinated, but a quarter have received only half or less of the recommended vaccinations. Vaccination is thus in 1993 already widespread in Burkina Faso, but coverage is still far from complete, even in urban areas.[6] The impact of vaccinations on illness amongst young children is, however, not very clear from Table 10.

Table 10. Vaccination and illness frequency of children age 3 and 4, Burkina Faso, 1993 (in percent)

	Population share in percent		Illness frequency
Number of vaccinations	Rural	Urban	In percent
0	12.5	4.0	33.1
1-4	12.8	9.0	43.6
5-7	24.6	15.6	40.4
8	50.1	71.4	41.8

Source: DHS 1993 Burkina Faso

[6] The level of vaccination appears correlated to the household living standard and the mother's education. Children with few vaccinations live more often in poorer households and have more often mothers with little education. However, even among the poorest households and amongst mothers without any education, about half of the children is fully vaccinated.

Health infrastructure

In rural Burkina Faso public wells are the main source of drinking water, as shown in Table 11. Some households have their own well, but water from a public or own tap is only used by 5 percent of the rural households. In urban household with mothers of young children, taps of piped water systems are the main drinking water source, either public taps or own taps in the residence. Still, about a quarter of the urban households use less safe water sources such as wells.

In almost all urban clusters included in the survey, a considerable share of the surveyed households uses either a private or public tap, from which it may be concluded that almost all urban households have access to a piped water system in their neighborhood. In rural survey clusters only few uses tap water, probably connected to a private tank instead of a piped water system. In almost all rural clusters a large share of the households uses a public well, thus it seems that households in rural Burkina typically have access to a public well as source of drinking water.

The average BMI of mothers of young children increases with the quality of the household water sources. The same holds for the long-term nutritional status (height for age) of their young children, except that children in households that use surface water do not seem to be worse off than those in households using a well. The short-term nutritional status (weight for height) of children seems less related to the drinking water source of the household, though children in households that use tap water seem better off than those in households that use wells or surface water. The illness frequency among young children does not show a regular pattern to the drinking water source of their household.

Table 11. Drinking water source of households of mothers of young children and health indicators, Burkina Faso, 1993

Source of drinking	Population share in percent		Mean of health indicators			
Water of household	Rural	Urban	BMI	HfA	WfH	Illness
Surface or rain water	4.7	1.2	20.27	-1.25	-0.79	51.6
Public well	81.7	12.7	20.78	-1.39	-0.74	51.5
Own well	7.8	13.4	21.49	-1.13	-0.76	54.7
Public tap or tanker	3.6	47.3	21.88	-0.97	-0.58	50.6
Own tap or bottled	1.4	24.7	23.10	-0.51	-0.56	56.0

Figures do not add to 100 percent due to small numbers of missing data
BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height, Illness = Illness frequency (%)
Source: DHS 1993 Burkina Faso

Toilet facilities in Burkina Faso were in 1993 rather simple, as shown in Table 12. In rural areas most households just use the bush around their house, and only one out of seven use a traditional pit latrine. In urban areas most households with mothers of young children use such a traditional pit latrine, and more hygienic toilet types are used only by few. Although some households use a flush toilet, there is little evidence that a sewerage system is available. Even in almost all urban clusters, most surveyed households use a pit latrine.

The average BMI of mothers increases steadily with the quality level of their toilet facility. Also the long-term nutritional status (height for age) of their young children shows such a pattern, though the ventilated improved pit latrine does not seem to be an improvement over traditional pit latrines. In contrast, the short-term nutritional status and the illness frequency of children do not show any regular pattern with respect to the quality of the household toilet facility.

Table 12. Toilet facility of households of mothers of young children and health indicators, Burkina Faso, 1993

Toilet facility of household	Population share (%)		Mean of health indicators			
	Rural	Urban	BMI	HfA	WfH	Illness
No facility, bush	84.2	10.1	20.72	-1.40	-0.74	51.5
Traditional pit latrine	13.9	84.4	21.97	-0.93	-0.63	53.2
Ventilated improved pit latrine	0.7	0.9	22.55	-0.97	-0.79	53.1
Shared flush toilet	0.0	1.2	23.97	-0.30	-0.35	61.9
Own flush toilet	0.0	2.5	24.41	-0.18	-0.63	40.6

Figures do not add to 100 percent due to small numbers of missing data
BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height, Illness = Illness frequency (%)
Source: DHS 1993 Burkina Faso

