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Spatial and Temporal Variations in Incidence of Tuberculosis in Africa, 1991 to 2005

Marching toward the Millennium Development Goals: What about Health Systems, Health-Seeking Behaviours and Health Service Utilization in Pakistan?

Contraception in India: Exploring Met and Unmet Demand

Work Status and Health of Women: A Comparative Study of Northern and Southern States of Rural India

Reducing Childhood Diarrhea Morbidity: Does Behaviour Change Matter? A Case Study from Northern Ghana

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IN THIS ISSUE

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From the Editor-in-Chief

This volume of *World Health & Population* presents papers which have recently been published online by WHP. They are included here as particularly representative of the diversity and focus of the journal. The papers in this issue include two from Africa and three from South Asia. All the papers have clear relevance to the Millennium Development Goals (MDGs), and represent the ongoing importance of monitoring and discussing MDG progress. Interestingly, two of the papers in this issue discuss the importance of "bottom-up" efforts to achieving the MDGs, versus the usual "top-down" perspective that governments and multilateral agencies might have for the MDGs.

The lead paper in this issue is by Olalekan Uthman at the Center for Evidence-Based Global Health in Ilorin, Nigeria. Uthman presents a spatial and temporal study of tuberculosis incidence for the African continent. Using currently existing data (an important attribute) and modern geospatial information system (GIS) approaches, the author is able to identify disease "hot-spots," as well as areas where progress toward reducing TB incidence and prevalence has been made. This information is useful both for (1) micro-targeting future programs and (2) identifying locales where progress has been made to investigate interventional, socio-economic, and cultural conditions that may have contributed to the apparent progress. Investigating TB in Africa is additionally important given its high comorbidity with HIV disease.

In "Marching toward the Millennium Development Goals" Babar Shaikh from Aga Khan University discusses the interrelatedness of health system characteristics, e.g. funding, resources, and intersectoral coordination, and health seeking and health care utilization behaviours, in the context of Pakistan. Macro-level improvements, represented by policy reform and increased availability of funding and resources, are not adequate without an equal focus at the micro-level on the people served, and their perceptions, practices, and healthcare seeking behaviours. Professor Sheikh focuses on MDGs 4, 5, and 6, the explicitly health-related MDGs, but notes the tremendous interdependence of all the MDGs. Achieving the health MDGs in Pakistan will require improving the status of women in Pakistan (and MDG in itself), as well as changing the paradigm for healthcare delivery to focus more on the "customs, values, needs and priorities" of the communities served.

The third paper in this issue, by S.C. Gulati and colleagues Alok Chaurasia and Raghubansh from the Institute of Economic Growth in Delhi, examines met and unmet demand for contraception in India. In many ways this is a "back to the basics" paper regarding family planning, using data from the 1998-1999 National Family Health Survey (NFHS-2) to analyze both supply side factors (the focus of early family planning efforts), and current demand side factors such as women's empowerment through education, directly related to MDG 3. They note that improving the supply side factors can also influence demand side factors increasing beyond the baseline measurement. The paper goes on to examine the reasons for non-use of contraception, as well as the determinants of demand for contraception through a multinomial logit approach.

Also using data from the NFHS-2, Basu and Sidh report a study across rural areas in states in both the north and south of India regarding the impact of work force participation and health. The focus of "Work Status and Health of Women" relates directly to MDG 3, promoting gender equality and empowerment among women. The authors put forward a helpful conceptual framework, and hypothesize that work participation (in particular agricultural work) would negatively affect women's health. The authors also hypothesize that there would be differences between the north and south of India where women's autonomy (i.e. empowerment) differences are known to exist. The results of their analysis, however, did not find significant regional differences by area of the country. They

further concluded that among the most important factors on health status is not work participation, per se, but larger socio-economic issues, of which work participation contributes only a part.

Finally, "Reducing Childhood Diarrhea Morbidity" is a qualitative analysis of focus group and semi-structured interviews in the northern region of Ghana. The author, Issaka Osumanu at the University for Development Studies in Wa, identifies behaviours impacting the incidence of childhood diarrhea that are socially and culturally amenable to change, and suggests focusing on these. Osumanu points out that top-down, technologically-driven solutions for environmental sanitation, which are often the sole focus of governmental and multilateral efforts, are inadequate without end-user, bottom-up behaviour change on the part of the mother (primarily), as well as other members of the household. The highest correlate for improved family hygiene is mother's education. The article further presents research findings from neighboring Burkina Faso regarding the cost-effectiveness of maternal education programs in disease prevention. Osumanu concludes with a recommendation for "integrated hygiene education at the household level" as a cost-effective approach to reducing diarrhea morbidity in the northern areas of Ghana.

To conclude, we hope that you find these articles of interest and value, and that you will consult other papers recently released online at www.worldhealthandpopulation.com. *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. As announced previously, *WHP* is now indexed on MEDLINE and accessible through PubMed. The reach and impact of *WHP* is greatly enhanced by this recognition, and we look forward to continued strong submissions. Note also that the editors and publishers of *WHP* are always interested in any comments or feedback you might have on the articles or journal. Please feel free to write or e-mail us.

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Spatial and Temporal Variations in Incidence of Tuberculosis in Africa, 1991 to 2005

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Abstract

Objective: To investigate the geographical and temporal distribution of tuberculosis in Africa in order to identify possible high-risk areas.

Design: Time-trend and spatial analyses.

Data sources: World Health Organization Statistical Information System and U.S. Census Bureau International Data Base.

Methods: Time trends in the 15-year study period from 1991 to 2005 were analyzed by Poisson regression models. Global Moran's I and Moran Local Indicators of Spatial Associations were used to test for evidence of global and local spatial clustering, respectively.

Results: Southern, Eastern and Middle Africa experienced an upward trend in the number of reported cases of tuberculosis (TB). The number of Northern African TB cases declined steadily over the 15-year study period. The spatial distribution of TB cases was nonrandom and clustered, with a Moran's I = 0.492 (p = .001). Spatial clustering suggested that 25 countries were at increased risk of tuberculosis, and ten countries could be grouped as "hot spots."

Conclusions: The study identified spatial and temporal patterns in tuberculosis distribution, providing a means to quantify explicit tuberculosis risks and laying a foundation to pursue further investigation into the environmental factors responsible for increased disease risk. This information is important in guiding decisions on tuberculosis control strategies.

Background

The World Health Organization (WHO) estimates that the largest number of new tuberculosis (TB) cases in 2005 occurred in the South-East Asia Region, which accounted for 34% of incident

cases globally. However, the estimated incidence rate in sub-Saharan Africa is nearly twice that of the South-East Asia Region, at nearly 350 cases per 100,000 population. It is estimated that 1.6 million deaths resulted from TB in 2005. Both the highest number of deaths and the highest mortality per capita are in the African region (WHO 2003, 2007b). Incidence (cases arising in a given time period) gives an indication of the burden of TB in a population and of the size of the task faced by a national TB control program (WHO 2007a). Incidence and prevalence of tuberculosis can change as the result of changes in transmission (the rate at which people become infected with *Mycobacterium tuberculosis*, the bacterium that causes TB) or changes in the rate at which people infected with *M. tuberculosis* develop the disease (e.g., as a result of changes in nutritional status or of HIV infection).

Millennium Development Goal 6, Target 8 is to "have halted by 2015 and begun to reverse the incidence of malaria and other major diseases" (including TB) (WHO 2007a). The WHO estimates that in 2005 the per-capita incidence of TB was stable or falling in six WHO regions and had peaked worldwide. However, the total number of TB cases was still rising slowly, because the caseload continued to grow in the African, Eastern Mediterranean and South-East Asian regions (Centers for Disease Control and Prevention [CDC] 1993; WHO 2003, 2007b). In common with international initiatives like the Millennium Development Goals (MDGs), numerous interventions have been instituted in Africa aimed at reducing the burden of tuberculosis. The challenge facing the control program is that the disease burden is not homogenous but varies geographically. Minimizing the risk of tuberculosis can be assisted by recognizing its geographical distribution and identifying areas of high risk. Policy makers and researchers often want to know the distribution of a disease incidence by geographical region or associated environmental factors. In addition, the success of any policy or healthcare intervention depends on a broader and accurate understanding of the socio-economic, environmental and cultural factors that determine the occurrence of disease and death (Kandala et al. 2006). The ability to map spatial and temporal variation in disease risk is more important than ever, given the ever-increasing disease burden in Africa (Tanser and Le Sueur 2002). In this regard, mapping and investigating risk variations in tuberculosis is an invaluable tool. Furthermore, mapping the variation in risk can help improve the targeting of scarce resources for public health interventions. With the above issues in mind, the objective of this study was to describe the geographical and temporal distribution of incidence of tuberculosis in Africa in order to identify countries with unusually high rates.

Methods

Data

This study primarily uses data from the WHO statistical information system (WHO 2008b) to describe the temporal and spatial variations in TB incidence in Africa. The data set includes the estimated number of TB cases reported between 1991 and 2005 (expressed as rate per 100,000 population per year). Estimates are based on annual case notifications, on special surveys of the prevalence of infection or disease and on information from death (vital) registration systems. All forms of TB, including cases in people with HIV, were included (WHO 2007a). Estimates of incidence, prevalence and mortality are based on a consultative and analytical process and are published annually (WHO 2008a). Estimates of the incidence of TB for each country are derived using one or more of four approaches, depending on the available data:

1. Incidence = case notifications/proportion of cases detected
2. Incidence = prevalence/duration of condition
3. Incidence = annual risk of TB infection Styblo coefficient
4. Incidence = deaths/proportion of incident cases that die

Available data differ from country to country but include case notifications and death records (from routine surveillance and vital registration) and measures of the prevalence of infection and disease

(from population-based surveys). Further details are available from Corbett and colleagues (2003), Dye and colleagues (1999, 2008) and the WHO (2008a). In addition, total mid year population data from 1991 to 2005 were compiled from the U.S. Census Bureau International Data Base (U.S. Census Bureau) for all African countries ($N = 53$).

Africa Sub-regions

For this study, Africa was divided into five sub-regions based on a combination of geographic, economic and scientific criteria. The sub-regions are Northern Africa, Western Africa, Middle Africa, Eastern Africa and Southern Africa.

Statistical Analyses

Estimation of Time Trend

Temporal patterns were displayed by plotting yearly TB cases against year. Time trends in the 15-year study period from 1991 to 2005 were analyzed by Poisson regression models. Specific counts for each calendar year were used as the unit of observation. Time-on-study was modelled as three different time periods, allowing time effects to be nonlinear. The tertiles were 1991 to 1995 (reference), 1996 to 2000, and 2001 to 2005. Time trend may differ across sub-regions.

The time-trend analysis was done in two steps. In the first approach, the analysis was carried out separately for each country. The Poisson regression procedure fits a model of the following form:

$$\log(tb) = \beta_1(cP_2) + \beta_2(cP_3) + \log(pop) \quad (1)$$

where tb equals number of cases of tuberculosis per year, β_1 and β_2 are trends, cP_2 and cP_3 are time-period (binary 0/1) 1996 to 2000 and 2001 to 2005, respectively, and $\log(pop)$ is an offset term for mid-year population.

In the second model, information on all five sub-regions was pooled into one data set and interaction effects between time trend and regional dummies were calibrated. Percentage changes were calculated using the following formula:

$$\text{Percent Change} = [\exp(\beta_i) - 1]\ \chi 100 \quad (2)$$

GIS Mapping and Smoothing

For conducting a GIS (geospatial information system)-based analysis on the spatial distribution of TB incidence, the country-level polygon map was obtained, on which the country-level point layer containing information regarding latitudes and longitudes of central points of each county was created. All TB cases were geocoded and matched to the country-level layers of polygon and point by administrative code using the software Stata *spmap* routine (Pisati 2004). To alleviate variations of incidence in small populations and areas, annualized average TB cases per 100,000 at each administrative region over the 15-year period were calculated, and spatial rate smoothing was implemented. Based on annualized average incidence, all countries were grouped into four categories: non-endemic area, with annualized average incidence between 54 and 217 per 100,000; low-endemic area, with incidence between 217 and 267 per 100,000; medium-endemic area, with incidence between 267 and 314 per 100,000; and high-endemic area, with incidence greater than 267 per 100,000. The four categories of country were colour coded on maps. To assess the risk of TB in each country, an excess hazard map was produced. The map represents the ratio of the observed incidence for each country over the expected number of cases. A likelihood function was used to test for elevated risk within the country in comparison with risk outside the country. The likelihood function for any given country was proportional to

$$\left(\frac{d}{n}\right) d\left(\frac{[D-d]}{[D-n]}\right)(D-d)\ \mathrm{I}\ (\ ) \quad (3)$$

where D is the total number of TB cases, d is the number of TB cases within the country and n is the expected number of TB cases. The indicator function I() is 1 when TB cases in the country are more than expected; otherwise it is 0. The excess risk is a nonspatial measure, which ignores the influence of spatial autocorrelation (Fang et al. 2006).

Spatial Autocorrelation Analysis

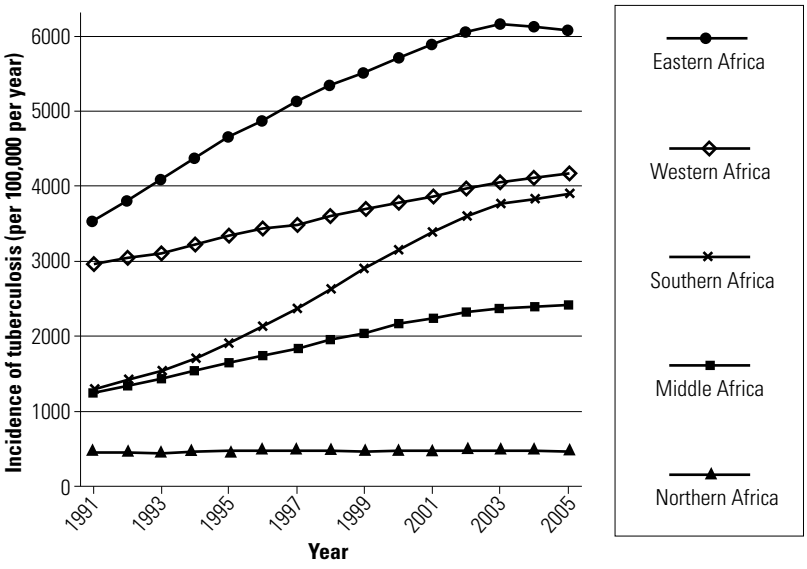
Global and Local Moran's I were used for evidence of global and local spatial clustering, respectively. The index fast becoming the standard tool to examine local autocorrelation is Luc Anselin's LISA (local indicator of spatial association), which can be seen as the local equivalent of Global Moran's I. The spatial weight was determined using first order queen contiguity (i.e., all common points including boundaries and verticals were included in the neighbour definition). LISA values allow for the computation of each location's similarity with its neighbours and also test its significance. Inference for Moran's I was based on a permutation approach in which a reference distribution is calculated for spatially random layouts with the same data as observed. The number of permutation tests was set to 999 and significance level was set as .001.

Results

Temporal variability

Figure 1 depicts the trends of reported cases of tuberculosis in the period 1991 to 2005. Eastern Africa ranked first in absolute upward trend in number of reported cases of TB, followed by Western and Southern Africa. The Northern Africa trend declined during the study period. Poisson regression analyses confirmed a continuous increase in the number of reported cases of TB in all African sub-regions except Northern Africa (Table 1).

Figure 1. Temporal trends in tuberculosis cases, African sub-region, 1991 to 2005



Compared to the reference period (1991 to 1995), incidence risk ratios in the years 1996 to 2000 and 2001 to 2005 were 1.56 (95% CI 1.52 to 1.60) and 2.12 (95% CI 2.07 to 2.18) for Southern Africa, respectively. This equates to a total increase of 55.9% and 112.0% in the number of reported cases of tuberculosis between 1991 and 2000 and 1991 and 2005, respectively. Total increases of

14.9% and 24.5% in the number of reported cases of tuberculosis were found for Eastern and Middle Africa between 1991 and 2005, respectively. The time-trend analysis was not significant for Western Africa. Compared with the reference period (1991 to 1996), incidence risk ratios in the years 1996 to 2000 and 2001 to 2005 were 0.92 (95% CI 0.87 to 0.97) and 0.82 (0.77 to 0.87) for Northern Africa respectively. This equates to a decrease of -8.2% and -17.9% in the number of reported cases of tuberculosis between 1991 and 2000 and between 1991 and 2005, respectively. Table 2 shows the results of time-trend analysis for the pooled cross-regional analysis. As expected, the effect of time trend varied across sub-regions. The cross-region variability in time trend observed is similar to those when the analysis was done separately for each sub-region (Table 1).

