Education, Health Knowledge, and Child Health in Ghana: What Do People Know and How Do They Know It?

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March 1, 2004

Accepted for presentation in Session #165:
Child Health in Developing Countries
Saturday, April 3, 2004, 12:30-2:20 pm
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Abstract
This paper is concerned with child health in Ghana. Specifically, what do people know about the causes of three serious child illnesses – malaria, diarrheal disease, and respiratory infection – and what determines biomedical knowledge of etiology? I rely on primary survey data (N=2500) collected in Ghana's Central Region in 2002. In descriptive and bivariate analysis I found that knowledge of etiology of these three illnesses is quite low. For example, only half of respondents can identify the cause of malaria, only nine percent attribute diarrheal disease to contagion, and only six percent attribute respiratory infection to contagion. In multivariate analysis I found that, as expected, education and literacy are strongly associated with knowledge of etiology of all three illnesses. In addition, other individual, household, and community characteristics are influential, including media exposure, civic participation, household SES, and urban residence.

I. Introduction

This paper is concerned with child health in the West African country of Ghana. More specifically, my research attempts to elucidate both what people know about child illnesses as well as how they know it. In other words, what do men and women know about the causes (i.e., etiology) of three child illness – diarrheal disease, malaria, and respiratory infection – and what determines biomedical knowledge?

As in other developing countries, infant and child morbidity and mortality are relatively high in Ghana, and most infant and child deaths are due to infectious illnesses. According to the 1998 Demographic and Health Survey (DHS), Ghana's infant mortality rate is 57 and its under-five mortality rate is 108 per 1000 live births (GSS and MI, 1999:83). One in nine Ghanaian children dies before reaching his or her fifth birthday.

There is a vast amount of empirical research on the determinants of child survival. One central socioeconomic influence – which has long been deemed influential – is the role of maternal education. Across many diverse cultural contexts, rising levels of maternal education and literacy are strongly associated with improved child survival. What is less clear, however, is exactly how improvements in education affect child survival. Is education simply a proxy for social and economic resources that promote health, or does education lead to improved health knowledge itself and subsequent health behaviors?

This paper is primarily concerned with one intermediate causal mechanism through which education is thought to affect child health: "health knowledge". This concept appears to be less routinely explored in standard socio-demographic research than more easily measurable concepts such as years of schooling obtained or literacy. Moreover, the ongoing debate about the "true" role of education, particularly maternal education, in child survival, suggests there is a need for additional research on health knowledge and the links between education, knowledge, and health behaviors and outcomes in high mortality countries such as Ghana. Yet most existing quantitative data sources do not fully address these relationships, and there are also substantial shortcomings to existing qualitative research in Ghana.

II. Theory and Literature

Theories of mortality change and the socioeconomic determinants of child health influence this study. Caldwell, in an influential 1979 paper based on Nigerian data, hypothesized that maternal education has a direct and independent effect on child survival. Even after incorporating other socioeconomic controls such as father's education and area of residence, Caldwell found that children of educated mothers fared better than those of uneducated mothers (1979). Caldwell argued that there are three pathways, or causal mechanisms, through which maternal education can affect child survival: 1) education increases health knowledge, and as a consequence, fosters behavior change; 2) education promotes an identification with modernity; and 3) education empowers women within the household (1979:410). Caldwell's seminal article has been followed by numerous studies, many of which demonstrate the generally positive relationship between maternal schooling and child health outcomes (Caldwell 1994, Tabutin and Akoto 1992, Raghupathy 1996, etc.).

To sketch over the vast literature on education and child survival, it is fair to say that there remains a need to "unpack" education – to identify what it is about formal schooling that results in improved child health – and thereby elucidate more appropriate child survival policy options (Basu 2000). One mechanism identified by many demographic theorists is "health knowledge," or knowledge of disease etiology. Preston and Haines (1991), in their analysis of child mortality in the U.S. in the late nineteenth century, identified health "know how" – acceptance of the germ theory of disease causality and associated hygienic practices – as an important determinant of mortality decline in the U.S. Moreover, Preston (1985) theorized that health knowledge was a product of formal education. And, as mentioned above, Caldwell also identified health knowledge, or "awareness of health matters," as a causal mechanism through which education operates (1979:396). Similarly, other demographic researchers have also noted the importance of health knowledge in child survival, including Garenne and F. van de Walle (1985), Oppong and Abu (1987) and Mosley and Chen (1984).

Yet despite the emphasis in the demographic literature on the importance of health beliefs in child morbidity and mortality, empirical research on this topic in developing countries is quite limited. Indeed, there appears to be a gap in the empirical research on child health between large-scale, quantitative data collection efforts such as the DHS, and smaller-scale, often qualitative health research. While the DHS is nationally representative and includes basic information on the socioeconomic characteristics of respondents (particularly level of schooling and literacy), the survey includes few measures of knowledge of disease etiology. In contrast, many smaller-scale studies of health or health-related behaviors – including innovative research on people's perceptions of the causes of illnesses – also have their limitations. Some rely on non-representative sampling designs which limit generalization (Wyllie 1983 and 1994, McLennan 1998 and 2000), overlook childhood illnesses (Wyllie 1983 and 1994), or are limited to descriptive or bivariate (rather than multivariate) analytical methods (Azevedo et al. 1991, Ene-Obong et al. 2000).

One notable exception to this apparent gap in the child health empirical research – to this dearth of information on knowledge of etiology – is the body of work in Guatemala by Pebley, Hurtado, Goldman, et al. (Pebley et al. 1999, Goldman et al. 2001). Subscribing to the theory that health beliefs are important in determining health behaviors, the 1995 Guatemalan Survey of Family Health (EGSF) included questions on mothers' beliefs about common child illnesses, including acute respiratory infection (ARI) and diarrheal disease. Pebley et al. (1999) found that, in contrast to previous ethnographic work in Guatemala, biomedical models of ARI and child diarrhea appear to have gained currency over traditional models of illness causation, and that traditional and biomedical belief systems may coexist to a greater degree than in the past. In this paper Pebley et al. did not explore in detail health beliefs by level of education; they focused instead on ethnic differences. In multivariate research on the diffusion of etiological beliefs about child diarrhea, Goldman et al. (2001) found that social contacts, particularly interpersonal social contacts, influence belief in hygiene (cleanliness) and contagion (pathogens) as causes of child diarrhea. Moreover, education and household economic status were strong predictors of biomedical views (2001:67).