Access to health facilities

In urban areas of Burkina Faso access to health facilities is considerably better for mothers with young children than in rural areas, see Table 13. Almost two-thirds of the urban respondents live within 5 km from a hospital or clinic,[7] while almost all live within 5 km from a district medical center, a private practice or pharmacy. In addition, lower level facilities such as Mother and Child Care (SMI), a Public health center or a Pharmaceutical depot are also available nearby. In contrast, in rural areas people live typically only close to primary or basic health facilities. The coverage at the lowest level is almost complete, since almost all have a health agent in their neighborhood and about 60 percent a primary health post (PSP). About half of the rural population lives within 5 km from a basic health center (CSPS) or similar level facility, where at least a nurse is available. However, only a small minority (15 percent) lives within 5 km from a higher level facility such as CMA, private practice or pharmacy, where at least a doctor or pharmacist is available, while almost all live more than 15 km away from the nearest hospital or clinic.

A pattern between the proximity of health facilities and health status of the population is not obvious from the figures in Table 13. For example, a smaller distance to a primary health post or similar facility is not associated to a higher body mass index of the mother or higher height for age, weight for height or lower illness frequency of her children. The same holds for district medical centers or similar facilities. A positive association with the health indicators is most clearly shown for hospitals and clinics, though the pattern for the weight for height is not completely regular, while for illness frequency no regular pattern is shown at all. Also for the basic health center or similar facilities, the mother's BMI is increasing with proximity and the same holds more or less for the children's height for age. In contrast, the pattern for the children's weight for height and illness frequency is rather irregular.

[7] A distance of 5 km corresponds to a travel time of about one hour of walking, which is for instance used by the World Bank to indicate access to health facilities (see World Development Indicators 1998 and 2000).

Table 13. Access to health facilities of mothers of young children and health indicators, Burkina Faso, 1993

	Population share (%)		Mean of health indicators			
	Rural	Urban	BMI	HfA	WfH	Illness
Primary health post						
0 – 1 km	92.5	30.5	20.97	-1.34	-0.72	52
1 – 5 km	0.0	0.0	.	.	.	.
5 – 10 km	1.3	0.0	19.91	-1.18	-1.23	47
10 – 15 km	0.0	3.1	22.59	-0.92	-0.56	54
more than 15 km [a]	6.2	66.4	22.08	-0.85	-0.63	69
Basic health center						
0 – 1 km	41.9	90.3	21.73	-1.09	-0.69	53
1 – 5 km	10.7	6.1	20.89	-1.19	-0.58	48
5 – 10 km	22.4	3.6	20.71	-1.41	-0.74	51
10 – 15 km	9.9	0.0	20.61	-1.08	-0.81	58
more than 15 km [a]	15.1	0.0	20.35	-1.60	-0.68	52
District medical center						
0 – 1 km	12.7	92.0	22.10	-0.94	-0.63	51
1 – 5 km	2.3	3.7	20.65	-1.28	-0.53	52
5 – 10 km	8.7	4.3	20.94	-1.51	-0.64	47
10 – 15 km	11.4	0.0	20.73	-1.26	-0.93	64
more than 15 km [a]	65.0	0.0	20.68	-1.37	-0.74	52
Hospital						
0 – 1 km	1.0	28.5	22.51	-0.80	-0.50	51
1 – 5 km	0.0	32.7	22.14	-0.84	-0.62	49
5 – 10 km	2.7	14.9	21.79	-1.02	-0.56	44
10 – 15 km	1.7	12.1	21.68	-1.07	-0.73	51
more than 15 km [a]	94.7	11.8	20.83	-1.36	-0.76	53

a) including respondents not knowing such a facility
BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height
Source: DHS 1993 Burkina Faso

Private suppliers of modern health care services are in Burkina Faso typically an urban phenomenon. Almost all urban mothers of young children live close to (i.e. less than 5 km from) a pharmacy, almost three quarter close to a private practice and 42 percent close to a private clinic. In contrast, rural respondents live more than 15 km from a private clinic or practice, and only 10 percent live less than 5 km from a pharmacy. In rural areas, traditional health services are may of course be supplied privately by traditional healers and midwifes.

Living standard

In rural areas the typical floor material is dung, as shown in Table 14, and only 17 percent of the rural households have a cement floor. Urban households of mothers of young children typically have a cement floor, and only a small minority has floor covering such as tiles. Hence, though the floor material can be considered to indicate household wealth, in practice it also roughly indicates a rural versus an urban location. The health status of mother and children, as shown in the table, improves in general with higher wealth according to the quality of the floor covering. A minor exception are the young children in households with expensive floor covering like tiles, whose weight for height and illness frequency is slightly worse then those of children in households with only a cement floor.