Table 1. Temporal trends in tuberculosis cases by sub-regions in Africa, 1991 to 2005

	Incidence rate ratio (95% CI) / percent change			*p*-value
	1991–1995	1996–2000	2001–2005	Linear trend
All Africa	1 (reference)	1.16 (1.14–1.17) 15.7	1.23 (1.22–1.24) 22.9	.001
Sub-regions				
Eastern Africa	1 (reference)	1.14 (1.12–1.16) 13.8	1.15 (1.13–1.17) 14.9	.001
Western Africa	1 (reference)	1.01 (0.99–1.03) 1.1	1.00 (0.98–1.02) -0.1	.448
Southern Africa	1 (reference)	1.56 (1.52–1.60) 55.9	2.12 (2.07–2.18) 112.0	.001
Middle Africa	1 (reference)	1.18 (1.15–1.22) 18.1	1.24 (1.21–1.28) 24.5	.001
Northern Africa	1 (reference)	0.92 (0.87–0.97) -8.2	0.82 (0.77–0.87) -17.9	.001

Spatial Distribution of Tuberculosis in Africa

The median annualized average incidence of tuberculosis at the country level was 243.0 (range: 23.4 to 628.5) per 100,000 population per year. Among the 53 countries (excluding the Western Sahara), 14 countries were non-endemic, with annualized average incidence between 54 and 217 per 100,000; 13 were low-endemic, with incidence between 217 and 267 per 100,000; 13 were medium-endemic, with incidence between 267 and 314 per 100,000; and 13 were high-endemic, with incidence greater than 267 per 100,000. The four type areas were displayed in the thematic map as shown in Figure 2. A spatially smoothed percentile map of annualized average incidence was created; smoothed incidence presents a better pattern and shows clearly where the problem is most severe (Figure 2). The incidence of tuberculosis was particularly high in Southern and Eastern Africa but lower in Northern and Western Africa. The excess hazard map showed distribution of the excess risk, which was defined as a ratio of the observed number over the expected number of cases. Countries marked blue had lower incidences than expected, as indicated by excess risk values less than 1. In contrast, countries in red and light yellow had incidences higher than expected, with risk values greater than 1 (Figure 3).

Spatial Autocorrelation of Tuberculosis in Africa

Global spatial autocorrelation analyses for annualized incidence of tuberculosis in Africa from 1991 to 2005 showed that the Moran's I was significant (.001 significance level) for each year (Table 3).

Table 2. Temporal trends in tuberculosis cases: main and interaction effects for Africa sub-regions, 1991 to 2005

Variable	Incidence risk ratio (95% CI)	Percent change
Main effect		
Region		
Northern Africa	1 (reference)	
Eastern Africa	6.33 (6.05, 6.62)***	137.7
Middle Africa	5.79 (5.52, 6.08)***	94.4
Southern Africa	12.90 (12.29, 13.54)***	112.6
Western Africa	5.26 (5.03, 5.51)***	115.3
Time trend		
1991–1995	1 (reference)	
1996–2000	1.03 (0.97, 1.09)	2.7
2001–2005	1.02 (0.96, 1.08)	1.9
Interaction effects		
1996–2000 **X** Eastern Africa	1.26 (1.19, 1.35)***	7.6
1996–2000 **X** Middle Africa	1.31 (1.23, 1.41)***	6.6
1996–2000 **X** Southern Africa	1.63 (1.52, 1.74)***	9.0
1996–2000 **X** Western Africa	1.12 (1.05, 1.20)***	3.5
2001–2005 **X** Eastern Africa	1.46 (1.37, 1.55)***	12.4
2001–2005 **X** Middle Africa	1.61 (1.50, 1.72)***	11.7
2001–2005 **X** Southern Africa	2.31 (2.16, 2.46)***	15.9
2001–2005 **X** Western Africa	1.27 (1.19, 1.35)***	7.4

***$p < .001$.

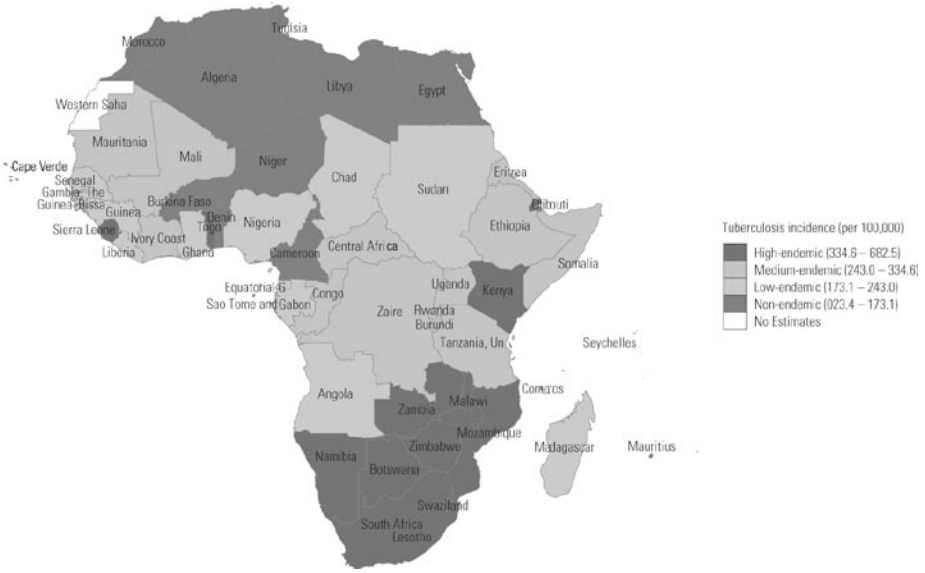
Table 3. Global spatial autocorrelation analyses for annualized incidence of tuberculosis in Africa, 1991 to 2005

Year	Moran's I	*E[I]*	*p-value*
1991	0.304	-0.021	.001
1992	0.343	-0.018	.001
1993	0.379	-0.021	.001
1994	0.426	-0.023	.001
1995	0.469	-0.014	.001
1996	0.507	-0.019	.001
1997	0.528	-0.019	.001

1998	0.538	-0.019	.001
1999	0.525	-0.019	.001
2000	0.512	-0.018	.001
2001	0.495	-0.023	.001
2002	0.480	-0.014	.001
2003	0.458	-0.019	.001
2004	0.428	-0.015	.001
2005	0.380	-0.018	.001

The results of Local Moran's I show statistically significance spatial autocorrelation (Moran's I = 0.492, p = .001) (Figure 4). Southern and some parts of Eastern Africa belong to High-high (hot-spot) clusters. These are locations with a higher incidence of tuberculosis with similar neighbours. The locations marked in blue belong to Low-low (cold-spot) clusters. These are countries with a low incidence of tuberculosis with similar neighbours. Madagascar is the only country in a Low-high cluster, potential an outlier. In order words, Madagascar is a country with a low incidence of tuberculosis and with high-incidence neighbours. The other countries marked in white are locations with no statistically significant autocorrelation.

Figure 2. Spatially smoothed percentile map of annualized average incidence of tuberculosis in Africa, 1991 to 2005



No estimates are available for the Western Sahara.

Discussion

Temporal Variability

The number of reported cases of tuberculosis increased yearly in Africa. Trends varied markedly among African sub-regions. The study found a total increase of 112.0%, 24.5% and 14.9% in the umber of reported cases of tuberculosis between 1991 and 2005 for Southern, Middle and Eastern

Africa respectively. Tuberculosis cases in Northern Africa declined steadily over the study period. Possible explanations for the reported temporal trends are that they are due mainly to changes in the distribution of causal factors, changes in diagnostic or registration practices, or just chance. Another explanation could be the HIV/AIDS epidemic. That the HIV/AIDS epidemic may have fuelled the current high levels of tuberculosis disease in sub-Saharan Africa has been established in the literature (Corbet et al. 2003; Evans et al 2004; Lawn, Bekker et al. 2006; Lawn et al. 2002; Lawn, Myer et al. 2006). HIV infection is a potential risk factor for tuberculosis (Corbet et al. 2003). Not only does HIV increase the risk of reactivating latent *M. tuberculosis* (MTB) infection (Bucher et al. 1999); it also increases the risk of rapid tuberculosis progression soon after infection or re-infection with MTB (Daley et al. 1992; Shafer et al. 1995). A TB-control strategy based on the directly observed treatment, short-course (DOTS) strategy has failed to contain the African TB epidemic, primarily because of the effects of the HIV epidemic in the region (Lawn, Bekker et al. 2006).

Figure 3. Excess hazard map of annualized average incidence of tuberculosis in Africa, 1991 to 2005

No estimates are available for the Western Sahara.

Spatial Variability

In the study, exploratory spatial data analysis and spatial cluster analysis of tuberculosis were conducted at country level in Africa. Tuberculosis cases were mapped from different aspects such as crude incidence, excess risk and spatially smoothed incidence. In addition, the study evaluated spatial patterns and highlighted geographic areas with a significantly high incidence of tuberculosis in Africa. Spatial empirical Bayesian smoothing of disease rates was chosen because it utilizes three kinds of information to estimate an area's disease rate: (1) the observed disease events in an area, (2) prior information on the variability of disease rates in the overall map, and (3) information on the disease rates in an area's neighbours, since geographically close areas tend to have similar rates of disease (Tobler 1970). Moran's I is a weighted correlation coefficient used to detect departures from

spatial randomness (Moran 1950). Departures from randomness indicate spatial patterns such as clusters. The statistic may identify other kinds of patterns such as geographic trend. The Moran's I statistic is a measure of autocorrelation, similar in interpretation to the Pearson's Product Moment correlation statistic for independent samples in that both statistics range between -1.0 and 1.0, depending on the degree and direction of correlation (Anselin 1995; Ord and Getis 1995).

The study showed that the spatial distribution of tuberculosis in Africa was nonrandom and clustered with a Moran's I of 0.492 (p = .001) from 1991 through 2005. Through exploratory spatial analyses, the study was able to pinpoint geographic areas with higher risk and to assess temporal variability of the risk areas, thus providing a working hypothesis on risk of tuberculosis and environmental exposures. Geographic areas with higher cases of tuberculosis need further epidemiologic investigation for potential relationships between lifetime environmental exposures and risk of tuberculosis.

Figure 4. Local Indicator of Spatial Association (LISA) cluster map for annualized average incidence of tuberculosis in Africa, 1991 to 2005

No estimates are available for the Western Sahara

Conclusions

This study has shown the presence of hot spots of tuberculosis in Africa, providing more information on priority areas for public health planning and resource allocation for preventing tuberculosis. The study has also demonstrated that using existing health data, GIS and GIS-based spatial statistical techniques could provide an opportunity to clarify and quantify the health burden from tuberculosis within highly endemic areas and also lay a foundation to pursue further investigation into the environmental factors responsible for increased disease risk. To implement specific and geographically appropriate risk-reduction programs, the use of such spatial analysis tools should become an integral component in the epidemiological description and risk assessment of tuberculosis.

Competing Interests
None

Authors' Contributions
OAU conceived the study, extracted the data, did the analyses and interpretation, and wrote the first draft of the manuscript.

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Marching toward the Millennium Development Goals: What about Health Systems, Health-Seeking Behaviours and Health Service Utilization in Pakistan?

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Abstract

Attaining the ambitious targets pronounced in the Millennium Development Goals (MDGs) will necessitate radical changes in policy as well as extensive reforms and strong inter-sectoral coordination in the healthcare system of Pakistan. While aiming for such macro-level achievements, it is imperative to analyze the on-the-ground realities of any health system. Improving health systems has the potential to assist progress toward MDGs in the near term by promoting more equitable access and introducing effective interventions. More money allocation and more health spending would not necessarily mean better health for Pakistanis. The complex composition of the healthcare system drives us to study the intricate phenomena of health service utilization and healthcare-seeking behaviours. Such an approach will thus provide evidence to sensitize health personnel to provide more empathetic care and to encourage the community at large to start seeking appropriate and timely healthcare. This paper advocates thinking beyond health services provision by reaching out to people and understanding their perceptions, practices and health-seeking behaviours. Achieving millennium development goals will necessitate interventions that address health issues of women, children and all other vulnerable groups in Pakistan.

The Context

In September 2000, the United Nations General Assembly adopted a number of resolutions aimed at alleviating poverty and promoting equitable and sustainable development in developing countries.

One of these resolutions identified eight areas for concrete action, with measurable results to be achieved by the year 2015. All 189 member states of the United Nations endorsed these Millennium Development Goals (MDGs) and vowed to make concerted efforts to achieve them (United Nations 2001). In subsequent meetings to monitor progress toward MDGs, further pledges and endorsements came from the member states. Three of the eight MDGs are unequivocally health related: Goals 4 and 5 call for a two-thirds reduction in the under-five child mortality rate and a three-quarters reduction in the maternal mortality ratio by 2015. Goal 6 is to combat HIV/AIDS, malaria and other diseases. The first three MDGs have an indirect impact on health: eradicating poverty and hunger (Goal 1), achieving universal primary education (Goal 2) and promoting gender equality and empowerment of women (Goal 3). The indirect relationship to health of the first three goals requires thinking about a holistic approach to the MDGs. (See Table 1 for a complete list of MDGs.)

Progress toward the MDGs for health has so far been mixed and will not necessarily be swifter in the second half of the 1990–2015 window (World Bank 2004). Health systems constraints are impeding the implementation of major global initiatives for health and the attainment of MDGs. Health systems research could potentially contribute to overcoming these barriers (Task Force on Health Systems Research 2004). The ambitious targets pronounced in MDGs will need fundamental changes in policy, as well as extensive reforms and strong inter-sectoral coordination in the health system of Pakistan. While aiming for such macro-level achievements, it is crucial to analyze the ground realities of any health system. Improving health systems has the potential to assist progress toward MDGs in the near term by promoting more equitable access and introducing effective interventions. This can be made possible by thinking beyond health services provision and reaching out to people and understanding their perceptions, practices and behaviours (World Health Organization [WHO] 2005a). The aim of this paper is to present an account of the health system, health-seeking behaviours and health service utilization in Pakistan, and to find out the issues in order to address the requisites and to accelerate the progress toward MDGs.

Table 1. The eight millennium development goals

Goal 1	Eradicate extreme poverty and hunger
Goal 2	Achieve universal primary education
Goal 3	Promote gender equity and empower women
Goal 4	Reduce child mortality
Goal 5	Improve maternal health
Goal 6	Combat HIV/AIDS, malaria and other diseases
Goal 7	Ensure environmental sustainability
Goal 8	Develop a global partnership for development

Methodology

This paper is based on a review of peer-reviewed literature published after the MDGs were institutionalized. Articles were searched using MEDLINE and Google. A combination of the following keywords was used: millennium development goals, health systems, health policy, health-seeking behaviours, developing countries and Pakistan. Also, official documents and reports from the Government of Pakistan have been critically reviewed, and official documents and reports from the WHO, the World Bank and other international organizations have been referred to. A brief preamble about Pakistan's healthcare system is presented, with emphasis on health-seeking behav-

iours and health service utilization trends in the country. Conclusions are drawn on the basis of recommendations presented by the international community, success stories of various states and lessons learned so far en route to achieve the MDGs by 2015.

A snapshot of the health system, health-seeking behaviours and health service utilization

The healthcare system in Pakistan comprises public as well as private health facilities. The system includes an elaborate network of dispensaries and basic health units (BHUs) (serving a population of 10,000–20,000) and rural health centres (RHCs) (serving 25,000–50,000). The next levels of referral are the *taluka/tehsil* hospitals (serving 0.5–1 million people) and the tertiary-level hospitals (serving 1–2 million). However, these basic-level facilities have restricted hours of operation and are often located far away from the population. For years, health facilities in the public sector lacked trained personnel, proper equipment, adequate medicines and a structured system of referral (Khan 1996; World Bank 1997). The public sector healthcare system remains underutilized, in spite of a large infrastructure (Government of Pakistan 2000a; Government of Pakistan 2001).

The nationwide network of medical services consists of 796 hospitals, 482 RHCs, 4616 BHUs and 4144 dispensaries. These are staffed by approximately 90,000 doctors, 3000 dentists, 28,000 nurses, 6000 Lady Health Visitors and 24,000 midwives (Government of Pakistan 2001). For years, Pakistan has been spending less than 1% of its Gross National Product on the health sector, one of the lowest rates in South Asia. A major chunk of health spending goes to salaries and operational costs (United Nations Development Programme 2005; Government of Pakistan 2006).

Good governance has also been an unrelieved issue in the health system, which is characterized by lack of continuity and adherence to policies (Government of Pakistan 2002). The social unacceptability of these centres has been due to a dearth of female staff in facilities (Gezairy 2004). In the private sector, besides few accredited hospitals, unregulated outlets and hospitals, scores of general practitioners, homeopaths, traditional/spiritual healers, *Unani* (Greco–Arab) healers, herbalists, bonesetters and quacks provide unchecked healthcare. A majority prefers consulting these healthcare facilities and providers for number of reasons, mainly for quality and compassionate care (Shaikh, Rabbani and Rahim 2006). Thus bringing about change in health-seeking behaviours and practices has been an uphill journey. The cost barrier has been crucial in accessibility and affordability of effective and quality health services (Shaikh and Hatcher 2005). Annual spending on health is nearly $17 per capita, of which $13 comes out of the patient's pocket (WHO 2006). The provision of accessible and affordable health services has often been cited as a high priority for poor communities in Pakistan. However, the crisis has never been dealt with on an emergency footing (Government of Pakistan 2003).

Since 2000, the health portfolio has been given to the districts, decentralizing the financial as well as administrative powers in the system (Government of Pakistan 2000b). These district health systems have so far been struggling to cope with the pressure of the colossal tasks assigned to them. Pakistan's health system was ranked 122nd of 191 in the WHO health systems performance rating in 2000, which was not praise-worthy at all (WHO 2000a). A coherent health system capable of addressing the real health needs of the people is yet to emerge.

Strategic planning and policy formulation in the healthcare system, however, must be based on knowledge of what determines people's health-seeking and health system utilization behaviour. These factors originate within the institutions of family, community and the healthcare system. Factors determining health behaviours may be seen in various contexts: physical, socio-economic, cultural and political (Kroeger 1983). Keeping in view this depiction of Pakistan's health system, we discuss and analyze the readiness to achieve Goals 4, 5 and 6 in light of determinants of healthcare-seeking and health service utilization studies in Pakistan.