In this brief review of the literature on the links between education, health knowledge and child health, I have attempted to emphasize four points: 1) the generally positive relationship between parental – particularly maternal – education and child health; 2) the ongoing debate in the literature between those that view education as essentially a proxy for socioeconomic status and those that believe that education is an important predictor in and of itself; 3) the theoretical importance of intermediate mechanisms, particularly health knowledge; and 4), the dearth of empirical research on health knowledge in sub-Saharan Africa.

III. Data and Methods

I rely on primary data for this paper: a standard household-based survey of 2500 inhabitants of coastal Ghana conducted in 2002. (I managed the fieldwork aspects of this survey from January through July of 2002 and returned again in January 2003 to conduct qualitative research on this topic.) The 2002 Population & Environment Survey, as the project came to be called, is a representative survey of non-institutionalized individuals in the six coastal districts of Ghana's Central Region, one of ten administrative regions in Ghana. These six districts represent approximately four percent of Ghana's population of 19 million people (GSS 2002:1, 17).

Study Site: Ghana's Central Region

Ghana, in coastal West Africa, has a land area of 238,539 square kilometers (GSS and MI 1999:1), or roughly the size of the U.S. state of Oregon. Its capital is Accra, on the southeastern coast. Ghana was formerly the British colony of the Gold Coast, and gained independence in 1957, the first sub-Saharan African nation to do so. The 2000 national census recorded a population of 18.9 million people, a 54 percent increase from the 1984 (the year of the previous census) population of 12.3 million, and representing an intercensal growth rate of 2.7 percent (GSS 2002:1).

The six Central Region districts in our study include: Komenda-Edina-Eguafo-Abirem (KEEA), Cape Coast, Abura-Asebu-Kwamankese, Mfantsiman, Gomoa, and Awutu-Efutu-Senya. This area of Ghana is primarily inhabited by the Fante ethnic group (an Akan sub-group linguistically related to the Ashanti), as well as other smaller groups (e.g., Ewe, Ga-Dangme, etc.). Nationally, the Fante comprise about 10 percent (about 1.7 million people) of Ghana's total population. While Ghana's major sources of foreign exchange are gold, timber and cocoa, economic activities in the study area include fishing, small-scale farming, salt production, and some tourism activities (concentrated around the former slave trading castles dotting the Central Region coastline which now operate as museums).

Sampling Design, Survey Instruments, and Fieldwork

The Population & Environment Survey included four components: a community questionnaire, a household questionnaire, a men's questionnaire, and a women's questionnaire. The household questionnaire contained questions on current household composition, basic characteristics of household members and economic characteristics of the household. The women's questionnaire had modules on the respondent's sociodemographic background, birth history, health knowledge, child health (of living children under six years of age), fertility preferences and family planning, environmental attitudes and awareness, and a life history calendar (by yearly intervals). The men's questionnaire was a reduced version of the women's questionnaire, excluding the modules on birth history and child health. While the survey instruments were similar to the Demographic and Health Survey in form and content, the instruments incorporated unique sections on knowledge of etiology of specific childhood illnesses, household hygiene practices, and environmental attitudes and awareness. Due to cost and feasibility issues, the survey instruments were printed in English, and interviewers translated in the appropriate language of the respondent, usually Twi (the Ashanti language) or Fante.

The survey followed a two-stage stratified sampling design. We selected equal numbers of PSUs [in Ghana they are called "Enumeration Areas," or EAs] in each of our three residence strata (rural, semi-urban, and urban) and I compensate for this in my analysis through the use of weights. We chose this design in order to evenly spread the sample across the strata, ensuring that there is sufficient sample size in each strata type. The stratification was done for the six districts, which, when multiplied by the three types of strata, resulted in 18 total strata. Within each of the 18 strata, we selected three EAs using probability proportional to size (PPS) of the

EA, totaling 54 clusters. The Ghana Statistical Service (GSS) aided us in this process by providing the list of EAs and their population information.

After we generated our first-stage sample of EAs (clusters), survey listing teams listed all of the households in our 54 selected EAs. We then randomly selected 24 households from each EA. Survey interviewing teams then interviewed all women and men age 15 and above in each selected household. The data were then entered in a computer database at the University of Cape Coast (UCC) in Ghana. Data corrections were done iteratively between Ghana and the U.S.

The sample size of the individual portion of the survey was 2506; 1093 men aged 15 and above, or 94 percent of identified eligible men, were interviewed. And 1413 women aged 15 and above, or 93 percent of identified eligible women, were interviewed. The sex ratio of our adult sample, or the respondents to our individual questionnaire, was 0.77, which, we believe, reflects high out-migration of men in this region of Ghana. Indeed, while the 2000 census all-ages sex ratio for Ghana's Central Region is 0.91 (and the lowest in Ghana), the sex ratio for the adult population (i.e., age 15 and above) is still lower: 0.84 (GSS 2002). This compares more favorably with our sex ratio of 0.77.

Methods

In this paper, I rely on descriptive (Tables 1 and 2), bivariate (Table 2), and multivariate methods (Tables 3 and 4) of analysis. For multivariate analysis, I use logistic regression for dichotomous outcome variables and ordered logistic regression for ordinal outcome variables (as well as, for comparison but not shown, ordinary least squares (OLS) regression). I calculated robust standard errors by clustering on each sampled household because multiple respondents were potentially drawn from each sampled household.

IV. Results

Descriptive Characteristics

Table 1 presents descriptive characteristics of our study population; I show frequencies, weighted means, and for continuous variables, standard deviations. Of the 1,296 households sampled in our study design, we successfully interviewed 1,197 households, achieving a response rate of 92 percent.

In the household questionnaire of our survey we asked about ownership of 17 common household possessions. I measured household socioeconomic status (SES) by a simple Likert index of 11 of the 17 possessions.[1] The average number of the 11 household possessions is just under three (2.9), demonstrating the low SES of this population. However, more than half (58 percent) of the households have access to electricity, a greater proportion than the 1998 national figure of 43 percent (GSS and MI 1999:14-15). Nearly three-quarters have access to piped water for their drinking water supply, while the remaining households rely on well water, surface water, or other sources of drinking water. Households in our study area appear to have much better sources of drinking water than the Ghanaian national average. The 1998 DHS found that, nationally, only about 40 percent of Ghanaian households had access to piped water (GSS and MI 1999:15), far fewer than the 73 percent of households in our study.