Table 14. Main floor material of mothers of young children and health indicators, Burkina Faso, 1993

Main floor material	Population share in percent		Mean of health indicators			
	Rural	Urban	BMI	HfA	WfH	Illness
Earth, sand	2.1	0.7	20.62	-1.93	-1.04	79.2
Dung	79.4	15.1	20.66	-1.36	-0.73	52.6
Cement	17.4	79.7	22.10	-0.97	-0.63	50.1
Tiles, other covering	0.0	3.1	24.29	-0.16	-0.69	51.1

Figures do not add to 100 percent due to small numbers of missing data
BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height, Illness = Illness frequency (%)
Source: DHS 1993 Burkina Faso

Most households with mothers of young children have a few types of household items, as shown in Table 15, typically a bicycle and/or a radio. The survey data show a logical ordering in the items that households own. Typically first a bicycle is purchased as a means of transport, then a motorcycle and finally a car; of the electrical appliances, typically first a radio is owned, then a television and finally a refrigerator. Most radio owners do not yet have electricity, but a television and a refrigerator are mostly owned where electricity is available. In rural areas, less than 1 percent of the households have more than 3 household items, and hence households with 4 or more items are mainly urban.

Nutritional indicators of mother and children increase more or less with wealth as indicated by the number of types of household items. For the short-term nutritional status of young children (weight for height) this pattern seems weaker than for their long-term nutritional status or the nutritional status of the mother. The illness frequency of children does not show any regular pattern relative to the number of household items.

Table 15. Number of items in households of mothers of young children and health indicators, Burkina Faso, 1993

Number of item types in household	Population share in percent		Mean of health indicators			
	Rural	Urban	BMI	HfA	WfH	Illness
0	13.0	7.4	20.73	-1.25	-0.64	57.7
1	37.5	14.8	20.80	-1.40	-0.73	50.7
2	30.9	28.2	21.16	-1.25	-0.73	52.3
3	16.8	21.5	21.41	-1.20	-0.71	50.0
4	0.8	10.7	22.24	-0.60	-0.54	54.1
5	0.2	7.3	23.11	-0.37	-0.62	54.4
6	0.0	4.9	25.69	-0.17	-0.35	49.3
7	0.0	4.5	24.10	0.04	-0.47	50.8

Figures do not add to 100 percent due to small numbers of missing data
BMI = Body Mass Index; HfA = Height for Age; WfH = Weight for Height
Source: DHS 1993 Burkina Faso

Collinearity

The indicators of education, health infrastructure and living standard of mothers with young children are correlated, with correlation coefficients ranging from 0.45 to 0.62, as shown in the upper part of Table 16. The correlation of these variables with the distance to health facilities clustered by quality level is of a smaller magnitude. This collinearity of the explanatory variables results in less precise parameter estimates, but this level of correlation is not considered to be fatal.

As can be expected, the quality of the household water source and toilet facility increases with the standard of living. Water taps in the own residence are mainly observed in relatively wealthy households, whereas the poorer households rely on public wells or public taps for their drinking water. Similarly, flush toilets are mainly observed in wealthier households, which typically also have piped water supply in the house. However, only one out of six households with an own tap also has a flush toilet, with three-quarter still using a traditional pit latrine. The observed correlation between the education level of the mother and the household living standard can work both ways: a higher education of the mother can contribute to a higher household income, and better-off families can demand more education for their children. More education of a mother might thus indicate that the household belongs to a better-off family.

Table 16. Correlation between household features of mothers of young children, Burkina Faso, 1993

	Education	Water source	Toilet facility	Floor material	Household items
Water source	0.49				
Toilet facility	0.47	0.62			
Floor material	0.45	0.61	0.62		
Household items	0.51	0.56	0.56	0.56	
Distance to:					
Primary health post	0.36	0.55	0.44	0.46	0.35
Basic health center	-0.21	-0.33	-0.28	-0.34	-0.22
District medical	-0.32	-0.52	-0.43	-0.47	-0.32
center	-0.35	-0.55	-0.46	-0.53	-0.39
Hospital					

Source: DHS 1993 Burkina Faso

When distance to health facilities is considered for all facility types separately (see Annex Table A.1), a cluster of private health facilities emerges, existing of private practices, private clinics and pharmacies, which all have an urban bias. Proximity to these facilities is positively correlated to the level of education, health infrastructure and living standard, which also have some urban bias. This may indicate that private health providers are intentionally more often located in areas with higher living standards, where demand for their services is higher. Correlated to this private cluster of high quality health services are also proximity to public hospitals and to a lesser extent to Mother and Child Health Centers (S.M.I.). The urban cluster has a counterpart in a rural cluster of simple health services existing of health workers, Primary Health Posts (P.S.P) and to a lesser extent Basic Health Facilities (C.S.P.S.), whose access is negatively related to quality of health infrastructure and household living standard. Access to other public health services, such as the public medical centers, health centers and pharmaceutical depots, is not correlated to either two clusters, and thus seem only partly to complement the urban health cluster of private and hospital services.

