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From the Editor-in-Chief

This volume of *World Health & Population* represents papers which have recently been published online by *WHP*, in response to the call by the Council of Science Editors for a "Global Theme Issue on Poverty and Human Development." The CSE Global Theme Issue (http://www.councilscienceeditors.org/globalthemeissue.cfm) resulted in more than 230 science journals throughout the world simultaneously publishing over 750 articles of worldwide interest, on October 22, 2007. The goal of the CSE Global Theme Issue is to stimulate interest and research in poverty and human development, and disseminate the results of this research as widely as possible. The mission of *WHP* clearly mirrors this goal in the areas of health and population.

In addition to the papers in this volume responding to the CSE call, Michel Landry and Sudha Raman prepared an invited editorial entitled "The Millennium Development Goals (MDGs): A Global Policy Paradox." Mike Landry is an Associate Editor of *WHP*. The MDGs provide extrinsic parameters around which to judge efforts to address global poverty and human development. Landry and Raman provide a concise summary of the MDGs, and also an interesting perspective on the intrinsic policy value and implications of the MDGs, which mirror in many ways the goals of the CSE Global Theme Issue. Although the world will almost certainly will fall short of achieving by the year 2015 many of the extrinsic goals expressed in the MDGs, the MDGs will from a policy standpoint still "set in place a framework through which to more fully appreciate the multidimensional health, economic and social factors that contribute to human development." The further hope is that this understanding will lead to a longer-term commitment to action at the community, country and international level.

Of the seven papers in this volume, four are from sub-Saharan Africa, three are from South Asia, and one is a multinational comparison. All relate to the impact of poverty and human development on health, and all address issues of importance to work toward achieving the objectives of the Millennium Development Goals.

The first paper in this volume examines the potential risk factors for developing complications during pregnancy. Chowdhury et al. reanalyze a relatively old cross-sectional survey on maternal morbidity in Bangladesh, and put the results in the context of supporting the MDG in this area. Complications are classified by Chowdhury et al. as either "life threatening" or "high-risk" and based upon the data the authors encourage better prenatal health education and social mobilization to reduce the incidence and prevalence of these negative factors.

Idowu and colleagues from the Nigerian Institute of Medical Research address a logistical and training issue in the delivery of health care in "Height as a Substitute for Weight for Estimating Praziqantel Dosage." Proper dosage of drugs is critical not only for efficacy but also safety. Establishing acceptable, simple dosing methods, however, can be a great advantage when training opportunities are scarce, and specialized equipment is difficult to acquire and maintain. Idowu et al.'s study show the adequacy of a measuring stick, versus more complex weight measurement, in determination of

proper praziquantel dosage for treatment of schistosomiasis. (Note that even a simple weight scale is considered "specialized equipment"!)

Most current programs to improve child survival focus on the child, e.g., improved nutrition, control of diarrhea and acute respiratory infections, use of vaccinations, etc. Working out of the Aga Khan University in Pakistan, Nuruddin and her coauthors examine through a cross-sectional survey what might be described as a second-order effect: maternal good health and freedom from chronic illness. Their working hypothesis could be paraphrased as "healthy moms lead to healthy kids" and they advocate for more focus on maternal health care in the overall goal of reducing under five child mortality.

The need to prioritize scarce health care resources is necessary for all economies, whether highly resource constrained or not. In the latter economies, however, this need is obviously more pronounced. Uzochukwu and colleagues from the University of Nigeria College of Medicine explore household perceptions and prioritization of endemic diseases through a cross-sectional survey of 16 communities. Interestingly, the survey revealed large discrepancies between community perceptions and the Nigerian government's own epidemiologic and statistical data on disease prevalence and impact. Community education is needed to better align community perceptions with scientific reality; however it is a fine line, in that community perceptions and priorities must also be acknowledged and respected.

In his paper, Binod Nepal provides a multinational ecological and structural analysis of the HIV/AIDS epidemic, discussing the issue of gender balance among those afflicted, and the relationship with the level of socio-economic development and good governance. There is a strong correlation between poverty (whether in developed or resource-constrained economies) and the proportion of women affected by the epidemic. Nepal argues that enhanced gender equity will reduce unsafe exposure to the epidemic, and that well-governed, prosperous societies, working toward gender equity, are necessary for controlling the disease.

Dongre et al. present a description and evaluation of an effective grass-roots, community-based intervention strategy involving menstrual education for rural adolescent girls in India. The effectiveness of the intervention in promoting behavior change was shown through both survey as well as focus group methods. Desired long run implications for interventions of this kind are improved reproductive outcomes, including maternal morbidity and mortality, clearly supportive of the MDGs.

"Maternal Healthcare and the Spread of AIDS" by Deuchert uses Demographic and Health Survey (DHS) data to argue that more attention needs to be paid to unsafe practices in the delivery of medical care, to prevent iatrogenic transmission of HIV. The epidemic is more, therefore, than just social and sexual behaviors. Deuchart's analysis shows a strong association between formal healthcare (tetanus toxoid injections during pregnancy) and HIV seropositivity. The HIV epidemic needs to be addressed from many fronts, and improved healthcare delivery is certainly one.

In summary, *WHP* is pleased to support the Council of Science Editors Global Theme Issue with these papers, and the editorial by Mike Landry and Sudha Raman explicating the Millennium Development Goals. *WHP* remains committed to its mission to provide a forum for researchers and policy makers worldwide to publish and disseminate health- and population-related research, and to encourage applied research and policy analysis from diverse international settings.

We hope that you also find these articles of interest and value, and will additionally consult other papers released online at www.worldhealthandpopulation.com. The editors and publishers of *WHP* are always interested in any comments or suggestions you might have on the articles or journal. Please feel free to write or e-mail us.

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Guest Editorial

Millennium Development Goals (MDGs): A Global Policy Paradox

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Health status is connected with factors such as the environment, trade, economic growth and national security. Due to these close associations, health has emerged as a mediating factor inherent to a nation's prospect for human development. The concept of human development is the extent to which people living in a community, region or country are able to fulfill their human rights and achieve personal aspirations. The Human Development Index (HDI) is a composite score used by the United Nations Development Programme (UNDP) to rank countries in terms of their human development status. Most regions of the world have shown improvement in the HDI between 1975 and 2003. However, the HDI of many low-income or developing nations, particularly within Sub-Saharan Africa (SSA), has declined since the late 1980s, creating a widening gap between the so-called rich and poor countries (UNDP 2005; Birn 2005).

In recognition of the widening gap in real and potential human development, the United Nations initiated a global campaign called Millennium Development Goals (MDGs) (UN 2005). The MDGs were adopted in 2000 as a framework aimed at scaling up the development process (Dodd and Cassels 2006). There are eight internationally agreed upon MDGs, measured by a series of 48 indicators geared at reducing economic, social and health disparities in developing nations.

Table 1. Millennium Develop Goals (MDGs) (UN 2005)

Goal 1: Eradicate extreme poverty and hunger
- Reduce by half the proportion of people living on less than a dollar a day
- Reduce by half the proportion of people who suffer from hunger

Goal 2: Achieve universal primary education
- Ensure that all boys and girls complete a full course of primary schooling

Goal 3: Promote gender equity and empower women
- Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015

Goal 4: Reduce child mortality
- Reduce by two thirds the mortality rate among children under five

Goal 5: Improve maternal health
- Reduce by three quarters the maternal mortality rates

Goal 6: Combat HIV/AIDS, malaria and other diseases
- Halt and begin to reverse the spread of HIV/AIDS
- Halt and begin to reverse the incidence of malarial and other major diseases
- Halt and begin to reverse the incidence of tuberculosis

Goal 7: Ensure environmental sustainability
- Integrate the principles of sustainable development into country policies and programs; reverse loss of environmental resources
- Reduce by half the proportion of people without sustainable access to safe drinking water
- Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020

Goal 8: Develop a global partnership for development
- Develop further an open, rule-based, predictable, non-discriminatory trading and financial system
- Address the special needs of the least-developed countries, landlocked countries and small island developing states
- Deal comprehensively with developing countries' debt
- In co-operation with developing countries, develop and implement strategies for decent and productive work for youth
- In co-operation with pharmaceutical companies, provide access to affordable essential drugs in developing countries
- In co-operation with the private sector, make available the benefits of new technologies, especially information and communication technologies

Source: www.un.org/millenniumgoals/goals.html

The 15-year period dedicated to the MDGs (2000–2015) has now reached the midway point, and the overall success of the initiative has been mixed. The United Nations estimates that some of the targets have already been met, whereas others are expected to be met in the next few years (UNDP 2007). However, sadly, the majority of MDGs are unlikely to be reached by 2015 (Davey et al. 2006; Olusanya 2006; Jansen 2007; Potts and Fotso 2007). Although some regions such as Northern Africa and South-Eastern Asia are progressing relatively well, SSA continues to be a particular concern: half of the indicators have demonstrated either no progress or reversal in the gains made from the 1990s (UNDP 2007). In recognition of this, the United Nations Secretary-General has convened a steering committee to get SSA on track before 2015. The goals set by this committee are threefold: first, to identify effective mechanisms for implementing commitments in the areas of health, education, agriculture, food security, infrastructure and statistical systems; second, to improve aid predictability; and third, to strengthen joint efforts at the country level in support of the MDGs. The difficulty lies in the empirical measurement of these and other macro-level goals. In recently published editorials, it is consistently argued that progress of the MDGs is almost impossible to gauge due to the lack of valid and reliable population data (Anonymous 2007; Murray 2007; Lawn et al. 2007). In response, the United Nations Statistical Division acknowledged these deficiencies, but, as might be expected, they also signalled that progress is being made (Cheung 2007). It is important to highlight that developing countries are not alone in this data conundrum.

Countries at all levels along the development continuum repeatedly deal with lack of data and tend to always signal the need for more and better data.

At the MDGs' midpoint, it can be argued that the process of identifying a series of specific and theoretically measurable goals has indeed served to reset the global development agenda among multiple stakeholders ranging from governments, policy makers and researchers to local communities. The MDGs have also served to create a common vision and discussion platform regarding the key aspects of the development process and have set the framework for comparisons among regions and countries. In her seminal book *Policy Paradox: The Art of Political Decision Making*, Stone argued that the intrinsic policy goals of a program or intervention can be quite different from the expected or extrinsic goals (Stone 1997). In other words, sometimes "losing" is in fact "winning." If the MDGs are not achieved by 2015, and by most accounts they will not be, many stakeholders will view the outcome as yet another example of the international community's failure to meet its own targets. On the other hand, from an analytical policy perspective, the intrinsic and extrinsic goals of the program should be questioned prior to judgment. For instance, it would be instructive to examine whether the overall extrinsic goal of the MDGs was designed to be a realistic, measurable and time-limited event, or, from an intrinsic perspective, were the MDGs designed to set the direction of future human development? Perspective, values and interests surrounding this issue will certainly drive the individual and collective final opinion in this regard, but global programs such as the MDGs represent a complex policy paradox that is riddled with challenges in terms of structure, processes and outcomes.

In the end, MDGs may achieve a policy goal by highlighting the embarrassing discrepancies in human development that exist between countries and regions, along with the scale of the international financing and action required to address these discrepancies. The MDGs may not achievable by 2015; however, from a global policy perspective, they will surely set in place a framework through which to more fully appreciate the multi-dimensional health, economic and social factors that contribute to human development. If in time this understanding leads to a long-term commitment to action at the community, country and international levels, then, irrespective of the success of the stated extrinsic goals, the achievement of the intrinsic goals of the MDGs – the promise of more equal global human development – may be the ultimate legacy of the MDGs.

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Determinants of Antenatal Morbidity: A Multivariate Analysis

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Abstract

Objectives: The aim of this paper was to investigate the potential risk factors for developing complications and their magnitude during the antenatal period. Methodology: The data used in this paper came from a prospective survey in rural areas of Bangladesh conducted by the Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies (BIRPERHT) between November 1992 and December 1993. The differential patterns were analyzed for respondents' selected characteristics, and multivariate analysis was performed employing logistic regression and proportional hazards models for life-threatening and high-risk complications during pregnancy. **Results:** For life-threatening complications during pregnancy, several factors emerged as potential risk factors, such as number of the pregnancy, age at marriage, duration of pregnancy, economic status and history of anemia prior to the index pregnancy. The last two covariates were associated only in the proportional hazards. Potential risk factors for high-risk complications during pregnancy were level of education, age at marriage, wanted pregnancy, duration of pregnancy and economic status.

Conclusions: Health planners and policy makers in developing countries are trying to facilitate health services at the doorsteps of rural people. Our findings will help them understand the magnitude and underlying determinants of maternal morbidities and help their health planning process to reduce both life-threatening and high-risk complications during the antenatal period. Early age at marriage needs to be prevented through encouragement of girls' education as well as through increased social awareness programs. An effective quick referral mechanism should be developed to provide emergency services to high risk-groups. Finally, the importance of additional food supplements needs to be promoted during antenatal care visits as well as through mass media in order to reach people living in remote areas of rural Bangladesh.

1. Introduction

Reducing maternal mortality is one of the major goals of several recent international conferences and has been included in the Millennium Development Goals. The estimated number of maternal deaths worldwide in 2000 was 529,000, and an overwhelming majority of those deaths take place in developing countries (WHO et al. 2004). Various studies have identified a relationship between maternal morbidity and mortality and socio-economic factors related to this morbidity (Fortney and Smith 1999; Jejeebhoy 1997; Okolocha et al. 1998). However, far less is known about the magnitude, dimension and determinants of maternal morbidity among women in developing countries such as Bangladesh (BRAC 1994). Rochat et al. (1981) reported that 26% of all pregnancy-related deaths were attributable to induced abortion. Several studies demonstrated that the most important causes of maternal death in rural Bangladesh were eclampsia, septic abortion, postpartum sepsis, obstructed labour, and antepartum and postpartum hemorrhage (Rochat et al. 1981; Khan et al. 1986; Koenig et al. 1988; Bhuiyan and Hussain 1995). It was observed that prior to death, 42% of the pregnancies were attended by traditional practitioners and 33% were not attended at all (Fauveau et al. 1989; Goodburn et al. 1995). In another study, Koblinisky et al. (1993) reported that the number of acute morbidities related to childbirth could be as many as 67 episodes for every maternal death in a country such as Bangladesh.

These results indicate that women do not receive adequate healthcare during pregnancy or delivery. Bhatia (1995) showed that in India, 18% of the women reported problems during the antenatal period and an equal proportion during delivery. In another study, conducted in South India, Bhatia and Cleland (1995) found that 33% of women reported at least one problem; the most common problems were weakness, anemia and lower abdominal pain. Bhatia (1993) also indicated that levels of maternal mortality in India were very high.

It is worth noting that maternal health is greatly affected by lack of adequate nutritional intake. Kulier et al. (1998) showed that nutritional interventions such as calcium supplementation during pregnancy reduce the risk of high blood pressure and pre-eclampsia. Similarly, iron and folate supplementation can reduce the incidence of low pre-delivery hemoglobin. Manual work and poor nutrition are certainly associated with the risk of prematurity and some of the medical complications of pregnancy. Incomes, type of housing, type of family, age at marriage, gainful employment and maternal education have a direct relationship with pregnancy and its outcome (Bhargava et al. 1991). It was also observed that women's health and well-being were most influenced by unwanted pregnancies and multiparities that led to greater harm than the occasional side effects of some of the contraceptives (Ray 1995).

The information on maternal morbidities at the community level in Bangladesh is scant. Several hospital-based or cross-sectional studies are available, and most of them focus on maternal mortality (Rochat et al. 1981; Khan et al. 1986; Fauveau et al. 1989; Chen et al. 1974; Obaidullah et al. 1981; Akhter et al. 1996). However, hospital-based studies are not representative samples of the community, because most rural pregnant women do not visit such facilities (Fortney and Smith 1999; Bhatia 1995). Cross-sectional surveys need very large samples to capture all the conditions as they vary during the gestation period. Prospective studies are an ideal approach in these situations, though very costly and time-consuming. In 1994, the Bangladesh Rural Advancement Committee

(BRAC), in collaboration with the London School of Hygiene and Tropical Medicine, undertook a prospective study on postpartum morbidity and its relationship to delivery practices. They identified that postpartum morbidities were very common in the community. So far, few prospective studies are available on maternal morbidity in different countries. Chakraborty et al. (2003a), using the multiple-decrement life table technique, reported the likelihood of high-risk disease conditions that women experience during the antenatal period for different age categories from the same data set. The objective here is to identify the selected background and demographic characteristics that influence life-threatening and high-risk complications during the antenatal period and the magnitude of antenatal morbidities, using the longitudinal data set on maternal morbidity from Bangladesh.

2. Methods

This paper is based on the data from the survey on Maternal Morbidity in Bangladesh, conducted by the Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies (BIRPERHT). Data collection spanned the period November 1992 to December 1993. The study was conducted after securing necessary permission from the Institutional Ethics Committee known as the Human Subjects Committee of the BIRPERHT.

Sampling

A multi-stage random sampling was employed to collect data on maternal morbidity. One district from each of four divisions was selected in the first stage. In the second stage, one *thana (a thana is comprised of several unions, giving a population size of 0.2-0.25 million)* from each selected district was selected randomly. Finally, two unions (unions are comprised of several wards, which are small geographical areas comprised of villages in rural areas) from each selected *thana* constituted the study area. For the prospective study, 1020 pregnant women (pregnancy less than 6 months) were interviewed. Prospective subjects were followed up, on average once a month, through full-term pregnancy, delivery and until 90 days postpartum or 90 days after any other pregnancy outcome. Information on socio-economic, background, pregnancy-related care and practice, extent of morbidity during the index pregnancy, delivery, and postpartum period or abortion was collected. Of 1020 women, 993 had at least one antenatal follow-up and 1005 had information available on pregnancy termination. Finally, 1006 had at least one postpartum follow-up. Details regarding data collection, sampling and the questionnaire are presented in a published report (Akhter and Chowdhury 1996; Islam and Chowdhury 2006).

Outcome variables

In this study, all major types of morbidity during the antenatal period are taken into account as outcome variables of interest on the basis of the published literature (Chakraborty et al. 2002; Chakraborty et al. 2003a). Different morbidities were observed for each subject during the follow-up period: hemorrhage, fits/convulsion, edema, excessive vomiting, cough or fever for more than 3 days. We did not consider other morbidities due to their very high proportion. For our analysis, we considered two binary variables: (i) life-threatening complications (hemorrhage, fits and convulsion), and (ii) high-risk complications (edema, excessive vomiting, and cough/fever for more than 3 days). For this paper, we considered the first-time occurrence of any morbidity during antenatal visits.

Covariates

To identify potential risk factors, we considered the following variables: education (no education = 0, primary [1–5 years education] = 1, & secondary and above [6 years or more] = 2); economic status (low [if roof of the house is made of bamboo/straw] = 0, & high [if roof is made of C.I. sheet/cement/tally] = 1); gainful employment (no = 0, & yes = 1); special food for pregnancy (no = 0, & yes = 1); age at marriage (15 years or less = 0, & more than 15 years = 1); number of pregnancies excluding current one (no pregnancy = 0, 1–4 = 1, & 5+ = 2); pregnancy wanted (no = 0, & yes = 1); anemia before pregnancy (no = 0, & yes = 1) and STD before pregnancy (no = 0, & yes = 1).

The cut-off points for independent variables were chosen based on those suggested in the literature (Chakraborty et al. 2002; Chakraborty et al. 2003a, 2003b; Islam et al. 2006).

Limitations of the Study

The study was conducted about 15 years ago but was longitudinal in nature, which gives better insight about the morbidities that occur at phases of the antenatal period. The sample size does not permit analyzing data more efficiently for some of the variables due to small cell frequencies. The number of follow-ups is not equal for each respondent due to the variation in entry time in the survey, which complicates the analysis to some extent. Although this survey was old, it was very extensive in order to cover different aspects of maternal morbidities. Since data collection, the socio-economic status of people in rural areas has not improved substantially; hence the findings of the study still have important policy implications of scientific merit.

Table 1. Distribution of respondents by background characteristics (*N* = 993)

Characteristics	%	*n*
Education		
No education	54.8	544
Primary	28.4	282
Secondary and above	16.8	167
Economic status		
Low	79.9	793
High	20.1	200
Special food for pregnancy		
No	74.8	743
Yes	25.2	250
Age at marriage		
Less than or equal to 15 years	65.1	646
More than 15 years	34.9	347
Number of pregnancies		
No pregnancy	27.1	269
1–4	57.1	567
5+	15.8	157
Wanted pregnancy		
No	31.6	314
Yes	68.4	679
Anemia before pregnancy		
No	38.6	383
Yes	64.4	610

Note. Some of the *n*'s may not add to the total due to missing values.

3. Results

Table 1 shows the distribution of respondents' background characteristics. It is clear that a majority had no formal education (54.8%), while a little more than one quarter had primary education and about one sixth had secondary or higher. As expected, an overwhelming majority of the respondents (79.9%) reported low economic status and less than one third were employed (not shown). The majority were married before they were 16 years of age (65.1%), indicating that most rural women marry at a very young age and are exposed to a number of health risks due to early initiation of

childbearing. Most (74.8%) received no special food during pregnancy. The index pregnancy was the first for 27.1% of the women, while a majority (57%) had experienced 1–4 pregnancies and 15.8% reported having had 5 or more pregnancies prior to the index pregnancy. Among respondents, 68.4% had wanted the index pregnancy. History of previous complications showed that 64.4% had anemia before the pregnancy.

Table 2 displays the distribution of respondents by reported duration of pregnancy and level of complications – life threatening or high risk. It is surprising to note that a very high proportion of respondents reported these complications during the first trimester, but levels declined steadily in subsequent trimesters.