Only 12 percent of households in our study area have access to a flush toilet, whether their own or a shared facility. Most households (56 percent) rely on a pit toilet or latrine. Almost one-third of the households (32 percent) have *no* toilet facility. Nationally, the 1998 DHS found slightly fewer (8 percent) had access to a flush toilet, more (65 percent) rely on pit latrines, and fewer (27 percent) have no toilet facility (GSS and MI 1999:15). It is interesting to note that, while the residents of our study area appear to have better-than-average drinking water, they appear to have worse-than-average sanitation facilities, in the sense that relatively more households in our study area have no toilet facility.

Most (72 percent) residents of our study area are Fante, and an additional 8 percent are some other Akan ethnic group (such as Ashanti). About 4 percent are Ewe, an ethnic group which

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[1] A Likert index simply sums the number of each of the 11 possessions. In other words, each possession is weighted equally, and the assessment of household SES is based on the total number of the 11 items owned. I also conducted principle components factor analysis of the 11 items to verify the accuracy of my Likert index. This analysis yielded comparable results – the correlation between the two indices was 0.98 – indicating that the Likert and factor analysis index techniques are in this instance equivalent.

traditionally hails from the Volta region. Five percent are Guan, just one percent are northerners, and the remaining 10 percent are members of assorted other ethnic groups. More than half of our sample (59 percent) are migrants, meaning that they were not born in their current place of residence.

Like Ghana in entirety, coastal Central Region is religiously diverse. The most common religion in our study area (as well as nationally) is Pentecostal, with 31 percent of our population, followed by Protestant (26 percent); Syncretic (15 percent), a religion which combines elements of both Christianity and traditional beliefs; Catholic (12 percent); Muslim (4 percent); and traditional religion (4 percent). About eight percent of our population reports no religious affiliation.

Educational attainment appears to be fairly high in this area relative to the rest of the country. Nearly one-third (29 percent) of our study population (adults age 15+) have no or only Arabic schooling, 15 percent have attended primary school, 37 percent have attended middle school (known in Ghana as Junior Secondary School, or JSS), and 18 percent have attended secondary school (Senior Secondary School, or SSS) or above. The 2000 census found that, nationally, fully 43 percent of Ghanaians age six and above have no schooling, 20 percent have completed only primary, 23 percent have completed middle school/JSS, and about 12 percent have completed secondary schooling or beyond (GSS 2002:8, 54).[2] However, it is important to note that our measure asks about schooling attended and asks it of people age 15 and above, whereas the census reports schooling completed of people age 6 and above, so it is difficult to compare these two sources of data. Nevertheless, the gap between the number of people in our study and nationally who have no schooling (29 percent versus 43 percent) is insightful.

Almost half (44 percent) of the study population is illiterate, reporting that they can read a letter or newspaper in any language "not at all", while 21 percent read "with difficulty". Just over one-third (35 percent) reports that they can read "easily". These figures, particularly illiteracy, appear to tally with Ghana's national literacy rates. The 2000 census found that 46 percent of

[2] The 1998 DHS, in comparison, found that 34 percent of Ghanaian females age 6 and above have no schooling, 32 percent have attended primary, 27 percent have attended middle school/JSS, and 6 percent have attended secondary school or beyond (GSS and MI 1999:12).

Ghanaian adults (age 15 and above) were illiterate, while 53 percent were literate in either English or a Ghanaian language (GSS 2002:7, 27). While the 2000 census' and our survey's literacy measures are not quite identical (e.g., we asked about literacy "in any language" and distinguished between reading "easily" versus "with difficulty"), it appears that, with respect to literacy, our study area mirrors Ghana nationally.

The most prevalent form of media in this area of Ghana appears to be radio. Nearly three-quarters (72 percent) of the study population reports listening to the radio daily. Fifty-eight percent watches television weekly, while only 23 percent reads a newspaper weekly. In addition to media exposure, we asked about another measure of exposure to "modernity" – civic participation. Sixty-two percent reported that they voted in the 2000 presidential election. Finally, just over one-third (34 percent) of the study population participates in some kind of community organization, such as an Asafo company[3] or women's group.

Lastly, given my interest in personal and household hygiene behaviors as they relate to child health, we asked respondents about their hand washing practices. Only half (50 percent) of respondents reported washing their hands with soap after toileting, and only about one-quarter (26 percent) reported washing with soap before eating. (Note that traditionally, Ghanaians tend to eat with their hands.) Less than one-quarter (23 percent) reported washing their hands with soap both after toileting and before eating.

Health Knowledge

Table 2 presents descriptive characteristics of the health knowledge questions in the survey, the focus of this analysis. We asked all respondents (adults age 15+) questions about knowledge of causes, prevention, and treatment of three serious child illnesses: diarrheal disease, malaria, and respiratory infection. Weighted means are presented for the total population and by level of education, and standard deviations are given for continuous variables.

[3] Asafo companies are Fante social and political organizations that traditionally functioned as local militias. Each Fante town typically has at least one Asafo company, and today they tend to function as public service and community organizations.

This table reveals that knowledge of contagion – infectious agents and microbes – is relatively low in this population, whereas knowledge of hygiene is higher. Moreover and as expected, level of education is significantly associated with every measure of health knowledge. Those with less schooling are less knowledgeable about etiology, prevention, and treatment of these three child illnesses than those with more schooling. (In addition, there is a sex differential in knowledge of causes and prevention of child illnesses (results not shown). Men generally demonstrated more "health knowledge" than women – in both bivariate quantitative analysis as well as my follow-up qualitative Focus Group Discussions (FGDs).)

Just over half – 53 percent – of respondents cited the mosquito vector as the main cause of malaria, and knowledge of the mosquito vector increases dramatically with increasing education. Despite the low level of knowledge of the etiology of malaria, most people (80 percent) view malaria as preventable and nearly all (97 percent) feel that malaria can be treated.