Goal 4: Two-Thirds Reduction of under-5 Child Mortality Rate

Infant, child and maternal mortality in Pakistan has been one of the highest in the region and in

the developing world. However, progress though slow is visible. The infant mortality rate of over 100/1000 live births in the 1990s has gone down to 78/1000 live births (National Institute of Population Studies [NIPS] 2007). Yet a considerable number of children are dying of diarrhea, acute respiratory infections and tetanus. The under-five mortality rate has gone down from 128/1000 live births in the 1990s to 94/1000 live births. This decline is mainly due to the encouraging level of the knowledge regarding immunization, especially in urban areas, but achieving universal immunization has been a big challenge in Pakistan. The routine immunization coverage for children aged 12–23 months is below 50%, and thus 10% of children do not reach their fifth birthday (National Institute of Health 2003). The expanded program of immunization (EPI) has been facing disheartening constraints in implementation. Moreover, malnutrition and micro-nutrient deficiencies also account for many deaths in Pakistan (Bhutta 2004). Bottle-feeding among children below 3 years is widespread. Promotion of breastfeeding and practices related to complementary feeding at the appropriate age would markedly reduce wasting and stunting among children (Black et al. 2008).

Poverty and illiteracy have been the major barriers in mobilizing people to look after their children's nutrition and immunization (Zaidi et al. 2004). Poor quality of services, inadequate referral systems, lack of integration among various vertical programs and inadequate resource allocation to EPI are some of the service-related or political problems that have never been determinedly addressed (World Bank 1997; Mangrio et al. 2007). Persistent under-utilization of public sector health facilities has contributed also over a period of time to the gravity of the situation (Government of Pakistan 1993; Government of Pakistan 2000a). Poverty, inadequate housing, lack of drinking water and sanitation facilities have had a profound impact on health of children (World Bank 2002). Among other factors prevailing at the community level, gender discrimination in child rearing, nutrition and healthcare seeking is still remarkably noticeable, especially in rural areas (Hunte and Sultana 1992). As in all other developing countries and restricted cultures, lack of mobility is another barrier to women seeking healthcare for themselves and their children, even in matters of utmost importance such as immunization or in emergencies. Distance to the nearest health facility, the availability of transport and the cost incurred in one round trip are genuine concerns (Shaikh and Hatcher 2005). EPI administration and coverage can be improved through mass campaigns but necessitates strengthening of health systems, enhancing political commitment and raising awareness among the masses. Working with private sector medical practitioners and traditional healers (through regulations and setting standards), to whom people often resort for healthcare (Waters et al. 2002), must be considered.

Goal 5: Three-quarters Reduction in Maternal Morality Ratio

This is the MDG where most countries have demonstrated unsatisfactory progress. More than 500,000 women die every year from pregnancy-related causes, and more than 99% of these deaths take place in the developing world (Population Action International 2005). The United Nations Children's Education Fund (UNICEF) (2007) and the NIPS (2007) in Pakistan simultaneously reported a high fertility rate and one of the lowest contraceptive prevalence rates (25%) in the world. This results in a huge number of unwanted pregnancies, which cause women to resort to unsafe abortions. In Pakistan abortion is illegal; therefore these women fall prey to unskilled providers in an unhygienic and unsafe environment, and the result is obvious (Fikree et al. 1994; Saleem and Fikree 2001).

According to the NIPS (2007), seeking antenatal care is still not universal (60%). Similarly, maternal tetanus toxoid vaccination should be an essential component of antenatal care in Pakistan, yet only 6% of babies delivered are reported to be fully protected against neonatal tetanus (NIPS 2007). Nonetheless, the maternal mortality ratio in Pakistan has declined considerably, from over 600/100,000 live births in the 1960s to 340/100,000 live births at the dawn of 21st century (World Bank 2000). However, the challenges have been enormous. There is a dearth of obstetric facilities for women in the basic health units and rural health centres (World Bank 1997). The Pakistan Medical Research Council's national health survey (1998) showed that an average Pakistani female calls on

a healthcare provider of any cadre six times a year (which is even higher than males in Pakistan). Reproductive health issues aside, she faces perpetual ill health, generalized weakness, depression and anxiety due to domestic and sexual violence (Mirza and Jenkins 2004). Yet the physical distance to the facility, lack of socio-cultural acceptability of the health services and need for round-the-clock emergency obstetric services remain unaddressed. Only 25% of primary healthcare facilities are staffed by qualified female health providers (Islam and Tahir 2002). Maybe that is why we see only 34% of deliveries conducted in healthcare facilities. Ensuring 24-hour emergency obstetric care, presence of a skilled attendant at birth and availability of post-abortion services could save many lives (World Bank 2005a).

Gender discrimination through the life cycle of a South Asian female determines her health status and outcomes (Shaikh, Hatcher and Haran 2006). Education could have made an impact on women's lives, but so far the female literacy rate is just 32% (Government of Pakistan 1998). The status of women is still to be acknowledged fully, whether it be her reproductive role or her basic rights to nutrition, health and education (Tinker 1998). Malnutrition and anemia are commonly seen among poor women and are significant factors contributing to morbidity and mortality. Programs and interventions at the community level must focus on advocacy to improve antenatal care-seeking and acceptance of family planning services.

Goal 6: Combat HIV/AIDS, Malaria and Other Diseases

Pakistan has a low to moderate seroprevalance of HIV/AIDS, unlike its neighbours in the region. Among diagnosed cases, males predominate (87%), most belonging to the 20–40 age group (Hyder et al. 1999). Heterosexual activity has been recognized as the principal mode of viral transmission, and the groups exhibiting high-risk behaviour include commercial sex workers, intravenous drug users, jail mates and professional blood donors. The detection of HIV has initiated a multi-sectoral response involving the government and non-governmental and donor agencies (Kazi et al. 2000). In Pakistan, women's low social status and their lack of negotiating power expose them to the risk of unprotected intercourse, a known risk factor for developing HIV. Moreover, there is a poor level of risk recognition and individual susceptibility to HIV among the general population (Sheikh et al. 2003). To address the complexity of the problem, culturally acceptable strategies need to be adopted, addressing the existing modes of HIV transmission. In 1993, the World Bank suggested investing in culture-specific interventions to adopt a comprehensive strategy for HIV/AIDS prevention (World Bank 1993).

As for malaria, the WHO has been recommending a multi-pronged strategy to combat the disease, including new medicines, vaccines, improvements in healthcare systems and insecticide-treated nets (ITNs) since 1997 (WHO 2000b; WHO 2002). Though no sound data is available in Pakistan, we know that malaria is one of the principal causes of anemia during pregnancy and may result in abortions and still births (Steketee et al. 2001). Women and children belonging to low income communities and residing in malaria-prone areas in urban slums and rural habitats appear to be the most vulnerable group. A behavioural change campaign for promoting use of ITNs can save substantial resources needed for treating the illness and its complications. ITNs ought to be available to the most vulnerable at subsidized costs or in easy installments; government investment would be required and donors would have to be mobilized.

Discussion

Besides the three goals related directly to health, the first three goals – eradicating poverty and hunger (Goal 1), achieving universal primary education (Goal 2), and promoting gender equality and empowerment of women (Goal 3) would also be accounted for in rethinking strategies to reform our health system. Various international treaties and conferences ratified that the rights of women to information and education, to decide about fertility, to access healthcare and to benefit from scientific progress must be ensured. Meaningful and strong inter-sectoral collaboration would be required to achieve such ambitious targets set out in MDGs, thus culminating in better health outcomes.

An approach suggested by Siddiqi et al. (2004) would involve non-governmental organizations,

donors and other stakeholders from civil society to combine efforts and address a complex horde of issues around reproductive health. More money allocation and more health spending would not necessarily mean better health. This is because of deep structural problems in our health sector that need rapid removal (Clemens and Moss 2004). Progress toward MDGs will require political and economic reforms in the civil service and governance structures, and a just allocation of resources to health in the national expenditure framework (Dodd and Cassels 2006). Whether it is a matter of introducing reforms or designing interventions, with the help of evidence-based research, researchers can influence the policy-making process (Nishtar 2006). The international community maintains that good health is a human right and that investing in health is the key to sustainable development; it should also strive to work in close partnership with governments and build their capacity to address the challenges and constraints to achieving reasonably well the targets set for each of the MDGs.

All these goals necessitate consequential policies to improve the status of women in Pakistan, who constitute almost half of the population. Improving the health and thus the productive potential of Pakistani women will play a vital role in all aspects of the country's development and economic upsurge. As we approach the halfway point of the 15-year period in the new millennium, efforts to strengthen immunization programs and expand health services must be amplified to the maximum, and quality maternal health services must be made widely accessible (United Nations 2007). Today, the consensus of the international community is to gear all efforts toward building the equitable, effective and client-friendly health systems required to achieve the MDGs. Investing in health necessitates in-depth research to visualize the real determinants of health-seeking behaviours and health services utilization among the most vulnerable sub-groups of the population. Moreover, very few public sector programs and interventions are subjected to rigorous, independent evaluation, which should be the foremost ingredient of any program to facilitate the choice of interventions to achieve the MDGs (World Bank 2005b).

Social marketing is not a new phenomenon in Pakistan; promoting contraceptive use for furthering family planning, use of oral rehydration salt to reduce childhood mortality from diarrhea and use of iodized salts in goiter-endemic areas are some of the more successful campaigns in which the government and the private sector have been involved. Lessons learned from these successful campaigns suggest a rationale for using various methods of disseminating information for bringing about a positive change in health-seeking behaviours (Husain and Shaikh 2005; Qazi and Shaikh 2007).

Customs, values, needs and priorities of the communities ought to be taken into consideration while reshaping the health system or revisiting policies. For the 66% of the population living in rural areas, poverty, along with illiteracy, low status of women and inadequate water and sanitation facilities have in actuality slowed down the improvement in health indicators in Pakistan (World Bank 2002). In the latest MDG monitoring report by the World Bank, emphasis has again been placed on gender equality and women's empowerment, which are not only crucial for women's own health, but also vital for other millennium goals – halving poverty, achieving primary education for all and lowering the under-five mortality rate (World Bank 2007). The complex composition of the healthcare system drives us to study the most intricate phenomenon of healthcare-seeking behaviours and health service utilization. Such an approach will thus provide evidence to sensitize the healthcare personnel to provide more empathetic care and to encourage the community at large to start seeking appropriate and timely healthcare.

Health workers must take responsibility for improving healthcare delivery in this highly pluralistic healthcare system and gender-sensitive culture. This change in paradigm will symbolize an opportunity for action on social determinants and for inventing healthy public policies, and not merely interventions for healthcare delivery (WHO 2005b). Health systems research must be another crucial add-on in this march toward MDGs, and it should encompass human resource requirements, financing, health service delivery mechanisms and, more importantly, socio-cultural determinants behind patterns of health service utilization (Task Force on Health Systems Research 2004). A practical and realistic approach, however, would be to identify and prioritize problems, analyze the socio-political system and then invest in selective interventions and reforms, together

with the government and the private sector. To eliminate stunting among children, for instance, all interventions would call for an appreciation of the underlying determinants of under-nutrition, such as poverty, poor education, disease burden and lack of women's empowerment (Bhutta et al. 2008). Accelerating progress toward the MDGs in all contexts requires strengthening of public health programs, social mobilization and a concerted action beyond the health sector. MDGs cannot be achieved with disease-focused interventions alone; an overall strengthening of the health system is called for. Needless to say, this would be, in a sense, an achievement of yet another millennium goal, which is to develop a global partnership for sustainable development.

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Contraception in India: Exploring Met and Unmet Demand

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Abstract

Our study examines factors influencing demand for contraception for spacing as well as for limiting births in India. Data on socio-economic, demographic and program factors affecting demand for contraception in India are from the National Family Health Survey, 1998–99. The recent document from the *National Rural Health Mission* has completely ignored the use of contraception in controlling fertility in India. Empirical results of our study suggest giving priority to and focusing attention on supply-side factors such as a regular and sustained supply of quality contraceptive methods to improve accessibility and affordability. Further, strengthening the information, education and communication (IEC) component of the reproductive and child health (RCH) package would allay misapprehensions about the side effects and health risks of contraception. Focusing attention on demand-side factors such as women's empowerment through education, gainful employment and exposure to mass-media would help reduce the unmet demand for family planning. The resulting reduction in fertility would hasten the process of demographic transition and population stabilization in India.

Introduction

The role of contraception in fertility regulation has always been crucial to success of historical as well contemporary fertility regulation (Harvey 1996). The advent of effective contraception made fertility a choice in most of the socio-economic theoretical frameworks that evolved during the Sixties and Seventies (Becker 1960; Easterlin 1969). However, most empirical studies have aptly demonstrated that contraception had always been the most significant catalytic factor and cost-effective strategy for fertility control (Gulati, 1998).

Realizing the potential dangers of a burgeoning population, in 1952 India became the first country to launch an official national family planning program, promoting contraception and responsible parenthood to control fertility and hasten the process of demographic transition in India.

Official efforts succeeded in averting about 339 million births up to 2005 (Government of India [GoI] 2006a). Although fertility decline has set in all over India, the slow pace in certain regions remains a serious concern to population and development planners.

Major paradigm shifts in India's population policies have occurred since the Cairo International Conference on Population and Development in 1994. The earlier method-mix target-oriented approach has shifted to a client-centered demand-driven approach to reproductive and child health. This new approach is enshrined in the National Population Policy 2000, with tangential reference to fertility control. The policy calls for vigorous promotion of a small-family norm to achieve replacement levels of fertility by 2010. The latest policy document, the *National Rural Health Mission*, launched in India in 2005, focused attention on mother and child healthcare and its determinants such as nutrition, sanitation, hygiene and safe drinking water to improve quality of life. Contraception as a fertility-control strategy is altogether missing from the document (National Rural Health Mission [NRHM] 2005). Nevertheless, a working group constituted by the National Population Commission and meeting on population stabilization has recommended to bring back the promotion of contraception as the main concern of family welfare programs in high-fertility states of India (GoI 2006b).

More importantly, using contraception to curtail fertility has been stressed for accelerating population stabilization in developing countries (Robey et al 1996; Westoff and Bankole 2000). The extent of unintended pregnancies, that is, unwanted or mistimed ones, was still around one in four worldwide (Haub and Herstad 2002). Reducing the unmet demand for contraception would help couples achieve their reproductive goals and reduce unintended pregnancies that lead to abortions and unwanted births, both of which are unacceptably high in many developing countries (Becker 1999; Potts 2006). The total unmet need for family planning in India was 15.8% in 1998–99 and has come down to 13.2% in 2005–06 (International Institute for Population Sciences [IIPS] 2000; 2007). One particularly harmful consequence of unintended pregnancies is unsafe abortion, leading to high rates of maternal morbidity and mortality in less-developed countries. An estimated 18 million unsafe abortions take place in these countries annually (Murray and Lopez 1998). Conceptual modifications to the measurement of unmet need for contraception have brought forth a lot of literature recently (Westoff 1992; Bhushan 1997; Casterline and Sinding 2000).

"Unmet need" refers to the proportion of sexually active women who are exposed to the risk of pregnancy and either do not want more children or wish to postpone the birth of their next child for at least 2 years but are not using any method of contraception. "Sexually active" means fecund women married or living in a union. Further, women who are currently pregnant but either said their pregnancy was mistimed or didn't want the pregnancy but are not using contraception also belong to the "unmet need" category. The category also includes women who are amenorrheic but whose last child was unwanted or mistimed. Definitions of unmet and met need for spacing as well as for limiting births are provided in the National Family Health Survey report (IIPS 2000: 172)

Several empirical studies have highlighted the influence of socio-economic, demographic and program factors such as age, religion, caste, place of residence, standard of living, female education, status of women, sex composition of living children, exposure to mass media and spousal communication about family planning on the demand for contraception in India and abroad (Bongaarts 1997; Gulati 1996a; 2005).

Our study explores factors influencing met and unmet need for family planning in India. Identifying the key factors and their relative significance would facilitate prioritization of factors influencing unmet as well as met demand for contraception for birth spacing as well as limiting births in India.

Data and Methodology

The second National Family Health Survey 1998–99 (NFHS-2) collected detailed information on fertility, mortality, family planning and important aspects of nutrition, health, and healthcare,

including maternal and child health. Primary data from 25 states and union territories of the country were collected from 88,562 households and 84,862 currently married women aged 13–49 years (IIPS 2000). Our study employs multinomial logit regression analysis to highlight important predictors of met and unmet demand for contraception. The response variable has been categorized into five mutually exclusive and exhaustive categories: (1) respondents not using any type of contraception, (2) respondents with an unmet need for spacing births, (3) respondents with an unmet need for limiting births, and (4) respondents whose need for contraception has been met for both spacing and limiting births. The reference category (5) comprises respondents who were not using any family planning method and had no unmet need for contraception at the time of the survey. Each respondent can fall into only one of the five categories.

Parametric estimates of the multinomial logit model are computed through the maximum likelihood estimation procedure. The estimated regression coefficients can be used to estimate multiplicative effects on the odds ratios and thereby probabilities of respondents with different background characteristics reporting use or non-use of contraception. The effects of the predictor variables on the response variable in the form of estimated probabilities based on parametric estimates are also calculated in our study. Proper interpretations of increase or decrease in odds ratios in the multinomial logit regression analysis are provided in an earlier study (Gulati 1996b). For further details on formulation, estimation procedures and proper interpretations of the effects, one can look into technical literature on the causal analysis (Retherford 1993).

Reasons for Non-use of Contraception

It may be of interest to first examine the reasons for non-use of contraception, as they could provide important clues about the demand- and supply-side constraints to contraception (Zappella 1997). Supply-side constraints such as inaccessibility or effectiveness of contraception methods, or misapprehensions about contraception methods, suggest that program interventions can improve the demand for contraception. On the other hand, demand-side constraints such as familial or societal opposition to family planning or lack of knowledge may suggest strengthening the IEC component to improve demand for family planning.