Table 2. Percent distribution of respondents for life-threatening and high-risk complications at different antenatal follow-ups

	Morbidities									
	Life-Threatening Complications				High-Risk Complications				Total *N*	
Follow-up Number	No		Yes		No		Yes			
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
1	804	24.1	188	38.0	562	22.7	430	31.9	992	25.9
2	786	23.6	131	26.5	631	25.4	286	21.2	917	24.0
3	687	20.6	84	17.0	532	21.4	239	17.8	771	20.1
4	549	16.5	45	9.1	405	16.3	189	14.0	594	15.5
5	340	10.2	30	6.1	231	9.3	139	10.3	370	9.7
6	135	4.1	13	2.6	99	4.0	49	3.6	148	3.9
7	31	0.9	3	0.6	21	0.8	13	1.0	34	0.9
8	0	0.0	1	0.2	0	0.0	1	0.1	1	0.0

Note. Some of the *n*'s may not add to the total due to missing values.

Table 3 shows the percentage of respondents with life-threatening and high-risk complications, by characteristic. As expected, the percentages of high-risk complications are much higher than those of life-threatening complications. There were few cases of fits or convulsion, but due to a higher number of excessive-bleeding cases (termed hemorrhage here), the percentage of life-threatening complications appears to be higher than expected. On Table 3, a significant negative association between level of education and prevalence of life-threatening complications is clearly evident, and although a similar pattern is observed for high-risk complications, it does not appear to be significant. It is quite surprising that economic status seems positively associated with high-risk complications. Special food for pregnant women seemed to have decreased the extent of life-threatening complications significantly. As expected, lower age at marriage is associated with higher prevalence of both life-threatening and high-risk complications. On the other hand, life-threatening complications are positively associated with number of pregnancies. If the pregnancy is desired, then it is likely that the prevalence of both types of complications would be reduced significantly. It is also observed that prior history of anemia increases the prevalence of life-threatening complications significantly.

Multivariate Analysis

To identify the net effects of the selected socio-economic, demographic and medical characteristics on antenatal complications, we employed both logistic regression and proportional hazard models. For each type of complication, one logistic and one proportional hazard model is used.

The occurrence of life-threatening complications is significantly associated with first-time pregnancy (no prior pregnancies) compared with 1–4 prior pregnancies (reference category), higher age at marriage, and duration of pregnancy (second trimester and third trimester compared to first trimester). All these associations indicate that prevalence of life-threatening complications decreases for respondents with no prior pregnancy compared with those with 1–4 prior pregnancies, age at marriage greater than 15 years compared with lower age, and duration of pregnancy to the second or third trimesters compared with the first (Table 4).

Table 3. Differential patterns of complications reported during antenatal period, by background characteristics (*N* = 993)

Characteristics	Prevalence of Complications		
	Life-Threatening Complications	High-Risk Complications	*n*
Education	**		
No education	28.86	63.05	544
Primary	21.63	62.76	282
Secondary and above	18.56	53.29	89
Economic status		*	
Low	24.46	59.65	793
High	27.50	68.00	200
Special food for pregnancy	*		
No	26.51	62.45	743
Yes	20.80	58.00	250
Age at marriage	**	**	
Less than or equal to 15 years	28.64	64.71	646
More than 15 years	18.44	55.04	347
Number of pregnancies	**		
No pregnancy	17.10	57.25	269
1–4	27.69	62.61	567
5+	29.30	63.69	157
Wanted pregnancy	**	**	
No	30.57	68.79	314
Yes	22.53	57.88	679
Anemia before pregnancy	**		
No	19.58	58.22	383
Yes	28.52	63.28	610

Notes. χ^2 was used to test association.
Some of the *n*'s may not add to the total due to missing values.
* Significant at 5% level. ** Significant at 1% level.

Similar findings are observed (Table 4) for high-risk complications. Their prevalence is observed to have negative associations with secondary or higher level of education compared with no education, age at marriage greater than 15 years compared with lower age, desired pregnancy, and pregnancy duration to the second and third trimesters compared with the first.

To consider the outcome variables as function of duration, we used the proportional hazards model for examining the relationships with selected covariates. We observed slight changes in results for both life-threatening and high-risk complications (Table 5). In the new model, based on duration of occurrence of life-threatening complications, age at marriage greater than 15 years is negatively associated as in the logistic regression model, but positively associated with economic status and history of anemia before the pregnancy. Similarly, for high-risk pregnancy complications, economic status is positively associated, while there is a negative association with wanted pregnancy.

Table 4. Logistic regression analysis for life-threatening complications (yes = 1) and high-risk complications (yes = 1)

Characteristics	Life-Threatening Complications				High-Risk Complications			
	Coefficient	OR	95% CI		Coefficient	OR	95% CI	
Education								
No education	0.000	1.00			0.000	1.00		
Primary	-0.435	0.65	0.404	-1.036	-0.207	0.81	0.544	-1.214
Secondary and above	-0.278	0.76	0.408	-1.403	-0.622*	0.54	0.323	-0.893
Number of previous pregnancies								
No pregnancy	-0.928**	0.40	0.238	-0.657	-0.303	0.74	0.487	-1.120
1–4 pregnancies	0.000	1.00			0.000	1.00		
5 or more pregnancies	-0.157	0.85	0.463	-1.578	-0.372	0.69	0.407	-1.169
Age at marriage (>15 years = 1)	-0.707**	0.49	0.315	-0.774	-0.430*	0.65	0.451	-0.937
Economic status (high = 1)	0.283	1.33	0.803	-2.194	0.354	1.42	0.907	-2.237
Anemia before pregnancy (yes = 1)	0.259	1.30	0.842	-1.993	0.165	1.18	0.823	-1.689
Wanted pregnancy (yes = 1)	-0.424	0.65	0.403	-1.063	-0.562**	0.57	0.376	-0.864
Special food for pregnancy (yes = 1)	-0.269	0.76	0.474	-1.233	0.002	1.00	0.672	-1.494
Duration of pregnancy								
1–3 months	0.000	1.00			0.000	1.00		
4–6 months	-1.385**	0.25	0.130	-0.482	-1.357**	0.26	0.125	-0.530
7 or more months	-5.081**	0.01	0.003	-0.013	-4.220**	0.01	0.007	-0.031
Constant	2.387**				3.597**			
Model Chi-square (p-value)	494.020 (0.000)				463.175 (0.000)			

OR = odds ratio. CI = confidence interval.
* Significant at 5% level. ** Significant at 1% level.

4. Conclusion

This paper examines the potential risk factors for developing complications during the antenatal period from a prospective study in rural areas of Bangladesh. For life-threatening complications during pregnancy, several factors emerged as potential risk factors, such as number of the pregnancy, age at marriage, duration of pregnancy, economic status and history of anemia prior to the index pregnancy. The last two covariates were observed to be associated only in the proportional hazards model. Similarly, potential risk factors for high-risk complications during pregnancy are level of education, age at marriage, wanted pregnancy, duration of pregnancy and economic status. In

general, the prevalence of different complications was very high and, in particular, the prevalence of life-threatening complications during pregnancy was relatively higher than those of a cross-sectional study in Bangladesh (Akhter and Chowdhury 1996). The high prevalence of these complications in rural Bangladesh indicates the poor safe-motherhood situation. High-risk conditions such as edema, fever for more than 3 days and excessive vomiting are also generally more prevalent among women in rural Bangladesh. However, there might be some over-reporting of the high-risk conditions during pregnancy.

Table 5. Cox regression analysis for life-threatening complications (yes = 1) and high-risk complications (yes = 1)

Characteristics	Life-Threatening Complications				High-Risk Complications			
	Coefficient	RR	95% CI		Coefficient	OR	95% CI	
Education								
No education	0.000	1.00			0.000	1.00		
Primary	-0.281	0.76	0.559	-1.021	0.016	1.02	0.845	-1.223
Secondary and above	-0.257	0.77	0.509	-1.174	-0.141	0.87	0.673	-1.120
Number of previous pregnancies								
No pregnancy	-0.300	0.74	0.524	-1.046	0.020	1.02	0.835	-1.246
1–4 pregnancies	0.000	1.00			0.000	1.00		
5 or more pregnancies	-0.124	0.88	0.618	-1.262	-0.124	0.88	0.694	-1.123
Age at marriage (>15 years = 1)	-0.396**	0.67	0.502	-0.903	-0.162	0.85	0.713	-1.015
Economic status (high = 1)	0.325*	1.38	1.015	-1.887	0.287**	1.33	1.092	-1.625
Anemia before pregnancy (yes = 1)	0.334*	1.40	1.056	-1.847	0.089	1.09	0.921	-1.298
Wanted pregnancy (yes = 1)	-0.255	0.78	0.585	-1.026	-0.264**	0.77	0.639	-0.923
Special food for pregnancy (yes = 1)	-0.175	0.84	1.056	-1.847	-0.075	0.93	0.765	-1.125
Model Chi-square (p-value)	35.490 (0.000)				21.972 (0.009)			

RR = risk ratio. CI = confidence interval.
* Significant at 5% level. ** Significant at 1% level.

We observed that past history of complications (anemia before pregnancy) is positively associated with complications during pregnancy, which was confirmed in other studies, as well (Bhatt 1995). The risk of developing complications increased during the first pregnancy, in an unwanted pregnancy, in women of lower age at marriage, with less education and in those who ate no special food during the antenatal period. Other studies found similar relationships in India (Bhargava et al. 1991; Ray 1995; Choolani and Ratnam 1995; Rao 1995). In rural Bangladesh, pregnant women do not have easy access to adequate antenatal care. In addition, there is an acute shortage of efficient healthcare facilities and providers. Hence, the problems accumulate, and in the absence of an effective referral system, they become more complex. Due to lack of awareness, women lack the nutritional intake necessary during pregnancy and thus suffer from avoidable causes of morbidity at a much higher rate than expected. Some important policy measures that emerged from the findings of the study are listed below.

Both life-threatening and high-risk complications during the antenatal period are associated with rural women's lower age at marriage. If marriage takes place at a very early age, childbearing also

starts at a relatively younger age, resulting in complications during the antenatal period. Early age at marriage needs to be prevented through encouraging girls' education as well as through increased social awareness programs. In fact, to encourage girls' primary and secondary education, the government introduced a nationwide stipend program for girls in secondary schools, and it has resulted in increased girls' enrolment (Raynor and Wesson 2006). As girls without much education tend to marry early, the increase in education could effectively increase their age at marriage, because these are positively associated.

First pregnancy always involves some risks, particularly if the pregnancy occurs at an early age. Antenatal services provided at the grassroots level need to emphasize the first pregnancy and follow-up visits during that pregnancy in order to identify both life-threatening and high-risk complications. In addition, an effective quick referral mechanism should be developed to provide emergency services to this high-risk group. In Bangladesh, there is a change from community-based outreach services to static clinics for service delivery of clinical and non-clinical needs, antenatal care, postnatal care, etc. Women with first pregnancies at a young age can be given special attention in order to provide them with necessary care, and a referral system can be developed to provide better healthcare facilities in emergencies.

A substantial proportion of unwanted pregnancies can be reduced by promoting family planning programs for the target group who want to either space births or end childbearing permanently. Bangladesh has a successful family planning program that can address unmet needs for pregnancies in the high-risk group, and this can reduce both life-threatening and high-risk complications significantly. The importance of food supplements needs to be promoted during visits for antenatal care as well as through mass media in order to reach people living in remote areas of rural Bangladesh.

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Height as a Substitute for Weight for Estimating Praziquantel Dosage

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Abstract

The study evaluated height and weight measurements of 750 school children from five rural communities in western Nigeria. The measurements were taken by 12 trained community members designated as distributors in determining treatment dose with praziquantel for these children. A very strong correlation value, $r = 0.97$, was obtained for the weight of treated children measured by the distributors and the research team. The distributors obtained a correlation coefficient value of $r = 0.87$ on weight and height measurements, showing that height can be used by community distributors in lieu of weight for correct dose determination.

Introduction

Schistosomiasis affects 200 million people worldwide; about 600 million are at risk of infection, and 4.5 million Disability Adjusted Life Years (DALYs) are lost annually (Morel 2000; WHO 2002).

Schistosomiasis is a public health problem in Nigeria (Cowper 1973; Adekolu-John and Abolarin 1986; Ejezie et al. 1989; Tayo et al. 1989; Mafiana and Adesanya 1994; Mafe et al. 1997). The National Control Programme has been in place for control of the disease since 1988. Despite much data on national disease prevalence, only the data from the 1991 national prevalence survey (Federal Ministry of Health [FMH] 1992) enables comparison of the disease status across the states, because it was based on a uniform methodology nationwide. Currently, there is an ongoing effort to provide a Geographical Information System map to guide disease control and monitoring of intervention (Mafe et al. 2000). The National Control Programme has, however, been supporting some states where schistosomiasis is endemic in controlling the disease through a search-and-treat effort aimed at school children (FMH 1999).

Although children aged 5–19 years are the ones most affected by schistosomiasis (Tayo et al. 1989; Mafiana and Adesanya 1994; Mafe et al. 1997), other groups within the community are also at risk of infection in an endemic area. These vulnerable persons need to be considered in a mass treatment exercise according to World Health Organization (WHO) advocacy (WHO, 2002).

Praziquantel is ideal for mass treatment of schistosomiasis because of its effectiveness against all species in humans, its ease of administration, single oral dose and safety. It has been shown to be easily managed by illiterate community members (Mafe et al. 1997, 2000, 2005). Praziquantel is administered at a dose of 40 or 60 mg/kg body weight, depending on the intensity of infection, and in accordance with the manufacturer's instructions.

Schistosomiasis primarily affects poverty-stricken individuals. There is a dearth of both health facilities and health workers in affected rural communities, and it is essential that drug distribution through a community-based approach be encouraged to ensure that treatment reaches these poor and affected communities.

Given the low literacy levels in most communities in which schistosomiasis is endemic in Nigeria, and that having, replacing and correctly using a weighing scale is unlikely, we need an alternate way of determining drug dosage. The use of height in lieu of weight has been evaluated in some African countries (Montresor et al. 2001, 2005) and found to be a good alternative to weight for praziquantel dose determination. There is therefore a need to adapt this device in schistosomiasis control in Nigeria.

This study evaluated the use of height in lieu of weight by community members trained as distributors in determining dosage of praziquantel for mass treatment in schistosomiasis control in rural communities of Nigeria. It was part of a larger study on identifying appropriate channels of distributing praziquantel to include communities at risk (Mafe et al. 2005).

Study Area

The study was carried out in five communities in which urinary schistosomiasis is endemic, namely Adepegba, Elere Adubi, Imala-Odo, Olapeleke and Imala, in Ogun State, Nigeria. These communities are located in Ewekoro, Odeda and Abeokuta South Local Government Areas of Ogun State, Nigeria. The national prevalence survey on schistosomiasis of 1991 classified Ogun State as hyper-endemic (FMH 1992). Reagent stick testing carried out among school-aged children of 5–19 years old in these communities showed high prevalence rates of 89%, 87.8%, 79.1%, 69.9% and 51.1% for Imala-Odo, Elere Adubi, Adepegba, Olapeleke and Imala, respectively (Mafe et al. 2005).

Methods

The research team is well known to the communities, having conducted previous studies on the disease in the area, with the co-operation of community members. Advocacy visits were made to mobilize the communities for mass treatment of all school-aged children, based on our previous studies.

Community members who were trained by the research team determined the census of the

communities. Two persons chosen by each community, based on ability to read and write and community acceptance, were trained as distributors by the research team. Training focused on the cause, transmission, prevention, treatment, dose determination, benefit of treatment, management of side reactions, drug inventory, exclusion criteria and record keeping. Distributors were taught to determine praziquantel dosage by weight, at 40 mg/kg body weight using a salter scale calibrated in kilograms according to the manufacturer's recommendation, and also to measure (using a dose pole calibrated in centimeters) the height of each treated child. Distributors were also taught to record the name, age, sex and number of tablets given to each child, and the occurrence and type of adverse reactions.

The research team visited the communities 2 weeks after the drug distribution had been completed, traced all the children treated by the distributors and measured their heights and weights using the same calibrated praziquantel dose pole and salter weighing scale. The height and weight measurements determined by the distributors were compared with those determined by the research team to evaluate the accuracy of measurement by the trained distributors and the dose determination.

The relationship between the heights and weights of these children as measured by the distributors was determined using the Pearson statistical test to obtain correlation coefficient values. The number of tablets the distributors administered to the children was compared with what would have been used had dosage been based on height. The data were entered and analyzed using Epi Info software Version 6.04 (Centre for Disease Control and Prevention, Atlanta, Georgia, USA).

The study received approval from the local Ethics Review Board of the Nigerian Institute of Medical Research, Yaba, Lagos, Nigeria.

Table 1. Weight and height measurements of school-aged children by community and sex

Community	Male				Female				Both			
	N	Weight Range (kg)	Height Range (cm)	*r*	*N*	Weight Range (kg)	Height Range (cm)	*r*	*N*	Weight Range (kg)	Height Range (cm)	*r*
Adepegba	25	13–46 (24.25)[a]	94–165.0 (122.60)[b]	0.90	20	15–31 (21.65)	94–199.0 (122.10)	0.08	45	13–46 (23.09)	94–199.0 (122.38)	0.50
Imala-Odo	98	14–75.0 (30.79)	94–179.0 (132.19)	0.94	98	14–65 (28.99)	99–175.0 (130.85)	0.90	196	14–75 (29.88)	94–179.0 (131.52)	0.92
Imala	233	15–53 (28.65)	96–167 (131.79)	0.94	210	15–58 (30.66)	95–198 (135.19)	0.86	443	15–58 (29.60)	95–198.0 (133.40)	0.89
Olapeleke/ Elere-Adubi	35	14–55 (31.17)	97–174 (134.22)	0.92	31	13–52 (25.50)	98–156 (124.87)	0.84	66	13–55 (28.50)	97–174 (129.83)	0.89
All	391	13–75 (29.13)	94–179 (131.52)	0.92	359	13–65 (29.26)	94–199 (132.39)	0.83	750	13–75 (26.0)	94–199.0 (131.93)	0.87

N = number in the population; *r* = coefficient value.
[a] mean weight, [b] mean height.

Results

A total of 750 children, 391 (52.1%) of whom were male and 359 (47.9%) were female, had their weights and heights measured and recorded, and were treated with praziquantel (Table 1). The mean weight and height with corresponding coefficient values are given for each study community. High correlation values were obtained for the communities studied. The poor coefficient value obtained for females for Adepegba is to be further investigated. A very strong correlation value of $r = 0.97$ was obtained for the weights of treated children measured by the distributors and the research team (Figure 1). Similarly, a coefficient value of $r = 0.97$ was obtained for the heights of the school-aged

children measured by the distributors and the research team during evaluation, indicating a strong relationship (Figure 2). A strong value of $r = 0.87$ (Figure 3) was also obtained for the distributors' measurements, indicating a good relationship between weight and height measurement for praziquantel dose determination. In all, 1146 tablets were used to treat the children based on weight measurement, while a total of 1267 tablets would have been needed if dosage had been based on height (Tables 2 and 3). Of 62 children whose ages ranged between 3 and 10 years, 82.3% were aged 5 to 7 years and received 1 tablet. The height measurements of these 62 children ranged between 94 and 109 cm. The WHO praziquantel dose pole (Montresor et al. 2005) is not calibrated to allow for administration of 1 tablet, the minimum being 1½ tablets, and similarly for 3½ tablets; hence the lack of records on these dosages as shown in Table 4. In this study, however, the pole has been calibrated to allow for 1 tablet. The proportion of those treated by tablet category differs for dosages based on height and weight ($p < .05$; $\chi_2 = 120.307$; df = 6).

Table 2. Dosage based on weight of children treated by the distributors and total number of tablets used

Number-of-Tablets Category							Number of Tablets
1	1½	2	2½	3	3½	4	
38	249	20	-	-	-	-	307
-	69	198	20	3	-	4	294
3	3	82	112.5	24	7	5	236.5
-	1.5	2	57.5	87	38.5	12.5	199
-	-	2	-	24	45.5	38	109.5
41	322.5	304	190	138	91	59.5	1146

Table 3. Estimated number of tablets that would have been used by school-aged children based on height measurement by researcher by height category if they had received tablets by height

Height Categories (cm)	Tablets Category	Number of Tablets That Would Have Been Used
94–109	1	62
110–125	1½	312
126–138	2	310
134–150	2½	255
151–160	3	204
161– 70	4	124
Total	-	**1267**

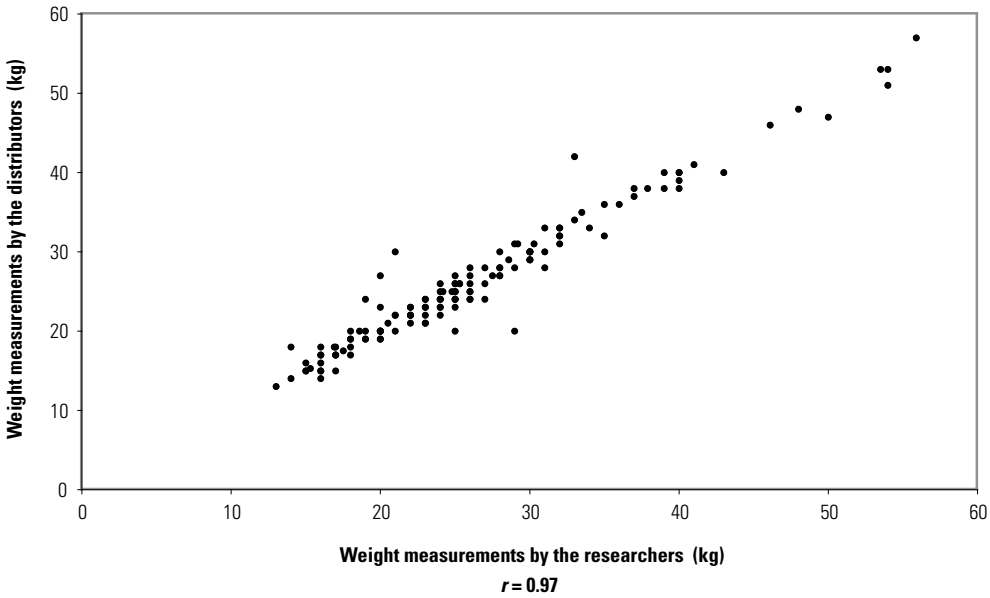
Discussion

The use of weight is the ideal means of dosage determination in drug administration; however, various factors militate against its use appropriately in largely rural communities with a high illiteracy level. This makes the use of height, measured with a calibrated device, a better alternative in such circumstances.