When queried about the etiology of diarrheal disease in children, knowledge of germ theory is very low in this population. Only nine percent of respondents cite contagion or germs as the main cause of diarrheal disease in children. However, more than half (60 percent) cite hygiene or dirt as the cause of diarrheal disease (e.g., dirty water, dirty food, dirty hands or utensils, etc.). As we saw with malaria, level of education is strongly associated with knowledge of contagion- and hygiene-related causes of diarrheal disease. It is noteworthy that nearly a third of the population cites things other than contagion- or hygiene-factors (e.g., eating unripe mangoes, eating starchy foods, playing in the sun, etc.) as the cause of diarrheal disease, and these beliefs were regularly cited in the FGDs as well. Finally, about three-quarters (73 percent) feel that diarrheal disease can be prevented in children and almost all (97 percent) feel that child diarrhea can be treated.

Similar to biomedical knowledge of diarrheal disease, very few respondents – only six percent – identify contagion factors (e.g., germs or infectious agents) as the cause of respiratory infection in children. More respondents – 17 percent – identify hygiene or dirt (e.g., dust in the air, etc.) as the cause of respiratory infection. Once again, level of education is strongly associated with knowledge of the etiology of respiratory infection. Those with more education are more likely to report biomedical causes, although a mere 13 percent of those with secondary or more schooling cite contagion as the cause of respiratory infection. More than three-quarters of the population (77 percent) cites causes other than contagion- or hygiene-related causes, including, for example, exposure to cold weather (a common perception in Western countries as well), the rise of the new moon, and, as we saw with diarrheal disease, eating starchy foods such as yam and rice. Finally, the majority of respondents (65 percent) feel that respiratory infection in children can be prevented, and nearly all respondents (96 percent) feel that respiratory infection can be treated.

To summarize respondents' general health knowledge, I created two indices of responses to the etiology questions. To construct the first index, knowledge of contagion factors, I summed the number of the three child illnesses – malaria, diarrheal disease, and respiratory infection – each respondent attributed to contagion factors (i.e., the mosquito or malaria parasite for malaria, germs or infectious agents for diarrheal disease, and germs or infectious agents for respiratory infection). Thus for each respondent, this ordinal variable ranges from zero (no illnesses attributed to contagion) to three (all three illnesses attributed to contagion). The mean value of the contagion index is 0.68. Respondents, on average, attribute 0.68 of the three illnesses – slightly over half of an illness – to contagion, and knowledge of contagion increases with increasing education, ranging from 0.36 for those with no schooling to 1.17 for those with secondary or more schooling.

I then constructed a less stringent index measure of health knowledge, allowing for both contagion- and hygiene-related causes. Drawing on Caldwell, who noted that the important thing, in terms of morbidity and mortality decline, may not be that people possess "any understanding of bacteriology," but that they possess the "ability to do what was recommended" (1986:206), I hypothesize that knowledge of the role of hygiene in disease transmission is likely as important as knowledge of the specific etiological agent of disease. Thus, my second index, knowledge of contagion *or* hygiene causes, is a sum of the number of the three child illnesses each respondent attributed to either contagion or hygiene factors. This ordinal variable also ranges from zero (no illnesses attributed to contagion or hygiene) to three (all three illnesses attributed to contagion or hygiene). As shown in Table 2, the mean value of this index is 1.45. Respondents, on average, attribute 1.45, or almost one and one-half of the three illnesses, to contagion- or hygiene-related causes. As with the first index, level of education is significantly associated with knowledge of contagion or hygiene.

To summarize my descriptive findings, biomedical knowledge of the three child illnesses is very low in this population in Ghana. Very few people appear to subscribe to germ theory by identifying infectious agents – germs, microbes, and, in the case of malaria, the mosquito vector or malaria parasite – as the main cause of these infectious diseases. Just over half (53 percent) cite the mosquito as the cause of malaria, only nine percent cite contagion-related causes of diarrheal disease, and only six percent cite contagion-related causes of respiratory infection.

However, more people cite hygiene-related causes of these illnesses – such as dirty water or dirty food – which can be viewed as biomedically appropriate when it comes to preventive measures. Sixty percent cite hygiene factors as the cause of diarrhea, and 17 percent cite hygiene factors as the cause of respiratory infection. Ultimately, as I have suggested above, it may not matter so much that people know the various viral or bacterial agents that cause specific infectious illnesses, for example, but that they know that contaminated water or food cause infections in children, as opposed to etiological beliefs such as the owl ("patu") causing respiratory infection, as was revealed in one of my FGDs (Dehia Men, January 13, 2003). What matters, when it comes to preventing infectious child illnesses, is ensuring that infants and children consume clean water and food, as well as other preventive measures such as handwashing with soap.

In the next section, I present multivariate analysis of these health knowledge indices toward improving our understanding of the multiple influences associated with biomedical knowledge of child illness.

Multivariate Results

Table 3 presents the results of multivariate analysis of biomedical knowledge of the three child illnesses: malaria, diarrheal disease, and respiratory infection. I predicted knowledge of the malaria parasite or mosquito vector as the cause of malaria (**Model 1**), knowledge of contagion- or hygiene-related causes of diarrheal disease (**Model 2**), and knowledge of contagion- or hygiene-related causes of respiratory infection (**Model 3**).[4] As shown in Table 2, only 53 percent of respondents identify the cause of malaria, 69 percent identify contagion or hygiene causes of diarrheal disease, and a mere 23 percent identify contagion or hygiene causes of respiratory infection.

Because all three outcomes are dichotomous variables (1=biomedical knowledge of the respective illness, 0=otherwise), I use bivariate logistic regression models. Both coefficients and odds ratios, calculated by simply by exponentiating the coefficients, are shown in Table 3. Positive coefficients indicate a positive association with biomedical knowledge of these illnesses, and negative coefficients indicate the opposite. As I mentioned previously, because both men and women were interviewed, and thus multiple respondents were potentially drawn from each sampled household, I calculated robust standard errors by clustering on each sampled household.

As expected, formal education and literacy are strongly associated with knowledge of etiology of all three illnesses. Compared to those with no or only Koranic schooling, men and women with primary or middle schooling are nearly twice as likely to identify the correct cause of each respective illness (i.e., the odds ratio equals 1.98 in Model 1 (Malaria), 1.74 in Model 2 (Diarrheal Disease), and 1.62 in Model 3 (Respiratory Infection)). Secondary schooling is particularly influential. Net of all the other characteristics in the model, those with secondary or more schooling are over five time more likely to know the cause of malaria, and over two and a half times more likely to know the causes of diarrheal disease and respiratory infection. Similarly, literacy positively affects knowledge of etiology across all three models; those who report that they read easily are about fifty percent more likely to know the cause of each respective illness than those who are illiterate.