Table 1 provides information on reasons for non-use among women who depict an unmet need for contraception to space and limit births and also among women who have no unmet need and are not using any contraception. Table 1 shows that the majority of women with an unmet need for contraception for spacing births have given fertility-related reasons for not using contraception. Around 44% of these women report non-use because of their desire for more children.

Table 1. Percent distribution of women by reasons for not using any contraception

Reasons	Unmet Need for Spacing Births (%)	Unmet Need for Limiting Births (%)	Non-use and No Unmet-Need (%)	Total Number of Women (%)
Wants more children	44.1	-	35.8	13834
Pregnant	16.4	9.2	16.0	6508
Fertility-related reasons	7.7	10.5	19.2	6901
Not having sex	0.6	1.3	1.1	448
Infrequent sex	0.5	1.4	0.8	365
Menopausal/had hysterectomy	0.0	0.2	8.2	2436
Subfecund/infecund	0.2	1.0	4.0	1257
Postpartum/breastfeeding	6.4	6.6	5.1	2395

Table 1. Continued

Opposition to use	4.3	10.5	4.3	2283
Respondent opposed	0.3	1.1	0.6	281
Husband opposed	2.6	6.2	2.1	1206
Other people opposed	0.5	1.1	0.3	201
Against religion	0.9	2.1	1.3	595
Lack of knowledge	4.6	5.6	2.8	1542
Knows no method	1.1	1.7	1.1	511
Knows no source	3.5	3.9	1.7	1031
Method-related reasons	4.7	15.5	5.0	2817
Health concerns	1.2	5.3	2.0	1028
Worry about side effects	2.5	6.4	2.2	1243
Hard to get method	0.3	0.9	0.2	126
Costs too much	0.6	2.3	0.5	347
Inconvenient to use	0.1	0.6	0.1	73
Other miscellaneous reasons	6.9	13.5	7.3	3548
Do not know	11.6	35.3	9.7	5902
Total number of women	6980	6747	29,608	43,335

Of 6980 women with an unmet need for spacing births, 16.4% were not using contraception because they were pregnant, which clearly shows that these pregnancies were mistimed. However, 7.7% of these women gave fertility-related reasons such as not having sex or infrequent sex, postpartum amenorrhea, infecundity because of menopausal conditions and hysterectomy; 4.3% reported opposition to family planning, predominantly from their husbands (2.6%). A further 4.7% of the women reported family-planning method-related problems such as concerns about side effects and health risks. Thus, overall we found that the majority of women with an unmet need for spacing births gave reasons for non-use such as a desire for additional children, familial opposition, especially from husbands, and concerns about side effects and health risks.

Among 6747 women with an unmet need for limiting births, we found that 9.2% were not using contraception because they were pregnant; these pregnancies can be categorized as unwanted. Other predominant reasons for not using contraception among these women were fertility related (10.5%), opposition to family planning (10.5%) and reasons specific to the contraceptive method (15.5%). However, lack of knowledge about methods (1.7%) and about source of contraception (3.9%) were also important reasons for non-use among 5.6% of these women. Similarly, societal and spousal opposition to using contraception or sterilization here, termed "high social cost from the social influence group" (Nag 1984), also turned out to be an important reason for non-use of contraception among women with an unmet need for limiting births or women who did not want more children. Other predominant reasons for non-use among women with an unmet need of contraception for limiting births were fear of side effects (6.4%) and health risks (5.3%).

Coming to the category of women with non-use and no unmet need for contraception, we found that predominant reasons were the desire for more children (35.8%), pregnancy (16%), menopausal/hysterectomy (8.2%), postpartum or breastfeeding (5.1%), husband's opposition to use (2.1%) and fear of side effects (2.2%).

Not all women with an unmet need may be potential users of contraception (Ashford 2003). However, analysis of reasons for non-use presented in Table 1 reveals that use of family planning can be improved in these categories of women through addressing method-specific reasons for non-use (n = 2817), elimination of familial and societal opposition through IEC interventions (n = 2283), increased knowledge about and accessibility of contraception (n = 1542), and taking

care of mistimed (n = 1067) and unwanted pregnancies (n = 599). By addressing these reasons, we can easily bring about a 19.2% increase in contraception use.

Determinants of Demand for Contraception

Factors influencing unmet and met demand for contraception for spacing and limiting births are highlighted through the multinomial logit regression analysis. For the multinomial logit model, responses about contraception use from the 84,862 currently married women are classified into five mutually exclusive and exhaustive categories: 6780 women with an unmet need for contraception for spacing births, 6747 women with an unmet need for limiting births, 3392 women with a met need for spacing births and 38,135 women with a met need for limiting births; the remaining women number 29,428 and belong to the reference category of non-use and no unmet need for contraception.

The predictor variables used in the model are both quantitative and categorical. The quantitative predictor variables are women's age (AGE) and its squared term (AGESQ), number of living sons (NLS) and its squared term (NLSSQ), and number of living daughters (NLD) and its squared term (NLDSQ). The categorical predictor variables in the model are women's education, with illiterate or no education as the reference category; women's religion, with Hindus as the reference category; women's rural–urban residence, with rural as the reference category; women's caste, with "others" as reference category; standard of living, with low standard as the reference category; women's occupation, with not working out of the home as the reference category; exposure to family planning through media, with no exposure as the reference category; exposure to family planning through a public health facility, with no exposure as the reference category; discussion of family planning with friends, husbands, etc., with no discussion as the reference category; and aspirations for children's education up to primary, secondary or higher education, with no aspiration as the reference category.

Multinomial Logit Regression Results

Parametric estimates of the multinomial logit regression model with all the predictor variables are presented in Table 2. The estimated coefficient (βi) suggests the additive effect of one unit change in the predictor variable (X_i) on the log of odds ($\log \Omega i$) of the response variable. Equivalently, the term ($e^{\beta i}$) suggests the multiplicative effect on the odds ratio or the ratio at which the odds of the response variable would increase or decrease depending upon the positive or negative sign of the coefficient, respectively. Parametric estimates of the coefficients and levels of significance of underlying models for unmet and met need for contraception for spacing and limiting births are provided in Table 2.

Table 2 reveals that the effects of demographic variables such as woman's age and number of living sons and daughters significantly affect all four components of demand for contraception. Moreover, the relationship of the demographic variables turns out to be non-linear. This means that met and unmet need for contraception for spacing as well as limiting births tend to increase to some threshold level of the age and the number of children and then level off or even decline. Interestingly, the fact that MNLB for sons (β=2.044) is higher than for daughters (β=0.913) suggests a much stronger impact (β = 2.044) on use of contraception for limiting births compared to daughters (β = 0.293) and accordingly the positive multiplicative effect on the odds ratio of number of living sons (e^{β}=7.723) is much more pronounced compared with number of living daughters (e^{β} =2.491) on the use of contraception for limiting births. The multiplicative effects on the odds ratios of the response variable in the multinomial logit regression analysis are provided in Appendix Table 2.

Adjusted Probabilities of Needing Contraception, by Background Characteristics

Adjusted probabilities of met and unmet need for contraception to space as well as limit births have been calculated using multinomial logit regression coefficients, and averages of the predictor variables are presented in Table 3. In the binary logit model, the sum of probabilities in the numerator and denominator add up to one, and hence an increase in the odds ratio automatically implies an increase in the probability, as the probability is monotonically increasing the function of the odds

ratio. However, in the multinomial logit model, the sum of probabilities in the numerator and the denominator do not add up to one, and thus an increase in the odds ratio could be possible even when both the probabilities in the numerator and denominator are decreasing, with a proportionate decline in the numerator being less than a proportionate decline in the denominator. Thus, interpretation of the regression coefficients and multiplicative effects on the odd ratios needs careful interpretation in the multinomial logit model compared with the binary logit model. Rather, clear understanding about the effect of a predictor variable is provided by the calculated probability rather than the coefficient or the odds ratio. Multiple classification analysis for the adjusted values of probabilities (p_j, j = 0, 1... 4) for women by background characteristics is provided in Table 3.

Table 2: Multinomial logit regression coefficients of the model with unmet need for spacing births (UNSB), unmet need for limiting births (UNLB), met need for spacing births (MNSB) and met need for limiting births (MNLB), with non-use of contraception as the reference category in the response variables

Predictor Variables	UNSB Log(p1/p0)		UNLB Log(p2/p0)		MNSB Log (p3/p0)		MNLB Log(p4/p0)	
	Coeff.	σ	Coeff.	σ	Coeff.	σ	Coeff.	σ
Intercept	-1.044	0.00	-10.592	0.00	-8.265	0.00	-13.556	0.00
AGE	0.051	0.00	0.438	0.00	0.379	0.00	0.612	0.00
AGESQ	-0.004	0.00	-0.007	0.00	-0.008	0.00	-0.009	0.00
NLS	0.363	0.00	1.650	0.00	0.294	0.00	2.044	0.00
NLSSQ	-0.035	0.00	-0.196	0.00	-0.139	0.00	-0.334	0.00
NLD	0.424	0.00	1.077	0.00	0.187	0.00	0.913	0.00
NLDSQ	-0.037	0.00	-0.125	0.00	-0.043	0.00	-0.165	0.00
WEDNP	0.157	0.00	0.248	0.00	0.470	0.00	0.460	0.00
WEDNHS	0.331	0.00	0.425	0.00	0.906	0.00	0.570	0.00
WEDNHIGR	0.624	0.00	0.782	0.00	1.408	0.00	0.404	0.00
RELMUS	0.114	0.01	-0.277	0.00	0.276	0.00	-0.885	0.00
RELCHR	0.718	0.00	-0.324	0.00	0.314	0.00	-0.776	0.00
RELOTH	0.147	0.04	-0.173	0.02	0.240	0.00	-0.107	0.02
EXPFPM	0.075	0.03	0.168	0.00	0.457	0.00	0.583	0.00
EXPFPHF	0.115	0.45	0.787	0.00	1.706	0.00	1.638	0.00
ASDEDNM	0.011	0.93	0.046	0.68	-0.025	0.92	0.157	0.05
ASDEDNH	0.192	0.10	0.264	0.02	0.121	0.61	0.669	0.00
ASDEDND	0.242	0.04	0.334	0.00	0.183	0.44	0.727	0.00
ASSEDNM	-0.301	0.04	-0.099	0.52	0.697	0.02	0.236	0.03
ASSEDNH	-0.242	0.08	-0.084	0.56	0.218	0.45	0.146	0.15
ASSEDND	-0.340	0.01	-0.090	0.53	0.114	0.69	0.225	0.03
LSS1	0.039	0.23	0.043	0.22	0.296	0.00	0.213	0.00

Table 2. Continued

LSS2	0.076	0.15	0.076	0.17	0.514	0.00	0.353	0.00
LSS3	-0.099	0.40	-0.126	0.29	0.595	0.00	0.326	0.00
WWNoCash	-0.103	0.02	-0.175	0.00	-0.132	0.08	0.028	0.34
WWWithCash	-0.171	0.00	-0.035	0.37	0.100	0.06	0.422	0.00
SC/ST	-0.003	0.93	-0.270	0.00	-0.169	0.00	-0.398	0.00
OBC	0.022	0.54	-0.148	0.00	-0.415	0.00	-0.194	0.00
FPDWOthers	0.172	0.00	0.127	0.03	-0.171	0.01	0.158	0.00
FPDWHusband	0.074	0.04	0.557	0.00	0.993	0.00	-0.015	0.58
FPDWFriends	-0.101	0.04	0.060	0.21	0.194	0.00	0.342	0.00
RES-Urban	-0.027	0.46	0.130	0.00	0.259	0.00	0.306	0.00
n	(n = 6980)		(n = 6747)		(n = 3392)		(n = 38,135)	

σ: Level of Significance; *n*: number of observations.
Note. *n* = 84,862 currently married women; *n* = 29,608 women in reference, or no-use, category.
Note. Details for abbreviated names of predictor variables are available in Appendix Table 1.

Met Need for Contraception for Limiting Births (MNLB)

Column 4 in Table 3 shows that the probability of using contraception for limiting births (p4) is not linear with women's age, as the likelihood of use increases from 0.04 at age 15 to 0.58 at age 35 and declines thereafter to 0.35 at age 45. The curvilinear nature of the relationship depicted by the estimated structural coefficients pertaining to age of women noted earlier is reflected in patterns of probabilities of contraception use.

We found a marginal difference in the probability of contraception use for limiting births among women with two sons (0.52) compared with women with one son and one daughter (0.45). However, the preference for sons in India is clearly shown, as the probability of using contraception for limiting births was much higher among women with only two sons (0.52) compared with women with only two daughters (0.20).

Women's education had a significant and positive impact on the likelihood of using contraception for limiting births. Similarly, exposure to family planning messages by mass media as well as at health facilities had a significant impact on use. The coefficient for exposure to family planning at a health facility was much higher (1.638) in the MNLB equation in Table 2, and accordingly the likelihood of contraception use for limiting births turned out to be much higher (0.72) compared with the reference category of no exposure (0.41) in Table 3.

Table 3. MCA Table of adjusted values of probabilities (*pj*) from the model for unmet and met need of FP for spacing and limiting births and no use of contraception

Predictor Variable	UNSB (p1) (1)	UNLB (p2) (2)	MNSB (p3) (3)	MNLB (p4) (4)	No Use (p0) (5)	Number of Women
Women's age						
p age 15*	0.40	0.04	0.03	0.04	0.49	
p age 25	0.10	0.14	0.04	0.37	0.35	
p age 35	0.01	0.13	0.01	0.58	0.27	

Table 3. Continued

p age 45	0.00	0.08	0.00	0.39	0.53	
Sex composition of children						
p 0s 0d	0.03	0.02	0.03	0.08	0.84	9481
p 1s 1d	0.03	0.10	0.02	0.45	0.40	10,813
p 2s 0d	0.02	0.10	0.01	0.52	0.35	6369
p 0s 2d	0.04	0.08	0.03	0.20	0.65	3412
Women's education						
No education[a]	0.04	0.15	0.02	0.25	0.54	41,798
Secondary	0.03	0.16	0.03	0.38	0.40	20,618
Higher	0.04	0.19	0.04	0.40	0.34	8111
Religion						
Hindu[a]	0.03	0.13	0.01	0.45	0.38	66,136
Muslim	0.04	0.14	0.03	0.26	0.53	10,121
Christian	0.07	0.12	0.03	0.28	0.50	4544
Exposure to family planning						
By media–no[a]	0.03	0.14	0.01	0.34	0.48	30,666
By mass media	0.03	0.12	0.02	0.47	0.37	54,196
At health facility–no[a]	0.03	0.13	0.02	0.41	0.41	83,450
At health facility	0.01	0.10	0.03	0.72	0.14	1412
Aspirations for children's education						
Aspiration–no[a]	0.05	0.16	0.02	0.19	0.59	
Daughter's edn. sec.	0.04	0.15	0.01	0.38	0.42	33,465
Son's edn. sec	0.03	0.13	0.02	0.29	0.53	31,242
Living style score						
Iss0[a]	0.03	0.14	0.01	0.38	0.44	22,569
Iss1	0.03	0.13	0.02	0.42	0.40	44,409
Iss2	0.03	0.12	0.02	0.45	0.37	15,738
Iss3	0.02	0.11	0.02	0.46	0.39	2146
Women's working status						
Not working[a]	0.03	0.14	0.02	0.39	0.42	54,828
Working no wage	0.03	0.12	0.01	0.41	0.43	11,267
Working with wage	0.02	0.11	0.02	0.50	0.35	18,767

Table 3. Continued

Caste						
Others[a]	0.03	0.13	0.02	0.45	0.37	36,051
SC/ST	0.03	0.12	0.02	0.37	0.45	24,334
OBC	0.03	0.13	0.01	0.42	0.41	24,477
Discussion on family planning						
With no one[a]	0.03	0.12	0.01	0.42	0.42	51,419
With husband	0.03	0.19	0.03	0.37	0.38	17,742
Residence						
Rural[a]	0.03	0.13	0.02	0.40	0.43	58,554
Urban	0.03	0.13	0.02	0.46	0.37	26,308

* *p* age 15: signifies likelihood of the usage by respondent at age 15.
[a] Reference category.

Met Need of Contraception for Spacing Births (MNSB)

Probabilities of using contraception for spacing births (*p*3) among women with different background characteristics are provided in Column 3 of Table 3. Overall, we found that the met need or use of contraception for spacing births far lower than for limiting births. However, the curvilinear relationship between usage for spacing births is also shown, along with age, and number of living sons and daughters. The likelihood of usage for spacing births increases marginally to age 25 and then levels off or even declines in higher age groups. The probability of usage for spacing births is substantially higher among women who are working for wages than for others, as well as among women in urban compared with rural areas.

Unmet Need of Contraception for Limiting Births (UNLB)

The likelihood of an unmet need for contraception for limiting births (*p*2) among women with different background characteristics is provided in Column 2 in Table 3. The UNLB increases with age but tapers off and even declines in higher age groups. Thus, the curvilinear nature of the relationship between respondent's age and unmet need for contraception for limiting births is also shown in the calculated probabilities. The probability of UNLB is higher among women with two sons than for women with two daughters. Similarly, the likelihood of needing contraception for limiting births is greater among women who only have boys reflecting the strong preference for sons in Indian society.

Unmet Need of Contraception for Spacing Births (UNSB)

The probabilities of having an unmet need for contraception for spacing births (*p*1) are provided in Column 1 of Table 3. The UNSB was around 8.2%. The unmet need for spacing births is also relatively high among younger women and declines to almost zero above age 35. Also, we find that the unmet need for spacing births is marginally lower among women with more sons than daughters. It may be of interest that the probability of an unmet need for spacing births is higher among Muslim and Christian than Hindu women. On the other hand, we find that unmet need for spacing births is high among women who don't state any aspiration for their children's education.