3.2 Results of econometric analysis

3.2.1 Health status indicators

Econometric estimations in reduced form have been made for the BMI of mothers of young children and the Height for Age, Weight for Height and the illness frequency of their

children, of which the main results will be presented.[8] The determinants of the nutritional indicators were estimated with non-linear regression, with as explanatory variables the indicators of the household living standard, of health knowledge, of health infrastructure, and of proximity to health care. The determinants of the binary illness variable were estimated with a maximum likelihood method (logit), with age (in months, linear and squared) as additional explanatory variable.

In the analysis several specifications have been used for the proximity to health care. Distance to health care is both measured in kilometers as well as in minutes travel time. Three types of proximity functions are used in the regression analysis of the nutritional indicators, as presented earlier; in the logit estimations of illness frequency only the linear proximity function is used. Health care facilities are distinguished in six different ways:

I. all types of health facilities as distinguished in the DHS separate
II. health care facilities grouped by quality level, as discussed before
III. as II, with a distinction between private and public facilities
IV. health care facilities grouped by quality level assuming they supply also the services of lower level facilities
V. as IV, with a distinction between private and public facilities
VI. all types of health services as distinguished in the DHS, at the nearest health care facility

The explanatory power of the estimations for the Weight for Height indicator for young children was so low according to the measure of fit that the specification of the explanatory equations seems seriously incomplete and no estimation results of it will be presented. Apparently, the DHS data do not show a serious impact of the determinants distinguished in this study on this health indicator, although some parameter estimates were significant.

BMI of mothers

The estimation results for the two main specifications are presented in Table 17. In general, the explanatory power of the estimations for the mothers' BMI is modest, about 0.10. Malnutrition can hardly be explained by the results, since in most estimations the constant term already exceeds the BMI threshold level of 18.5, and coefficients are expected to be positive.

The level of education[9] and the household living standard show a clear influence on the BMI of mothers of young children, since their indicators[10] have highly significant parameter

[8] Detailed estimations results are available from the author upon request.

[9] Years of education remains the most important education determinant when other indicators of education and access to information are included in the analysis, such as literacy level, reading a newspaper, watching television or listening to radio. This result does not confirm the finding of Thomas and Strauss (1991) using DHS data for Brazil that access and processing of information through reading a newspaper or watching television is more important than years of education by itself. In Burkina Faso reading newspapers and watching television are mainly confined to urban areas, and only through radio part of the rural illiterate population can be reached. Moreover, literacy and reading newspapers are highly correlated to years of education.

[10] Use of dummy variables for all indicator levels instead of the indicators themselves reduces the precision of the parameter estimates considerably and results in few significant coefficients for the dummies in the estimations for adult BMI. A reduction to only dummies for the drinking water source and the household items results in significant and increasing coefficients for the own well, public tap and private tap. Of the household items, the coefficient for owning a refrigerator (only 9 percent of the households) is in that case strongly significant, while weakly significant coefficients are shown for having a motorcycle or a television. For the other health indicators the use of these dummies is not investigated in detail.

estimates in all specifications. Also a safer drinking water source has a positive effect on the BMI, as in most specifications its parameter is estimated with acceptable significance level. In contrast, the toilet facility shows no effect at all. Proximity to health care shows only influence in a few specifications. Significant parameter estimates are most often shown for private clinics and for mother and child care facilities (S.M.I.), or groupings that contain these, such as 'Basic health center or alike'. Proximity to a health facility providing curative care shows a positive effect on BMI, but significant effects could not be established for typical primary health care services.

Table 17. Determinants of Body Mass Index of mothers of young children, Burkina Faso, 1993

	(III, logistic, km)	(VI, logistic, km)
Constant	18.816	18.760
	(0.0001)	(0.0001)
Education	0.1323	0.1394
	(0.0001)	(0.0001)
Drinking water source	0.1284	0.1618
	(0.0796)	(0.0165)
Floor material	0.3707	0.4474
	(0.0069)	(0.0008)
Household items	0.2216	0.2136
	(0.0001)	(0.0001)
Basic health center or alike	0.3381	
Private clinic	(0.0126)	
	0.8087	
Curative care	(0.0019)	
		0.3540
		(0.0355)
R-square	0.103	0.101

Only significant parameter estimates are shown, with P-values in parentheses.
Specification of estimated equations indicated above the results, for details see text.