Moreover, contrary to both my bivariate and qualitative results, which suggested that men were significantly more knowledgeable than women about the etiology of all three illnesses, in Table

[4] I had wanted to predict just contagion-related responses for both diarrheal disease and respiratory infection, but because the numbers of respondents who correctly cited contagion for both these illnesses was so low – 9 and 6 percent, respectively, as shown in Table 2 – I had to collapse contagion and hygiene responses together. This is substantively appropriate, however, because knowledge of either contagion- *or* hygiene-related causes of these illnesses (e.g., not only microbes and infectious agents but dirty water, dirty food, dirty hands, etc.) likely manifests in appropriate child illness prevention behaviors (e.g., hand washing, etc.).

3 we see that the sex differential in health knowledge is attenuated when other socio-demographic characteristics are incorporated, no doubt due to the influence of schooling. Indeed, in multivariate analysis, men are about 20 percent *less* likely than women to know the cause of malaria (Model 1), and there is no significant difference in both Models 2 and 3.

Neither age nor children ever born (CEB), which, I believe, may be proxies for experience with children (and thus childhood illnesses), are significantly associated with biomedical malaria knowledge (Model 1), but they are slightly influential, but in opposite directions, in Models 2 and 3.

In addition to the importance of education and literacy, my models of knowledge of etiology of each child illness also include measures of incorporation into "modern life". I include two indices, one of civic participation and one of media exposure. Drawing on Caldwell (1979 and 1986), exposure to these aspects of modernity may influence individuals' health knowledge. My civic participation index is a simple summary measure (ranging from 0 to 2) of voting in the 2000 national election and participation in a community organization. Those who did both activities have the value of 2, those who did only one have the value of 1, and those who did neither have the value of 0. Similarly the media exposure index is a simple measure (ranging from 0 to 3) of the respondent's regular use of newspapers, radio, and television. As we see in Table 3, media exposure is positively associated with biomedical knowledge of all three illnesses. Moreover, civic participation is positively associated with greater knowledge of malaria and diarrheal disease, but it appears to have no influence on knowledge of respiratory infection.

Membership in a traditional religion (Ghanaian traditional or Syncretic) is negatively associated with malaria knowledge; net of other characteristics, adherents to more traditional religious beliefs are about one-third less likely to know the cause of malaria. However, traditional religion is not significantly associated with knowledge of etiology of either diarrheal disease or respiratory infection.

Relative to non-migrants, or those who have never left their place of birth, migrants are more biomedically knowledgeable about the causes of malaria and diarrheal disease (Models 1 and 2), net of other characteristics. Strangely, migrants may be less knowledgeable about respiratory infection than non-migrants. Household socioeconomic status (SES), as measured by my Likert index of household possessions, is positively associated with knowledge of the cause of malaria, but it does not appear to be influential for the other two illnesses.

Finally and similar in magnitude to the effect of literacy, urban residence positively affects knowledge of etiology across all three models. Relative to those who reside in rural areas, urban dwellers are more likely to report biomedical causes of the three illnesses, and the effect is particularly pronounced for malaria (Model 1). Urbanites are about 80 percent more likely to cite mosquitoes or the malaria parasite as the cause of malaria than are rural dwellers, even when controlling for other important influences on health knowledge such as education, literacy, civic participation and SES.

In addition to the influence of our strata (rural, semi-urban, and urban), in other models (results not shown), I included dummy variables for the each the 54 sampled communities in our survey. Including a measure for each community increases the pseudo-R^2 by 10 percent for malaria, 4 percent for diarrheal disease, and 5 percent for respiratory infection, suggesting the importance of individual communities.

To summarize, most of the covariates in Table 3 are consistently influential across the three models of knowledge of etiology of malaria, diarrheal disease, and respiratory infection. Important influences on knowledge of these illnesses include education, particularly secondary education, literacy, and urban residence. In addition, exposure to media, civic participation, migrant status, and SES also appear to be influential, although their effects differ across models. Model 2 (diarrheal disease) and, in particular, Model 3 (respiratory infection), with pseudo-R^2s of only 0.08 and 0.06, respectively, appear to be less well explained than Model 1, the determinants of malaria (pseudo-R^2 = 0.15).

From a child survival policy point of view, Table 3 suggests, first, that while formal schooling is undoubtedly important in influencing health knowledge, other, perhaps less costly, characteristics are also important pathways. Even when controlling for education and literacy, things such as media exposure and urban residence lead to improved knowledge of etiology. And migrants, often considered to be an intransigent group, may be selected on characteristics associated with more "modern" biomedical health knowledge. Secondly, most of the covariates in Table 3 work the same way across the models, suggesting that knowledge of each illness is, by and large, influenced by some of the same factors.

Summary Measures of Health Knowledge

In Table 3 I presented estimates for each illness separately. In **Table 4**, I present multivariate analysis of the two health indices discussed in Table 2. **Model 1** in Table 4 is an ordered logistic regression model of the knowledge of contagion index. Recall that this index was constructed by summing the number of the three child illnesses – malaria, diarrheal disease, and respiratory infection – each respondent attributed to contagion factors. Thus for each respondent, this ordinal variable ranges from zero (no illnesses attributed to contagion) to three (all three illnesses attributed to contagion, with a mean of 0.68. **Model 2** in Table 4 is an ordered logistic regression model of the knowledge of contagion or hygiene index. This is the less stringent measure of general health knowledge, in which I considered both contagion- and hygiene-related causes as biomedical responses to the cause of diarrheal disease and cause of respiratory infection questions. Thus, the second index, knowledge of contagion *or* hygiene causes, is a sum of the number of the three child illnesses each respondent attributed to either contagion or hygiene factors. This ordinal variable also ranges from zero (no illnesses attributed to contagion or hygiene) to three (all three illnesses attributed to contagion or hygiene), with a mean of 1.45.