No Use of Contraception

The likelihood of not using contraception (*p*0) by background characteristics is provided in Column

5 of Table 3. It seems to be higher among illiterate and less educated than educated women. The curvilinear relationship of probability of no-use of contraception with women's age, number of living sons and daughters also emerges for obvious reasons as one minus the probability of no-use depicts demand for contraception and all the four components of the demand depict curvilinear relationship with the three demographic variables. Similarly, we find that the likelihood of non-use of contraception is higher among women who are less educated, who are not exposed to family planning messages by the media or at health facilities, whose aspirations for their children's education are low, who are not working, etc. Also we find that the likelihood of not using contraception is higher among Muslim and Christian women than Hindu women.

Discussion

Women's socio-economic background characteristics such as education; gainful employment or working for cash; living standards; exposure to family planning messages through mass media; participation in discussions on family planning, especially with their husband, and aspirations for their children's education significantly affect all four components of demand for contraception. Interestingly, the effect of women's higher education on met need for contraception for limiting as well as spacing births turns out to be much more pronounced than the effect on the unmet need for contraception. Women from households with higher standards of living also show a higher tendency to use contraception for spacing births. Exposure to family planning at a health facility shows a much stronger impact on met need or usage of contraception for spacing as well as limiting births compared to exposure through other sources.

Contraception use as well as unmet need for contraception for limiting births is significantly lower among Muslim and Christian women than among Hindus. On the other hand, use of as well as unmet need for contraception for spacing births is significantly higher among Muslim and Christian women than among Hindus. This possibly reflects a religious bias against using permanent methods of contraception for limiting births.

Exposure of women to family planning through mass media has a significant and positive impact on met as well as unmet need for contraception for spacing as well as limiting births. However, the impact of exposure at a health facility has a much more pronounced effect on demand for contraception for limiting as well spacing births. Urban women shown a higher tendency to use contraception for spacing as well limiting births than their rural counterparts.

The probability of using contraception to limit births also increases with an increase in the number of living sons as well as daughters. Further, the likelihood of usage increases much faster with more living sons than daughters. It may be of interest to mention that probabilities of using contraception to limit births show that couples or women want a balanced number of boys and girls.

Using contraception for limiting births is also higher among women with aspirations for higher education for their children compared to women who do not have such aspirations. The probability of use is significantly higher among women working for wages. Also we find that the likelihood of use increases with an increase in the standard of living and is also higher in urban than in rural women.

More-educated women are more likely to have an unmet demand for contraception to limit births than their less-educated counterparts. Possibly, more-educated women are more intent on limiting births than less-educated women. Also we find that unmet need for contraception to limit births is higher among Hindu than Muslim and Christian women. Similarly, the likelihood of an unmet need for limiting births is higher among women who have discussed family planning with their husband. Also we find that women counselled about family planning at health facilities show a much higher demand for contraception to limit births. Overall we find that the unmet demand of contraception to limit births is higher among middle-aged women or those in peak-fertility years, among the more educated, among women with more sons than daughters and among women who discuss family planning with their husband.

The analysis reveals that 27% of the total pregnancies among non-users of contraception were unintended These are mistimed and unwanted pregnancies, which implies a lot of unfulfilled

demand for contraception. Thus, potential users of contraception could be many more. Just satisfying important reasons of non-use could increase demand for contraception by 19.2% among non-user categories of women implying usage of contraception could easily be increased from 48.9 to 57.5%. Still we find that increased awareness and accessibility of quality contraception is needed and can conveniently increase contraception use.

The multinomial logit regression analysis clearly reveals a curvilinear relationship between the four components of demand for contraception and the three demographic variables of age of respondent, number of living sons and number of living daughters, suggesting that the effects on the four components of demand for contraception increase along with age, and number of living sons and daughters, up to a certain level, beyond which the effects taper off or even decline. The unmet demand for contraception for spacing births is highest among younger women, aged 15–24 years, and for limiting births is highest among women of 25–39 years. However, use of contraception to limit births is much higher among women with more sons than daughters, implying a deep-rooted son-preference phenomenon in Indian society.

Unmet need of contraception to limit births is higher among women beyond age 25 with at least two children. Thus, advocating methods to limit births should focus on women in the middle age groups and predominantly on women with at least one or two children, with special focus on those with only daughters whose contraception use is low because of their desire for a son. Alleviating the preference for sons, deeply rooted in Indian society, could lead to changes in fertility preferences and increase contraception use to limit births.

Use of contraception to limit births increases much faster among women with more living sons than daughters. Women's empowerment through better education and gainful employment, which by itself is an ideal goal and would alleviate son preference, also helps increase demand for contraception space and limit births. Counselling about family planning at health facilities has a more pronounced effect than that of mass media on using contraception to space as well as limit births.

Religious differentials in contraception use for limiting as well as spacing births narrowed after accounting for other socio-economic factors in the multivariate analysis, but use to limit births remains significantly higher among Hindu than Muslim and Christian women. On the other hand, contraception for spacing births remains significantly higher among Muslim and Christian women than among Hindus. This could be reflect a religious bias against limiting contraception among Muslim and Christian women. Such religious biases can be alleviated through interventions from religious leaders, or by appropriate and effective IEC interventions through mass media.

Conclusions

The study's primary conclusions are that policies and programs should focus on promoting contraception use among the categories of women who do not currently use it. Women's fears can be allayed through counselling on side effects and health risks, by imparting accurate information on contraceptive methods through mass media and through appropriate counselling at health facilities, and through increased supply and accessibility of quality contraceptive methods. Promoting contraception will also reduce unintended pregnancies, which often lead to unsafe abortions and are detrimental to women's health. Awareness-building activities in health facilities will contribute significantly to improved contraception use. Education and gainful employment of women will improve their status and enhance their use of contraception. Increased demand for and use of family planning and an easily accessible, wider range of quality contraception methods will be important factors in improving the health of women, reducing fertility, achieving demographic goals and enhancing individual rights.

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Appendices

Appendix Table 1. Descriptive statistics of the selected variables under study

	Description of the Variable	Min.	Max.	Mean	Std. Deviation
AGE	Current age – respondent	15	49	31.0	8.6
AGESQ	Age squared	225	2,401	1,037.5	559.3
NLS	Number of living sons	0	10	1.4	1.2
NLSSQ	nlssq	0	100	3.2	4.9
NLD	Number of living daughters	0	11	1.3	1.2
NLDSQ	nldsq	0	121	3.1	5.3
WEDNP	Primary education	0	1	0.2	0.4
WEDNHS	Secondary education	0	1	0.2	0.4
WEDNHIGR	Higher education	0	1	0.1	0.3
RELMUS	Muslim	0	1	0.1	0.3
RELCHR	Christian	0	1	0.1	0.2
RELOTH	Other religion	0	1	0.0	0.2
EXPFPM	Exposure to family planning by mass media	0	1	0.6	0.5
EXPFPHF	Exposure to family planning at health facility	0	1	0.0	0.1
ASDEDNM	Aspirations for daughter's education up to middle	0	1	0.1	0.3
ASDEDNH	Aspirations for daughter's education up to higher level	0	1	0.4	0.5
ASDEDND	Aspirations for daughter's education up to her desired level	0	1	0.4	0.5
ASSEDNM	Aspirations for son's education up to middle	0	1	0.0	0.2
ASSEDNH	Aspirations for son's education up to higher level	0	1	0.4	0.5
ASSEDND	Aspirations for son's education up to his desired level	0	1	0.6	0.5
LSS1	Living style score low	0	1	0.5	0.5
LSS2	Living style score medium	0	1	0.8	0.4
LSS3	Living style score high	0	1	1.0	0.2
WWNoCash	Working without wage	0	1	0.1	0.3

Table 1. Continued

WWWithCash	Working with wage	0	1	0.2	0.4
SC/ST	Scheduled castes/schedules tribes	0	1	0.3	0.5
OBC	Other "backward" castes	0	1	0.3	0.5
FPDWOthers	Family planning discussed with others	0	1	0.1	0.3
FPDWHusband	Family planning discussed with husband	0	1	0.2	0.4
FPDWFriends	Family planning discussed with friends	0	1	0.1	0.3
RES – Urban	Urban residence	0	1	0.3	0.5

Appendix Table 2. Multiplicative effects of predictor variables (eâi) on the odds ratios (Ωi's) in the multinomial logit model

	Exp (βi)			
Abbreviated Variable	**UNSB (p1/p0)**	**UNLB (p2/p0)**	**MNSB (p3/p0)**	**MNLB (p4/p0)**
AGE	1.053	1.549	1.461	1.845
AGESQ	0.996	0.993	0.992	0.991
NLS	1.438	5.205	1.342	7.723
NLSSQ	0.965	0.822	0.87	0.716
NLD	1.528	2.935	1.206	2.491
NLDSQ	0.964	0.883	0.958	0.848
WEDNP	1.17	1.281	1.6	1.584
WEDNHS	1.392	1.53	2.474	1.769
WEDNHIGR	1.866	2.185	4.086	1.498
RELMUS	1.12	0.758	1.317	0.413
RELCHR	2.051	0.723	1.369	0.46
RELOTH	1.159	0.841	1.272	0.899
EXPFPM	1.077	1.183	1.579	1.792
EXPFPHF	1.122	2.197	5.508	5.147
ASDEDNM	1.011	1.047	0.976	1.17
ASDEDNH	1.212	1.303	1.128	1.95
ASDEDND	1.274	1.397	1.201	2.068
ASSEDNM	0.74	0.906	2.009	0.79
ASSEDNH	0.785	0.92	1.244	0.864
ASSEDND	0.712	0.914	1.121	0.799

Appendix Table 2. Continued

LSS1 (Low)	1.04	1.044	1.345	1.238
LSS2 (Med)	1.079	1.079	1.673	1.423
LSS3 (High)	0.905	0.881	1.813	1.385
WWWNoCash	0.902	0.839	0.876	1.029
WWWCash	0.843	0.966	1.105	1.525
SC/ST	0.997	0.764	0.844	0.671
OBC	1.022	0.862	0.661	0.824
FPDWOthers	1.188	1.135	0.843	1.172
FPDWHusband	1.077	1.746	2.699	0.985
FPDWFriends	0.904	1.062	1.214	1.408
RES-Urban	0.974	1.139	1.296	1.357

UNSB = unmet need for spacing births; UNLB = unmet need for limiting births; MNSB = met need for spacing births; MNLB = met need for limiting births (with non-use of contraception as the reference category).

Work Status and Health of Women: A Comparative Study of Northern and Southern States of Rural India

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Abstract

The paper examines the net effect of work status on women's health and whether the effect persists after controlling for the influence of socio-economic factors. Our hypothesis is that working women face a greater risk of morbidity and mortality, given that most would be expected to shoulder dual responsibilities: market and household. The paper also examines whether the risk varies across regions. In particular, we examine whether the work status–health relationship differs between the southern and northern regions of India, which are known to be distinct in female autonomy.

While women in India face many serious health concerns, this analysis focuses on only two issues: nutritional status (as measured by body mass index and prevalence of anemia) and reproductive health (as assessed by the presence of reproductive health problems) of women from villages in the study area. Results show that though both work status and socio-economic factors influence health status, the latter are more important; most of the gross effect of work status is due to socio-economic conditions rather than work participation. This calls for policy intervention in providing better health facilities, female education and supplementary nutrition programs for poor women.

Introduction

Women's participation in the labour force is generally related to their empowerment through income generation (Gallin 1989; International Institute for Population Sciences [IIPS] and ORC Macro 2000; Johansson et al. 2007). On the other hand, "women's involvement in multiple roles (job plus

family responsibility) may harm their physical health." (Verbrugge 1983: 16) Thus the rewards and the "stress-and-strain" model involve the positive role of employment and its negative spillover on health, respectively (Gallin 1989; Waldron et al. 1998). In this paper we try to understand the negative effect of work on the health of women in India – the stress-and-strain model. Our particular focus is on whether working Indian women face even greater risks of morbidity and mortality, given their dual responsibilities of paid and household work.

India has a predominantly agricultural economy where rural women play a major role in both agricultural production and marketing (Chattopadhyay 1982). A large portion of working women come from the poorer sections of society, and their health reflects their poor living conditions (WHO 1992). This paper focuses on the work participation of women in rural areas because, in India, rural work participation is higher (42.1%) than urban (24.2%). Moreover, poor rural women are "altruistic and self-sacrificing in contributing towards common households and nutritional needs, [and] employment is a family obligation and a double burden rather than a basis of independence." (Malhotra and Mather 1997: 608) The National Family Health Survey-II (NFHS-II), 1998–99, reported that in rural areas in India, 76% of women who work are agricultural workers (farmers, farm workers and other agricultural occupations) (IIPS and ORC Macro 2000), which involves more physical labour.

NFHS-II also shows large interstate variations in work participation (economically valued) among ever-married women of age 15–49 years in rural India. The state of Maharashtra has the highest level of work participation (71.5%) among women of that age group, followed by Andhra Pradesh (68.6%). The lowest level of work participation is found in Punjab (6.4%), Haryana (10.5%) and Kerala (23.4%). (See Appendix – Table A2).

The health of Indian women is intrinsically linked to their status in society (Gothoskar 1997; Yadava and Yadava 1999). A high proportion are uneducated and have limited control over resources, even though their level of work participation is moderate. (According to NFHS-II 1998–99, 39% of ever-married women aged 15–49 were either currently employed or employed during the 12 months preceding the survey). Dyson and Moore (1983) note that the economic, educational and kinship status of women is higher in southern than in northern states. Against this backdrop, our research examines the north–south divide in the relationship between work status and health. Southern states such as Kerala and Tamil Nadu are linked with higher female autonomy than northern states such as Bihar and Uttar Pradesh. Women's autonomy can affect their health through health-seeking behaviour and access to resources (Nanda 2000).

This paper focuses on only two issues: nutritional status and reproductive health of rural women and how rural women's work status influences these factors. We chose nutritional status and reproductive health because they have been measured in some recent surveys with large sample sizes.

A proper understanding of women's health status and work participation, particularly in rural India, can provide helpful information for policy interventions in nutritional and healthcare programs for rural women as well as for socio-economic development.

Objectives

The objectives of this paper are to examine the overall effect of work status on the health of rural Indian women and to see whether such effects persist after controlling for the influences of socio-economic factors. The paper also reports on north–south differences in the relationship between work status and health.

Hypotheses

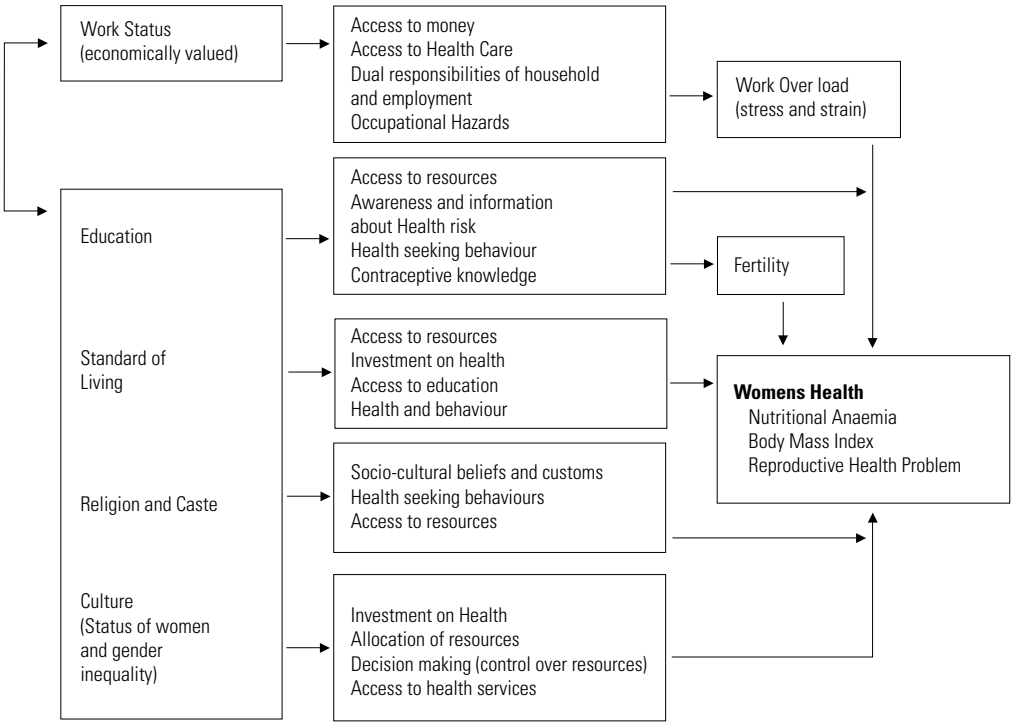
The hypotheses on which the study is built around are:

1. The net effect of work status on health of women residing in rural India is adverse.
2. The work status–health relationship differs between the southern and northern regions of India that are known to be distinct in female autonomy.

Conceptual Framework

The conceptual framework (Figure 1) showspathways of influence of work status and socio-economic variables on health status, which can be positively or negatively related. The analysis assesses the net influence of work and background factors (socio-economic). Intermediate variables are not directly addressed in this paper, as many are not easily measured.