Table 4. Comparison of number of children treated by weight with estimated number of children that would have been treated by height

Number-of-Tablets Category	Number of Children Treated by Weight	Estimated Number of Children That Would Have Been Treated by Height
1	102	-
1½	261	214
2	172	155
2½	92	101
3	62	67
3½	36	-
4	25	27
Total	**750**	**750**

Figure 1. Relationship between measurements of weights of school-aged children by the researchers and distributors



Several means of determining drug dosage have been explored, such as use of mid-upper-arm circumference, estimation based on physical appearance, and age (Alexander et al. 1993; Shu and Okonkwo 2001; Idowu et al. 2003). Some of these, such as age, have been found unsuitable for dose determination (Idowu et al. 2003).

The distributors' measurements of height and weight of the treated individuals are highly reliable based on high correlation values obtained when compared with the research team's measurements during evaluation.

The use of height-measuring devices has been shown to be easily understood and used even by illiterate persons (WHO 1996; Hall et al. 1999; Idowu et al. 2003), and height is widely used globally in annual delivery of ivermectin in onchocerciasis control, for example, in the Ipogun

community, Southwestern Nigeria (Idowu et al. 2003). Hall et al. (1999) also reported height as a reasonably accurate estimate of weight in school children from Ghana, Tanzania and Malawi. The praziquantel dose pole has been adapted in this study to allow for dosage of praziquantel below 1½ tablets to children so qualified, which is within the manufacturer's dose recommendation.

Figure 2. Relationship between height measurements of school-aged children by the researchers and distributors

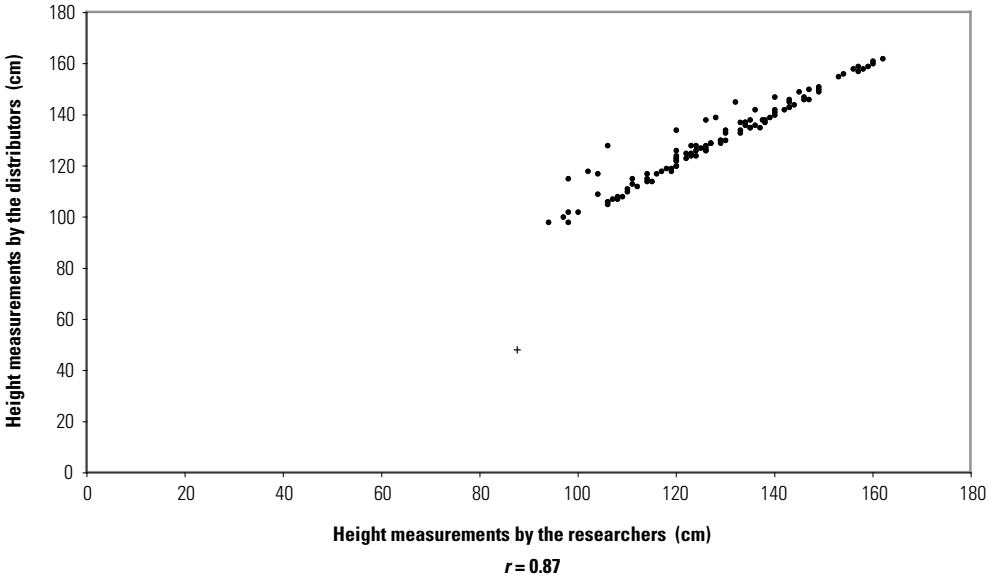
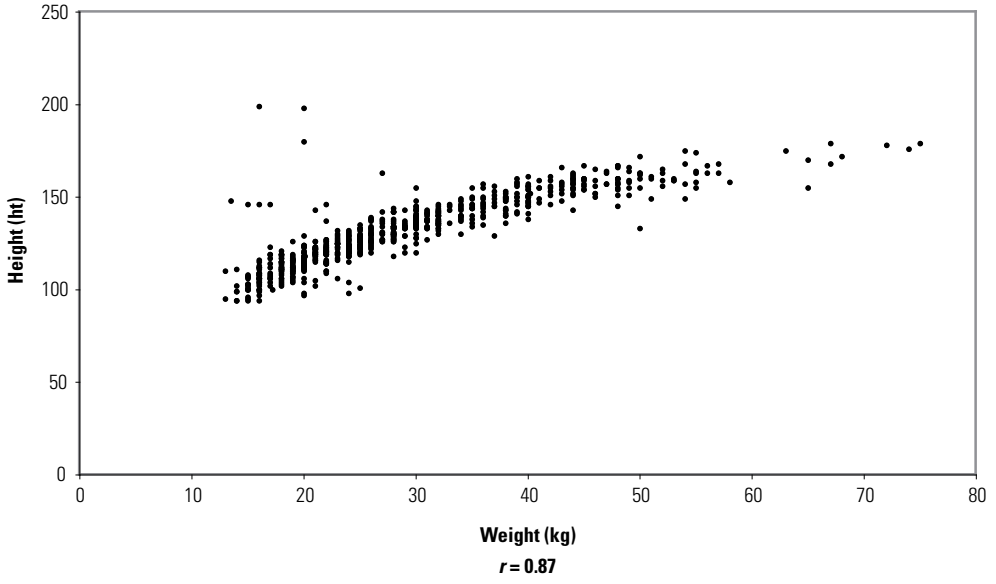


Figure 3. Relationship between weight and height measurements of school-aged children by distributors



We therefore recommend that the praziquantel dose pole be calibrated to administer 1 tablet to children whose height ranges from 94 to 109.9 cm. The use of height in praziquantel administration is user-friendly. The measuring device can be locally sourced, made and replaced. Given the use of a similar device in the delivery of ivermectin in onchocerciasis control programs, the use of height will allow for integration of community-directed health programs that will not only ensure that needy communities are served, but also minimize cost and enable capacity building.

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Maternal Chronic Ill Health Negatively Affects Child Survival in a Poor Rural Population of Pakistan

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Abstract

Pakistan ranks fourth globally in terms of absolute numbers of under-5 deaths. Although several determinants of child deaths have been identified, the possibility of an association between mother's health and under-5 deaths has not been assessed in Pakistan. We compared data on 106 deceased children 0–59 months old with those on 3718 live children, using a cross-sectional survey of 2276 households among 99 randomly selected villages in Thatta, a rural district of Pakistan. We examined the association between self-reported maternal health status and under-5 deaths, using the SUDAAN statistical package to account for cluster sampling technique. Three models for logistic regression analysis were Model-1: demographic factors, Model-2: household socio-economic factors and Model-3: demographic and household socio-economic factors. Mothers of deceased children were 60% more likely to report chronic illnesses than mothers of live children after controlling for child's age, mother's

age and type of house (final Model-3 analysis) (adjusted odds ratio [aOR; 95% confidence interval]: 1.6 [1.01, 2.5]). The association of self-reported maternal ill health with under-5 deaths in Thatta suggests the role of maternal health in child survival. Child survival strategies should include screening and treating mothers for common chronic illnesses. This is particularly important in a setting where only a quarter of chronically ill mothers seek care outside the home.

Background

A widely used analytical framework for child mortality proposed by Mosley and Chen (1984) identifies five sets of proximate determinants, which include maternal factors, environmental contamination, nutrient deficiency, injury and personal illness control. An alternative framework proposed by D'Souza and Bryant (1999) identifies six sets of determinants, including maternal, child, socio-demographic, socio-economic, behavioral and environmental factors. Even though maternal factors such as age, parity and birth interval are included in these theoretical frameworks, mother's health status has not been explicitly described as associated with childhood mortality.

An association between maternal health and child survival, though long appreciated, has been described in only two settings. In a rural area of Bwamanda, Northern Zaire, Broeck et al. (1996) reported a 4.8-times greater mortality in infants 0–3 months old among mothers with more than one sign of chronic disease, compared with mothers without any sign of chronic disease (95% confidence interval [CI]:1.1, 20.7). In rural Western India, Hirve and Ganatra (1997) found a four-times (95% CI: 1.7, 9.6) greater infant mortality and a three-times (95% CI: 1.7, 5.6) greater under-5 mortality among mothers with a non-pregnant weight of less than or equal to 40 kg, compared with those of more than 40 kg. This association between poor maternal health and deaths among under-5 children has not been examined in Pakistan, despite a high prevalence of anemia (47%) as evidence of poor health status in rural Pakistani women of reproductive age (15–44 years) (Pakistan Medical Research Council [PMRC] et al. 1998).

Worldwide, Pakistan ranks fourth by number of under-5 child deaths in a year (Robert et al. 2003) and 47th in descending order by under-5 mortality rate (United Nations Children's Fund [UNICEF] 2005). Pakistan's under-5 mortality rate is the highest among the South Asian countries (High Commission of Pakistan 2003) and exceeds the average for low-income countries by 60% (World Bank Group 1998). In order to achieve the Millennium Development Goal 4, Pakistan aims to reduce its under-5 mortality rate from around 140/1000 live births in 1990 to around 50 /1000 live births by 2015 (Planning Commission of Pakistan 2004).

Currently, a number of child-survival programs have been implemented by the World Health Organization (WHO; Expanded Programme of Immunization – EPI, Control of Diarrhoeal Diseases – CDD and acute respiratory infections – ARI) and UNICEF (growth monitoring, oral rehydration, breastfeeding promotion and Immunization-GOBI and Integrated Management of Childhood Illnesses – IMCI). In spite of these efforts, however, Pakistan's under-5 mortality rate (100/1000 live births) remains unacceptably high (WHO 2006a). Hence, locally relevant factors associated with child mortality need to be examined and incorporated in child-survival programs.

Data from a large community survey in a rural district of Sindh, Pakistan, provides an opportunity to examine whether mother's health is associated with child survival. We hypothesize that poor maternal health is associated with high under-5 mortality.

Material and Methods

Study Site

Thatta is a predominantly rural district located 60 kilometres east of Karachi, in the southernmost part of Sindh province, the second largest province of Pakistan. There are 49 administrative units (called union councils) and 6614 village settlements in Thatta (Government of Sindh and UNICEF 1993). Children aged 5 years and below make up 16% of Sindh's population of 2 million. Indicators of health status reflect the population's poor health and the inadequacy of the healthcare

system. Indicators include a high maternal mortality ratio (800/100,000 live births), low immunization coverage (46% complete immunization for children under 3 years of age), high total fertility rate (7.5) and low contraceptive prevalence (3.3%) (Department of Community Health Sciences [DCHS] 1994).

Data Source and Survey Design

The data analyzed here were collected in a survey by the Research Information System (RIS) of the Thatta Health System Research Project of The Aga Khan University, Karachi, from November 1992 to February 1993, after obtaining approval from the Institutional Ethical and Review Committee (DCHS 1994). The survey served as a baseline in a research project aimed at evaluating interventions in the government health system implemented at district, primary healthcare unit and community levels. Villages (*Primary Sampling Units*) located within a radius of 5 kilometers of 12 different Government Health Facilities (GHFs) (9 intervention and 3 reference health facilities) were listed and mapped to provide *a sampling frame for the first-stage sampling*. Villages (5 to 12) were randomly selected from each service area, with a target to sample at least 250 households per GHF catchment area. In this way, 99 villages were selected, serving as clusters. Within these selected clusters, all 2276 households (*Secondary Sampling Units*) were surveyed.

Data Collection

Interviewers (20), supervisors (four) and a survey manager were trained through a 3-week field-based program. A pre-coded questionnaire was pre-tested for ease and accuracy of data collection. Trained interviewers visited each household, with the assistance of village volunteers, and conducted the survey after securing informed consent. Completed questionnaires were checked and validated by field supervisors daily.

Household heads (or in their absence, the next elder/responsible member of the household) provided information on socio-demographic characteristics of households and their members. A complete reproductive history was obtained from mothers by asking about the number of times they had been pregnant, had live deliveries and still births, the number of live children, and when the last delivery was and its outcome. Children's ages were estimated with the aid of local event calendars listing important events, festivals and moon cycles in the last 5 years. If there had been a death in the household during the last year, information was collected regarding age and sex of the deceased and probable cause of death. Mothers and fathers were asked whether they had been ill during the last year. Those who reported illness were asked an additional series of questions about symptoms, probable cause and duration of illness, and source of care. Interviewers were trained to code common chronic illness from the reported symptoms.

Study Design

This is a cross-sectional study analyzed as a case-control study. We studied all children aged 0–59 months, including those who had died in the last year. Index series are defined as children under 5 years of age who died during the year prior to the survey. Reference series are subjects of similar age to those in the index series and who were alive at the time of interview.

Variables

Five mortality ratios were calculated according to WHO standards (WHO 2006b; Nathan et al. 2002). For each ratio, the number of live births in a year expressed per 1000 served as the denominator. The numerator varied for each ratio as the number of deaths among neonates (newborn to 29 days old), post-neonates (1–11 months old), infants (newborn to completed 11 months old), early childhood (12–59 months old) or under 5 (newborn to 59 months old). These ratios are traditionally referred to as neonatal, post-neonatal, infant, early childhood and under-5 mortality rates (WHO 2006b; Nathan et al. 2002).

Main Independent Variable

The main independent variable, self-reported by mothers, was the presence or absence of illnesses that lasted for more than 2 weeks and occurred during the year prior to the survey. Mothers reporting such illnesses were classified as chronically ill.

Other Independent Variables

(a) *Demographic variables* included (i) child's age (grouped as newborn to 11 months and 12–59 months), (ii) gender, (iii) mother's age (grouped as 30 years or less and above 30 years), (iv) chronic illnesses in father (as defined for mother), (v) number of siblings in the family (categorized as three or less and four or more) and (vi) number of adults (persons older than 18 years of age) in the household (as a proxy measure of alternative care providers, categorized as two or less and three or more).

(b) *Household socio-economic factors* were assessed by (i) average monthly income per capita (categorized as less than 200 Pak. Rupees [6.5 US dollars] or 200 Pak. Rupees and more), (ii) mother's literacy status (ability to read and/or write a short simple statement), (iii) father's literacy status (as defined for mother), (iv) housing construction material (made of concrete or non-concrete, such as mud, stone or wood) and (v) land ownership.

Data Management and Analysis

Data were checked for internal consistency before entry. Questionnaires with inconsistencies were returned to the field for correction. The data were double entered using Borland dBase III Plus 1.1 for DOS Version XX.X computer software and checked for obvious errors of data entry and editing. An error rate of less than 3/1000 strokes was considered clean data entry. Analysis was performed with SUDAAN Release 9.0. due to its computational efficiency and to account for cluster survey design in point and variance estimation.

The statistical power of detecting a difference in under-5 mortality in the presence or absence of self-reported mother's chronic illness was estimated as 83%, assuming an unadjusted odds ratio of 1.90 and prevalence of mother's illness among live children was 20% (NCSS statistical package: Power Analysis & Sample Size, Version XX.X).

To account for unequal selection probabilities, we calculated sample weights from the number of villages in each service area and the number of villages sampled from each area. The use of weights reduces bias in estimation. Keeping in view without replacement (WOR) sampling design, we present weighted estimates of mortality and odds ratios and their 95% CIs.

Multi-collinearity among various independent variables was also assessed using Cramer's V. Three models constructed for logistic regression to examine association between mother's health and child death consisted of the following covariates:

Model-1: Demographic variables
Model-2: Household socio-economic factors
Model-3: Demographic and household socio-economic factors

In each model, after examining the full set of variables, non-significant variables were dropped from the final. We present the results of final models.

Results

Characteristics of the Study Population

Among 3824 children, infants constituted almost a quarter (22.5%) of the study population. Overall, boys and girls were almost equally distributed (50.6% and 49.4%, respectively). The mean age of mothers was 30.0 years (*SE* = 0.12 years). Mean numbers of siblings in a family and mean

number of adults in a household were 4.3 (*SE* = 0.04) and 3.3 (*SE* = 0.04), respectively. Both average (median) monthly income (only 1415 Pak. Rupees or 47.2 US dollars, 1993) and average (median) monthly per capita income (only 193 Pak. Rupees or 6.4 US dollars, 1993) were low. Considerably more mothers (84%) than fathers (54%) were illiterate. One third of households reported owning some land (35%). A majority lived in non-concrete houses (83%).

Overall, 20.2% and 17.7% of mothers and fathers, respectively, reported being ill for more than 2 weeks during the last year. Among mothers defined as chronically ill (725), 40.3% reported weakness/anemia, 19.3% were classified with respiratory illness including tuberculosis and asthma, 12.6% with jaundice/hepatitis, 8.4% with kidney problems, 7.7% with diabetes, 5.9% with skin infections/scabies, 1.4% with fever/malaria and the remaining 4.4% with illnesses other than those listed above. The proportion of child deaths differed significantly by child's age, gender, maternal health status and type of house (Table 1).

Table 1. Significant factors by survival status, Thatta District, Pakistan, 1992–1993 (n = 3824) (unadjusted analysis)

Variables	Groups (*n*)	Deaths (%)	Odds Ratio (95% CI)
Child's age	Infants (862)	8.9	9.6 (6.7, 13.6)
	1–4 years (2962)	1.0	1.00
Child's gender	Female (1902)	3.4	1.5 (1.05, 2.20)
	Male (1922)	2.2	1.00
Maternal health status	Reported ill (725)	4.4	1.9 (1.2, 2.8)
	Reported not ill (2874)	2.4	1.00
Type of house	Non-concrete (3118)	2.9	1.9 (1.1, 3.5)
	Concrete (632)	1.5	1.00

Age-Specific Death Ratios

During the year prior to the survey, 106 children aged 0–59 months died, accounting for 43.4% of total deaths (244). Of the 996 live births during the same period, 508 were males. Infant deaths constituted 72.6% of child deaths, and neonatal deaths accounted for 39% of infant deaths (Table 2).

Table 2. Age-specific mortality ratios: Thatta District, Pakistan, 1992–1993

Age Group	Number of Deaths	Mortality Ratio (Deaths per 1000 Live Births in a Year) (95% CI)
Neonates	30	30.6 (21.4, 39.8)
Post-neonates	47	47.0 (32.2, 61.8)
Infants	77	77.7 (57.8, 97.5)
12–59 months	29	30.4 (19.7, 41.1)
0–59 months	106	108.1 (82.6, 133.5)

Association between Mother's Health and Child Mortality

Unadjusted analysis suggested that children of mothers with reported chronic illness were 90% more likely to die compared with children whose mothers did not report chronic illness (critical odds ratio [cOR; 95% CI]: 1.9 [1.2, 2.8]) (Table 1). After simultaneous adjustment of demographic and socio-economic factors in the final Model-3, although the association of mother's health with under-5 mortality dropped to 60%, it remained significant (Table 3).

Table 3. Association between maternal health and child mortality: Thatta District, Pakistan, 1992–1993

Variables	Adjusted Odds Ratio (95% CI)		
	Final Model-1	Final Model-2	Final Model-3
Chronically ill mother	1.9 (1.2, 2.9)	1.8 (1.2, 2.7)	1.6 (1.01, 2.5)
Child's age	9.1 (6.5, 12.9)	–	9.9 (6.6, 15.0)
Child's gender	1.6 (1.1, 2.4)	–	–
Mother's age	–	–	1.5 (1.1, 2.2)
Non-concrete house	–	2.0 (1.1, 3.5)	2.0 (1.1, 3.7)

List of non-significant variables dropped from final models
Model-1: (i) Chronic illnesses in father (ii) Number of siblings in the family and (iii) Number of adults in the family.
Model-2: (i) Average monthly income per capita (ii) Mother's literacy status (iii) Father's literacy status and (iv) Land ownership.
Model-3: (i) Child's gender (ii) Chronic illnesses in father (iii) Number of siblings in the family (iv) Number of adults in the family (v) Average monthly income per capita (vi) Mother's literacy status (vii) Father's literacy status and (viii) Land ownership.

Other Associations with Child Mortality

Besides child's age, the final Model-3 analysis showed an association of child mortality with mother's age and type of house. Children whose mothers were 30 years or older were 50% more likely to die compared with children of younger mothers. In addition, children who lived in non-concrete houses were twice as likely to die as children who lived in concrete houses (Table 3).

Discussion

Main Study Findings

The observed association between self-reported maternal ill health and under-5 mortality could be due to reduced maternal ability for child-rearing activities, reduced duration of breastfeeding, low birth weight, increased childhood malnutrition, increased child morbidity and reduced utilization of services for curative or preventive care.

As expected, child's age remained the most powerful determinant of child's survival. We identified two more associations with under-5 mortality in Thatta district, namely mother's age of 30 years or above and living in non-concrete houses. Greater mortality associated with older mothers could possibly be due to the increasing number of children and subsequent demand on the mother's physical strength for child rearing, as shown by a highly significant association between maternal age and number of live children. Mothers 30 years and older were 8.4 times more likely to have four or more children than were younger mothers (OR [95% CI]: 8.4 [6.5, 10.8]) (result of a separate analysis). Living in a non-concrete house was also associated with 90% greater under-5 mortality, which could be either a reflection of low socio-economic or poor environmental conditions.