Because both outcome variables are ordinal variables, I relied on ordered logistic regression models to analyze the two health knowledge indices. Ordered logit models are used to estimate the effect of independent variables on an ordinal dependent variable with more than two outcomes. In my case, ordered logit is preferable to Ordinary Least Squares (OLS) regression because OLS assumes a continuous dependent variable, however it is important to note that the results for both the ordered logit and OLS models (results not shown) were very similar.

Odds ratios, also shown in Table 4, were obtained by exponentiating the ordered logistic coefficients. Odds ratios tell us how much more (or less) likely people with a particular characteristic, say education, are to be in a higher category (e.g., knowing causes of 3 illnesses) than in the lower categories (e.g., knowing causes of 0, 1, or 2 illnesses), compared to those without that characteristic and net of other effects.

As expected, Table 4 reveals that education and literacy are strongly associated with health knowledge. Those with primary or middle school are over two times more likely in both models to be in a higher category. Those with secondary or more schooling are over four times more likely. Literacy, as well, is strongly associated with general health knowledge.

Age and children ever born (CEB) are not significant in either model. This is interesting given that one might think that both age and children ever born may be proxy measures of experience with children (and their ailments). Additionally, both models reveal that the sex differential found in bivariate analysis, in which men were consistently more knowledgeable than women about biomedical causes of the three illness, reverses in multivariate analysis. In both models of my contagion and contagion and hygiene knowledge indices, men are *less* likely than women to be in a higher knowledge category, net of the effect of education and other socioeconomic factors. This is revealing, although the effect is fairly small (and only marginally significant ($p=0.083$) in Model 2). Not only does it contradict simple bivariate analysis, it also contradicts our knowledge of etiology Focus Group Discussions (FGDs), in which the moderators and myself were consistently struck by the greater child health knowledge demonstrated by members of the male FGDs than by members of the female FGDs.

In addition to the strong effects of education and literacy on these knowledge indices, other individual, household and community characteristics are influential. Greater exposure to media (measured via an index constructed from reports of newspaper, radio, and television usage) is associated with increased biomedical knowledge. Civic participation (again, measured via an index of voting and membership in a community organization) is also positively associated. Identification with a traditional religion appears to hinder knowledge of etiology, but it is only significant in Model 1.

Interestingly, Table 4 also reveals that migration experience is positively associated with knowledge of contagion or hygiene (Model 2), suggesting the possible selectivity of migrants on characteristics associated with biomedical health beliefs. In contrast, non-Akan ethnicity (the twenty percent of residents who are not members of the predominant Akan ethnic group) is associated with greater knowledge of contagion (Model 1).[5]

With respect to household and community influences, household SES, measured by my possession index, is positively associated with health knowledge in both models. Urban residence is also positively associated, and the effect is quite strong. Net of all the other individual and household characteristics included in the models, especially education, residents of urban areas are about 75 percent more likely to be in a higher category of knowledge of etiology than residents of rural areas. Finally, when I added in community controls for the 54 sampled communities (results not shown), I found that the pseudo-R^2 increased 6 percent in Model 1 and 4 percent in Model 2, demonstrating that individual communities are also influential.

In summary, what we see from Table 4 is that general health knowledge – in this case, measured by two indices of knowledge of causes of three child illnesses – is influenced by both formal education and literacy, as we would expect, but also by other individual, household and community characteristics. Net of the effect of education and literacy, media exposure, civic participation, migration, household SES, and, particularly, urban residence all influence biomedical knowledge in both models. This suggests that there are other routes to biomedical knowledge – and, it follows, to improved preventive and treatment behavior and, ideally, improved child health – than simply formal education. This is, I contend, an important finding for child health programs in southern Ghana.

[5] In another set of models (results not shown), I included an interaction term for migrants and non-Akan ethnicity. The coefficients for the interaction terms were positive and significant in both models, and odds ratios (calculated by exponentiating the sum of the component coefficients) were 1.78 for Model 1 and 1.77 for Model 2. Substantively, this means that non-Akan migrants are about 75 percent *more* likely to be in a higher category of knowledge of etiology than the reference group, Akan non-migrants, or never-movers of local (Akan) origin. This implies that it may be the long distance movers, the migrants from non-Akan ethnic areas (i.e., further away), who are most knowledgeable about biomedical causes of illness, net of other effects, suggesting, once again, the selectivity of migrants on characteristics associated with biomedical health beliefs.

V. Conclusions

In this paper I have attempted to answer two questions: 1) What do people know about the causes of child illnesses? and 2) How do they know it? The theoretical and public policy importance of these questions is bolstered by the education-child health literature, in which "health knowledge" is deemed important as a mechanism linking maternal education to improved child health behaviors and outcomes (Caldwell 1979 and 1986, Preston and Haines 1991).

I relied on a unique developing country primary data source for my analysis: a representative household-based survey of 2500 respondents in southern Ghana. In this survey, we asked both men and women about knowledge of causes, prevention, and treatment of three serious child illnesses: malaria, diarrheal disease, and respiratory infection.

Descriptive analysis (Table 2) revealed that people in this area of Ghana have low levels of biomedical knowledge of the three illnesses. For example, only about half of our sample (53 percent) could identify the cause of malaria, less than one-tenth (9 percent) and even fewer (6 percent) attributed diarrheal disease and respiratory infection, respectively, to contagion or infectious agents. Moreover, and as expected, bivariate analysis revealed that schooling is strongly associated with biomedical beliefs about child illnesses.

Bivariate results do not tell the whole story, however. When demographic and socioeconomic controls were introduced in multivariate models (Tables 3 and 4), we find that, in addition to the effect of formal education, other individual, household, and community factors were found to be influential, including media exposure, civic participation, migration experience, household SES, and urban residence. These findings suggest that, in addition to the very important influence of schooling on biomedical knowledge of child illness, there are other important pathways to health knowledge. This, I believe, has important implications for child survival policies and programs.

VI. References

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Table 1: Household and Individual Descriptive Characteristics

(Weighted value unless indicated.)