Height for Age of young children

The results of four main estimations for the Height for Age indicator of young children are shown in Table 18. The explanatory power of the estimations for this health indicator is in general low, only about 0.05. Malnutrition can hardly be explained by the results, since in most cases the constant term already exceeds the cut-off point of -2 for the Height for Age indicator, and parameter coefficients are expected to be positive.

The estimation results for the Height for Age indicator for young children show similarity to those of the mothers' BMI estimations, but are in general weaker. Again the years of education of the mother and one of the living standard indicators (number of types of household items) appear to have a clear influence, since their parameter estimates are highly significant in all specifications. The second living standard indicator only shows significant influence in one third of the estimated specifications (none shown in the table). As with BMI, the quality of the household's source of drinking water has a positive influence on the child's health status, while any influence of the type of toilet facility is hardly shown. Proximity to health care facilities seems of minor importance, with most influence shown for private clinics, private practices and public basic health centers. Proximity to curative care shows again some positive health effect.

Table 18. Determinants of Height for Age indicator of young children, Burkina Faso, 1993

	(III,inverse, km)	(III,logistic, min)	(V,logistic , km)	(VI,logistic, km)
Constant	-1.738	-1.616	-1.727	-2.338
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Education	0.0506	0.0502	0.0516	0.0515
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Drinking water source			0.0626	0.0865
			(0.0575)	(0.0036)
Household items	0.0620	0.0536	0.0622	0.0615
	(0.0037)	(0.0176)	(0.0036)	(0.0038)
Health center or higher public facility			0.2733	
			(0.0578)	
Private practice		0.1894		
		(0.0544)		
Private clinic	0.3049		0.2213	
	(0.0260)		(0.0337)	
Curative care				0.4022
				(0.0086)
R-square	0.050	0.049	0.048	0.052

Only significant parameter estimates are shown, with P-values in parentheses.
Specification of estimated equations indicated above the results, for details see text.

Illness frequencies among young children

The main results for the reduced form estimations of the illness frequencies are presented in Table 19. The explanatory power of these equations appears to be rather low. For the combined illness frequency the fit was around 0.06, for the diarrhea frequency around 0.08, for fever frequency 0.04 and for cough frequency around 0.02. Due to the low explanatory power, estimation results for the latter two equations are not presented.

According to the age parameters, illness frequency increases during the first 18 months of life, and decreases afterwards. This age pattern is strongest for diarrhea.

Household hygienic behavior does not show the expected negative correlation with illness frequencies among young children. The mother's education level does not show any significant correlation and the quality of the drinking water source and the toilet facility show even positive correlation with illness frequency. A more detailed analysis reveals that in particular the use of a public tap is correlated with the prevalence of diarrhea. This may point to a low hygienic level of water at public taps or to a less hygienic living situation for users of public taps. The detailed analysis also shows that using a latrine is associated to more illness compared to using no facility at all. Remarkably, the type of toilet facility even does not show a significant correlation with the diarrhea frequency among young children.

Living standard indicators show some negative correlation with illness frequency among young children. The number of types of household items is negatively associated with diarrhea frequency, and the type of floor material is negatively associated with both the combined illness frequency as well as the diarrhea frequency. More detailed analysis reveals that in particular the most simple floor material (earth or sand) is associated with more frequent illness, and this may indicate an effect of living standard on illness for in particular the poorest groups.

The proximity to health facilities shows few systematic correlation patterns with illness frequency. In the table, a negative association of illness frequencies with the proximity to a pharmacy is shown. Other specifications (not shown in the table) show negative association to the proximity of high quality facilities with doctors (hospitals or private clinics, private practice or pharmacy). In contrast, illness frequency is positvely correlated to the proximity to a health post or to a basic health center, typically facilities where more simple health services are supplied by less trained staff such as nurses or midwifes. The impact of the high quality facilities may to some extent be confounded by their location in better-off neighborhoods, and thus support the effect of a higher living standard. With respect to proximity to health services, availability of nutrition services often is negatively associated with illness frequencies, as shown in Table 19 for the combined illness frequency. Proximity to other health care services hardly show a systematic correlation pattern to illness frequency. For example, the table shows that postnatal care is negatively associated to illness, but that baby care consults show a positive association.