Earlier Work on the Topic

The relationship between maternal health and deaths among the specific age group of children 0–59 months has not been studied in Pakistan. In a rural area of Bwamanda, Northern Zaire (Broeck et al. 1996), a prospective study revealed an association between maternal health and death among infants 0–3 months old. Compared with Northern Zaire, the magnitude of the association is relatively small in Thatta district. This could be due to difference in age distribution of study populations and instruments used to assess chronic diseases in the two surveys. In Northern Zaire, chronic maternal disease was assessed by clinical examination and by history. Prevalence of chronic maternal disease was much less in Northern Zaire (3.1%) than in Thatta (20.2 %). Due to variations in living and

environmental conditions between the settings, different sets of covariates were examined in the two studies through different analytical approaches. In rural Western India, Hirve and Ganatra (1997) considered maternal health status as poor if the mother's non-pregnant weight was less than or equal to 40 kg. In this prospective study, the survival analysis showed a strong association of maternal nutritional status and under-5 mortality. Although we have defined maternal health status subjectively, based on self-reporting of illness, the findings of our study, though lower in magnitude, are consistent with other studies (Broeck et al. 1996; Hirve and Ganatra 1997). These findings are also important since ours is the first such study from Pakistan, a country with a high under-5 mortality ratio (WHO 2006a) and high prevalence of poor maternal health (PMRC et al. 1998).

The observed magnitude of the association between under-5 mortality and child's age (OR = 9.9) is similar to that reported in rural Upper Egypt (OR = 10) by Yassin (2000). Despite using a different age cut-off (20 years) for mothers than ours (30 years), Ahmed (1992) reported lower child mortality for young rural mothers, using the Pakistan Contraceptive Prevalence Survey (1984–85). Other studies from Pakistan using information from the Pakistan Integrated Household Survey 1991 (Agha 2000), the Pakistan Demographic and Health Survey, 1990–91 (Ali et al. 1993; Zahid 1996), and the Pakistan Labor Force and Migration Survey, 1979 (Sathar 1987), reported higher infant death rates among mothers less than 20 years. We did not choose a cut-off at age 20, as only 8.3% of the mothers reported being 20 years or below. In Karachi slums, no association was reported between maternal age and infant or child death (D'Souza and Bryant 1999; Thaver et al. 1990). This suggests that the relationship between maternal age and child survival for rural populations differs from other areas of the country. In a rural population, older mothers have greater rates of child mortality than younger mothers.

The association between type of house and under-5 mortality was stronger in our population than in that reported for Zimbabwe (Root 1997), where households with clay flooring had 47% (95% CI: 1.06, 2.05) greater mortality for children 1–5 years old compared with households with cement flooring. However, using information from the Pakistan Integrated Household Survey 1991, Agha (2000) did not find any significant relationship between type of house and infant mortality. This suggests that observations from a rural population of Sindh are different from those from a national sample.

Study Limitations

Certain methodological issues need to be highlighted. Though death, being a definitive event, is easily measured, the possibility of under-reporting cannot be ruled out. Women are at times reluctant to talk about their dead children or may not count children dying shortly after birth as live births, which would affect estimates of the mortality ratio. Using reported age at death or at survey without reference to exact dates of birth and death results in misclassification or age heaping across the boundaries of 1 month, 1 year and 5 years.

The method of assessing maternal health deserves special consideration. Timing of measurement in this study does not ensure that maternal illness occurred prior to the death of the child. Since both the child death and maternal illness were assessed during a 1-year period prior to the survey, it is possible that maternal illness might have occurred after the death of the child. This makes causality difficult to establish. Assessment of maternal health by self-report could account for non-differential misclassification of exposure status and under-estimation of the effect (Rothman and Greenland 1998). Moreover, defining chronic diseases as those of more than 2 weeks' duration includes diseases of varying severity, making interpretation difficult.

Characteristics of parents and households were assessed at the time of survey and not when the children under study were exposed to risk of death. However, it is unlikely that factors such as socio-economic status had changed significantly over a 1-year period for the majority of the study population. For factors such as income, inaccuracy in reporting cannot be ruled out. Creation of a wealth variable might have addressed this problem, but it was not possible due to lack of such information. We did not account for nutritional status of mothers and deceased children's birth

weights because the information was not available, although they could possibly be associated with chronic maternal illness and child survival (Hirve and Ganatra 1997).

Inclusion of villages located within a radius of 5 kilometers of the selected GHFs may influence the extent to which the findings can be generalized, as child mortality ratios and maternal health status may be worse in far-off villages.

Conclusion: Policy Implications

Currently, local child-survival programs focus on control of diarrhea, acute respiratory infections, malnutrition and vaccine-preventable diseases and ignore the important contribution of maternal health to child survival (Bhutta 2004). Promotion of mother's health, particularly prevention and treatment of anemia, though encouraged during antenatal, natal and postnatal periods, is not performed beyond the postpartum period. This study points out that child-survival programs should include activities leading to the promotion of mother's health beyond pregnancy and postpartum. This is particularly relevant in the underprivileged area of Thatta, where only a quarter of mothers with chronic illness report receiving treatment at a government or private health centre. Whenever a mother comes in contact with the healthcare system (e.g., for routine vaccination of her child), she should be opportunistically screened and treated for common conditions such as anemia, undernutrition or chronic cough. These study findings need to be tested further by studies in which maternal health is assessed objectively, with an etiologically relevant induction period.

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Competing Interests

The authors declare that they have no competing interests.

Author's contributions

RN participated in the design of survey, conceived and designed the study, performed the literature review and data analysis, interpreted the data and drafted and revised the manuscript.

LMK provided guidance during study design and data interpretation and in revising the paper critically for important intellectual content.

WCH provided guidance during data analysis and data interpretation and in revising the paper critically for important intellectual content

IA participated in the data organization and in revising the paper critically for substantial intellectual content.

All authors read and approved the final manuscript.

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Households' Perceptions and Prioritization of Tropical Endemic Diseases in Nigeria: Implications for Priority Setting for Resource Allocation

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Abstract

This study was undertaken to explore how rural households perceive and prioritize tropical endemic diseases in different Local Government Areas (LGAs) of Southeast Nigeria. Marked differences in perception and prioritization of endemic diseases exist across the LGAs. Malaria is ranked highest as the most serious disease, followed by typhoid fever and HIV/AIDS. In addition, malaria and other endemic diseases are wrongly perceived as not being serious in some population groups.

Introduction

The health situation in Nigeria is typical of that elsewhere in sub-Saharan Africa. It is characterized by high maternal and childhood mortality and morbidity. Mortality in childhood is due mainly to endemic tropical diseases such as malaria, measles, acute respiratory infection and diarrheal diseases (WHO 2004). Other endemic tropical diseases such as onchocerciasis, guinea worm, leprosy, tuberculosis, filariasis and schistosomiasis that are now readily controlled by drugs also cause considerable morbidity and mortality in later life.

Disease prioritization is important in healthcare policy because it guides priority setting and resource allocation by policy makers; no health system can afford to pay for every service it wishes to provide, especially in developing countries (Sonderlund 1998; Klein 1998). However, there is no consensus on the best methods for setting priorities. Guidelines, checklists and minimum packages have been suggested (Ham and Coulter 2000). An unclear mix of criteria is sometimes used in current global health reforms, including cost-effectiveness, equity, individual rights and ideological criteria (Blas 2002). In developing countries, the burden of disease (BOD), measured in terms of Disability Adjusted Life Years (DALY), and cost-effectiveness analysis, which compares cost per outcome of different interventions, have been recommended for priority setting (Jayasinghe et al. 1998; World Bank 1993). Most of these methods have centered on the supply side, which is driven mainly by the central government and ignores the local communities that constitute the demand side of healthcare services.

The acceptance of measures based on the BOD and cost-effectiveness approaches, especially where a cost to the individual is involved, will depend to a large extent on the household's perception of the diseases and the importance attached to the diseases. Professional views usually differ from community priorities and aspirations (Kapiriri and Norheim 2002). For example, although community-perceived health problems were similar to those identified by the burden-of-disease study in Uganda, social stigma and cultural values were not considered in the study, while socially stigmatized diseases were considered to be more serious among community members compared with non-stigmatized conditions, in spite of their low prevalence (Kapiriri and Norheim 2002). The ability to sustain disease control programs depends very much on 'listening to the people' (Vlassof 1992). In Uganda, the community's preferences and disease prioritization were sought on how to set priorities (Kapiriri and Norheim 2004). Many other studies have shown the importance of understanding and adapting health programs to take account of community wishes and priorities if long-term participation is to be guaranteed (Panicker and Dhanda 1992; Bichmann and de Koning 1992; Rifkin 1992).

Studies have shown that compliance with disease eradication programs may not be effective if communities perceive the disease as a low-priority health problem (Shu et al. 1999). Therefore, several important questions need to be addressed to effectively set priorities and allocate resources for endemic disease control that would have the greatest impact at the community level. Do communities perceive malaria and other tropical endemic diseases as a problem? Are there differences in perception of seriousness of these tropical endemic diseases among people of different geographic backgrounds? Answers to these questions are important because if the BOD and cost-effectiveness approaches produce results at variance with community expectations, people may end up not using the health services in enough socially desirable quantities, thus leading to program failure.

The need to involve the community in estimating disease burden and setting priorities at the LGA level is an important component in the health-sector reform process, as the ways in which the community responds to malaria and other endemic tropical diseases will depend on their assessment of the importance of those diseases.

Materials and Methods

Study area

The study took place in four rural LGAs in southeast Nigeria from June to September 2004. The

LGAs were selected because of their varying distance from the urban state capital. They are Ihiala and Nnewi-South in Anambra state, and Isi-uzo and Oji-River in Enugu state. Isi-uzo LGA is about 70 kilometers from the state capital, Enugu. It covers a wide area and is sparsely populated; agriculture is the primary occupation. Modern infrastructure is modest, and settlements are strongly nucleated with poor road networks. Oji-River is about 40 km from the state capital. It is the site of a thermal-electricity generating station based on Enugu coal and has a concentration of public health institutions and some industrial establishments. Infrastructure development is moderate and Oji-River is essentially an elite rural LGA when compared with Isi-uzo. In comparison, the two LGAs in Anambra state are less rural and have more educated people than the Enugu state LGAs. Nnewi-South is about 50 km from the state capital, Awka. Modern infrastructure is modest, and trading is the main occupation. Ihiala LGA is about 80 kilometers from the state capital and is less developed than Nnewi-South; agriculture is the main occupation.

Study Design

The cross-sectional survey involved 16 communities in four LGAs. In each LGA, four communities were randomly selected from those with at least one health centre. The sample size was determined using the formula for sample size for a definite population, considering 0.3 as the proportion of the population positive for malaria illness, power of 80%, confidence interval of 95%, and 0.05 as the absolute sampling error that can be tolerated. The Primary Health Care house numbering system was used as the frame for the sampling of 100 households in each community to give a total sample size of 1600 households.

Trained community-health extension workers interviewed the female primary caregiver, or the household head in her absence, using a pre-tested, semi-structured questionnaire. The female primary caregiver or the household head who answered the question was allowed to consult his or her spouse and other household members before responding.

The survey collected information on the households' socio-demographic characteristics. Respondents were asked to indicate the degree of importance attached to 10 different diseases suffered in the community in terms of occurrence and effects, and rank them. The ranking system assigned 1 to the most important disease, 2 to the next most important, and so on. The 10 diseases had been identified during formal discussions with community leaders. Respondents were also asked whether these diseases were more serious for adults only, children only, pregnant women only, equally serious for adults, pregnant women and children, or not serious for anybody. Those who were not sure were also asked to say so. Oral informed consent was obtained from all respondents, and all were given the option of not participating in the study if they so wished.

Data Analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 10. Frequency distribution was computed and the Chi-square test for trend was used to test for statistically significant differences across the LGAs and in each LGA, within diseases.

Results

Demographics

Demographic and socio-economic characteristics of the study population are shown in Table 1. Most of the sample, 1594 (99.8%) individuals, responded in the survey. The majority were female primary caregivers, married and farmers. Most were middle aged. The average household size was 5.1 people.

Table 1. Socio-economic and demographic characteristics of the respondents and their households

Variables	Ihiala *n* = 397	Nnewi-South *n* = 397	Isi-uzo *n* = 400	Oji-River *n* = 400
Status: head of household: *n* (%) representative	177 (44.6) 200 (55.4)	201 (50.6) 196 (49.4)	223 (55.8) 177 (44.2)	187 (36.7) 213 (53.3)
No. of household residents: mean (S.D.)	5 (2.8)	5.3 (2.9)	5 (2.3)	5 (5.1)
Age (years): mean (S.D.)	45.9 (13.5)	49.1 (14.9)	42.7 (12.20)	50 (15.9)
Sex: male: *n* (%) female	178 (44.8) 219 (55.2)	169 (42.6) 228 (57.4)	228 (57) 172 (43)	185 (46.2) 215 (53.8)
Years of formal education: mean (S.D.)	5.6 (6.3)	5.7 (5.8)	7.3 (6.3)	5.4 (5)
Marital status: married: *n* (%) not married	348 (87.7) 49 (12.3)	372 (93.7) 25 (6.3)	359 (89.7) 41 (10.3)	385 (96.3) 15 (3.7)

Priority Ranking of Diseases

Table 2 shows the ranking of diseases when respondents were asked the question, "What do you think is the most serious disease suffered in your village in terms of occurrence and its effects?" Thus, malaria was ranked highest as the most serious in all the LGAs studied. Typhoid fever and HIV/AIDS featured as the second and third leading health problems respectively in all the LGAs except in Isi-uzo, where HIV/AIDS was ranked ninth. Malnutrition was ranked fourth in two of the LGAs, while all ranked tuberculosis very low. Pneumonia was ranked high (third) by only one LGA. Onchocerciasis was ranked high by Oji-river LGA.

Table 2. Priority ranking of diseases by LGA

Rank	Ihiala	Nnewi-South	Isi-uzo	Oji-River
1	Malaria	Malaria	Malaria	Malaria
2	Typhoid fever	Typhoid fever	Typhoid fever	Typhoid fever
3	HIV/AIDS	HIV/AIDS	Pneumonia	HIV/AIDS
4	Guinea worm	Malnutrition	Diarrhea	Onchocerciasis
5	Eye disease	Diarrhea	Eye disease	Eye disease
6	Pneumonia	Pneumonia	Malnutrition	Malnutrition
7	Diarrhea	Eye disease	Guinea worm	Diarrhea
8	Malnutrition	Onchocerciasis	Tuberculosis	Pneumonia
9	Onchocerciasis	Tuberculosis	HIV/AIDS	Tuberculosis
10	Tuberculosis	Guinea worm	Onchocerciasis	Guinea worm

Perception of Seriousness of Diseases

Table 3 shows respondents' responses when asked the question, "Are the illnesses more serious for adults, children or pregnant women in terms of causing discomfort and death?" Thus for malaria, respondents perceived some seriousness among the different population groups in terms of disability and mortality. However, in all LGAs respondents felt malaria was more serious for adults, and only very few thought it was serious for pregnant women alone. A few in three of the LGAs also thought it was not serious for any group, while a good number thought the illness equally serious

for adults, children and pregnant women. Across the LGAs, there was a statistically significant difference among those who reported that malaria was serious for children alone, equally serious for adults, children and pregnant women, and not serious for any population group. Typhoid fever was ranked second and perceived to be more serious in only adults, although a few thought it was serious for children. A majority of respondents in all the study areas thought HIV/AIDS was more serious in adults and pregnant women. A few thought that HIV/AIDS was serious for children and not serious for any group. A good number felt that HIV/AIDS was equally serious for all three population groups. Across LGAs, there was a statistically significant difference among those who reported that HIV/AIDS was more serious only in adults and pregnant women. For malnutrition, a majority thought it was serious for children alone, while some thought it was equally serious for the three population groups and a few thought it was not serious for any group. Across LGAs, there was a statistically significant difference among those who reported that malnutrition was equally serious among all groups.

Within each LGA there was a statistically significant difference in the perception of seriousness of all the diseases among different population groups, except in Oji-River LGA, where there was no statistically significant difference in the perception of seriousness of malaria among different population groups.

Table 3. Perception of seriousness of diseases by LGA

Variables	Ihiala (%)	Nnewi-South (%)	Isi-uzo (%)	Oji-River (%)	*p*-value
Malaria					
Serious for adults only	26.7	35.5	33.5	29.3	.847
Serious for children only	41.6	11.3	31.3	7.2	.00001*
Serious for pregnant women only	1.3	1.3	1.5	1.0	.840
Equally serious for adults, children and pregnant women	19.4	37.0	29.8	49.5	.00005 *
Not serious for anybody	7.3	13.9	3.0	0.0	.0026 *
Not sure	3.8	1.0	1.0	13.0	.00460
p-value	.0000*	.00003*	.0000*	.0956	
Typhoid Fever					
Serious for adults only	75.2	70.0	81.4	64.0	.271
Serious for children only	15.2	12.0	9.0	21.0	.338
Serious for pregnant women only	1.5	5.6	2.9	1.2	.4323
Equally serious for adults, children and pregnant women	1.7	3.5	2.1	0.5	.451
Not serious for anybody	2.6	4.9	3.0	5.8	.438
Not sure	3.8	4.0	1.6	7.5	.281
p-value	.0000*	.0000*	.0000*	.0000*	
HIV/AIDS					
Serious for adults only	42	39.2	53.1	58.0	.00558*
Serious for children only	1.5	4.0	2.0	5.0	.377
Serious for pregnant women only	43.6	24.8	9.6	19.0	.0000*
Equally serious for adults, children and pregnant women	9.5	24.8	30.0	15.0	.264
Not serious for anybody	2.0	3.0	1.9	1.0	.523
Not sure	1.4	4.2	3.4	2.0	.775
p-value	.0000*	.0000*	.0000*	.0000*	
Malnutrition					
Serious for adults only	.5	1.7	2.0	2.8	.338
Serious for children only	72.6	66.0	74.0	82.0	.075
Serious for pregnant women only	.8	0.0	1.0	0.0	.669
Equally serious for adults, children and pregnant women	22.2	22.0	18.0	12.0	.05*
Not serious for anybody	2.4	6.3	3.6	2.2	.81
Not sure	1.5	4.0	1.4	1.0	.338
p-value	.0000*	.0000*	.0000*	.0000*	

*$p < .05$ = statistically significant.

Discussion

Overall, malaria featured as a foremost priority disease in terms of both prevalence and seriousness in all the LGAs surveyed. It is possible that repeated attacks of malaria over the years and the amount of money and illness days involved have made it a very common and serious disease. This ranking corresponds with data from health facilities in Nigeria that show malaria to be a leading disease (National Bureau of Statistics [NBOS] 2005) and with data from sub-Saharan Africa on the burden of disease (Murray 1996).

Apart from malaria, there is a complete disconnect between the ranking of the other diseases and the social statistics data of the Nigeria National Bureau of Statistics (NBOS). For example, typhoid fever, HIV/AIDS and malnutrition were ranked second, third or fourth as the largest health problems by the communities in this study, but this is not so with the NBOS data, where diarrhea and acute respiratory infection were ranked second and third after malaria. In the NBOS data, malaria, diarrheal diseases and acute respiratory infection accounted for 62.4%, 20.9% and 5.8% of all cases reported in 2004 (NBOS 2005). Also, malaria, measles, diarrheal diseases and acute respiratory infection accounted for 25.7%, 16.4%, 14.8% and 7.2%, respectively, of deaths recorded.

Typhoid fever was ranked high as an important disease by the communities. The classification of typhoid fever in this environment is based on laboratory diagnosis with the Widal test, which is non-specific, and its usefulness is limited (Shukla et al. 1997). Most persistent illness episodes with severe headache and fever are regarded as typhoid fever. However, typhoid fever is an important cause of morbidity and mortality in resource-poor regions of the world (Parry et al. 1998), and the global BOD estimate for typhoid fever shows that it is common and more serious among younger age groups (Crump et al. 2004). This contrasts with the findings in this study, where majority of respondents perceive it as more serious in adults. The importance attached to typhoid fever among Nigerians is such that the National Assembly passed a bill for mass immunization of Nigerians with typhoid fever vaccines in 2005. Yet this disease is not ranked high in the BOD estimate in the country, and policy makers and healthcare providers have not considered this disease to be as important as the community members are saying in this survey.

Despite the fact that the respondents ranked HIV/AIDS as important, they considered tuberculosis less so. This perception portends danger for the control of the disease, and people still do not appreciate the relationship between HIV/AIDS and tuberculosis. So efforts should be made by government and non-governmental organizations to address this issue through appropriate and targeted information, education and communication strategies. The high ranking of HIV/AIDS is not unconnected with its severity among the population, and the fact that it is not curable.

The differences in ranking of illness between the LGAs can be explained by differences in prevalence and endemicity. For example, onchocerciasis is highly endemic in Oji-River (Okonkwo et al. 1991), hence it was ranked high only in this LGA.

In contrast to clinical evidence and evidence from the medical profession that malaria and other endemic tropical diseases are more serious in children and pregnant women, participants in this survey do not think so as exemplified by their responses. Some even think the diseases are not serious in any group. Because it is such a common condition in children in malaria-endemic countries, fever is most often treated at an early stage in the home. This could have contributed to the low perception of the seriousness of malaria, as most fevers/cases of malaria are mild, and only a few become severe. This is likely to have far-reaching consequences in the health seeking practices of these vulnerable groups. Thus their perception of the severity of the diseases will not only influence what they do at home, but also their choice of healthcare provider, their compliance with treatment and even their cooperation in control programs. Studies have shown that the poor rural population does not use healthcare services when experiencing perceived minor illness; instead they resort to self-treatment, buying drugs with or without prescription and seeking medical services only in more severe cases (Liu and Goa 2002).

The inability of some groups to associate the severity of malaria with younger age is a source for concern and poses a great danger to the campaign for prompt treatment of children suffering from

malaria. The implication for the treatment of childhood malaria is that the delay in seeking treatment will lead to death and subsequently increase the burden of malaria disease. Also of concern is the failure to acknowledge the danger of malaria to pregnant women; this will contribute to an increase in maternal and infant mortality/morbidity.