2002 Ghana Population & Environment Survey

Characteristic	Freq.	Mean (Std. Dev.)
Household Characteristics		
Number of Households[1]	**1197**	
Number of People Enumerated[1]	**4685**	
Male	2135	**45.6**
Female	2550	**54.4**
SES Index[2]		**2.86**
		(2.47)
Electricity	699	**58.4**
Drinking Water Source		
Piped Water	870	**72.7**
Well Water	164	**13.7**
Surface Water	58	**4.9**
Other (sachets, rainwater, tanker water)	105	**8.7**
Toilet Facility		
Flush Toilet	141	**11.8**
Pit Toilet/Latrine	674	**56.3**
No Facility/Bush	382	**31.9**
Cleanliness of HH (interviewer's assessment)		
Very Unclean	29	**2.4**
Unclean	220	**18.4**
Clean	795	**66.4**
Very Clean	153	**12.8**
Individual Characteristics		
Number of Respondents[1]	**2506**	
Male	1093	**43.6**
Female	1413	**56.4**
Ethnicity		
Fante	1800	**71.9**
Other Akan (including Asante)	199	**8.0**
Ewe	104	**4.2**
Guan	134	**5.3**
Other Northern	28	**1.1**
Other	239	**9.5**

Table 1: Household and Individual Descriptive Characteristics

(Weighted value unless indicated.)

2002 Ghana Population & Environment Survey

Characteristic	Freq.	Mean (Std. Dev.)
Migrant	1470	**58.7**
Children Evern Born	1437	**3.4**
		(3.2)
Religion		
None	192	**7.7**
Catholic	312	**12.4**
Protestant	645	**25.8**
Pentecostal	774	**30.9**
Syncretic	366	**14.6**
Muslim	97	**3.9**
Traditional	88	**3.5**
Other	30	**1.2**
Education (highest level attended)		
None/Arabic	734	**29.3**
Primary	385	**15.4**
Middle/JSS	929	**37.1**
Secondary+	458	**18.3**
Literacy (read and understand letter/newspaper)		
Not at All	1092	**43.6**
With Difficulty	519	**20.7**
Easily	886	**35.4**
Exposure to Media		
Reads Newspaper (weekly)	585	**23.4**
Listens to Radio (daily)	1811	**72.3**
Watches Television (weekly)	1441	**57.5**
Voted in Last Election	1561	**62.3**
Member of Community Organization	850	**33.9**
Handwash with Soap		
After Toileting	1260	**50.3**
Before Eating	657	**26.2**
Both after Toileting and before Eating	568	**22.7**

[1] Unweighted frequencies.

[2] Measured via a Likert index of 11 household possessions.

Table 2: Knowledge of Child Illnesses, for All and by Education Level

(N≈2500, Weighted mean unless indicated.)
2002 Ghana Population & Environment Survey

Characteristic	All	*Highest Level of Schooling Attended*				Sig.
		None	Primary	Middle	Second.+	
	(Std. Dev.)	(Std. Dev.)	(Std. Dev.)	(Std. Dev.)	(Std. Dev.)	
Knowledge of Malaria						
Cause of Malaria						
Caused by mosquito/malaria parasite	**0.53**	**0.29**	**0.41**	**0.59**	**0.89**	***
Can be prevented	**0.80**	**0.65**	**0.75**	**0.87**	**0.98**	***
Can be treated	**0.97**	**0.95**	**0.99**	**0.98**	**0.99**	**
Knowledge of Diarrheal Disease						
Cause of Diarrhea						
Contagion/germs	**0.09**	**0.05**	**0.07**	**0.09**	**0.15**	***
Hygiene/dirt	**0.60**	**0.45**	**0.55**	**0.66**	**0.74**	***
Other causes	**0.32**	**0.50**	**0.38**	**0.25**	**0.11**	***
Can be prevented	**0.73**	**0.58**	**0.65**	**0.77**	**0.95**	***
Can be treated	**0.97**	**0.93**	**0.97**	**0.99**	**0.99**	**
Heard of ORS	**0.84**	**0.67**	**0.80**	**0.92**	**0.97**	***
Knowledge of Respiratory Infection						
Cause of Respiratory Infection						
Contagion/germs	**0.06**	**0.02**	**0.04**	**0.07**	**0.13**	***
Hygiene/dirt	**0.17**	**0.14**	**0.13**	**0.16**	**0.28**	***
Other causes	**0.77**	**0.84**	**0.83**	**0.77**	**0.59**	***
Can be prevented	**0.65**	**0.54**	**0.55**	**0.67**	**0.87**	***
Can be treated	**0.96**	**0.94**	**0.93**	**0.97**	**0.99**	**
Spiritual Causes of Child Illnesses	**0.48**	**0.56**	**0.56**	**0.46**	**0.34**	***
Knowledge of Causes Indices						
Contagion factors [0, 3] [1]	**0.68**	**0.36**	**0.52**	**0.76**	**1.17**	***
	(0.67)	(0.52)	(0.61)	(0.67)	(0.62)	
Contagion or Hygiene factors [0, 3] [2]	**1.45**	**0.95**	**1.20**	**1.57**	**2.19**	***
	(0.96)	(0.86)	(0.93)	(0.89)	(0.73)	
***Knowledge of Prevention Index* [0, 3]** [3]	**2.18**	**1.76**	**1.96**	**2.30**	**2.79**	***
	(1.08)	(1.19)	(1.15)	(0.98)	(0.55)	

***** = p < 0.001, ** = p < 0.01, * = p < 0.05**
Significance tests are unweighted.
[1] Number of three illnesses -- malaria, diarrheal disease, and respiratory infection -- attributed to contagion.
[2] Number of three child illnesses attributed to contagion or hygiene.
[3] Number of three child illnesses considered to be preventable.

Table 3: Determinants of Knowledge of Etiology of Three Child Illnesses: Malaria, Diarrheal Disease, and Respiratory Infection