Figure 1. Conceptual framework



Socio-economic factors have been conceptualized to affect women's health, particularly nutritional status and the presence of any reproductive health problems (WHO 2000). Women's workforce participation is also affected by socio-economic and cultural factors such as standard of living, education, religion and status (Nam 1991; Malhotra and Mather 1997; Panda 2003). Rural women's higher participation in the work force is probably necessitated by their poverty status. On the other hand, working status (economically valued) of women is expected to influence their health positively, through increased income leading to investment on health. Dual responsibilities of household chores and employment can lead to overload and role conflict, which results in increased stress and strain and finally contributes to poor health (Waldron et al. 1998). Much energy is needed by women who manage both employment and domestic chores; thus, there should be sufficient food to supply this need. As already stated, in rural India 76% of women who work are agricultural workers (IIPS and ORC Macro 2000). Responsibility for farm and family, if not supported by proper nutrient intake for the energy expended, can lead to a deterioration of women's nutritional health and, finally, reproductive health.

Educational status improves women's access to resources, awareness and information about health risks, ability to take decisions about well-being and utilization of healthcare (Jejeebhoy 1995; Bloom et. al. 2001). Education can also lead to increased contraceptive knowledge, which ultimately affects

reproductive health through its effect on fertility outcomes (Jeffery and Basu 1996; Ganguli 1998; Basu 2002) or directly influences reproductive health through use of contraception and prevention of sexually transmitted diseases. Standard of living is an important economic variable (Nanda 2000; Johansson 2007) affecting health through access to resources (Kimhi 2003; Davison et. al. 2006), education level, intake of balanced diet, access to health services and health-seeking behaviour (Adamson et. al. 2003). Religion (Chapple 1998) and ethnicity (Basu 1993) would plausibly affect health of women through their beliefs and customs.

In India, women's health is also shaped by culture. The status of women in southern India is considered higher than in northern India, and this can influence investment on healthcare and food allocation for boys and girls differently. Gender inequality affects the decision-making power as well as mobility of females (Rahman and Rao 2004). This affects health-seeking behaviour as well as investment on personal health expenditure through control over resources (Jejeebhoy 1995; Nanda 2000). Thus, region (northern or southern state) can influence the work status–health relationship.

Methodology and Database

This paper focuses on the issues of nutritional status and reproductive health, assessed by the presence of any reproductive health problems (Ramanathan 1998). Nutritional status is measured by two indicators – anemia and body mass index (BMI). Anemia is a low level of hemoglobin in the blood and results from a nutritional deficiency of iron, folate, Vitamin B12 and some other vital nutrients. Iron deficiency is the most widespread form of malnutrition. In India anemia affects almost 50% of women (IIPS and ORC Macro 2000); it may play a role in maternal mortality because of its detrimental health effects. The second indicator is BMI. A body mass index of <18.5 kg/m² indicates undernutrition, which is related to chronic energy deficiency and thus to morbidity.

Reproductive health (RH) is operationalized as the presence of RH problems. Reproductive morbidity can also capture reproductive health of women as it is a hindrance to reproductive goals (Qadeer 1998; Sagar 1994). Reproductive morbidity can further affect pregnancy-related complication, congenital infection, infertility and chronic pain (Zurayk et al. 1993; WHO 1990).

We used the NFHS-II 1998–99 data to examine selected socio-economic and demographic variables at the state and individual level. First, we conducted state-level analysis to test for regional variation. For a sharper and clearer picture, we conducted individual-level analyses.

State-Level Analysis

The state-level analysis used state-level data for both the dependent and independent variables. All variables in the state-level analysis are in the form of aggregates, mostly percentages, and are thus in continuous form. This facilitates multiple linear regression analysis. All variables are measured as a percentage of ever-married women aged 15–49 years for the rural areas of 19 states in India.

Dependent Variables

Percentage of women with moderate or severe anemia. The NFHS-II had undertaken hemoglobin testing in households. (The health investigator had read a detailed informed consent statement to the respondent, informing her about anemia, describing the procedure for the test and emphasizing the voluntary nature of the test.) Anemia among women was divided into three levels: mild (10.0–10.9 g/dl for pregnant women and 10.0–11.0 g/dl for non-pregnant women), moderate (7.0–9.9 g/dl) and severe (<7.0 g/dl).

Percentage of women with low BMI (i.e., <18.5 kg/m²). The second dependent or response variable is based on the BMI and can be used to assess both thinness and obesity. Body mass index is defined as the weight in kilograms divided by the height in square meters (kg/m²). Chronic energy deficiency is usually indicated by a BMI <18.5 kg/m². (In NFHS-II, ever-married women aged 15–49 were weighed using a solar-powered digital scale with an accuracy of ±100 g. Their height was measured using an adjustable wooden measuring board specifically designed to provide accurate measurement (to the nearest 0.1 cm).

Percentage of women with reproductive health problems. The third dependent variable considered in our study is any one or more symptoms of reproductive health problems (i.e., any reported reproductive health problem or not-reported problem). NFHS-II contains information on the following symptoms: vaginal discharge, pain during urination, pain in the abdomen or vagina during intercourse, and bleeding after intercourse, with a 3-month reference period. A woman reporting any one or more of these symptoms is deemed to have reproductive morbidity.

However, all the above symptoms were self-reported rather than the result of clinical or laboratory tests, a limitation of the study.

The explanatory variable work status is measured as the percentage of ever-married women aged 15–49 years currently working. Control variables in the analysis included percentage below the poverty line and percentage of literate women.

All these variables are measured as percentage of ever-married women aged 15–49 years for the rural areas of 19 states in India. Multiple linear regression analysis was done to capture the relationship between work participation and health of women (nutritional and reproductive). This model tries to answer the question whether women's health (nutritional status, moderate or severe anemia, low BMI and any reproductive health problems) is dependent on the work participation variables which is percentage currently working even when controlled for other socio-economic variables or the gross effect of work status is due to the socio-economic condition (Velkoff et al. 1998) rather than work participation.

Individual-Level Analysis

We chose six states for individual level analysis, three each from the northern and southern regions to see the north–south divide in the linkage between women's health status and their work participation. Northern and southern states are different in various socio-economic conditions, and above all, southern states are distinct in their degree of female autonomy. The particular states from north and south represent high, medium and low percentages of women currently working in rural India. The highest percentage in the northern region is in Rajasthan, and in the southern region, Andhra Pradesh. Medium levels are seen in Uttar Pradesh and Tamil Nadu, and low levels work in Punjab and Kerala, respectively.

The individual-level analysis uses the following response variables:

Dependent Variables

Anemia among women. Our study has two categories (dichotomous response variable): moderate or severe anemia (>10 g/dl) and mild or no anemia (≥10.0 g/dl).

Body mass index: The dichotomous response variable used to measure nutritional status has two categories: BMI <18.5 kg/m2 and BMI ≥18.5 kg/m^2.

Presence of any reproductive health problem: The third dependent variable considered in the present study is any one or more symptoms of reproductive health problems (i.e., any reported reproductive health problem or not-reported problem).

Explanatory Variables:

Available literature has suggested that women's health is a function of societal factors – cultural, economic, education, social and political (Basu 1993). Standard of living is particularly strongly related to chronic energy deficiency. Nutritional anemia and low BMI, which show that chronic energy deficiency increases fatigue, are related to household income and thus to standard of living. A number of variables were chosen to represent socio-economic factors. These are in a categorical form. The logistic regression programs allow the use of categorized explanatory variables, with one category designated as reference. The five independent variables for the individual analysis are: respondents currently working (Yes/No), religion (Hindu, Muslim, Others), ethnicity (SC, ST, OBC, Others),

educational level (no education, primary, secondary and higher secondary), and standard-of-living index (low, medium and high).The recoding list is given in Table A1 (Appendix).

For individual-level analysis, we used only the rural sample. The multivariate statistical analysis used in the paper is logistic regression, in order to estimate the net effects of each variable on probability of occurrence of mild or severe anemia, low BMI and presence of any reproductive health problems. The dependent variables are dichotomous, so the technique of logistic regression has been adopted instead of multiple regressions (Rutherford and Choe 1993). Moreover, multiple linear regressions cannot predict the value of a categorical outcome. For explanatory variables in a categorical form, a category is designated as "reference" and if Bk is the logistic regression coefficient for category '*k*', then exp (Bk) is the odds ratio, which is the ratio of odds for the category '*k*' to the odds for the reference category.

Results and Discussion

The state-level analysis tested only our first hypothesis.

The NFHS-II survey provides the figures of anemia, BMI and reproductive health problems. Tables A2 and A3 (Appendix) show the state-level percentages pertaining to those variables. The state with highest percentage of moderate and severe anemia is Assam (27.3%); lowest is Kerala (3.1%). The percentage of women with low BMI is highest in Orissa (40.0%), West Bengal (49.8%) and Maharashtra (49.3%). The percentage of currently working women is highest in Andhra Pradesh (68.6%) and lowest in Punjab (6.9%).

Multiple regression analysis is done and the equation is represented in the linear form as follows:

$$Y = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \beta_3\chi_3 + \ldots\ldots + e$$

where Y is the dependent variable, $\chi 1$, $\chi 2$, $\chi 3$… are the independent variables, 0, 1, 2, 3 are the regression coefficients and e is the error term.

Table 1 shows that moderate or severe anemia is not significantly related to the percentage of women currently working but is significantly related to levels of literacy in rural areas.

This shows that at the state level our first hypothesis is not supported; that is, the net effect of work status (economically valued) is inconsistent and weak. However, the negative relationship of literacy and prevalence of moderate and severe anemia can be explained by poor access to resources, by no awareness of or information about balanced diet and health risks, and by not seeking health services when necessary. Higher levels of literacy also affect the number of children and nutritional status. Thus, higher educational status is related to lower prevalence of moderate to severe anemia.

The percentage of women with low BMI is significantly related to work status. Adjusted R^2 value of the low BMI equation is higher than both the severe and moderate anemia equation and any reproductive health problem equation. Any reproductive health problem is also not significantly related to women's work status.

Following this, we take up individual-level analysis of three northern and three southern states to test both our hypothesis. Table 2 shows results of logistic regression for the southern states and Table 3 the northern states.

Table 2 shows that in Tamil Nadu rural working women have a lower probability of severe and moderate anemia than non-working women. In contrast, the probability of lower BMI among rural working women in Tamil Nadu is high, along with those in Andhra Pradesh. This may be explained by the fact that in rural areas most women currently working are engaged in strenuous physical labour. Thus energy loss is not replaced by proper food intake. Education has a mild effect on undernutrition in all three southern states (Andhra Pradesh, Tamil Nadu and Kerala), showing lower odds ratio for primary and secondary education compared to illiterates. On the other hand, income as examined through the standard-of-living index has a strong effect, and the probability of moderate and severe anemia is lowest in those with a medium or high standard of living. To some

extent this is also true for anemia. Religion and ethnicity, however, show no clear effect in the south. Reproductive morbidity does not seem to be influenced by these socio-economic factors.

Table 1. Work status and health relationship: state-level multiple regression analysis

Explanatory variables (χ)	Dependent variables (Y)		
	Percentage of women with moderate or severe anemia	Percentage of women with low BMI	Percentage of women with any reproductive health problem
	Regression coefficient (metric)		
• % of women currently working	0.0028	0.302**	-0.181
• % below poverty line	0.170	0.154	-0.317
• % of literate women	-0.226**	0.004	-0.003
Constant	11.934	34.547	75.317
R^2 (adjusted R^2)	0.322	0.486	0.188
n	19	19	19

** Significant at 1% level; * Significant at 5% level. BMI = body mass index.

Table 2. Logistic regression: Southern states

	Dependent variables	Moderate and severe anemia			Low BMI			Any RHP		
Background Variables	States	AP	TN	Kerala	AP	TN	Kerala	AP	TN	Kerala
		Exp (β)								
Respondent currently working										
No (RC)										
Yes		0.950	0.605**	0.897	1.543**	1.336**	1.246	0.658	1.359	.363
Religion										
• Hindu (RC)										
• Muslims		0.355**	1.191	0.462**	1.047	0.424	0.835	0.638	0.005	0.755
• Others		1.648**	0.918	0.652	0.799	0.858	0.610**	0.741	2.063	0.723
Ethnicity										
• SC (RC)										
• ST		0.711	0.668	0.472	0.780	2.194*	1.528	0.324	0.005	0.906
• OBC		1.00	0.865	0.370**	1.054	0.839	1.055	1.208	0.901	0.527
• None of Them		1.142	1.211	0.758	0.800	0.321	0.978	0.774	0.006	0.799
Educational level										
• No (RC)										
• Primary		1.197	0.799*	0.582	0.780**	0.866	0.642*	1.085	1.772	0.412
• Secondary		0.784	0.824	0.417	0.697**	0.765**	0.722	2.037	1.682	0.517
• Higher Secondary		0.564	0.442	0.324	0.510	0.721	0.593	2.032	1.962	0.999
Household standard-of-living index										
• Low (RC)										
• Medium		0.785**	0.674**	0.605	0.690**	0.752**	0.520**	1.241	1.627	2.216
• High		0.752	0.321	0.619	0.328**	0.214**	0.290**	1.271	0.525	2.148
Constant		0.255	0.566	0.215	0.974	0.777	0.737	0.021	0.011	0.058
-2LL		2682.40	2956.02	554.77	3499.26	3444.56	1798.57	537.78	526.59	542.7
Pseudo R^2		0.019	0.044	0.059	0.091	0.084	0.073	0.030	0.036	0.046
N		2826	2478	1925	2625	2304	1851	2593	2227	1882

** Significant at 1% level; * Significant at 5% level.
AP = Andhra Pradesh; TN = Tamil Nadu; BMI = body mass index; RHP = reproductive health problem; RC = reference category; SC = scheduled caste; ST = scheduled tribe; OBC = other backward classes.

Among the northern states in Uttar Pradesh and Punjab, a significant effect of work status on BMI and reproductive health is seen. In Uttar Pradesh the probability of low BMI among rural working women is higher than among non-working women. Moreover, the probability of reproductive health problems among rural working women is higher than among non-working women.

Religion, ethnicity and education show no clear or consistent effect in the northern region. Similar to southern states, a higher standard-of-living index leads to better health status, particularly in terms of BMI (moderate and high standard-of-living odds ratios are lower for low BMI in Rajasthan, Uttar Pradesh and Punjab and for moderate to severe anemia in Rajasthan).

The above discussion highlights that neither hypothesis stated initially is empirically validated. The effect of work status on the health of women residing in rural India is mild or insignificant. Moreover, the work status–health relationship does not differ between the southern and northern regions of India that are known to be distinct in female autonomy (Rahman and Rao 2004).

Thus, northern states sketch a more or less similar picture to that of the southern states, though the socio-economic setting is different (Table 3). The effect of work status on women's health is generally insignificant when the explanatory variables are controlled for the logistic regression.

Table 3. Logistic regression: Northern states

	Dependent variables	Anemia			BMI			Any RHP		
Background variables	**States**	**RJ**	**UP**	**Punjab**	**RJ**	**UP**	**Punjab**	**RJ**	**UP**	**Punjab**
		Exp (β)								
Respondent currently working										
No (RC)										
Yes		0.883	0.876	0.869	0.975	1.215**	0.778	1.001	2.228**	3.901**
Religion										
• Hindu (RC)										
• Muslims		1.331*	1.162	1.024	1.184	1.264*	0.139*	0.549*	0.532	0.003
• Others		0.034	4.764	1.486	0.769	0.026	0.654	0.065	0.014	5.488*
Ethnicity										
• SC (RC)										
• ST		1.065	0.954	0.507	0.828*	0.749	1.611	1.080	1.972	0.007
• OBC		0.872	1.062	0.604*	0.854	0.864	0.833	1.210	0.754	1.073
• None ofn tThem		0.954	0.772	0.648**	0.722**	0.895	0.782	1.455	0.613	1.214
Educational level										
• No (RC)										
• Primary		1.029	0.779	0.991	0.925	1.121	0.743	0.680	1.546	2.782**
• Secondary		0.893	1.074	1.100	0.808*	0.794	0.779	0.984	1.554	1.633
• Higher Secondary		0.962	0.853	0.648	0.636**	0.564	0.894	0.853	1.208	0.002
Household Sstandard-of-living index										
• Low (RC)										
• Medium		0.793**	0.888	0.711	0.991	0.784**	0.550**	0.803	1.406	0.971
• High		0.756**	0.855	0.622	0.564**	0.496**	0.275**	0.741	1.875	0.108
Constant		0.244	0.223	0.379	0.920	0.919	0.911	0.038	0.020	0.010
-2LL		5200.41	3579.41	1427.0	7488.47	4958.65	1670.42	1949.53	960.632	389.26
Pseudo R^2		0.008	0.010	0.038	0.040	0.037	0.078	0.008	0.034	0.075
N		6010	4253	1682	5745	3804	1593	6512	4084	1606

** Significant at 1% level; * Significant at 5% level.

RJ = Rajasthan; UP = Uttar Pradesh; BMI = body mass index; RHP = reproductive health problem; RC = reference category; SC = scheduled caste; ST = scheduled tribe; OBC = other backward classes.

Conclusions

Women's health is a function of their work status as well as socio-economic and cultural factors (Prasad 1989). However, from the discussion above, we infer that socio-economic factors affect the health of women, rather work status alone. From the state-level analysis, we see that effects of work status and women's education on nutritional health are unclear. At the individual level, results indicate a weak effect on nutritional health and reproductive health in some states. On the other hand, the effect of standard of living is strong and consistent in both north and south India. Consequently, the net effect on women's health status is mostly due to economic conditions rather than to work status per se. We found no indication of a north–south divide is the relationship between work status–health relationships in our study.

Work participation alone did not seem to have a clear adverse effect on women's health, contrary to the popular belief. However, the effects of education and standard of living were significant.