Across the LGAs and within the LGAs, there are statistically significant differences in the perception of these diseases. In Nigeria, the differences between states and LGAs as well as the differences within LGAs are well recognized. It is always important to elicit community perceptions about diseases and health programs, because studies have indicated that differences exist in community preferences, knowledge and perception about disease control and health programs, as well as in geographical constraints in community participation in health programs (Haddad at al. 1998; Uzochukwu and Onwujekwe 2004, Uzochukwu et al. 2004). According to some reports, provision of healthcare is expected to respond directly to patients' preferences, perceptions and demands (Calnan 1988). Thus our finding is important for geographical targeting of health education programs for disease control to have maximum effect. The relative impact of targeted and random controls have been demonstrated (Ghebreyesus at al. 2000).

Conclusions

The policy implication of our findings is that, given the concern the community expressed on certain diseases as reflected in their ranking, and the WHO recommendation that services should be responsive to the needs of the people (within limits) (WHO 1993, 2000), there is a need to change the incorrect perceptions about those diseases through appropriate information, education and communication. Thus the community perceptions as expressed by ranking in the current survey can be modified by education. Also, in order to decide where to invest funds for the greatest impact on the health of the largest possible number of people in the community, it is important that decision makers and program managers consider the concerns expressed by the community on certain diseases.

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APPENDIX 1

1. Household Questionnaire

Dear respondent,

We are trained local workers sent by staff of the University of Nigeria Teaching Hospital (UNTH) Enugu. We are interested in your opinion about the diseases that trouble this community. To achieve this aim, we wish to conduct a questionnaire survey on your perceptions about the diseases, together with your experiences in treating them. You shall in the future get the results of this exercise, which

we hope to use to help your community and the government to control the diseases and improve your health. All information given will be private. Your participation is voluntary, and you do not have to answer questions you do not want to answer.

Please tick the appropriate answers and also enter the appropriate number representing the answer given in the spaces provided.

What is your state? [ ]
1 = Anambra. 2 = Enugu.
What is your LGA? [ ]
1 = Ihiala. 2 = Nnewi-South. 3 = Isi-uzo. 4 = Oji-River.

1: DEMOGRAPHIC INFORMATION

I would like to begin by asking a few questions about you and your household.

1. What is your status in this household? [ ]
1 = household head. 0 = representative of household.

*[Note: **Only** the spouse, or the head of household in her absence, should be interviewed.]*

2. How many people live in this household, including yourself? [ ]
3. [**Enumerator:** What is the gender of the respondent?] [ ] 1 = male 0 = female
4. How old are you? [ ]
5. Did you go to school? [ ] 1 = yes 0 = no
6. If #5 is yes, what was the total number of years that you spent schooling? [ ]
7. What occupation is your major source of getting money? [ ]
8. Are you married [ ] 1 = yes 0 = no
9. What is your current marital status? [ ]
1 = single. 2 = married. 3 = widowed. 4 = divorced/separated.

2. UTILIZATION

2a. Diseases prioritization

10. What do you think is the most serious disease suffered in your village in terms of occurrence and its effect? ***(Enumerator: Do not read list of responses. Rank from 1 to 10 as they are mentioned: 1 being most important and 10 least important.)***

_____ (1) Malaria
_____ (2) Tuberculosis
_____ (3) Pneumonia
_____ (4) Diarrhea
_____ (5) Onchocerciasis
_____ (6) Eye disease
_____ (7) Malnutrition
_____ (8) Guinea worm
_____ (9) HIV/AIDS
_____ (10) Typhoid fever
_____ (-98) Don't know/Not sure

2b. Disease perceptions

Now I would like to ask you what you know about the sicknesses that trouble you and your household.

11. Are illnesses more serious for adults, children or pregnant women in terms of causing death? ***(Enumerator: Mark one response only for each disease)***

____ (1) Malaria
____ (1) Adults

____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(2) Tuberculosis
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(3) Pneumonia
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(4) Diarrhea
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(5) Onchocerciasis
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

6) Eye Disease
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(7) Malnutrition
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them

____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(8) Guinea worm
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(9) HIV/AIDS
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

(10) Typhoid fever
____ (1) Adults
____ (2) Children
____ (3) Pregnant women
____ (4) Equally serious for all of them
____ (5) Not serious for any of them
____ (-98) Don't know/Not sure

2c. Health seeking and cost of illness (respondent)
12. Which diseases did you and or other member(s) of your household have in the past one month?
(Enumerator: Do not read list of responses. Mark as many as mentioned 1 = yes 0 = no)
12a. Malaria [ ]
12b. Tuberculosis [ ]
12c. Respiratory problems, not including tuberculosis (for example, asthma or bronchitis) [ ]
12d. Diarrhea [ ]
12e. Onchocerciasis [ ]
12f. Eye disease [ ]
12g. Malnutrition [ ]
12h. Guinea worm [ ]
12i. HIV/AIDS [ ]
12j. Other (please specify) _____ [ ]
12k. Don't know/Not Sure [ ]

13. How did you know that either you or some body in your household was sick? ***(Enumerator: Mark first response only.)***
____ (1) Medical tests
____ (2)Community health worker told me
____ (3)Traditional healer told me
____ (4)I recognized the symptoms myself
____ (5) A family member told me that I was sick
____ (6) Others _____

____ (-98)Don't know/Don't remember

14. Did you seek treatment? [ ] 1 = yes 0 = no

15. If yes to Q 14, what treatment did you first seek? ***(Enumerator: Do not read list. Mark first response only.)***
[ ] (1) Traditional medicines:
[ ] (2) Went to the clinic:
[ ] (3) Went to chemist (patent medicine dealer):
[ ] (4) Went to the Community health worker:
[ ] (5) Went to the health center:
[ ] (6) Went to the hospital:
[ ] (7) Clean the environment
[ ] (-95) Other (specify:)

16. Why did you seek treatment where you did? ***(Enumerator: Mark as many as mentioned)***
1 = yes 0 = no
16a. Good services provided [ ]
16b. Readily available drugs [ ]
16c. Near [ ]
16d. Affordable services [ ]
16e. Prompt attention [ ]
16f. Polite health workers [ ]
16g. Others (specify) [ ] _____

17. How much did it cost to receive this treatment not including the cost of transportation?
a. ____ Naira
b. ____ (-98) Don't know/Not Sure

18. What kind of medicine did you receive? ***(Enumerator: Mark first response only)***
____ (0)None
____ (1) Chloroquine
____ (2) Antibiotics
____ (3) Pain relievers
____ (4)Quinine
____ (5) Herbal treatment (specify:) _____
____ (-95) Other (specify): _____
____ (-98) Don't know

The Effect of Community-Based Health Education Intervention on Management of Menstrual Hygiene among Rural Indian Adolescent Girls

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Abstract

Objective: To study the effect of a community-based health education intervention on awareness and behaviour change of rural adolescent girls regarding their management of menstrual hygiene. **Materials and Methods:** A participatory-action study was undertaken in Primary Health Centres in 23 villages in Anji, in the Wardha district of Maharashtra state. Study subjects were unmarried rural adolescent girls (12–19 years). We conducted a needs assessment for health messages with this target audience, using a triangulated research design of quantitative (survey) and qualitative (focus group discussions) methods. Program for Appropriate Technology for Health (PATH) guidelines were used to develop a pre-tested, handmade flip book containing needs-based key messages about the management of menstrual hygiene. The messages were delivered at monthly meetings of village-based groups of adolescent girls, called *Kishori Panchayat*. After 3 years, the effect of the messages was assessed using a combination of quantitative (survey) and qualitative (trend analysis) methods. **Results:** After 3 years, significantly more adolescent girls (55%) were aware of menstruation before its initiation compared with baseline (35%). The practice of using ready-made pads increased significantly from 5% to 25% and reuse of cloth declined from 85% to 57%. The trend analysis showed that adolescent girls perceived a positive change in their behaviour and level of awareness. **Conclusion:** The present community health education intervention strategy could bring significant changes in the awareness and behaviour of rural adolescent girls regarding management of their menstrual hygiene.

Introduction

Menstruation is a physiological phenomenon unique to females that begins in adolescence. In India, about 50% of rural adolescent girls have no information on or understanding of this basic biological process (CREA 2005). According to Khanna et al. (2005), due to lack of information on this natural phenomenon and culturally divergent beliefs and practices, rural adolescent girls in India often manage menstruation in an unsafe manner that leads to reproductive tract infections (RTIs) and other reproductive health problems. Younis et al. (1993) reported that women who practise poor menstrual hygiene had a significantly higher risk of RTIs (odds ratio of 1.66) compared with women with better menstrual hygiene. Wasserheit et al. (1989) found that women who used rags to absorb menstrual bleeding suffered from RTIs more frequently than women who used sterilized material (90% versus 40%). Bali and Bhujwala (1969) found that women with the poorest level of menstrual hygiene had the highest infection rates. RTIs result in adverse reproductive health outcomes such as infertility, repeated abortions and ectopic pregnancies (Buchan et al, 1990; Wasserheit 1989). Menstrual hygiene management practices developed in adolescence are likely to persist in adult life (Khanna et al, 2005). Germain et al. (1992) have recommended interventions to change behaviour directed toward improving menstrual hygiene as a strategy to prevent RTIs and to promote reproductive health.

Little is known about the effect of health education intervention on how adolescent girls manage their menstrual hygiene. Taking into consideration the recommendations for health education research in developing countries by Loevinsohn (1990), the present article focuses on the effect of community-based health education intervention on rural adolescent girls' awareness and behaviour regarding management of their menstrual hygiene.

Materials and Methods

The Kasturba Rural Health Training Centre (KRHTC) (a peripheral centre of the Dr Sushila Nayar School of Public Health, Mahatma Gandhi Institute of Medical Sciences [MGIMS], Sewagram) in Anji undertook the present study in Primary Health Centres in 23 villages in Anji, with a population of 31,482. Unmarried adolescent girls constituted 8% of the total population. The study area is located in the Wardha district of Maharashtra state. Study subjects were unmarried adolescent girls aged 12–19 years. The study was conducted in two phases. The first comprised the needs assessment and development of low-cost, needs-based health education material. The second involved disseminating health messages and assessing the effect of the community-based health education.

Phase I: Needs Assessment and Development of Health Education Material

Needs Assessment

A triangulated research design of quantitative (survey) and qualitative (focus group discussions, or FGDs) methods was used for the needs assessment for health messages. Considering the rough estimate of adolescent girls' proportion, which could have knowledge and practices of study variables as 0.5, 95% confidence interval and 5% precision, the minimum sample size required was 384 (Lwanga and Lemeshow, 1991). We increased this number by 10% to cover non-responses. Thus, 420 unmarried adolescent girls (12–19 years) were to be covered. To develop a sampling frame, a detailed house-listing exercise was carried out in the study villages. Finally, the sample was drawn systematically from the village sampling frames. The response rate was about 91%. After obtaining informed consent, a trained female social worker interviewed 381 adolescent girls, using a pre-designed and pre-tested questionnaire in home visits. The structured questionnaire covered knowledge and practices regarding menstrual hygiene. The prevalence RTIs and sexually transmitted diseases (STDs) was judged by self-reported symptoms. Respondents were told a few symptoms of RTIs and STDs and were asked whether they had had any during the 3 months prior the survey. Five percent of questionnaires were checked to ensure quality of data. The data was entered and analyzed using the Epi Info 6.0 software package (Centre for Disease Control and Prevention, Atlanta,

Georgia, USA). Later, three FGDs were conducted with a group of adolescent girls to understand the various reasons behind their current menstruation management practices. No new information ensued after the first two FGDs. A note taker carefully recorded the discussion. Data collection was carried out in December 2003.

Development of Low-Cost, Needs-Based Health Education Material

PATH (Program for Appropriate Technology for Health) guidelines were adopted to develop health education material (PATH 1997). A team consisting of a social worker, a medical intern and an Auxiliary Nurse Midwife (ANM) developed the health messages after carefully reviewing the quantitative and qualitative information from the survey and FGDs, respectively. The health messages focused on (1) awareness regarding menstruation, (2) importance of its acceptance as a normal phenomenon and (3) hygiene to be maintained during menstruation. The rough draft of health education material consisted of handmade sketches and handwritten messages. This draft was presented to a local group of adolescent girls to test if the sketches and messages conveyed the appropriate meaning. Modifications suggested by the group were made before the final handwritten flip book was prepared. Pictures were socially and culturally relevant, and messages were written in the local language, *Marathi*, incorporating local terms. Subsequently, the field workers used photocopies of the flip book to disseminate the health messages among adolescent girls.

Phase II: Dissemination of Health Messages and Assessment of Effect

Dissemination of Health Messages

One *Kishori Panchayat* (KP, forum of adolescent girls) was formed in each of the 23 villages. This informal group of 12 to 20 adolescent girls from the same village acted as a platform for disseminating health messages during the monthly meeting. A female social worker or ANM delivered the health messages to the girls of the village KP, using the health education material previously described. Later, KP members arranged a quarterly meeting for all adolescent girls in their respective villages. All adolescent girls of the village constituted *Kishori Sabha*. In this meeting, the previously sensitized girls from the KP delivered the messages using the same health education material. Since flip book development was a participatory team exercise with the target audience, there was no need for separate orientation of KP girls. Although *Kishori Sabhas* were supervised by a female social worker, the adolescent girls were the active agents for change. In this strategy, sensitized KP members were used to ensure participation of other adolescent girls in the village.

Assessment of Effect of Community-Based Health Education

In April 2007, triangulated research of quantitative (survey) and qualitative (trend analysis) methods was used to look for change in behaviour of the target audience. About 383 unmarried adolescent girls (12–19 years) were selected by simple random sampling and were interviewed using the same pre-designed and pre-tested questionnaire. A trend analysis was undertaken with a representative group of KP members (one representative from each KP) to discover their perception of change in practices over the period of 3 years. The girls were asked to draw a trend of perceived behaviour change on chart paper. In the first column, they recorded their perceptions of a specific practice prior to the study; in the second, they recorded their current perception. The group discussed the various practices and assessed them for every 10 girls in the village.

Results

Characteristics of the Sample

There was no significant difference in age distribution of respondents between 2003 and 2007 (Table 1). More than 75% of girls responding to the survey were attending school. In 2003 and 2007 respectively, 71.1% and 75.5% respondents were menstruating. The percentage of adolescent

girls who were aware of menstruation before its onset increased significantly, from 35.1% to 55.4%. In 2007, 160 (55.4%) menstruating girls knew about the menstrual cycle prior to its onset. Their sources of information were mothers (17%), KP members (24%), female school teachers (13%) and friends (45%). The percentage of adolescent girls who were members of community-based organizations increased from 4.5% to 28.5%. Similarly, participation of adolescent girls in village-based health programs increased significantly from 2.1% to 46.5% (Table 2.).

Table 1. Age distribution of adolescent girls

Age in completed years	Year 2003 *N* (%)	Year 2007 *N* (%)
12	55 (14.4)	40 (10.4)
13	57 (15)	52 (13.6)
14	48 (12.6)	50 (13.1)
15	49 (12.9)	51 (13.3)
16	49 (12.9)	60 (15.7)
17	52 (13.6)	55 (14.4)
18	48 (12.6)	47 (12.3)
19	23 (6)	28 (7.3)
Total	**381 (100)**	**383 (100)**

Table 2. Background information about respondents

Indicators	Year 2003 (*n* = 381)		Year 2007 (*n* = 381)	
	N (%)	95% CI	*N* (%)	95% CI
School going adolescent girls	294 (77.2)	72.6 – 81.3	319 (83.2)	79.2 – 86.9
Currently menstruating girls*	271 (71.1)	66.2 – 75.6	289 (75.5)	70.8 – 79.6
Membership in community based groups*	17 (4.5)	2.6 – 7.0	109 (28.5)	23.9 – 33.3
Participation in health education session in last three months.*	8 (2.1)	0.9 – 4.0	178 (46.5)	41.4 – 51.6

*$p < .05$

Effect of Health Education in Terms of Awareness and Behaviour Change

The average age of menarche was 14 years. Among currently menstruating girls, ready-made pad users increased significantly, from 5.2% to 24.9%. Conversely, cloth users declined from 94.8% to 72.7%. The practice of taking a bath during menstruation was almost universal. The percentage of adolescent girls observing dietary restrictions during menstruation showed marginal decline (Table 3). Reusing cloth declined from 84.8% to 57.1%. Notably, among the reusers of cloth, the practices of washing it with soap and water and sun drying increased from 86.2% to 94.2% and 78.4% to 90.0% respectively (Table 4). As seen in the trend analysis, the group of adolescent girls perceived similar behaviour changes (Figure 1).

Table 3. Distribution of currently menstruating adolescent girls by type of cloth used during menstruation, awareness before its onset and restrictions

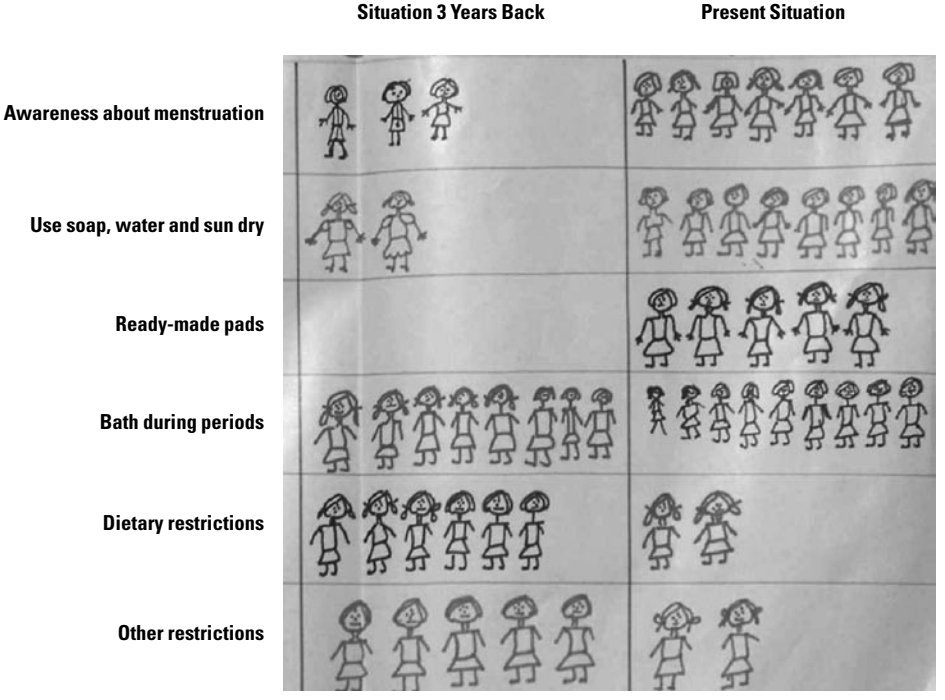
Indicators	Year 2003 (*n* = 271)		Year 2007 (*n* = 289)	
	N (%)	95% CI	*N* (%)	95% CI
Adolescent girls aware of menstruation before its onset*	95 (35.1)	29.4 – 41.0	160 (55.4)	49.4 – 61.2
Piece of cloth*	257 (94.8)	91.5 – 97.1	210 (72.7)	67.1 – 77.7
Readymade pads*	14 (5.2)	2.9 – 8.5	72 (24.9)	20.0 – 30.3
Follow dietary restrictions	56 (20.7)	16.0 – 25.9	48 (16.6)	12.5 – 21.4

*p < .05

Table 4. Washing and drying practices among those who reuse the cloth

Indicators	Year 2003 (*n* = 218)		Year 2007 (*n* = 120)	
	N (%)	95% CI	*N* (%)	95% CI
Wash reused cloth with soap/powder/Dettol	188 (86.2)	80.9 – 90.5	113 (94.2)	88.3 – 97.6
Sun dry	171 (78.4)	72.4 – 83.7	108 (90.0)	83.2 – 94.7
Shade	47 (21.6)	16.3 – 27.6	12 (10.0)	5.3 – 16.8

Figure 1. Trend analysis with the group of adolescent girls: Their perception of change in menstrual management



In 2003, 8% of girls (16–19 years) reported any one of the RTI/STD symptoms in the 3 months prior to the survey. Of those girls, 54% received medical treatment from a skilled provider. In 2007, again, 8% (16–19 years) reported any one of the RTI/STD symptoms in last 3 months, yet 87% received medical treatment from a skilled provider.

Discussion

The community-based intervention strategy focused on the social mobilization of adolescent girls and peer groups to spread the messages using simple handmade and locally prepared flip books.

Gupta et al. (2004) have emphasized a need for developing information, education and communication strategies to focus on raising awareness of reproductive-health and gender-related issues. Devi et al. (1994) have suggested approaches such as educational television programs, school nurses or health personnel, compulsory sex education in the school curriculum and education of parents. In the present study, only 13% and 17% of girls got firsthand information about menstrual cycles from their female school teachers and mothers, respectively. Notably, 69% of adolescent girls got information regarding their menstrual cycle and its hygienic management prior to its onset from their friends and KP members. Thus, in a cultural milieu where parents and teachers cannot be relied on to provide adequate information on and support for reproductive health, community-based organizations may step in to fill this gap (CREA 2005). This is relevant where girls are denied access to information about reproductive and sexual health and are expected to not ask questions about such issues because they are unmarried and female (CREA 2005). The social mobilization skills of an Accredited Social Health Activist (ASHA), a village-based female health worker under the National Rural Health Mission (NRHM) of Government of India, could thus be utilized for overcoming the social barriers to an effective community-based adolescent-friendly program. As an ASHA would be trained in public health pedagogy, she should be given the responsibility of such an effort at the village level along with the Anganwadi* worker. However, such an effort needs to be tested.