Table 19. Determinants of illness frequency of young children, Burkina Faso, 1993

	Illness		Diarrhea
	(III, linear, km)	(VI, linear, km)	(III, linear, km)
Age (months)	0.0282	0.0278	0.0639
	(0.0001)	(0.0001)	(0.0001)
Age squared	-0.00083	-0.00081	-0.00162
	(0.0001)	(0.0001)	(0.0001)
Education of mother			
Drinking water source	0.0959	0.0814	0.1454
	(0.0167)	(0.0270)	(0.0037)
Toilet facility	0.1547	0.1267	
	(0.0255)	(0.0622)	
Floor material	-0.3066	-0.3192	-0.2933
	(0.0001)	(0.0001)	(0.0026)
Household items			-0.0650
			(0.0533)
Health post or alike			0.2477
			(0.0293)
Health center or alike	0.7200		
	(0.0235)		
Pharmacy	-0.2411		-0.5033
	(0.0417)		(0.0005)
Postnatal care		-0.4657	
		(0.0430)	
Baby care consult		0.6647	
		(0.0239)	
Nutrition consult		-0.6068	
		(0.0165)	
R-square	0.060	0.058	0.083

Standardized significant parameter estimates are reported, with P-values in parentheses; the R-square is rescaled with maximum of 1.

3.2.2 Illness probabilities of young children

The probability that young children show illness symptoms has been estimated as a structural form equation. The explanatory variables cover individual characteristics of the child (age, weight for height), illness prevalence among other children in the neighborhood (at cluster level), a location indicator (urban-rural), and prevention activities by the household (vaccination of the child, drinking water and toilet of the household, education of the mother). Table 20 shows the results of the logit estimations. The measures of fit for these maximum likelihood estimations are modest, but sufficient to consider the significant parameter estimates.

Table 20. Determinants of illness probability of young children, Burkina Faso, 1993

	Illness	Diarrhea	Fever	Cough
Age (months)	0.1996	0.5614	0.2016	
	(0.0130)	(0.0001)	(0.0168)	
Age squared	-0.3548	-0.8338	-0.3192	
	(0.0001)	(.0001)	(0.0001)	
Weight for Height	-0.1279	-0.1365	-0.1578	-0.0748
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Location	0.0660		0.1047	0.0549
	(0.0234)		(0.0008)	(0.0758)
Diarrhea prevalence	0.0564	0.0952		
	(0.0027)	(0.0001)		
Fever prevalence	0.0562		0.0826	0.0599
	(0.0254)		(0.0018)	(0.0230)
Cough prevalence	0.1148		0.0879	0.1873
	(0.0001)		(0.0004)	(0.0001)
Education of mother				0.0463
				(0.0251)
Drinking water source	0.0515	0.0632	0.0491	
	(0.0577)	(0.0562)	(0.0872)	
Toilet facility				0.0457
				(0.0734)
DPT vaccination 1		-0.2391		
		(0.0240)		
Polio vaccination 1	0.2516	0.2115		
	(0.0209)	(0.0436)		
Measles vaccination	-0.0865	-0.0790	-0.0652	-0.0565
	(0.0019)	(0.0128)	(0.0209)	(0.0484)
R-square	0.099	0.101	0.091	0.078

Standardized significant parameter estimates are reported, with P-values in parentheses; the R-square is rescaled with maximum of 1.

According to the estimation results, the probability of falling ill for young children up to the age of 5 is to a large extent biologically determined. Like for the estimations for illness frequency, the parameter estimates for age imply that illness probability increases in the first months of life to a maximum at around 18 months, and decreases afterwards. Breast-feeding may protect babies against diseases in their first months, but this positive influence declines when breast-feeding is reduced and later stopped. Through illnesses, children build up

immunity against diseases, lowering their probability of falling ill over the years.[11] A good nutritional status improves the resistance against diseases, as shown by the negative coefficient estimated for their weight for height.[12] The probability of illness is positively correlated to the prevalence of illness in the neighborhood, what can be expected for communicable diseases. In rural areas the probability of illness is larger than in urban, as indicated by the positive coefficient for the location variable, which can not be completely explained by the other variables used in the analysis. Of the household illness prevention variables, vaccination against measles is negatively associated with illness. Other vaccinations do not show a significant correlation with illness probability, except for the first DPT and polio vaccinations in case of diarrhea. The wrong sign for the latter is hard to explain. One may conclude from these findings, that vaccinations against tuberculosis, diphtheria, pertussis, tetanus and polio may protect children against these specific diseases and corresponding mortality, but that they do not reduce the probability of illness, probably from less fatal diseases. Finally, hygienic behavior as indicated by the household drinking water source, the toilet facility and the mother's education do not show a positive impact on illness probability. The correlation shown in the table is low and parameters have systematically the wrong sign. This finding is difficult to explain, unless one assumes that mothers who are more aware of the importance of household hygiene report their children more often ill, even according to rather clearly defined symptoms.