As socio-economic factors affect women's health, free health provisions and health awareness should be an integral part of governmental policy. Further, supplementary nutrition programs should be made available to poor women because of its importance for nutritional health. India's Integrated Child Development Scheme (Nutritional Program), which provides supplementary nutrition to children, has also been including pregnant and lactating women. Thus policy attention is addressing the issue of women's health. The Maternity Benefit scheme covers poor women, but otherwise there is nothing for the wider group of poor rural women. In addition, secondary school education for girls is an important means of promoting women's health status. Rural employment programs for women can also include nutritional components.

Future research on women's health should redefine "work" status of women and also look into the intermediate pathways of effect.

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Appendix

Table A1. Coding of variables included in analysis

Label	Coding	Recoding	New Variable	Reference Category
Independent Variables				
Religion	Hindu = 1 Muslims = 2 Christian = 3 Sikh = 4 Buddhist = 5 Jain = 6 Jewish = 7 Zoroastrrtian/Parsi=8 No Rreligion=9 Others = 96	Hindu = 1 Muslims = 2 Others=3	V130_cd	Hindu
Ethnicity	S.C = 1 S.T = 2 O.B.C = 3 None of them = 4			Scheduled Caste
Highest Education Level	0 = No education 1 = Primary 2 = Secondary 3 = Higher			No education
Household standard-of-living index	Low = 1 Medium = 2 High = 3			Low
Respondent currently working	No=0 Yes=1			No
Dependent Variables				
Respondent's haemoglobin level (gram/decilitre)	Mild anaemia = 10.0—-11.0 0 g/dl = 1 Moderate anemia = 7.0—9.9 g/dl = 2 Severe anaemia = < 7.0 g/dl = 3	Mild and no anaemia (10.0 g/dl or higher) = 0 Severe and mModerate anaemia (<10 g/dl) = 1	ANA_Cd	
Body Mass Index(BMI) of Respondent		High BMI = ≥18.5 kKg/m^2 = 0 Low BMI = <18.5 kKg/m^2 = 1	BMI_Cd	
Itching/irritation Bad odour Abdominal pain Fever Other Problems Pain or burning while urination Pain during intercourse Blood visible after sex	No = 0 Yes = 1	No = 0 Presence of any reproductive health problems (S486A, S486B, S486C, S486D, S486E, S487, S489, S490 = Yes) = 1	RH_CD	

SC = scheduled caste; ST = scheduled tribe; OBC = other backward class; BMI = body mass index.

Table A2. India, NFHS-II (1998–99) rural

States	Percentage				
	Bpl*[a]	Msanaei	BMI	RHP	Currwor
Andhra Pradesh	15.77	18.1	43.2	48.8	68.6
Assam	33.47	27.3	27.9	51.9	19.8
Bihar	42.6	20.8	40.3	45.1	26.5
Goa	4.4	9.4	30.3	43.5	46.2
Gujarat	14.07	19.9	47.7	28.7	64.2
Haryana	8.74	17.9	30.8	39.9	10.5
Himachal Pradesh	7.63	9	31	34.6	18.2
Jammu & Kashmir	3.48	20.5	30.4	61.4	41.7
Karnataka	20.04	18.2	47	18.9	62.6
Kerala	12.7	3.1	19.9	44	23.4
Madhya Pradesh	37.43	18	41.8	46	63
Maharashtra	25.02	18.1	49.3	36	71.5
Orissa	47.15	18.5	49.9	27.4	29.9
Punjab	6.16	14.2	22.2	27.5	6.4
Rajasthan	15.28	16.4	38.7	44.3	48.3
Sikkim	15.06	24.7	10.8	48.6	19.2
Tamil Nadu	21.12	21.9	35.2	27.8	58.8
Uttar Pradesh	31.15	15.5	39.1	37.9	23.1
West Bengal	27.02	17.8	49.8	49.6	30.4

Source: NFHS-II, India (IIPS and ORC Macro 2000).

[a] Bpl has been taken from Statistical Year Book 1998–99.

Bpl = % of population below poverty line; Msanei: = % of women with moderate and severe anemia (rural); BMI = % of women with low body mass index, RHP = % of women with any reproductive health problem; Currwor = % of women currently working.

Table A3. India, NFHS-II rural

States	Hindu	Muslim	Christ	SC	ST	OBC	Others	Lit
Andhra Pradesh	90.2	3.3	6.4	22.3	6.3	44.9	26.3	28.4
Assam	61.7	34.4	2.4	9.9	21.5	11.6	54.6	43.3
Bihar	84.4	14.1	0.7	21.1	9	52.1	17.7	19.9
Goa	62.5	3.7	33.4	5.9	0.4	8.9	84.7	67.3
Gujarat	95.8	3.4	0.5	15.9	26.5	24.3	33.3	36
Haryana	88.9	4.9	0	23.3	0.1	25.4	51.2	34.4
Himachal Pradesh	93.8	3.1	0	22.3	0.5	19.6	57.6	61.7
Jammu & Kashmir	43.5	55.7	0.2	13.7	3.1	11.8	71.4	24.3
Karnataka	90.2	8.3	0.9	18	6.9	44.3	29.4	32.3
Kerala	48.3	36.1	15.5	9.5	1.2	41.4	47.9	86.1
Madhya Pradesh	95.5	2.3	1.4	15	28.4	41.2	15.4	22.2
Maharashtra	89.6	3.5	0.3	10.6	13.3	22.9	52.4	44.4
Orissa	97.3	1.2	1.4	21.7	21	30.8	26.4	37.8
Punjab	30.9	1.2	1.5	33	0.1	15.6	51.2	51.5
Rajasthan	93	5.8	0	19.5	15.5	23.4	41.6	15
Sikkim	59.2	0.6	5.6	7.5	28.1	34.9	29.4	47.2
Tamil Nadu	93.4	3	3.6	26.4	1.2	72	0.4	42.1
Uttar Pradesh	86.7	12.4	0.1	21.3	2.3	30.5	41	22.9
West Bengal	68.9	28	0.2	25.1	9.3	3.9	61.1	42.6

Source: NFHS-II, India (IIPS and ORC Macro 2000).
Hindu = % of rural Hindu women; Muslim = % of rural Muslim women; Christ = % of rural Christian women; SC = % of scheduled caste women; ST = % of scheduled tribe women; OBC = % other backward classes women; Others = % of rural women of other category; Lit = % of rural women who are literate.

Reducing Childhood Diarrhea Morbidity: Does Behaviour Change Matter? A Case Study from Northern Ghana

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Abstract

Diarrhea ranks second among the diseases reported in health institutions in Ghana, with children below 5 years of age from Northern Ghana being the worst affected. Using semi-structured interviews and focus group discussions conducted with 285 mothers drawn from various communities, this study was undertaken to identify local adaptive behaviours that could be modified for childhood diarrhea reductions in the Tamale Metropolitan Area (TMA), the largest urban centre in Northern Ghana and the third largest in the country. Findings reveal the importance of water and food storage practices as well as mothers' understanding and practice of hygiene in determining the incidence of childhood diarrhea morbidity. The study concludes that mothers' lack of understanding of the link between infections and diarrhea incidence is crucial and stresses that building the capacity of households and community members to recognize and change inappropriate behaviours can increase the efficiency and cost-effectiveness of child health intervention programs in Northern Ghana.

Introduction

Diarrhea is one of the deadliest childhood diseases in the world. It ranks among the top five health problems in many countries and is responsible for four to six million deaths of children under age 5 per year worldwide (World Health Organization [WHO] 2002). Diarrhea has been identified as the second most common health problem treated in outpatient clinics in Ghana. According to a Ghana News Agency (GNA) report in 2003, the disease accounts for 84,000 deaths annually in Ghana, with 25% of these being children under 5 years (GNA 2003). Diarrhea is the second most important cause of child morbidity and mortality in the Tamale Metropolitan Area (TMA), accounting for 5.8% and 7.2% of outpatient treatments in the metropolis in 2003 and 2004, respectively (Tamale Metropolitan Health Directorate 2005).

While there is reasonable evidence of the impact of improved water quantity and quality and sanitation on diarrhea incidence, the facts are generally not clear and consistent, most likely because of limitations in study design as well as the confounding effects of several environmental factors and cultural practices related to the disease. Evidently, gains made in achieving health infrastructure coverage over the last two decades, including the rehabilitation and equipping of the Tamale Teaching Hospital as well as the provision of community-based health planning services compounds, have not brought about as significant a health impact as donors had anticipated. Larsen (2002) has suggested that one of the fundamental weaknesses of the programs undertaken by various developing countries to attain the Millennium Development Goals (MDGs) is the tendency to give priority to water supply over sanitation, and sanitation over hygiene. It has also been argued that the presence of water does not mean that people will take advantage of it to wash their hands consistently and well (Favin et al. 1999). Moreover, poor water storage and use practices, as well as other poor hygiene practices, can easily contaminate even clean water that is available conveniently (Osumanu 2007).

There appear to be a reasonable agreement that interventions to improve hygiene at the household and/or community level have the greatest impact on diarrhea incidence (Favin et al. 1999; Jinadu et al. 2004). Several ethnographic studies on diarrheal diseases in children of various sociocultural environments have noted that cultural attitudes and healthcare practices have an impact on the risk of diarrhea, indicating that modifying traditional practices in the home is necessary to reduce disease (Kendall et al. 1984; Coreil and Mull 1988; Malik et al. 1992). According to Cairncross (1996) and Jinadu et al. (2004), hygienic disposal of children's stools is associated with 30–40% less risk of serious diarrhea. Other studies have demonstrated that hand washing at appropriate times with appropriate techniques can reduce overall diarrheal disease morbidity by 30–50% (Black 1981; Khan 1982; Clemens and Stanton 1987). Contaminated food has also been shown a common vehicle for disease germs, accounting for an estimated 15–20% of diarrheal disease incidence (Esrey and Feachem 1989). A case-control study in Manila that correlated various home factors among children hospitalized with severe diarrhea found that low scores for kitchen hygiene (cleanliness of food and water storage containers and the sanitary condition of the cooking and eating areas) and overall cleanliness (general appearance of the house inside and out, and physical appearance of the mother/caretaker and index child) were strongly associated with high risk of severe diarrhea (Baltazar et al. 1993).

Viewed from the perspective of the health sector, hygiene intervention has been shown to be very cost-effective for the control of diarrhea in children under 5 years, comparing favourably with oral rehydration therapy (WHO 1979). According to Christoffers et al. (2005), the monetary cost of producing a unit of effect, such as the reduction of diarrhea cases, through a hygiene-promotion intervention provides value-added benefit relative to health and infrastructure investment. Improving the level of hygiene practices may be highly effective, although social and cultural factors may have a reinforcing or restraining influence. This explains why many hygiene interventions that attempted to reduce childhood diarrhea failed to demonstrate any effect (WHO 1979). Additionally, knowledge alone is not necessarily a strong predictor of desirable hygiene behaviour. In light of this, our study sought to identify local adaptive behaviours that could be modified and implemented while remaining culturally acceptable. The main objective was to provide the insights needed to design an effective intervention program to promote behavioural change for diarrhea reduction. Without these insights, any behavioural or social intervention program aimed at reducing the incidence of diarrhea in local communities might not be successful. We also discuss the evidence on cost-effectiveness of behavioural interventions to reduce the incidence of diarrhea, as this will be an important consideration when deciding whether to proceed with such programs in the population studied in this paper and in other jurisdictions.

The issues covered in this paper are presented in six parts. Following this brief introduction, the next section discusses the methods of collecting the data used in this paper; the third presents the incidence and determinants of diarrhea at the local level; the fourth describes cultural understandings related to diarrhea in the study area; the fifth presents evidence from the literature on

the cost-effectiveness of behaviour change to reduce diarrhea; and the last concludes with some recommendations to improve the implementation of effective behavioural change programs for the reduction of diarrhea. In this paper, behaviour is defined as an action or set of actions that an individual or group carries out routinely in daily life.

Materials and Methods

The data for this paper form part of a comprehensive survey conducted to establish the link between the environment and health in the Tamale Metropolitan Area of Ghana. A detailed description of how households were selected for the survey has been presented elsewhere (see Osumanu 2007). The analysis presented here is based on semi-structured interviews and focus group discussions conducted with 285 mothers. Issues covered in the survey include the mother's level of education, the household's access to and use of water and sanitation facilities, the mother's hygiene practices and the occurrence of diarrhea in children below 5 years. The use of the mother's knowledge and practices in this context is based on the notion that mother's and child's health are closely linked, particularly during nursing (Zaman et al. 1997).

Diarrhea was described to the mothers as the passage of watery stools, usually at least three times in a 24-hour period. (However, it is the consistency of the stools rather than the number that was most important.) Frequent passing of formed stools was not taken as diarrhea. Babies who feed on only breast milk often pass loose, "pasty" stools; this was also not deemed diarrhea. Diarrhea is often accompanied by stomach pains, feeling sick and vomiting (WHO 1979). The point prevalence of diarrhea and its occurrence over the preceding 2 weeks were measured by the mother's recall, as recommended in the WHO rapid assessment manual (WHO 1979). A composite variable representing the diarrhea history of the child was also constructed by summing the responses to the following questions, which mothers answered according to their own interpretation and recall:

1. Has your child had diarrhea in the last two weeks? (No = 0, yes = 5)
2. Does your child have diarrhea today? (No = 0, yes = 5)
3. Does your child often have diarrhea? (Never = 0, rarely = 1, sometimes = 2, often = 3, almost always = 5)
4. When was the last time your child had diarrhea? (Never = 0, more than two months ago = 1, last month = 2, last week = 3, this week = 4)
5. Was your child seriously ill with diarrhea in the last wet season? (No = 0, yes = 5)

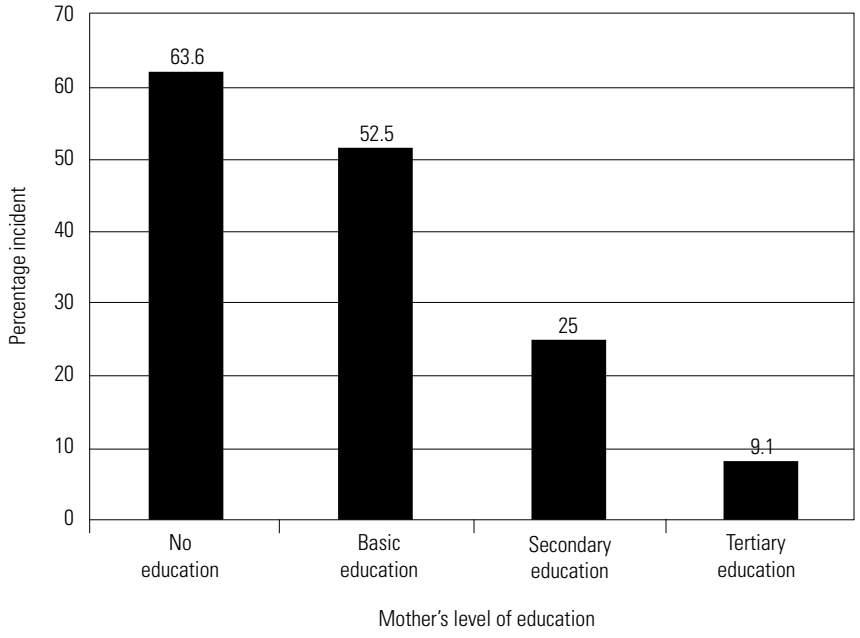
The wet season is usually accompanied by severe cases of diarrhea often translating into outbreaks of cholera in the Tamale Metropolitan Area.

The maximum composite variable score for this scale is 24. The composite variable scores provide a simplified scale for comparing the incidence (and frequency of occurrence) of childhood diarrhea among the various risk factors covered in the survey. The information on cost-effectiveness, presented in the fifth section, is based on literature review.

Incidence and Major Determinants of Childhood Diarrhea in the Tamale Metropolitan Area (TMA)

Of the children covered in the survey, 38% had had diarrhea in the 2 weeks preceding the interview, while only 6% had diarrhea on the day of the interview. Analysis of survey data (Figure 1) showed that children of mothers who had never been to school had approximately seven times as many cases of diarrhea compared with children whose mothers had received tertiary education ($F = 6.67$, $p = 0.03$). The association between childhood diarrhea and maternal education in the Tamale Metropolitan Area agrees with the findings of other studies in Ghana (Benneh et al. 1993; Tagoe 1995; Boadi and Kuitunen 2005) and other parts of West Africa (Togunde 1999). It has been argued elsewhere that the relationship between maternal education and childhood diarrhea is equally influenced by household wealth (Osumanu 2007).

Figure 1. Relationship between childhood diarrhea and maternal education (%)



Source: Based on questionnaire survey, 2005.

The study considered a number of household conditions in determining the major risk factors for diarrhea in children. The incidence of diarrhea in children was higher in the households that used water from vendors, boreholes and well/dugouts. Storing water in pots, sharing a toilet with more than four other households and not washing hands after defecation or before cooking were also associated with high incidence of childhood diarrhea. Other factors found to be responsible for high incidence of diarrhea in children were the presence of many flies in food preparation areas, not having a toilet facility and feeding children with cold leftover foods or prepared foods from open-air street vendors. Table 1 summarizes the results of the composite variable scores for the major household risk factors

Table 1. Major determinants of childhood diarrhea in TMA, Ghana

Risk factor	Number of house-holds	Children's 2-week diarrhea preva-lence (%)	Composite variable score (%)		
			0–8	9–16	17–24
Store water in pot	107	47.9	14.8	28.4	56.8
Share toilet with more than four households	192	36.8	15.6	30.2	54.2
Buy prepared food from open street vendors	122	45.1	20.8	28.5	50.7
Feed children with cold leftover foods	98	43.4	10.8	42.9	46.3
Depend on water from vendors	137	42.1	12.0	43.4	44.6
Do not wash hands after defecation	106	39.3	16.7	39.1	44.2
Do not wash hands before cooking	111	22.5	28.0	35.3	36.7
Many flies in cooking area	65	42.1	44.0	27.8	28.2
Depend on water from borehole, well or dugout	53	30.0	42.5	41.4	16.1
Have no toilet facility	16	35.5	47.0	37.3	15.7

Source: Based on questionnaire survey, 2005.