Very few studies of community-based health education interventions to improve management of menstrual hygiene among adolescent girls are available to compare with our results. Swasthya, a Delhi-based nongovernmental organization (NGO), also reported improvement in menstrual hygiene behaviour among adolescents through messages disseminated by community-based worker in the slums of Delhi (International Centre for Research on Women 2006). Chiou et al. (2007) in Taiwan developed a dysmenorrheal self-care pamphlet in quasi-experimental design for female adolescents and tested the effect. Results revealed a significant increase in the experimental group members' dysmenorrhea-related knowledge and self-care behaviour but not in their attitudes. In the present study, the marginal decline in dietary restrictions and other social and religious restrictions reflected a more positive attitude towards menstruation. Although there was significant improvement in the hygienic management of menstruation, the proportion of girls (16–19 years) with a history of RTIs/STDs did not change. There was, however, a significant improvement in health-seeking behaviour. Cooke (2006) also emphasized a need for community sensitization and education of the adolescent girls regarding menstrual management.

According to Loevinsohn (1990), the involvement of community in health education efforts has rarely been seen, and the use of more participatory techniques had been advocated many times before. In the present study, the overall research process and intervention was participatory in nature; the target audience was involved in the needs assessment, in developing health education material, in disseminating messages and, finally, in evaluating the study. The methods adopted were feasible, flexible and required minimal resources. Carrying out the needs assessment before the development of health education material and participatory development of health messages provided an opportunity to understand the target audience for the flip book. This approach could be a useful resource for poor NGOs working in rural parts of developing countries.

However, limitations of the study should be kept in mind. This was a small-scale study in one Primary Health Centre area. It needs to be tested at a larger scale to confirm the findings. In the

present study, there may have been reporting biases, as the study focused on key behaviours that are difficult to verify objectively.

Conclusion

To conclude, the present community-based participatory health education strategy could bring significant changes in awareness and behaviours of rural adolescent girls regarding hygienic management of menstrual periods. A similar strategy may be useful for resource-poor NGOs working in developing countries.

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Maternal Healthcare and the Spread of AIDS in Burkina Faso and Cameroon

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Abstract

This paper analyzes whether exposure to maternal healthcare is associated with a higher risk of HIV infection. Using data provided by Demographic and Health Surveys in Burkina Faso and Cameroon, the paper finds that women are 26% to 78% more likely to be HIV positive if they received tetanus toxoid injections during their last pregnancy. The analysis does not provide empirical evidence for the hypotheses that this association might be due to reverse causality, omitted variables or self-selection.

1. Introduction

At the end of 2005, an estimated 38.6 million people were infected with the Human Immunodeficiency Virus (HIV). More than 60% are living in sub-Saharan Africa, where 2.7 million people became newly infected and 2.0 million died from the acquired immune deficiency syndrome in 2005 (AIDS; see UNAIDS 2006).

HIV transmission occurs through direct contact with contaminated body fluids (blood, semen, vaginal fluid or breast milk). The transmission modes are unprotected sexual contacts, vertical transmission from mother to child, punctures with contaminated needles and sharp instruments (such as tattoo needles and injection equipment) and blood transfusions.

The relevance of different transmission modes is the subject of a controversial debate. It is widely asserted that in sub-Saharan Africa, HIV is predominantly transmitted heterosexually, and that this transmission mode accounts for more than 95% of all HIV infections (Schmid et al. 2004;

Garnett et al. 2006). Varying HIV prevalence rates are explained by differences in sexual behaviours (Philipson and Posner 1995; Caldwell 2000; Shelton et al. 2005), sexual network patterns (Morris and Kretzschmar 1997) and differences in transmission efficiencies through different levels of male circumcision (Auvert et al. 2001) or untreated sexually transmitted diseases (Oster 2005).

In contrast, Gisselquist and colleagues (2002) argue that unsafe medical care, particularly the re-use of syringes and needles, contributes to the spread of HIV/AIDS in sub-Saharan Africa and accounts for 20% to 40% of HIV infections. This hypothesis rests on the observation that rapid growth in the HIV/AIDS epidemic occurred in countries with wide access to medical care (Brewer et al. 2003). Increased risk of HIV seropositivity is associated with medical injections (Bloom et al. 2002; Pepin et al. 2006; Quigley et al. 1997, 2000; St Lawrence et al. 2006), blood transfusion (Adejuyigbe et al. 2003; Iliyasu et al. 2004) and exposure to maternal healthcare (Chao et al. 1994; Deuchert and Brody 2006). It was argued, however, that reverse causality hampers the interpretation of these studies. The positive association between exposure to healthcare and HIV seropositivity could be explained by HIV positives receiving treatment for HIV-related illnesses. Thus, a positive association between exposure to healthcare and HIV seropositivity is not necessarily an indicator for iatrogenic HIV transmission (Schmid et al. 2004).

The extent to which unsafe healthcare contributes to the spread of HIV in sub-Saharan Africa remains unclear. Having knowledge of the relevance of different transmission modes is, however, of special importance for the design of efficient HIV prevention strategies. If unsafe healthcare is an important factor driving sub-Saharan Africa's HIV/AIDS epidemic, more attention and resources need to be devoted to the prevention of iatrogenic HIV transmission. To provide further insight on the risk of HIV transmission within the formal healthcare sector, this paper empirically analyzes the determinants of HIV seropositivity (including exposure to healthcare). The study contributes to the existing literature because it empirically tests whether the positive association between healthcare exposure and HIV seropositivity is explained by data limitations such as confounding, reverse causality, omitted variables and self-selection.

The paper uses data from Demographic and Health Surveys (DHS) conducted in Burkina Faso and Cameroon. It analyzes data for a subsample of women who gave birth in the past 5 years and examines whether exposure to maternal healthcare (measured by receiving tetanus toxoid injections) is associated with HIV seropositivity. Because tetanus injections are not therapeutic injections but are given during pregnancy to prevent neonatal tetanus, this proxy for healthcare exposure largely reduces the bias caused by reverse causality. It is shown that receiving tetanus toxoid injections is powerfully and robustly associated with HIV seropositivity in Burkina Faso and Cameroon. The probability of HIV seropositivity increases by 26% in Burkina Faso and by 78% in Cameroon if the woman received any tetanus injections during last pregnancy. The analysis does not provide empirical evidence for the hypotheses that the association between tetanus injections and HIV seropositivity is explained by reverse causality, omitted variables or self-selection.

The remaining sections of the paper are organized as follows. Section 2 provides information on access to and quality of the formal healthcare sector in Western Africa. Section 3 presents the data used for this analysis and discusses the hypotheses tested in the paper. Section 4 portrays the methodology and presents the results. Section 5 discusses the results and provides a conclusion.

2. Challenges for Healthcare Services in Western Africa

The Human Development Report (UNDP 2005) reveals several severe health problems in Western Africa. Life expectancy at birth is lower than the African average, the burden of malaria is very high, and tuberculosis and HIV/AIDS are major health problems but less common than in Eastern or Southern Africa.

A particular problem is the high level of maternal and infant mortality. In Western Africa, the infant mortality rate is around 100 per 1000 live births; the maternal death rate is 430 to 1800 per 100,000 live births (UNDP 2005).[1] High levels of maternal and child mortality are associated with low access to maternal healthcare (Ronsmans et al. 2003). In Western Africa, less than 50% of births

are attended by skilled health personnel (WHO 2005). Additionally, it is argued that the quality of maternal healthcare services is poor, resulting in severe maternal morbidity (Prual et al. 2000). This is confirmed by maternal health facility surveys conducted in Burkina Faso and Cameroon, which discovered major shortages of basic equipment, supplies and essential drugs. Many maternal health facilities had no electricity or source of clean water, and did not employ any skilled birth attendants or were understaffed. Most providers needed training in essential obstetric care functions (Family Care International 2005; Averting Maternal Death and Disability Program [AMDD] 2002).

A critical component of healthcare quality is injection and blood safety, because contaminated injection equipment and blood products carry a high risk of transmitting blood-borne pathogens such as HIV and hepatitis B and C. The WHO Regional Office for Africa carried out injection safety surveys that included several countries in Western Africa[2] (Dicko et al. 2000). Re-use of injection materials without sterilization, accidental needle-stick injuries among healthcare workers and injection-related abscesses were common in all considered countries.[3] Shortage of injection equipment, improper disposal leading to recycling and re-sale after use, and the lack of awareness about the risk of blood-borne–pathogen transmission explain this pattern (Dicko et al. 2000; Musa 2005). A similar picture can also be drawn for blood safety: In 2002, more than 25% of all units of blood transfused in sub-Saharan Africa had not been tested for HIV (WHO 2002). In Cameroon, HIV screening for blood transfusions was not available until the mid-1990s (Langman et al. 2006). Thus, at least until the late-1990s, administering unscreened blood products was very common in Western Africa.

3. Data and Hypotheses

This paper assesses the role of unsafe healthcare in spreading HIV/AIDS in Western Africa using data from Burkina Faso and Cameroon. The countries were chosen because they have recently conducted Demographic and Health Surveys (DHS) that allow a link to be made between individual HIV test results and information about receiving healthcare and sexual behaviour. They are nationally representative surveys designed to provide information on fertility; family planning; antenatal-, delivery- and postpartum-care; AIDS and other sexually transmitted infections.

In Cameroon, the DHS covered more than 10,000 households. All women attending the household (and men in 50% of households[4]) were interviewed. In households chosen for the male interviews, HIV tests were offered to all adults. In total, 10,565 women and 5280 men were interviewed; 5277 women and 5125 men were tested for HIV. The consenting rates for HIV testing were 92% for women and 90% for men. In Burkina Faso, the DHS covered more than 9000 households. Twelve thousand women and 3605 men were interviewed; 4223 women and 3418 men were tested for HIV. The participation rates for HIV testing were similar to those found in Cameroon (92.3% for women and 85.8% for men). National HIV prevalence rates based on DHS data are 1.8% for women and 1.9% for men in Burkina Faso, and 6.8% for women and 4.1% for men in Cameroon.[5]

Table 1 shows that HIV prevalence rates are higher for women who have been in contact with the formal healthcare system. HIV prevalence rates are considerably higher in Cameroon; however, the relative risk ratios (RR) are similar in Burkina Faso and Cameroon, indicating that HIV prevalence rates are 34% to 125% higher for women who were in contact with the formal healthcare sector.

It has been argued that the association between recent exposure to formal healthcare (i.e., visiting a healthcare provider in the past 12 months, injections in the past 3 months) and HIV seropositivity are constrained by reverse causality. HIV-positive women visit healthcare facilities or receive injections because they are ill with AIDS-related symptoms, including opportunistic infections (Schmid et al. 2004).

This argument is, however, less relevant for receiving blood transfusions, because blood transfusion is not a common treatment for opportunistic infections or other AIDS-defining conditions. The HIV transmission efficiency of blood transfusion is more than 90% (Piot and Bartos 2002), and it has been argued that contaminated blood transfusions may have played an important role in spreading HIV in sub-Saharan Africa (Schneider and Drucker 2006). However, only 10% of

HIV-positive women in the Cameroon DHS sample received blood transfusions, suggesting that the association of increasing HIV prevalence with other variables measuring exposure to healthcare may not exclusively be explained by transmission through contaminated blood transfusion.

Table 1. HIV prevalence rates for women, by exposure to formal healthcare

	Burkina Faso				Cameroon			
	No	Yes		RR	No	Yes		RR
All women								
Visited health facility	1.80%	2.42%		1.34	5.47%	7.95%	***	1.45
Injection in past 3 months	n/a	n/a		n/a	6.16%	9.15%	***	1.49
Blood transfusion	n/a	n/a		n/a	6.43%	12.21%	***	1.90
Women who gave birth in past 5 years								
Any tetanus injections	1.34%	2.00%		1.49	3.72%	7.68%	***	2.06
Skilled prenatal healthcare	0.96%	2.15%	*	2.25	4.26%	7.15%	**	1.68
Skilled birth assistance	1.59%	2.20%		1.38	4.40%	8.02%	***	1.82
Delivery in health facility	1.54%	2.25%		1.46	4.13%	8.18%	***	1.98

Note. Information about injections in the past 3 months and blood transfusions is not available for Burkina Faso.
RR = relative risk ratio; n/a = not available.
Significance levels based on Pearson chi2 test of independence: *** 1%, ** 5%, * 10%.

The positive association between receiving antenatal healthcare (tetanus injections,[6] skilled prenatal healthcare and birth assistance, delivery in health facilities) and HIV seropositivity is less constrained by reverse causality. The primary reason for receiving maternal healthcare is because women are pregnant, not because they are sick. Thus, this paper analyzes the association between receiving maternal healthcare and HIV prevalence using data from the subsample of women who gave birth in the past 5 years. [7]

This subsample is not representative because it concentrates on sexually active women of reproductive age who are exposed to both risk factors (unsafe sex and potentially unsafe healthcare). Of all women in the subsample, 67% in Burkina Faso and 75% in Cameroon received any tetanus injections during the last birth; 76% and 81% received skilled prenatal care; 42% and 62% received skilled birth assistance; and 43% and 63% delivered in a health facility in Burkina Faso and Cameroon, respectively. Detailed information about medical treatments other than receiving a tetanus vaccination is not available. Thus, receiving antenatal healthcare serves only as proxy for receiving (potentially) unsafe healthcare.

Unconditional risk ratios provided in Table 1 show that HIV prevalence rates for women who received any kind of maternal healthcare are 38% to 125% higher than for women who did not receive maternal healthcare during last pregnancy. However, DHS data is non-experimental. In principle it could be true that the observed association between maternal healthcare exposure and HIV serostatus does not portray a causal relationship but is driven by data limitations. To verify that the observed association between receiving maternal healthcare and HIV serostatus is not driven by data limitations, this paper tests the following hypotheses:

Hypothesis 1: Exposure to maternal healthcare is not independent from other risk factors (see

Appendix A.3). For example, promiscuous behaviour or concurrent partnerships may be correlated with wealth and, thus, increase HIV infection rates for wealthy people (Shelton et al. 2005). Wealth, however, increases access to maternal healthcare. Thus, the pattern can be explained by *confounders.*

Hypothesis 2: Higher HIV prevalence rates among women who receive maternal healthcare may be driven by the behaviours of their partners. Household wealth, for example, is an important determinant of male risk-taking sexual behaviours (Kongnyuy et al. 2006). As a consequence, wealthier men may be at higher risk of sexual HIV transmission, and this risk may be carried over to their partners (who have better access to maternal healthcare). Thus, the positive association between maternal healthcare and HIV seropositivity may be explained by *unobserved variables.*

Hypothesis 3: Exposure to maternal healthcare may not be independent from HIV serostatus. The positive relation between HIV seropositivity and exposure to maternal healthcare could be explained by HIV-infected women being more likely to receive maternal healthcare. This could be the case if antiretroviral treatment is available to reduce HIV transmission from mother to child, which increases the incentive to search for prenatal healthcare. Another possibility is that HIV-infected women are more likely to be sick and, thus, search for treatment. Once women are in contact with the healthcare system, the probability of accessing maternal healthcare services increases. Thus, the pattern may be explained by *reverse causality.*

Hypothesis 4: Respondents voluntarily decide on HIV testing. HIV tests results are not provided automatically, but respondents can get them from a nearby Voluntary Counselling and Testing (VCT) provider. However, women with limited access to healthcare providers may also have limited access to VCT providers and, thus, are less likely to consent to HIV testing. Thus, women who received maternal healthcare may be over-represented in the subsample, and the observed pattern between HIV prevalence and maternal healthcare may be driven by a *self-selection bias.*

4. Methodology and Results

To test Hypothesis 1, regression analyses are used to control for confounders. Since the outcome variable is a binary variable indicating that a woman tests HIV positive, the paper uses a Probit model[8] to estimate the probability of a positive HIV test.

The central explanatory variable proxies access to healthcare. A binary variable indicates that the respondent received any tetanus toxoid injection during last pregnancy. A second set of regressions is estimated, including the number of tetanus toxoid injections.

The analysis controls for factors that may be associated with sexual HIV transmission. The model includes the number of sexual partners in the previous 12 months and variables on sexual history: the years of sexual activity and the number of lifetime partners. The latter variable is available for Cameroon only. To allow for nonlinear effects, square terms of these variables are included. Consistent condom use can reduce the risk of sexual HIV transmission and, thus, a variable indicating that condoms are used as a contraception device is included.[9] The risk of HIV infection depends on HIV prevalence in the contact group. Risk profiles are not available and, thus, regional HIV prevalence rates are used as a proxy. Socio-economic variables (wealth and education), marital status, rural residence, employment and religious confession may be risk factors (e.g., they may capture unobserved differences in sexual behaviours or sexual networks) and, thus, are included into the regression.

The regression coefficients are presented in Table 2. Receiving tetanus injections is significantly associated with HIV seropositivity. In Burkina Faso, the number of injections is significantly associated with HIV seropositivity; in Cameroon, the binary variable that indicates the respondent received any tetanus injections is significantly associated with HIV seropositivity. Conditional relative risk ratios (evaluated at mean values of covariates) reveal that receiving any tetanus injections increases the probability of a positive HIV test by 78% in Cameroon and 26% in Burkina Faso.

Sexual history is positively associated with HIV serostatus. Years of sexual activity increases the probability of HIV infection. The effect is nonlinear, peaking at 17 years in Burkina Faso and 15 years in Cameroon. It could be the case that women who started their sexual activity before the

epidemic took off may be less likely to have acquired the virus. Another possibility is that women who acquired the disease at their sexual debut have already died of causes related to HIV/AIDS. In Cameroon, the number of lifetime partners increases the risk of HIV; the effect is nonlinear, peaking at 15 partners. Because more than 98% of women report less than 15 lifetime partners, the peak is a statistical effect rather than indicating that having more than 15 partners decreases the probability of HIV seropositivity. Recent sexual behaviour measured by the number of partners in the past 12 months and condom use is not significantly associated with HIV. Surprisingly, women who reported sexual activity in the past 4 weeks are less likely to be HIV positive (significant for Cameroon only). One possible explanation is that recent sexual activity is constrained by reverse causality. HIV-positive women may be more likely to be sick and, as a consequence, abstain from sexual activity.

Table 2. Regression results (Probit model)

	Burkina Faso						Cameroon					
	coef.		t	coef.		T	coef.		t	coef.		t
Number of tetanus injections	0.11	*	1.72				0.05		1.50			
Any tetanus injections				0.09		0.61				0.26	**	2.39
Number of partners (12 months)	0.00		-0.02	-0.01		-0.07	0.10		1.62	0.10		1.59
Number of partners (lifetime)							0.09	***	2.96	0.09	***	2.96
Number of partners (lifetime), squ.							0.00	**	-1.99	0.00	**	-1.99
Condom use (contraception)							-0.10		-0.62	-0.09		-0.56
Sexual active in past 4 weeks	-0.09		-0.59	-0.09		-0.55	-0.21	**	-2.34	-0.21	**	-2.33
Years of sexual activity	0.07	*	1.89	0.07	*	1.85	0.11	***	4.28	0.11	***	4.27
Years of sexual activity, squared	0.00		-1.63	0.00		-1.61	0.00	***	-4.02	0.00	***	-4.01
HIV prevalence	0.12	*	1.93	0.12	*	1.91	0.12	***	5.77	0.12	***	5.74
Rural resident	-0.30		-1.38	-0.30		-1.37	-0.17	*	-1.78	-0.17	*	-1.76
Wealth: poorest quintile	-0.07		-0.33	-0.07		-0.33	-0.01		-0.08	0.00		0.01
Wealth: richest quintile	0.13		0.57	0.14		0.64	0.04		0.33	0.05		0.37
Education: primary	0.07		0.36	0.07		0.33	-0.15		-1.00	-0.17		-1.15
Education: secondary, higher	-0.19		-0.57	-0.17		-0.53	-0.12		-0.72	-0.15		-0.89
Working	0.09		0.38	0.06		0.26	-0.04		-0.39	-0.03		-0.33
Married	-0.45	***	-2.91	-0.44	***	-2.86	-0.43	***	-4.48	-0.43	***	-4.49
Muslim	0.04		0.28	0.04		0.28	0.11		0.77	0.12		0.85
_cons	-2.16	***	-3.75	-2.05	***	-3.55	-2.59	***	-8.70	-2.70	***	-8.85
Pseudo R2			0.08			0.07			0.12			0.12
N			2412			2412			2571			2572

Significance levels: *** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years.

In both countries, married women are less likely to be infected. Women are more likely to be infected when living in a region with higher HIV prevalence rate and less likely to be infected if they are residents of rural areas (in Cameroon only). In contrast to other DHS studies (Shelton et al. 2005), socio-economic factors (education and wealth) are not significantly associated with HIV prevalence. Education and wealth are jointly insignificant in regressions excluding tetanus injections and also insignificant in regression including only wealth or education.[10]

Hypothesis 2 states that the higher risk for women receiving tetanus injections is driven by the partners' behaviour. Information about partners is available for married women. Eighty-six percent of women in Burkina Faso and 68% in Cameroon in the considered subsample are married. Figure 1 shows that the increased risk of wives who received tetanus injections is unlikely to be explained by the higher risk of their husbands. In Burkina Faso, husbands of women who received tetanus injections have lower HIV prevalence than husbands of women who did not receive them. In Cameroon, HIV prevalence is higher for husbands if their wives received tetanus injections. However, the increase in risk is far less than their wives' risk increase, which makes it unlikely that the association between female HIV prevalence and receiving tetanus injections is explained by husbands infecting their wives. This result is in line with the study from Rakai, Uganda, that shows the higher risk of HIV infection during pregnancy is not explained by women's or men's sexual behaviour, because pregnant women and their partners reported significantly fewer external sexual partners (Gray et al. 2005). However, this result holds only for married couples. Information about extramarital partners and non-married couples is not available. To statistically test if the association between tetanus injection and HIV prevalence is explained by omitted variables (i.e., risk profiles of the partners), instrumental variables with Probit estimation (IV Probit) is applied (Wooldbridge 2002).