[11] Part of the decrease in illness probability with age may be explained by selective survival. Mortality may be higher among genetically less healthy children, thereby reducing the illness probability of the survivors. However, child mortality alone can not explain the observed reduction in illness probability after the age of 18 months.

[12] For children that are ill for a longer period, the illness itself and the corresponding loss of appetite will lead to a lower weight, partly explaining the large correlation found. However, no information is available in the DHS on the duration of the illness, and the size of this effect can not be evaluated.

Section 4
Discussion

Estimation issues

One could argue that the correlation found in the regression analysis for nutritional indicators is partly caused by the endogenous effect of current health on current income. However, all explanatory variables in the analysis refer to previous events or longer-term situations. First, the level of education is exogenous for the adult women and for her current BMI. Second, the household health infrastructure has a 'durable' character, and depends thus most likely on average income over a longer period and not just on current income. Third, the living standard indicators refer also to durables and choices on the type of main floor material of the house and the number of types of household items depend typically on average income over a longer period. Thus a large endogenous correlation effect of current year's health on these explanatory variables is not to be expected. To correct for endogeneity of current income instrumental variables such as household assets could be used. In this analysis, by lack of data on current income or expenditures, an indicator of household durables and a house characteristic are directly used as explanatory variables, thereby avoiding the endogeneity problem of current income.

The analysis could also be criticized mainly to confirm the correlation between health and wealth as found in the literature (see for instance Smith, 1999), since all explanatory variables except for the proximity to health care facilities might be interpreted as dependent on or even as indicators of longer term living standards (see Sahn and Stifel, 2000). The level of education and the quality of health infrastructure can be expected to improve with the overall living standard, and indeed considerable collinearity is shown (in Table 16). However, the data contain enough variation to allow for separate effects. For instance, in the households with the highest living standard indicators, even about a quarter of the women from 15 to 49 years of age have no education at all and another quarter only at most six years of education. About 10 percent of those households still use public or own wells as source of drinking water, while already 18 percent of the poorest household use water of tap quality. The collinearity between the explanatory variables may of course have reduced the significance levels, but still significant correlation results from the analysis.

The mother's BMI and the children's Height for Age indicate partly a longer-term health status, around which short term fluctuations may occur. With this interpretation an endogeneity could exist between this longer-term health status and most household features, which also refer to a longer term. One could even argue that the correlation found is caused by the long-term living standard of the family as confounding factor. Richer households tend to send their girls to school, to have a better house with better hygienic facilities, to have more durable commodities and their members also tend to be healthier. However, their better health will for a large part be due to the healthier lifestyle they can afford. Nevertheless, in the longer term the indicators of drinking water source and toilet facility include an element of choice, just as the health status. One would thus prefer more exogenous indicators of health infrastructure in the neighborhood, such as piped water system or sewerage, to use as explanatory variables. Unfortunately, meaningful indicators on this topic are not available from the DHS data: evidence of access to a sewerage system is hardly found, while access to

water infrastructure (piped water system, public well) is almost an urban – rural dummy variable.

In the longer run, even the proximity to health facilities could be considered endogenous if either people move frequently and the proximity to health facilities is a major determinant in their location decision, or if health facilities are intentionally located in areas with structurally more health risks. However, neither argument seems plausible in the context of Burkina Faso.

The positive association of private health care facilities with the health of mothers and their young children could be confounded by higher living standard of households in their neighborhood. When household living standard is measured by the number of types of household items, women living in richer households (4 or more items) are clearly overrepresented close (i.e. less than 5 km away) to private health care facilities. To the extent that living standard is imperfectly measured by the used indicators, the correlation found could indicate the relation between health and wealth, and not a positive effect of the private health facility itself. However, most women living close to private health care facilities belong to poorer households (at most 3 items): on average 66 % of the women close to a pharmacy, 61 % for a private practice and 57 % for a private clinic. When the estimations are repeated for only these women, the effects of private providers, in particular clinics, on health on the people in their neighborhood become weaker but remain present. Also poorer households thus benefit from private health providers in their neighborhood, but to a lesser extent. The positive effects of private providers on health are thus not just a wealth effect.

Policy issues

Given these technical considerations, the results of the analysis suggest that indirect policies may be more effective in improving health than specific policies on health infrastructure or on health care facilities. First, the results show that better health is partly a consumption effect of a higher living standard, and policies that increase the living standard of the poor will also achieve an improvement of their health. Second, the analysis results show that the education level of the mother considerably affects her own health and that of her young children. The health status of the population might thus be improved by further promoting education, in particular to girls, for which considerable scope exists in Burkina Faso since current levels of education of mothers of young children are very low. More and better education will give a direct effect from what was learned on school on health topics, and may also give an indirect effect of being better able to absorb health information later in life, less clouded by ignorance and superstition.