The association between diarrhea, vended water and toilet sharing has been adequately explained in the literature (Benneh et al. 1993; McGranahan, et al. 2001). While admitting that these conditions are made possible by the lack of adequate water supply and sanitation, it is also important to acknowledge the role of confounding factors arising from routine practices of water and toilet use in explaining the occurrence of childhood diarrhea. For example, water is often used for several domestic chores. The water used to wash vegetables is afterwards used to wash dishes and/or hands. Also, households cope with the problem of frequent interruptions in water supply by storing water in containers such as barrels, plastic cans, pots and buckets. However, household water storage, used to make up for intermittent or insufficient piped water, provides reservoirs for diarrhea pathogens, particularly for poor households who cannot afford safe storage containers (Osumanu 2007).

The use of pots to store water in particular was associated with significant incidence of childhood diarrhea. It must be noted that pots themselves do not contaminate water. Of concern, is the way pots and their contents are treated. Pots are generally kept in open places, usually not covered or well covered, and exposed to dust and domestic animals. Children within the household usually scoop water directly from them, with any "reasonably" clean cup or bowl for drinking, increasing the risk of contamination. In addition, pots are hardly ever disinfected, since most households do not know about disinfection. The consumption of contaminated water is further increased by the failure of households to treat water, by boiling or filtering, before drinking. Households fail to treat water because of the lack of real acceptance of water's role in causing disease as well as an unwillingness to purchase materials for water treatment, particularly filtering. Reasons for non-treatment of water were: materials for water treatment are expensive, 27.4%; time consuming, 25%; boiling of water produces flat taste, 24.6%; and good quality, 23%.

Handing washing after defecation appears to be a function of whether there is a toilet in the home. Ninety percent of mothers with flush toilets in their home said they washed their hands any time after defecating, compared with only 25% of mothers who used public toilets. Generally, communal toilets (mostly pit, including the Kumasi-ventilated improved-pit latrines) do not offer water for hand washing. The majority of people who used these facilities and washed their hands after defecating happened to be Muslims, who carried their own water whenever they visited the facilities, depicting a general situation where Muslims washed their hands after defecating but in most cases without soap. The danger associated with carrying water to toilets is that children usually also drink water directly from the ablution containers, increasing the risk of diarrheal diseases.

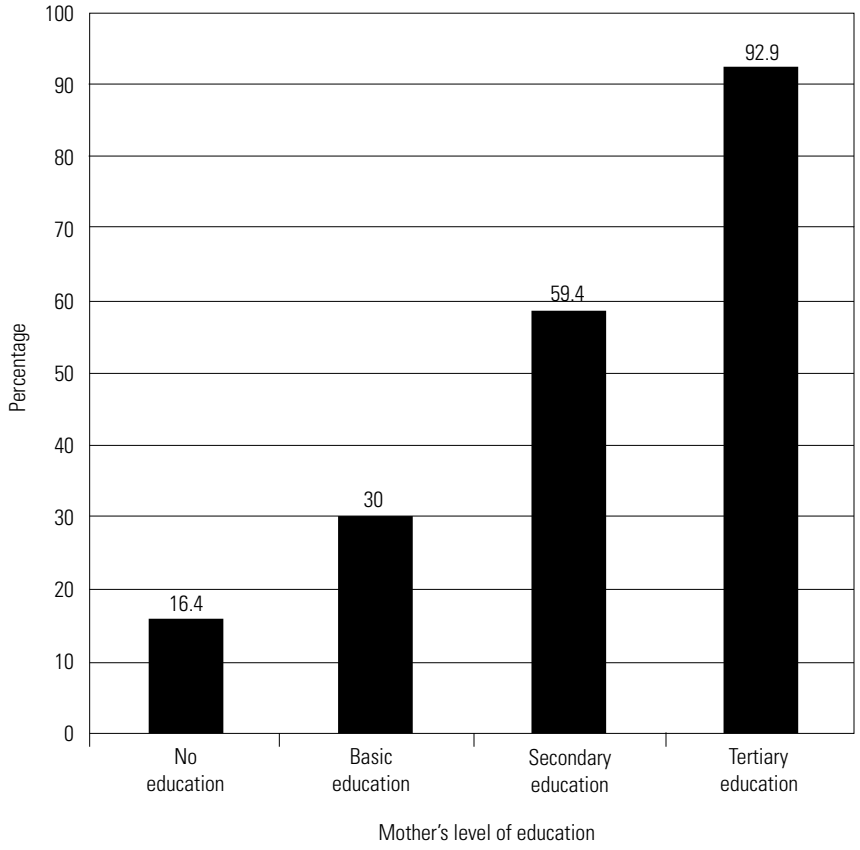
Although the scarcity and cost of water influenced the way in which it was used, having water conveniently available inside the house did not seem to affect hand washing before food preparation. Cultural beliefs related to the concept of "cleanliness" and the social prestige attached to it seem to be most important in explaining mothers' hand-washing behaviours. There are four kinds of "dirtiness" and, therefore, "cleanliness" that may lead mothers to wash their hands:

1. Perceived "dirtiness": mothers wash their hands when they are visibly soiled, smell strongly or feel sticky. This is the most common reason for hand washing.
2. Contaminating "dirtiness": mothers wash their hands when they have been in contact with anything considered dirty, such as garbage, human feces or urine. Although mothers reported that they wash their hands on these occasions, observation showed that this is not always the case.
3. Social "dirtiness": mothers wash their hands when they wish to improve their general physical appearance. This type of hand washing is very common and occurs before receiving guests at home. It is associated with esthetic values.
4. Religious "dirtiness": mothers wash their hands when they are compelled to fulfill their religious obligations. Islamic teaching in connection with hand washing stipulates that hands must be washed as many times as possible and in connection with these occasions: on waking from sleep, when leaving the toilet, before and after eating food, after touching the genital or anal area or that of others, after touching a dead body, after touching any dirty or suspicious

thing, when a dog is touched (hands must be washed seven times), and in ablution before the five daily prayers, when the hands are washed three times on every occasion (plus washing the face, throat, nose, ears, arms and feet and rubbing the hair with water). These frequent hand washings are done by every practising Muslim.

How mothers wash their hands depends on the kind of dirtiness. For perceived, contaminating and religious dirtiness, "clean" water alone or, in a few cases, clean water with soap, is used. For social dirtiness, "clean" water alone is considered adequate. Mothers usually dry their hands on their clothes. They may also, in a few instances, use nappies or any available material. The differences regarding mothers' hand washing behaviours becomes larger when looking at habits of washing hands with soap and water. Since hand-washing habits are related to a mother's knowledge of the links between hygiene and health, hand washing with soap is largely dependent on the educational attainment of the mother which, in turn, is also influenced by a household's ability to afford soap. Figure 2 shows the relationship between hand washing with soap and educational attainment of the mother. This finding is consistent with earlier ones from other parts of the country (Benneh et al. 1993; Gyimah 2003; Boadi and Kuitunen 2005).

Figure 2. Relationship between mother's education and hand washing with soap (%)



Source: Based on questionnaire survey, 2005.

The overwhelming emphasis placed on the role of vended food in causing diarrhea in the literature has led many people to believe that food poisoning is associated with eating food outside the home. However, this is rarely the case in many low-income communities, and the majority of incidents occur within the home environment. Most poor households do not understand the

principles of basic food hygiene such as hand washing before food preparation and how to cook food safely, or that unhygienic kitchens attract vermin such as rats and mice, and that flies transmit various diseases. Other considerations are the bacterial content of cooking and feeding utensils. All these are possible sources of food contamination within the home environment. One factor that emerged in this study as a major determinant of childhood diarrhea is feeding children with cold leftover foods (Table 1). For many low-income households in the metropolis, leftover cooked foods constitute a major component of morning meals and, to a lesser degree, midday meals as well.

The role of leftover foods in the prevalence of childhood diarrhea emanates from food-storage practices. Improperly stored food can go bad and contain pathogens. The use of refrigerators to store leftover foods is not popular in the metropolis. Many households prefer to store their leftover foods in a covered dish. The frequency of food contamination with pathogens is high when inefficient storage methods are used; however, this depends on the food type, storage time, the ambient temperature of storage and the temperature reached on rewarming before feeding. The risk of contamination is increased by the fact that most staple foods in the metropolis are potentially hazardous when left overnight. These include meat and meat products, fish, diary products, soups, cooked rice, grains and cereal. This is reflected in a larger proportion (65%) of households for whom leftover foods spoiled rapidly. The survey results revealed that when a covered dish is used to store leftover foods, the average spoilage time is 24 hours.

The presence of houseflies in the domestic environment is widely recognized as a potential health hazard in many low-income communities. When considering the presence of flies in the kitchen and, therefore, the risk of exposing food and drink to flies, it is important to recognize the role of many household factors. The use of open containers to store solid waste in the house before final disposal is more likely to attract flies to the kitchen. About 90% of households that used open containers to store waste reported having many flies in their cooking area. Another striking difference is the relationship between the type of kitchen and the presence of flies. Households with separate rooms for kitchens had far fewer flies than those cooking in communal kitchens, on verandas, or in the open air and cooking huts. Other conditions associated with the presence of many flies in the kitchen were keeping domestic animals in the house and the use of "chamber pots" for defecation by children.

Local Beliefs and Attitudes about Diarrhea

The study revealed a relatively low level of knowledge about the causes and effects of diarrhea in children. Generally, mothers identified two forms of diarrhea – binsaa and tirikanyera. Binsaa is common diarrhea not accompanied by vomiting. Bin is from the word bini, which means feces, but the whole word binsaa refers to watery stool. Mothers believe that binsaa is caused by "hot" foods, hunger and teething. Binsaa is seen as an old and traditionally known condition of imbalance in life forces and is considered a cleansing of the inside of a child and a washing away of impurities from the child's stomach. It is therefore seen as a normal part of growing up – not an illness but a usual occurrence in the young child's life. This is how a mother described the effects of binsaa: "Binsaa is surely not dangerous, for all young children suffer multiple episodes of it and most of them continue to live in reasonably good health."

Tirikanyera is diarrhea accompanied by vomiting. Tirikanyera is a compound word made up of tiri, which means vomiting, and nyera, which means defecating. This form of diarrhea is believed to be caused by ingestion of "dirty foods." Traditionally, tirikanyera is considered somehow dangerous and is therefore given some attention.

Diarrhea is simply not perceived as life-threatening or even debilitating. This is because many infected children do not suffer to any great extent. The economic and environmental conditions of low-income community members also explain their inability to avoid diarrhea risk factors. Economic deprivation considerably affects ability to access clean water and better sanitation, as well as provide soap for hand washing. Again, the fact that the disease is chronic and usually untreated by households leads to high rates of re-infection. Re-infection is very common, as exposure is usually

continuous. Many mothers mistakenly believe that with diarrhea children should stop eating and drinking, fearing that these activities would cause indigestion, making things worse. However, diarrhea causes rapid depletion of water and sodium – both of which are necessary for life. If the water and salts are not replaced fast, the body starts to "dry up" or get dehydrated. If more than 10% of the body's fluid is lost, death can occur (Healthlink Worldwide 1995). Appropriate medicine and visits to a clinic or health centre are not considered necessary for a condition that is not accepted as one of ill health. However, in cases where diarrhea persists for 3 or 4 days, mothers usually provide some management in the home. Management measures derive from the folk perception of the cause and severity of the disease. The decision may also be influenced by the educational level of the mother. Mothers with a higher level of education are more likely to use a combination of Western and traditional treatments. Health centres, clinics and hospitals are additional important sources of advice and prescriptions for the therapy of childhood diarrhea outside the home. However, due to lack of understanding of disease condition, limited access, long waits for attention, misgivings about the effectiveness of Western medicine and cultural dependency on traditional methods, the formal health sector is often used as the last resort.

So far, oral rehydration therapy (ORT) seems to be the most accepted remedy for diarrheal diseases. However, knowledge of oral rehydration salt (ORS) is low among many mothers in Tamale, hence its use remains very low, mainly as a result of lack of health education. The underutilization of ORS may also be due to the lack of acceptance of the taste, as many mothers reported that their children did not like it. Health workers also frequently fail to provide ORT or to advise mothers and caretakers to administer it at home. When ORS is recommended, there is often a greater emphasis on how to prepare it at home than on how much should be given, how long ORT should be continued, how to recognize severe dehydration or the importance of continued feeding during diarrhea episodes.

Cost-effectiveness of Behavioural Change

The important role of behavioural change interventions for the control of diarrheal diseases has been justified in terms of high cost-effectiveness by several studies. Cost-effectiveness is the cost, in monetary terms, of producing a unit of effect such as a reduction in the number of diarrhea cases, through some intervention such as a hygiene promotion (Varley and Bendahmane 1997). Cost-effectiveness analysis compares program costs to program performance as measured by health impact (i.e., dollar cost per unit of effect). It is often expressed as the amount in US dollars spent per case of illness averted, death averted and averted disability-adjusted life years (DALYs). The WHO estimates that an intervention is cost-effective when it costs less than 25 US dollars per DALY saved (WHO 1981). The World Bank (1993) suggests a cut-off for cost-effectiveness at 150 US dollars per DALY saved as the defining criterion for cost-effective interventions for child survival programs.

A Case Study of Cost-Effectiveness from West Africa

One of the few cases in West Africa where cost-effective analysis data exist and have been documented objectively is the Saniya program in urban Burkina Faso (Borghi et al. 2002). The demographic and socio-cultural profiles of the case study area, Bobo-Dioulasso, are similar to those of Tamale. Hence the use of this cost-effectiveness analysis will provide a basis for pushing for hygiene intervention strategies in Northern Ghana. To estimate the cost-effectiveness of the 3-year Saniya Hygiene Promotion Program in Bobo-Dioulasso, with a population of 341,000, Borghi et al. (2002) measured behaviour change associated with the prevention of diarrheal diseases. The program's effects were estimated through a time-series method of observing 37,319 mothers. In particular, the study showed that hand washing with soap after cleaning a child who had defecated rose from 13% to 31%, and safe disposal of children's stools rose from 80% to 84%. Hand washing with soap after latrine use by mothers increased from 1% to 17%. The study concluded that the program changed the hygiene practices of 18.5% of mothers of young children, and it was therefore seen as an effective program.

Health impacts were not measured, but using the literature, Borghi's team estimated that the

impact of hand washing with soap is likely to result in an average reduction in diarrhea incidence of 42%. They assumed that 10% of children with diarrhea are taken to see a health agent and another 10% see a traditional practitioner. An assumption that 3.7% of children with diarrheal disease require hospital admission was taken from an earlier study in the same town in Burkina Faso (Soton 1994). Based on a global review study (Bern et al. 1992), Borghi et al. (2002) assumed that 1.21% of childhood diarrhea cases result in death. These figures, used in combination with the above-mentioned change in hygiene practices by 18.5% of mothers, led to the following estimates of the impact of the program: 8638 cases of diarrhea, 864 outpatients, 324 hospital referrals and 105 deaths averted.

Borghi et al. (2002) showed that the total cost to the provider of the 3-year intervention was 292,000 US dollars. That is converted to 0.65 US dollars per head of population covered or 4.55 US dollars per seven-person household, after deducting the cost of the international research component. The significant proportion represented by overheads was illustrated by the fact that 63% of this total was composed of project administration and undifferentiated start-up costs. Most of the remaining costs were accounted for in roughly equal measure by house-to-house visits, discussions in health centres, hygiene lessons in schools and street-theatre presentations. The total program cost of 292,000 US dollars apportioned over the 8638 cases of diarrhea averted resulted in a cost of 24 US dollars per case. On the other hand, on the basis of the observed increase in prevalence of hand washing with soap, the intervention was estimated to avert sufficient diarrhea morbidity and mortality to save 15 US dollars per compliant household per year in direct costs of medical care and indirect costs due to lost productivity. Cost-effectiveness of the study was not expressed in DALYs, but Borghi et al. (2002) measured cost-effectiveness by stating costs per diarrhea episode averted, per outpatient visit averted, per hospital referral averted and per death averted. The study concluded by mentioning that the program has been cost-effective because it reduced the occurrence of childhood diarrhea in Burkina Faso to less than 1% of the Ministry of Health budget and less than 2% of the household budget, and could be replicated at even lower costs.

Conclusion and Recommendation

The study revealed a significantly wide gap in awareness of the role of infection in causing diarrhea in the Tamale Metropolitan Area. Improving access to safe drinking water and adequate sanitation facilities alone may not lead to significant reductions in the incidence of childhood diarrhea in the metropolis unless accompanied by a change in mothers' attitudes and behaviours. Good hygiene practices can accelerate a reduction in the present morbidity pattern and improve the quality of life of the people in the area to a great extent. It therefore presupposes that while creative technological solutions are certainly needed to bring about diarrhea reductions, the greatest of all challenges is to ensure that appropriate behaviours are followed. Although there is no documentary information on the cost-effectiveness of hygiene interventions for diarrhea reductions in Ghana, the Saniya program case study in Burkina Faso provides a justification for adopting similar strategies in the Tamale Metropolitan Area. Any effort to reduce childhood diarrhea in the metropolis must be built around effectively applying principles of integrated hygiene education at the household level. Interventions include encouraging households and mothers to adopt hygienic water storage practices, appropriate kitchen and food hygiene and safe disposal of children's feces and promoting the practice of hand washing with soap and water.

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