Instruments can be also used to test Hypothesis 3. This hypothesis refers to reverse causality, which arises if women who are HIV positive are more likely to received tetanus injections.

Access to (maternal) healthcare is determined by demand- and supply-side factors (Ensor and Cooper 2004). Because DHS did not conduct a detailed community questionnaire in Burkina Faso and Cameroon, supply-side determinants for healthcare are not available. Therefore, the paper uses as instruments self-reported demand barriers that prevent women from getting medical advice or treatment.

The self-reported barriers are (i) difficulties in reaching a health facility, (ii) intra-household allocation and (iii) cultural factors. Difficulties in reaching a health facility are measured by lack of knowledge about where the next health facility is, long distance and having to take transportation. The factor measuring intra-household allocation is whether the woman needs permission to get treatment. Cultural barriers are defined by the concern that there may not be a female health provider. For each of these variables, women responded whether the factor was a "big problem" or a "small problem" (reference value).

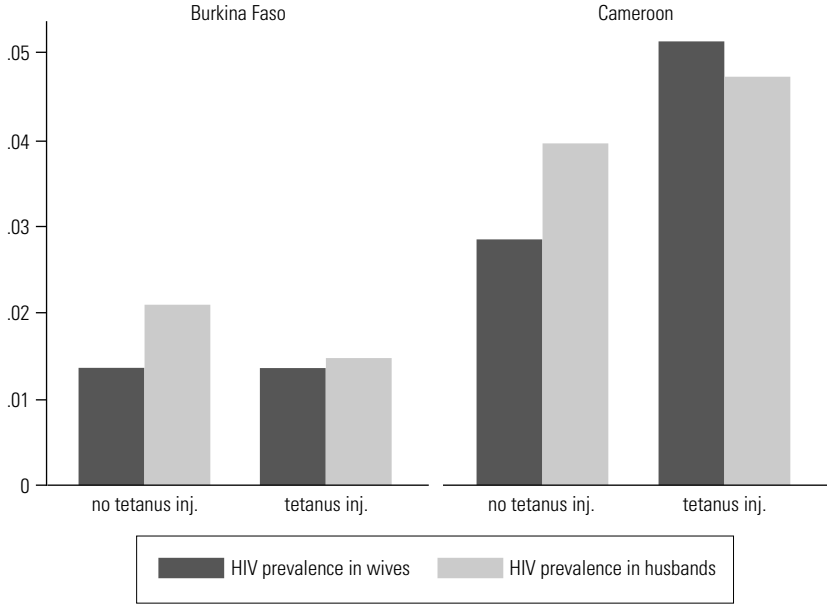
The results from the reduced form specification of the instrumented variable can be found in the Appendix (Table A.4). The F-test rejects the null hypothesis that the coefficients of all instruments are jointly zero on a 1% significance level. With exception from the regression model using the number of injections in Burkina Faso, all F-statistics are greater than 10, which provides reasonable insurance against a weak instrument bias (Bound et al. 1995).

The over-identifying restriction is tested after the two-step estimation of the IV Probit model.[11] The corresponding test statistics are between 2.6 and 3.1 and do not provide sufficient empirical evidence that the instruments are correlated with the error term of the second-stage equation. Thus, the instruments appear to be valid.

The results for the IV Probit are presented in the Appendix (Table A.5). The coefficients for tetanus injections are positive in all regressions. The results confirm those from the standard Probit model. For Cameroon, the coefficient for receiving any tetanus injections is significant on the 5% significance level; for Burkina Faso, the coefficient for number of tetanus injections is significant on the 11% significance level. All other coefficients are similar in size and significance to the coefficients from the standard Probit regression. However, exogeneity of the instrumented variable cannot be

rejected in any model. Thus, the estimates from the regular Probit appear to be consistent but have smaller standard errors than those from the IV Probit (Wooldridge 2002). This may explain why the coefficient for the number of tetanus injections in the Burkina Faso model loses significance.

Figure 1. HIV prevalence in marital couples (by wives receiving tetanus injections)



Note. Only couples in which the wife gave birth in the past 5 years are included.

One may argue that self-reported difficulties in reaching a health facility may not be strictly exogenous, because difficulties in reaching a health facility are more common in rural settings, where people have less opportunity for risk-taking sexual behaviours. Therefore, this paper uses an alternative specification and excludes self-reported difficulties in reaching a health facility from the list of instruments (Table A.6). In both countries, the coefficients for receiving tetanus injections are larger than in the standard Probit model and are significant on the 1% significance level.[12]

Hypothesis 4 refers to the methodology of how the sample is collected. Because women voluntarily decided on HIV testing, the sample is self-selected. The association between HIV prevalence and tetanus injection may be a result of a sample selection bias if women receiving tetanus injections are more likely to consent to HIV testing. To account for a possible selection bias, a Heckman Selection Probit[13] model is employed; it separately models the probability of consenting to HIV testing (selection model) and the probability of HIV infection (outcome model).

Women did not receive test results automatically, but obtained them from a nearby VCT provider. VCT is often provided by health facilities and, thus, barriers that prevent women from accessing medical advice or treatment are also barriers to HIV testing. Thus, access barriers are used as additional instruments to model the selection stage. Results are presented in the Appendix (Tables A.7 and A.8). Receiving tetanus injections is not related to testing (selection stage). The coefficients for tetanus injections are significant in the outcome equation (probability of HIV seropositivity), confirming the positive association between tetanus injections and HIV serostatus. Again, all other coefficients are similar in size and significance, as are the coefficients from the standard Probit regression.

To test if the error terms of the selection and outcome models are dependent, a likelihood-ratio test is employed. Dependence can be rejected for all models, suggesting that the outcomes from

the Probit model and the outcomes from the Heckman Selection Probit model are not significantly different. Thus, results from the standard Probit model appear to be unbiased.

5. Discussion and Conclusion

This study analyzes the association between healthcare exposure and HIV serostatus. Within standard Probit models that control for socio-economic variables and sexual behaviour and history, HIV seropositivity is significantly associated with tetanus injections received during last pregnancy. The paper does not find empirical evidence consistent with the hypotheses that this pattern is explained by confounding, reverse causality, omitted variables or self-selection. Thus, the positive association between receiving tetanus injections and HIV seropositivity could be an indicator for the hypothesis that unsafe healthcare contributes to the spread of HIV in Burkina Faso and Cameroon.

A low quality of healthcare has been documented for Burkina Faso and Cameroon. The results from this analysis raise the fear that further distributing low-quality healthcare services may accelerate the spread of HIV in these countries. Thus, public health interventions may need to concentrate on providing safe medical equipment (such as surgical instruments, syringes and safe blood products) and on training health workers to adequately use this equipment. In addition, patients may need to be informed about the risk of HIV transmission by iatrogenic procedures. Informed patients can protect themselves when seeking medical care by, for example, insisting on unused injection equipment or bringing their own equipment.

Several factors may hamper the interpretation of the results presented in this paper. DHS data relies on self-reported sexual behaviour and it is not known if results are skewed by misreporting, in particular, by under-reporting the number of partners. However, women receiving tetanus injections are not known to under-report the number of partners more than other people. Thus, the results from the study are unlikely to be biased by under-reporting by women receiving tetanus injections. Furthermore, relevant information is missing, such as the number of lifetime partners (Burkina Faso) and sexual practices. Moreover, it is not known when the infection occurred and which treatment women received (i.e., how many injections the respondent received in total and whether or not these injections were unsafe). Therefore, it is not possible to quantify the relative importance of sexual transmission versus transmission by unsafe medical care. Since knowledge about the relevance of different transmission modes is essential for efficiently designed public health interventions, further research is needed.

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Notes

1 In high-income countries, the infant mortality rate is 5 per 1000 births; the maternal death rate is 8 per 100,000 live births (UNDP 2005).

2 The considered countries in Western Africa are Burkina Faso, Cameroon, Chad, Guinea-Bissau and Senegal.

3 In Burkina Faso, the survey found that only 11% of rural health centres, 60% of provincial dispensaries, and 80% of urban health centres used new syringes and needles for each injection. A substantial amount of injections were given by untrained labourers. A later study observed 116 injections in 52 health facilities and found that almost all were given with new single-use syringes and needles (Fitzner et al. 2004). However, this may have been a demonstration effect and does not provide compelling evidence for injection safety in Burkina Faso.

4 Households were randomly selected for the male survey.

5 The term HIV refers to HIV-1 and HIV-2 infections. In Burkina Faso, 0.3% of women and 0.4% of men were infected with HIV-2; 1.5 % of men and women were infected with HIV-1. In Cameroon, almost all respondents were infected with HIV-1. A detailed description of the surveys can be found in INS (2004) and INSD (2004).

6 Tetanus toxoid injections are given to mothers to protect their infants against neonate tetanus, a frequent cause of death in many developing countries.

7 Descriptive statistics for this subsample is presented in Appendix Tables A.1 and A.2.

8 Unlike the Logit model, which assumes errors follow the standard logistic distribution, the Probit model assumes the standard normal distribution. The linear transformation on the dependent variable is fairly similar for Logit and Probit models (details can be found in Greene 2000). The Probit model is chosen over the Logit model because subsequent analyses are based on the normal assumption. Re-estimating the models from Table 2 using the Logit model shows that the outcome was not affected by the distributional assumption. The results are not reported but are available from the author upon request.

9 In Burkina Faso, too few women use condoms as contraception method. This variable predicts the failure perfectly and, therefore, this information is not included in the Burkina Faso model.

10 To test for multicollinearity, Variance Inflation Factors (VIF) based on a linear probability model (OLS) are estimated. Apart from variables that are included as polynomials, all remaining VIFs are less than three, suggesting that multicollinearity is not a problem. Results are not reported but are available from the author upon request.

11 The results are not reported but are available from the author upon request.

12 This indicates that HIV positive women are less likely to get tetanus injections; this may be explained by the supply and the demand side of healthcare. If the maternal health provider knows (or at least guesses) the serostatus of the patient, the provider may be less willing to administer injections because she tries to avoid acquiring a known infection by accidental needle-stick injuries, or because syringes and needles are not available and she does not want to contaminate scarce equipment. Supply-side discrimination has been reported (Sadob et al. 2006). Viewed from the demand side, women who adopt a healthy lifestyle (including the avoidance of high-risk sexual behaviours) may also be more likely to vaccinate their unborn babies.

13 Details on the Heckman Selection Probit can be found in Greene (2000).

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Appendix

Table A.1. Descriptive statistics (Burkina Faso)

Variable	*N*	Mean	Std. Dev.	Min.	Max.
HIV serostatus	2448	0.02	0.13	0	1
Any tetanus injections	7290	0.67	0.47	0	1
Number of tetanus injections	7290	1.20	1.02	0	6
Barrier: where to go	7367	0.83	0.37	0	1
Barrier: permission	7366	0.84	0.37	0	1
Barrier: distance	7366	0.52	0.50	0	1
Barrier: transport	7366	0.60	0.49	0	1
Barrier: no female provider	7366	0.86	0.35	0	1
Number of partners (12 months)	7359	0.70	0.46	0	2
Sexual active in past 4 weeks	7359	0.40	0.49	0	1
Years of sexual activity	7344	12.80	7.54	0	36
HIV prevalence	7367	1.69	1.05	0.1	4.2
Rural resident	7367	0.82	0.38	0	1
Wealth: poorest quintile	7367	0.18	0.38	0	1
Wealth: richest quintile	7367	0.18	0.38	0	1
Education: primary	7367	0.10	0.29	0	1
Education: secondary, higher	7367	0.04	0.21	0	1
Working	7367	0.92	0.27	0	1
Married	7367	0.84	0.36	0	1
Muslim	7365	0.57	0.50	0	1

Table A.2. Descriptive statistics (Cameroon)

	N	Mean	Std. Dev.	Min.	Max.
HIV serostatus	2646	0.07	0.25	0	1
Any tetanus injections	5224	0.75	0.43	0	1

Table A.2. Continued

Number of tetanus injections	5222	1.55	1.18	0	6
Barrier: where to go	5315	0.17	0.38	0	1
Barrier: permission	5313	0.13	0.33	0	1
Barrier: distance	5313	0.41	0.49	0	1
Barrier: transport	5312	0.39	0.49	0	1
Barrier: no female provider	5297	0.13	0.34	0	1
Number of partners (12 months)	5300	0.91	0.59	0	20
Number of partners (lifetime)	5302	3.08	4.55	1	95
Condom use (contraception)	5321	0.07	0.26	0	1
Sexual active in past 4 weeks	5301	0.56	0.50	0	1
Years of sexual activity	5307	11.93	7.23	0	36
HIV prevalence	5321	5.47	2.44	1.7	8.7
Rural resident	5321	0.59	0.49	0	1
Wealth: poorest quintile	5321	0.22	0.42	0	1
Wealth: richest quintile	5321	0.16	0.37	0	1
Education: primary	5321	0.44	0.50	0	1
Education: secondary, higher	5321	0.32	0.47	0	1
Working	5321	0.70	0.46	0	1
Married	5321	0.67	0.47	0	1
Muslim	5313	0.19	0.39	0	1

Table A.3. Average values (confounders) by receiving tetanus injections

	Burkina Faso			Cameroon		
	Received any tetanus injections			Received any tetanus injections		
	No	Yes		No	Yes	
Number of partners (12 months)[§]	0.70	0.70		0.91	0.91	
Number of partners (lifetime)[§]				2.70	3.22	***
Condom use (contraception)	0.01	0.03	***	0.04	0.08	***
Sexual active in past 4 weeks	0.40	0.40		0.59	0.54	***
Years of sexual activity[§]	13.73	12.34	***	12.46	11.74	***
Rural resident	0.92	0.81	***	0.69	0.57	***
Wealth: poorest quintile	0.24	0.15		0.33	0.18	***

Table A.3. Continued

Wealth: richest quintile	0.08	0.22	***	0.11	0.17	***
Education: primary	0.05	0.12	***	0.36	0.47	***
Education: secondary, higher	0.02	0.06	***	0.20	0.35	***
Not working	0.94	0.91	***	0.72	0.70	
Married	0.86	0.83	***	0.74	0.65	***
Muslim	0.55	0.58	**	0.29	0.16	***

Note. Variables marked with [§] are tested on equality of mean; remaining (dummy) variables are tested on independence (Pearson chi^2 test).
*** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years.

Table A.4. Reduced form specification of tetanus injections (OLS)

	Burkina Faso						Cameroon					
	Any tetanus injections			Number of tetanus injections			Any tetanus injections			Number of tetanus injections		
	coef.		t	coef.		t	coef.		T	coef.		t
Barrier: where to go	0.02		0.79	0.06		1.01	-0.07	***	-2.61	-0.10		-1.47
Barrier: permission	-0.10	***	-3.40	-0.11	*	-1.65	-0.05	*	-1.77	-0.07		-0.95
Barrier: distance	-0.09	***	-3.79	-0.12	**	-2.32	-0.04		-1.41	-0.08		-1.00
Barrier: transport	-0.02	***	-0.80	-0.03		-0.57	-0.08	***	-2.78	-0.21	***	-2.72
Barrier: no female provider	-0.03	***	-1.22	-0.14	**	-2.28	-0.09	***	-3.28	-0.27	***	-3.64
_cons	0.73		53.41	1.28	***	42.75	0.81	***	71.58	1.68	***	55.00
F(5)			11.29			4.96			19.79			14.48

*** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years and who consented to HIV testing.

Table A.5. Regression coefficients (IV Probit), full specification

	Burkina Faso						Cameroon					
	coef.		t	coef.		t	coef.		t	coef.		t
Number of tetanus injections	0.73		1.60				0.47	**	1.99			
Any tetanus injections				0.04		0.03				1.10	*	1.72
Number of partners (12 months)	0.04		0.34	-0.01		-0.07	0.11	*	1.82	0.10	*	1.65
Number of partners (lifetime)							0.08	***	2.82	0.08	***	2.74
Number of partners (lifetime), squ.							0.00	*	-1.88	0.00	*	-1.88
Condom use (contraception)							-0.14		-0.93	-0.11		-0.71

Table A.5. Continued

Sexual active in past 4 weeks	-0.08		-0.61	-0.09		-0.56	-0.20	**	-2.31	-0.20	**	-2.15
Years of sexual activity	0.06		1.46	0.07	*	1.8	0.10	***	3.83	0.11	***	3.95
Years of sexual activity, squared	0.00		-1.14	0.00		-1.59	0.00	***	-3.67	0.00	***	-3.79
HIV prevalence	0.10		1.39	0.12	*	1.9	0.11	***	4.13	0.11	***	4.07
Rural resident	-0.18		-0.76	-0.30		-1.35	-0.12		-1.19	-0.13		-1.28
Wealth: poorest quintile	-0.02		-0.14	-0.07		-0.33	0.06		0.47	0.06		0.46
Wealth: richest quintile	-0.06		-0.23	0.15		0.51	0.03		0.29	0.07		0.60
Education: primary	-0.07		-0.33	0.08		0.28	-0.32	**	-2.05	-0.33	*	-1.87
Education: secondary, higher	-0.23		-0.87	-0.17		-0.5	-0.33	*	-1.76	-0.34		-1.61
Working	0.14		0.76	0.06		0.26	-0.04		-0.48	-0.02		-0.27
Married	-0.37	*	-1.75	-0.44	***	-2.85	-0.35	***	-2.81	-0.41	***	-3.93
Muslim	0.05		0.42	0.04		0.28	0.10		0.78	0.15		1.07
_cons	-2.61	***	-5.27	-2.01		-1.64	-2.89	***	-10.67	-3.07	***	-9.59
N			2411			2411			2557			2558
Wald test of exogeneity (chi^2)			0.78			0.00			2.14			1.41
Amemiya-Lee-Newey (Two step)			2.60			3.07			2.63			2.94
Instruments	Barriers to get medical treatment: knows where to go, permission to get treatment, distance to next facility, transport, no female health worker											

*** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years.

Table A.6. Regression coefficients (IV Probit), restricted specification

	Burkina Faso						Cameroon					
	coef.		t	coef.		t	coef.		t	coef.		t
Number of tetanus injections	0.83	***	2.73				0.66	***	3.38			
Any tetanus injections				0.80		0.55				1.83	***	3.53
Number of partners (12 months)	0.05		0.48	0.01		0.09	0.10	*	1.80	0.09		1.50
Number of partners (lifetime)							0.07	**	2.46	0.06	**	2.13
Number of partners (lifetime), squ.							0.00	*	-1.77	0.00	*	-1.67
Condom use (contraception)							-0.12		-0.90	-0.07		-0.50
Sexual active in past 4 weeks	-0.07		-0.62	-0.08		-0.51	-0.17	**	-2.08	-0.15	*	-1.70
Years of sexual activity	0.05		1.35	0.07	*	1.89	0.09	***	2.88	0.08	***	2.63
Years of sexual activity, squared	0.00		-1.04	0.00		-1.58	0.00	***	-2.83	0.00	***	-2.62

Table A.6. Continued

HIV prevalence	0.08		1.28	0.12	*	1.83	0.09	***	2.78	0.08	**	2.19
Rural resident	-0.14		-0.62	-0.25		-1.03	-0.07		-0.72	-0.06		-0.59
Wealth: poorest quintile	-0.01		-0.08	-0.04		-0.19	0.09		0.81	0.10		0.96
Wealth: richest quintile	-0.10		-0.48	0.03		0.09	0.02		0.24	0.09		0.85
Education: primary	-0.10		-0.58	-0.03		-0.11	-0.39	***	-3.06	-0.44	***	-3.33
Education: secondary, higher	-0.22		-0.96	-0.21		-0.66	-0.42	***	-2.72	-0.51	***	-3.03
Working	0.14		0.89	0.06		0.27	-0.04		-0.47	-0.01		-0.07
Married	-0.32		-1.54	-0.42	**	-2.32	-0.26	*	-1.81	-0.31	**	-2.43
Muslim	0.05		0.47	0.03		0.23	0.09		0.81	0.16		1.41
_cons	-2.52	***	-4.46	-2.50	***	-2.87	-2.78	***	-7.70	-3.03	***	-8.94
N			2412			2412			2561			2562
Wald test of exogeneity (chi^2)			1.37			0.20			3.62			3.37
Amemiya-Lee-Newey (Two step)			0.35			1.12			0.00			0.05
Instruments	Barriers to get medical treatment: permission to get treatment, no female health worker											

*** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years.

Table A.7. Regression coefficients for Burkina Faso (Heckman Selection Probit)

	Selection			Outcome			Selection			Outcome		
Barrier: where to go	-0.23		-1.30				-0.24	*	-1.69			
Barrier: permission	0.08		0.54				0.08		0.55			
Barrier: distance	-0.05		-0.35				-0.06		-0.44			
Barrier: transport	0.08		0.61				0.07		0.55			
Barrier: no female provider	-0.23		-1.50				-0.22	*	-1.67			
Number of tetanus injections	0.02		0.14	0.08		0.49						
Any tetanus injections							-0.02		-0.36	0.10	*	1.72
Number of partners (12 months)	-0.09		-0.72	0.01		0.04	-0.11		-0.83	-0.01		-0.04
Sexual active in past 4 weeks	0.03		0.26	-0.09		-0.61	0.04		0.32	-0.09		-0.56
Years of sexual activity	0.04		1.50	0.06		0.78	0.04		1.49	0.07	*	1.94
Years of sexual activity, squared	0.00		-1.06	0.00		-0.82	0.00		-1.03	0.00	*	-1.66
HIV prevalence	0.03		0.60	0.11		0.98	0.03		0.56	0.12	*	1.94
Rural resident	0.45	***	2.84	-0.37		-1.04	0.45	***	2.82	-0.27		-1.26
Wealth: poorest quintile	-0.07		-0.42	-0.05		-0.25	-0.06		-0.39	-0.07		-0.35