The findings also suggest that improving access to safe water can be an effective policy to raise the health status of the people. This may include the extension of piped water systems or of wells, as well as improving the hygienic quality of the water in these sources. The influence of more hygienic toilet facility types could not be established, possible due to insufficient variation in the data, as the large majority of the urban households use a simple latrine, while in rural areas hardly any toilet facilities are available. These facts show that considerable scope exists for improving the hygienic level of feces disposal in Burkina Faso, but a significant effect on the health status from it can not be derived from the DHS data.

A large positive effect of prevention or access to health services on health could also not be established. Again, this is partly a data problem, since for prevention only data on vaccinations are included in the Demographic and Health Survey and not on other prevention policies. Vaccination will undoubtedly protect children against the target diseases, but does

not seem to reduce their frequency of being ill. With respect to health facilities, in the Demographic and Health Survey only information is known on the distance to the health care facilities but not on the costs of the services. Also, in rural areas the simplest health care seems widely available, so insufficient variation in the data may exist to establish a positive effect of their availability on health. A similar argument may be raised for the urban areas where access to higher level health care is sufficiently available. However, in rural areas proximity to health facilities with nurses or physicians shows sufficient variation in the data, and the same holds for hospitals and clinics in urban areas. Most effect has been shown for private practices and clinics, next to the public basic health centers and the mother and child care facilities. Since in urban areas access to health care seems sufficient, while in rural areas only simple health care is available, government could focus its effort of promoting health care supply to the rural areas, thereby giving the private sector scope to expand in the urban areas. To improve financial access to such facilities, it could promote health insurance. The modest impact of public health facilities may also point to problems with quality of the services provided, and policies to improve the effectiveness of public health care may be considered.

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Annex Table A.1. Correlation between distance to health facilities and other variables

	health worker	P.S.P.	C.S.P.S.	Public health center	S.M.I.	Public medical center	private practice	private clinic	public hospital	pharmacy	pharma-ceutical depot
Distance to :											
P.S.P.	0.60										
C.S.P.S.	0.36	0.29									
public health center	-0.20	-0.26	0.06								
S.M.I.	-0.30	-0.14	-0.09	0.27							
public medical center	-0.08	-0.16	-0.00	0.07	0.34						
private practice	-0.52	-0.20	-0.32	0.16	0.33	0.05					
private clinic	-0.59	-0.32	-0.44	0.13	0.36	0.07	0.77				
public hospital	-0.49	-0.33	-0.26	0.18	0.43	0.14	0.63	0.67			
pharmacy	-0.35	-0.37	-0.23	-0.01	0.19	0.22	0.52	0.54	0.68		
pharmaceutical depot	0.07	0.08	0.21	0.23	0.27	0.23	0.00	-0.01	0.05	-0.11	
years of education	0.34	0.28	0.18	-0.10	-0.19	-0.16	-0.36	-0.40	-0.34	-0.30	-0.03
water source	0.54	0.40	0.27	-0.13	-0.37	-0.21	-0.58	-0.64	-0.54	-0.48	-0.00
toilet facility	0.43	0.33	0.24	-0.11	-0.27	-0.18	-0.48	-0.53	-0.45	-0.40	0.00
main floor material	0.46	0.34	0.23	-0.11	-0.31	-0.25	-0.52	-0.58	-0.52	-0.49	-0.02
household items	0.35	0.25	0.17	-0.12	-0.24	-0.17	-0.39	-0.45	-0.38	-0.32	-0.07

Source : Demographic and Health Survey 1993 Burkina Faso

Explanation of health care facility types:
P.S.P. : Primary Health Post, typically staffed with health agent and midwife
C.S.P.S. : Basic Health Center, typically staffed with nurse, midwife and possible health agent
public health center : like P.S.P. but more often urban and sometimes with nurse
S.M.I. : Mother and Child Health facility, typically staffed with midwife and nurse
public medical center : district health facility staffed with 2-3 physicians (among which director), experienced nurses and midwife
private practice : physician with support staff
private clinic : physicians with support staff, with possibly in-patient facilities
public hospital : hospital with in-patient facilities, specialists, nurses and other support staff
pharmacy : private pharmacy
pharmaceutical depot : simple public pharmaceutical shop

The Centre for World Food Studies (Dutch acronym SOW-VU) is a research institute related to the Department of Economics and Econometrics of the Vrije Universiteit Amsterdam. It was established in 1977 and engages in quantitative analyses to support national and international policy formulation in the areas of food, agriculture and development cooperation.

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