2002 Ghana Population & Environment Survey

	Model 1: Malaria *Logit* **Knowledge of Mosquito or Malaria Parasite** N = 2479			**Model 2: Diarrheal Disease** *Logit* **Knowledge of Contagion or Hygiene** N = 2479			**Model 3: Respiratory Infection** *Logit* **Knowledge of Contagion or Hygiene** N = 2479		
Independent Variable	**Coef.** (Rbst. Std. Err.)		***Odds Ratio***	**Coef.** (Rbst. Std. Err.)		***Odds Ratio***	**Coef.** (Rbst. Std. Err.)		***Odds Ratio***
Sex									
Male	**-0.206**	*	***0.81***	0.004		*1.00*	-0.117		*0.89*
	(0.10)			(0.093)			(0.109)		
Age	0.000		*1.00*	**-0.009**	*	***0.99***	**0.018**	***	***1.02***
	(0.00)			(0.004)			(0.005)		
Children Ever Born (CEB)	0.015		*1.02*	**0.035**	+	***1.04***	**-0.043**	+	***0.96***
	(0.02)			(0.021)			(0.023)		
Education									
None/Arabic School (Ref.)	0.000	--	*1.00*	0.000	--	*1.00*	0.000	--	*1.00*
Primary/Middle School	**0.682**	***	***1.98***	**0.556**	***	***1.74***	**0.481**	**	***1.62***
	(0.13)			(0.119)			(0.174)		
Secondary+ School	**1.629**	***	***5.10***	**0.988**	***	***2.69***	**0.986**	***	***2.68***
	(0.22)			(0.219)			(0.245)		
Literacy									
Reads Easily	**0.415**	**	***1.51***	**0.383**	**	***1.47***	**0.365**	*	***1.44***
	(0.13)			(0.131)			(0.146)		
Media Exposure Index	**0.126**	*	***1.13***	**0.097**	+	***1.10***	**0.214**	**	***1.24***
	(0.06)			(0.058)			(0.074)		
Civic Participation Index	**0.202**	**	***1.22***	**0.255**	***	***1.29***	-0.019		*0.98*
	(0.08)			(0.069)			(0.081)		
Traditional Religion [1]	**-0.419**	**	***0.66***	-0.057		*0.94*	0.173		*1.19*
	(0.14)			(0.122)			(0.164)		
Migrant	**0.340**	**	***1.40***	**0.401**	***	***1.49***	**-0.248**	*	***0.78***
	(0.10)			(0.093)			(0.125)		
Non-Akan	0.173		*1.19*	-0.017		*0.98*	**0.300**	+	*1.35*
	(0.14)			(0.137)			(0.164)		
SES Index	**0.102**	***	***1.11***	0.025		*1.03*	-0.003		*1.00*
	(0.03)			(0.024)			(0.029)		
Community									
Rural (Ref.)	0.000	--	*1.00*	0.000	--	*1.00*	0.000	--	*1.00*
Semi-Urban	0.132		*1.14*	0.057		*1.06*	0.061		*1.06*
	(0.13)			(0.113)			(0.155)		
Urban	**0.587**	***	***1.80***	**0.392**	**	***1.48***	**0.305**	+	***1.36***
	(0.14)			(0.130)			(0.163)		
Intercept	**-1.932**	***	***0.14***	**-0.551**	**	***0.58***	**-2.793**	***	***0.06***
	(0.21)			(0.190)			(0.239)		
	Chi^2 = 315.64 **pseudo R^2 = 0.1498**			**Chi^2 = 193.96** **pseudo R^2 = 0.0784**			**Chi^2 = 115.43** **pseudo R^2 = 0.0588**		

***** = p < 0.001, ** = p < 0.01, * = p < 0.05, + = p < 0.10**

[1] Includes traditional Ghanaian and Syncretic.

Table 4: Determinants of Index of Knowledge of Contagion (Model 1)[1] or Contagion or Hygiene (Model 2)[2]

2002 Ghana Population & Environment Survey

	Model 1 *Ordered Logit* Knowledge of Contagion N = 2479				Model 2 *Ordered Logit* Knowledge of Contagion or Hygiene N = 2479			
Independent Variable	**Coef.** (Rbst. Std. Err.)		**p**	***Odds Ratio***	**Coef.** (Rbst. Std. Err.)		**p**	***Odds Ratio***
Sex								
Male	**-0.195**	*	0.026	***0.82***	**-0.139**	+	0.083	***0.87***
	(0.088)				(0.080)			
Age	0.002		0.660	*1.00*	0.000		0.890	*1.00*
	(0.004)				(0.004)			
Children Ever Born (CEB)	0.003		0.877	*1.00*	0.011		0.545	*1.01*
	(0.018)				(0.018)			
Education								
None/Arabic School (Ref.)	0.000	--		*1.00*	0.000	--		*1.00*
Primary/Middle School	**0.696**	***	0.000	***2.01***	**0.738**	***	0.000	***2.09***
	(0.123)				(0.113)			
Secondary+ School	**1.435**	***	0.000	***4.20***	**1.529**	***	0.000	***4.61***
	(0.200)				(0.189)			
Literacy								
Reads Easily	**0.518**	***	0.000	***1.68***	**0.499**	***	0.000	***1.65***
	(0.128)				(0.113)			
Media Exposure Index	**0.175**	**	0.003	***1.19***	**0.172**	**	0.001	***1.19***
	(0.060)				(0.053)			
Civic Participation Index	**0.161**	*	0.020	***1.17***	**0.203**	**	0.001	***1.22***
	(0.069)				(0.063)			
Traditional Religion[3]	**-0.339**	*	0.011	***0.71***	-0.154		0.190	*0.86*
	(0.134)				(0.118)			
Migrant	0.136		0.168	*1.15*	**0.291**	**	0.001	***1.34***
	(0.098)				(0.088)			
Non-Akan	**0.283**	*	0.033	***1.33***	0.166		0.215	*1.18*
	(0.133)				(0.134)			
SES Index	**0.091**	***	0.000	***1.10***	**0.056**	**	0.007	***1.06***
	(0.023)				(0.021)			
Community								
Rural (Ref.)	0.000	--		*1.00*	0.000	--		*1.00*
Semi-Urban	0.110		0.359	*1.12*	0.130		0.217	*1.14*
	(0.120)				(0.105)			
Urban	**0.544**	***	0.000	***1.72***	**0.588**	***	0.000	***1.80***
	(0.129)				(0.122)			
Intercept 1	1.671				0.401			
	(0.191)				(0.168)			
Intercept 2	4.815				2.119			
	(0.224)				(0.174)			
Intercept 3	7.504				4.341			
	(0.337)				(0.193)			
	Chi^2 = 385.25 pseudo R^2 = 0.1228				**Chi^2 = 438.28 pseudo R^2 = 0.0941**			

***** = p < 0.001, ** = p < 0.01, * = p < 0.05, + = p < 0.10**

[1] Number of three child illnesses attributed to contagion.

[2] Number of three child illnesses attributed to contagion or hygiene.

[3] Includes traditional Ghanaian and Syncretic.