Table A.7. Continued

Wealth: richest quintile	-0.35	**	-2.23	0.20		0.64	-0.35	**	-2.21	0.11		0.47
Education: primary	-0.06		-0.42	0.07		0.36	-0.06		-0.37	0.07		0.34
Education: secondary, higher	-0.33	*	-1.76	-0.07		-0.14	-0.34	*	-1.80	-0.21		-0.67
Working	0.06		0.39	0.05		0.24	0.02		0.17	0.10		0.44
Married	0.02		0.14	-0.42	*	-1.76	0.02		0.16	-0.45	***	-2.91
Muslim	-0.19	*	-1.79	0.07		0.34	-0.20	*	-1.83	0.03		0.21
_cons	0.60		1.46	-1.74		-1.01	0.66		1.62	-2.24	***	-3.91
N						2521						2411
LR test of independent equations						0.03						0.10

*** 1%, ** 5%, * 10%; data is from the subsample of women who gave birth in the past 5 years.

Table A.8. Regression coefficients for Cameroon (Heckman Selection Probit)

	Selection			Outcome			Selection			Outcome		
Barrier: where to go	0.23		1.39				0.23		1.39			
Barrier: permission	-0.43	***	-2.81				-0.43	***	-2.79			
Barrier: distance	-0.04		-0.23				-0.05		-0.27			
Barrier: transport	-0.19		-1.12				-0.20		-1.15			
Barrier: no female provider	0.59	***	2.62				0.57	**	2.50			
Number of tetanus injections							-0.07		-1.52	0.06		1.57
Any tetanus injections	-0.07		-0.53	0.26	**	2.35						
Number of partners (12 months)	0.01		0.09	0.11		1.62	0.00		0.00	0.11		1.64
Number of partners (lifetime)	0.04		1.59	0.09	***	2.95	0.04		1.63	0.09	***	2.89
Number of partners (lifetime), squ.	0.00	*	-1.81	0.00	**	-2.01	0.00	*	-1.86	0.00	**	-1.99
Condom use (contraception)	-0.21		-1.33	-0.13		-0.81	-0.21		-1.35	-0.14		-0.84
Sexual active in past 4 weeks	0.03		0.26	-0.22	**	-2.35	0.04		0.31	-0.22	**	-2.36
Years of sexual activity	-0.03		-0.85	0.11	***	4.33	-0.03		-0.92	0.11	***	4.36
Years of sexual activity, squared	0.00		1.27	0.00	***	-4.04	0.00		1.30	0.00	***	-4.08
HIV prevalence	-0.03		-1.32	0.12	***	5.71	-0.03		-1.34	0.12	***	5.77
Rural resident	0.50	***	3.92	-0.18	*	-1.74	0.50	***	3.96	-0.19	*	-1.81
Wealth: poorest quintile	0.00		-0.01	0.01		0.10	-0.02		-0.10	0.00		0.02
Wealth: richest quintile	-0.43	***	-3.24	0.05		0.39	-0.42	***	-3.20	0.06		0.43
Education: primary	-0.12		-0.71	-0.17		-1.17	-0.11		-0.68	-0.15		-1.01

Table A.8. Regression coefficients for Cameroon (Heckman Selection Probit)

Education: secondary, higher	-0.01		-0.05	-0.14		-0.85	-0.01		-0.03	-0.11		-0.69
Working	-0.03		-0.31	-0.04		-0.40	-0.04		-0.33	-0.04		-0.45
Married	0.03		0.24	-0.44	***	-4.51	0.03		0.23	-0.44	***	-4.49
Muslim	-0.12		-0.79	0.12		0.84	-0.11		-0.76	0.11		0.77
_cons	1.49	***	4.22	-2.69	***	-8.37	1.56	***	4.49	-2.56	***	-7.97
N						2655						2654
LR test of independent equations						0.01						0.07

*** 1%, ** 5%, * 10%; data is from the sub-sample of women who gave birth in the past 5 years.

Prosperity, Equity, Good Governance and Good Health: Focus on HIV/AIDS Pandemic and Its Feminization

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Abstract

This paper examines the association of wealth, equity and good governance in the HIV/AIDS pandemic and the feminization of this disease. A cross-country analysis was performed on adult HIV prevalence and the percentage of women among adults living with HIV/AIDS. These two indicators were significantly correlated with wealth, economic equity, gender equity and good governance. Multivariate linear regression analysis identified economic and gender equity as the two prominent factors linked with the HIV/AIDS epidemics. Gender equity, measured by the gender-related development index, emerged as the consistently significant determinant of the overall HIV epidemic and the female epidemic as well. Promoting equity, particularly gender equity, should justifiably be a primary concern of policies and programs to defeat the HIV/AIDS pandemic.

Introduction

Two faces of the HIV/AIDS pandemic have been evident and are increasingly important. First, this epidemic tends to concentrate in the countries, territories or population groups that are socially, economically or politically impoverished (Farmer 1999; Mann and Tarantola 1996). On aggregate, the magnitude of the pandemic in developed regions is consistently much lower than that in developing regions. In none of the developed countries has HIV prevalence ever crossed the 1% mark (see Appendix 1). In 2005, adult HIV prevalence was less than 0.3% in the high-income countries,

except in the United States (0.8%) and Spain (0.6%). In many developing countries, HIV prevalence was above 1%. Sub-Saharan Africa has experienced the most severe epidemic. In 17 out of 44 sub-Saharan African countries for which UNAIDS (2006) produced estimates, more than 5% (up to 34%) of adults were living with HIV/AIDS in 2005.

Second, HIV infection is rising among women. The 2004 global report by UNAIDS drew attention to the speed with which HIV incidence had been rising among female populations who were normally regarded as low-risk groups (UNAIDS 2004). By 2003, 47% of all people living with HIV/AIDS were women, but in sub-Saharan Africa women accounted for more than half (57%) of people living with HIV/AIDS. In this region, 76% of young people aged 15–24 years were women. The fastest growth of HIV among women occurred in East Asia, where women living with HIV jumped by 56% in 2 years (UNAIDS 2004).

Much has been known about what determines the spread and prevention of the HIV/AIDS epidemics. Proximate measures such as promotion of condoms (Ainsworth and Teokul 2000) and clean needles (Hurley et al. 1997) have been found effective in controlling the epidemic. On the structural front, ecological analyses have pointed out that wealth, equity and good governance are fundamental to good health and a low level of AIDS (Drain et al. 2004; Mahal 2001; Menon-Johansson 2005; Over 1998; Reidpath and Allotey 2006). It has been argued that wealth, social cohesion, social capital, equity and respect for human rights are essential for avoiding massive infection and suffering from AIDS epidemics (Barnett and Whiteside 2002; Farmer 2003; Mann and Tarantola 1996). The human capability or human development approach provides a sound conceptual backing to these findings and arguments (Senn 1999).

This paper extends these works to the issue of feminization of HIV/AIDS. It examines how strongly wealth and economic equity, gender equity and governance influence the size of HIV/AIDS epidemics in general and the scale of this disease among women in particular.

Study Design and Data

A cross-sectional ecological study was conducted, with nations as units of analysis. Keeping with the purpose of the study, two dependent variables were chosen for analysis: (1) size of HIV/AIDS epidemics at the national level as measured by adult HIV/AIDS prevalence and (2) share of females in the epidemics as measured by the proportion of adults living with HIV/AIDS who are women. Explanatory variables were (1) level of wealth as measured by gross domestic product per capita adjusted for purchasing power parity (GDP PPP), (2) economic inequality as measured by the Gini index, (3) gender equity as measured by the gender development index (GDI) value and (4) good governance as measured by the governance score. Values of the Gini index range between 0 (perfect equality) and 100 (perfect inequality). GDI values also range between 0 (minimal gender equality) and 100 (maximal gender equality). Good governance scores were reconstructed from the given database and are explained below.

A dataset was created by compiling data from three different sources. Estimates of women and adults (15+ years) living with HIV/AIDS, from which the percentage of women among HIV-positive adults was calculated, was obtained from UNAIDS (2006). Adult (15–49 years) HIV prevalence data for 2005 was also obtained from UNAIDS. Where a definite estimate of female HIV cases was unavailable, an imputed value was assigned by halving the given maximal value. The percentage of female HIV/AIDS cases for Japan was calculated from the 2003 estimates (UNAIDS 1994).

Data on GDP PPP, the Gini index and GDI were obtained from the United Nations Development Programme (UNDP) database (UNDP 2006). The good governance score was computed from the World Bank database (World Bank 2006a). This database presented data for six dimensions of governance: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption. For any country, the scores for each component lay between -2.5 and +2.5. To simplify further analysis and interpretation, the six governance dimensions were reduced to a variable by using factor analysis. The first principal component, which explained 87% of the variance, was used to construct a single governance score. The scores were rescaled to fall

between 0 (poorer governance) and 100 (better governance). The explanatory variables referred to the year 2003 while the dependent variables (AIDS epidemics) pertained to the year 2005.

Results

The analysis was performed on 100 countries for which the data were available on all variables included in this study. Table 1 presents summary information about the variables of interest and shows that there was considerable variation among the countries examined. The countries included 21 high income, 17 upper middle income, 29 lower middle income and 33 low income countries. Twenty-eight countries were from sub-Saharan Africa; 19 from northern, western and southern Europe; 18 from Latin America and the Caribbean; 17 from South, East and Southeast Asia; and the remaining 18 from other regions.

Bivariate and multivariate approaches were applied in the analysis. Roles of wealth, economic equity, gender equity and good governance are examined here in turn.

Table 1: Description of the variables used in the analysis

	N	Mean	Std. Deviation	Median	Minimum	Maximum
Adult HIV prevalence	100	2.8	6.1	0.5	<0.1	33.4
Percentage of women among HIV-positive adults	100	35.7	17.7	28.6	3.1	61.9
GDP per capita (PPP)	100	9607	10542	4961	548	37738
Gini index	100	41.1	10.6	39.3	24.7	70.7
GDI value	100	0.7	0.2	0.7	0.3	1.0
Good governance score	100	51.2	19.7	46.4	17.3	91.9

Bivariate Analysis

Correlation coefficients (*r*) were derived to examine direction, strength and significance of linear relationships between the variables included in the study (Table 2).

Wealth: A significant inverse relationship was found between wealth and size of the HIV/AIDS epidemics. The correlation was slightly stronger for size of the epidemic among females (r = -.363) than the overall adult HIV prevalence (r = -.228).

Economic equity: The HIV/AIDS epidemics and share of women were higher in societies with larger income gaps. The Gini index, a measure of income inequality, was significantly associated with adult HIV prevalence and share of women in adult HIV/AIDS cases. Economic inequality showed a slightly stronger relationship with overall epidemic (r = .524) than with female epidemic (r = .409). Comparatively, income inequality rather than level of wealth was a stronger correlate of the epidemic.

Gender equity: Gender equity was measured by the GDI (gender-related development index), which adjusts for gender disparities in three basic categories – income, longevity and education (UNDP 2006). As expected, gender equity is inversely associated with the overall prevalence (r = -.415) and the female share of the epidemic (r = -.640). The strength of the relationship matched that shown by the Gini index.

Governance: Correlation coefficients show that the better the governance, the smaller the HIV/AIDS epidemics. However, among the four explanatory variables considered, governance score appeared to have an insignificant, and the weakest, relationship with adult HIV prevalence (r = -.181). But its correlation was significant and slightly stronger with the proportion of HIV-positive

adults who are women (r = -.309). These observations warrant further examination and will be revisited in the discussion section.

Additional information available in Table 2 merits attention. Extent of female HIV epidemic shows a significant and strong positive relationship with the overall epidemic. Also, though governance was rather weakly correlated with size of the epidemic, it showed a strong relationship with GDP per capita and GDI. Likewise, GDI and GDP per capita were strongly correlated. This additional information was taken into account in the multivariate analysis.

Table 2: Correlation between the variables that were examined

	Adult HIV Prevalence	Percentage Of Women Among HIV-Positive Adults	Per Capita Income (GDP PPP)	Gini Index	Gender Development Index Value	Good Governance Score
Adult HIV prevalence	1					
Percentage of women among HIV-positive adults	0.527**	1				
GDP per capita (PPP)	-0.228*	-0.363**	1			
Gini index	0.524**	0.409**	-0.432**	1		
Gender development index value	-0.415**	-0.640**	0.791**	-0.406**	1	
Good governance score	-0.181	-0.309**	0.884**	-0.342**	0.742**	1

** Significant at the .01 level , * Significant at the .05 level.

Multivariate Analysis

Two sets of multivariate linear regressions were conducted (Table 3). In the first set, the dependent variable was adult HIV prevalence, and in the second set, percentage of women among HIV-positive adults.

In the fist set of regression models, Gini index and GDI were included, and both these variables were significant predictors of adult HIV prevalence. Gini index was stronger than GDI and better explained the model as indicated by higher values of R^2 (Models 1–3). The second set of regression models showed that GDI and adult HIV prevalence were the two significant predictors of the share of females in the HIV epidemics (Models 4–7). When adult HIV prevalence was included in the model, GDI remained a significant predictor but Gini index was no longer significant (Model 7), although it was significant independently (Model 4). GDP per capita and good governance score were not included in the regression analysis because of their strong correlation with GDI.

Discussion

The analysis shows that good governance and wealth are important, but economic and gender equity are much more important factors in determining the overall level and feminization of the HIV/AIDS pandemic. More precisely, gender equity appears to be a consistently significant correlate of both the HIV/AIDS pandemic and its female face.

A few issues underlying the strength and limitations of this analysis must be discussed. The data on HIV/AIDS epidemics are arguably the best estimates ever, because the database and methods have improved substantially over the years and uncertainty surrounding the estimates has been

reduced (Morgan et al. 2006). This strengthens the credibility of the findings from this study over the previous cross-country analyses. However, sex-segregated estimates were unavailable for many countries. This was an important drawback that compelled the analysis to reduce the number of countries examined. A lack of comparable sex-segregated data also constrained a time-series analysis of the epidemic and its feminization. Since this epidemic, like many other health problems, is shaped by complex biosocial processes, the findings of this study can be indicative rather than predictive and are helpful to advance discussion on the emerging patterns of the HIV pandemic. Yet the countries represent all regions, income groups and epidemic phases, and thus findings can reasonably be generalized and are also in harmony with the previous, similar studies.

Table 3: Linear regression models explaining the HIV/AIDS epidemics

Explanatory Variables	Dependent Variables and Standardized Coefficients			
Set 1	**Adult HIV Prevalence**			
	Model 1	**Model 2**	**Model 3**	
Gini index	.524**		.425**	
GDI value		-.415**	-.242**	
Adjusted R^2	.267	.164	.309	
Set 2	**Women among HIV-Positive Adults**			
	Model 4	**Model 5**	**Model 6**	**Model 7**
Gini index	.409**		.178*	.053
GDI value		-.640**	-.567**	-.496**
Adult HIV prevalence				.293**
Adjusted R^2	.158	.403	.424	.478

** Significant at .01 level, * Significant at .01 level.

That governance is weakly correlated with the HIV/AIDS epidemic is in agreement with the previous findings (Menon-Johansson 2005; Reidpath and Allotey 2006). This is not surprising, because governance is a grand foundational force influencing and influenced by a range of social processes and institutions, and works indirectly through other components to influence the size and course of the HIV/AIDS epidemics. This was implied by the strong correlations found among governance scores, GDP per capita and GDI. Future analytical work may conduct a path analysis to identify the pathways through which governance influences this epidemic.

The finding that higher inequality is independently associated with the size of the epidemic agrees with the past ecological analysis conducted among developing countries (Drain et al 2004). The present analysis, however, includes both the developed and developing countries. Inclusion of both types of countries provides an opportunity to examine the nature of the pandemic at the global level. Likewise, previous studies found that societies with a higher human development index had smaller HIV epidemics (Mahal 2001), and those with higher economic inequality experienced larger epidemics (Over 1998). Present research adds the finding that gender equity is another important underlying factor – be it the overall HIV epidemic or the female epidemic.

The relationship of wealth, as measured by GDP per capita, and HIV epidemic, remains as an

issue for further in-depth analysis. A lower GDP per capita does not necessarily increase the risk of HIV, nor can a higher per capita income guarantee protection. Perhaps there may be an income threshold – somewhere at $10,000–$15,000 GDP per capita – beyond which the epidemic stays small (as indicated by a scatter plot not shown here). This possibility is implied by the cases of Botswana and South Africa, which are moderately wealthy but high-epidemic countries. Per capita income was $8,714 in Botswana and $10,346 in South Africa in 2003 (UNDP 2006). In these countries, adult HIV prevalence was 24.1% and 18.8%, respectively, in 2005 (UNAIDS 2006). These countries have moderately high wealth but inequality is also high. The Gini index is 63 in Botswana and 57.8 in South Africa (UNDP 2006). Yet economic inequality may not be the only defining factor. Besides extreme economic inequality, argue Barnett and Whiteside (2002), weak social cohesion could be responsible for unusually large HIV/AIDS epidemics in these countries. Gender inequality could be one among various social inequalities influencing the HIV/AIDS epidemics and their feminization.

Share of women in the HIV epidemic is higher where the epidemic is larger. Female HIV epidemic is also influenced by the type of transmission routes; a high proportion of female cases exist in settings where heterosexual transmission is dominant. Also, a clear relationship between deprivation and HIV transmission can be found across the world. Usually, heterosexual transmission is dominant in countries or territories that are lagging behind in terms of economic and social progress. Most of these are located in sub-Saharan Africa and some are in Latin America, the Caribbean (e.g., Haiti) and Asia–Pacific (e.g., Papua New Guinea). In contrast, in high-income regions and countries such as western Europe, Japan, Australia and the United Kingdom, HIV is mainly confined to male homosexuals and in some cases is found among injecting drug users. The female HIV epidemic is very low in these societies. In the transitional or developing countries of Asia and eastern Europe, HIV is spreading through multiple routes such as injecting drug use, commercial sexual relations, other heterosexual relations and male-to-male sex (Grassly and Garnet 2005; Monitoring the AIDS Pandemic Network 2004). The HIV epidemic is expanding in these populations in terms of overall size and female face.

How does equity, particularly gender equity, prevent large-scale HIV/AIDS epidemics? This should work by modifying the proximate factors such as sexual behaviours, injecting drug use and invasive procedures (e.g., medical injections and the like). Even in the advanced economies, activities such as injecting drug use are high and perhaps even higher than in economically impoverished countries (Aceijas et al. 2004: Tables 1 and 2). But the difference between prosperous and impoverished countries is that the former may afford a wider range of preventive measures than the latter. This gap is largely due to differences in capacities of healthcare systems and investment in health and welfare. A strong healthcare system can arrange for an effective supply of preventive measures, including condoms and needles. But the use of such methods ultimately depends on individuals. In an equitable society, sex partners can, for example, negotiate safer sex and thus prevent unsafe heterosexual networking and ultimately a large scale HIV epidemic.

Then, what about the HIV/AIDS epidemics in the developed societies? The epidemics are low but not nil. The United States provides abundant examples of the relationship between inequality and HIV/AIDS in the developed settings. Holtgrave and Crosby (2003) found that income inequality and social capital were strongly correlated with AIDS case rates at the state level. Among races, African-Americans and Hispanic-Americans have been disproportionately affected by the disease (UNAIDS 2006). African-Americans, who make up 13% of the US population, account for 50% of people living with HIV/AIDS (US Centers for Disease Control and Prevention). The effect was more pronounced among women than men. Information gathered during 2001–2004 from 33 states showed that African-American women accounted for more than two thirds (68%) of new female HIV/AIDS cases, and African-American men accounted for 44% of new male cases (US Centers for Disease Control and Prevention). The disadvantaged segments of any society seem to be bearing the most severe brunt of this disease, even if the overall epidemic is small.

Stating it succinctly, good governance builds on and enhances equity, and equity reduces unsafe

exposure to the epidemic. A well-governed, prosperous society is better positioned to ensure social and economic equity and tackle health problems, including HIV/AIDS. Social development, equity and justice, which provide a strong foundation for the good health of a population (Caldwell 1986; Wilkinson 2005), can also contribute to preventing the growth and impact of the AIDS epidemic. Enhancing economic and gender equity are justifiably relevant and essential steps toward defeating the pandemic.

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Appendix 1: Classification of countries examined according to income level and HIV prevalence

	HIV Prevalence			
Income Level	**Less than 0.5%**	**0.5 to <1%**	**1 to Less than 5%**	**5% or Above**
High	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Japan, Korea South, Netherlands, Norway Portugal, Sweden, Switzerland, United Kingdom	Italy, Spain, United States		
Upper middle	Chile, Costa Rica, Czech Republic, Hungary, Lithuania, Malaysia, Mexico, Poland, Uruguay	Argentina, Latvia, Panama, Venezuela	Estonia, Trinidad and Tobago	Botswana, South Africa
Lower middle	Algeria, Armenia, Azerbaijan, Belarus, Bolivia, China, Indonesia, Iran, Jamaica, Kazakhstan, Morocco, Nicaragua, Paraguay, Philippines, Sri Lanka, Tunisia	Brazil, Colombia, El Salvador, Guatemala, Peru	Dominican Republic, Moldova, Thailand, Ukraine	Cameroon, Lesotho, Namibia, Swaziland
Low	Bangladesh, Laos, Mongolia, Pakistan, Tajikistan, Uzbekistan	India, Madagascar, Mauritania, Nepal, Senegal, Vietnam,	Burkina Faso, Burundi, Cambodia, Ethiopia, Gambia, Ghana, Guinea-Bissau, Mali, Niger, Nigeria, Papua New Guinea, Rwanda, Sierra Leone	Ivory Coast, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe

Sources: UNAIDS (2006), World Bank (2006b).
Note. HIV prevalence was expressed to two decimal points; a slightly different list may be obtained for the first two columns if the prevalence is rounded off to one decimal point.

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