Beyond and Below the Nation State:Challenges for Population Data Collection and Analysis

*We need to look both beyond and below
the nation state in our efforts to understand population change.*

By Terence H. Hull*

While the science of demography addresses the whole of the human population, substantive demographic research is most often focused on populations with common characteristics. For the last six decades the nation state has been the social unit that has dominated demographic research.

* Professor, Australian National University, Canberra, Australia, e-mail: Terry.Hull@anu.edu.au.

The reasons for this focus make perfect sense. Nations define their populations in terms of citizenship and define the ways in which people will be identified in any effort to count the numbers. They have the authority, the interest and the resources to carry out collections of information about members of these defined populations. As members of the United Nations they collaborate with other nations to develop the methodological and technical tools used to analyse national population numbers in ways that are relevant to state policies and actions. In short, the nation is the foundation unit for understanding human population composition and growth.

Global population numbers are estimated by compiling the information collected by nations. Interest in populations of units smaller than the nation also relies on national statistical collections and national definitions of component populations, but for most users of data the focus is on the nation, and not the units beyond or below that political entity.

The most obvious expression of the importance of the nation state is the production of "data sheets" by research organizations and United Nations agencies. One of the longest running of these efforts is the annual publication of the Population Reference Bureau's (PRB) *World Population Data Sheet*.[1] For many years the PRB Data Sheet has been placed on the bulletin boards of libraries around the world and has been cited as the source of information in student papers, faculty lectures and even government policy documents. From time to time the development banks and various development assistance programmes emulated the PRB data sheet with wall charts designed to highlight different regions or measures of interest to their constituents. The World Bank's annual World Development Report[2] and UNDP's Human Development Report[3] contain substantial data annexes with information on nations and often provide critical analyses of the quality of the information provided by national statistical offices.

The proliferation of data sheets waned in the new century after 2000 as computerized data collections became more readily available on the Internet and therefore easier to update. For those in the Asian and Pacific Region, ESCAP's annual *Population Data Sheet* has long provided an authoritative collection of national statistics on a wide range of topics.[4] Like so many other data compilations the *ESCAP Population Data Sheet* is now available online, thus greatly reducing the cost and increasing the accessibility of the material, and making it more useful to the broad range of potential users across Asia and the Pacific.

The common characteristic of all these data sheets is the reliance on the nation as the key data unit. Compilers rely on national statistical offices to report information on population numbers and characteristics, either directly or through

the United Nations Population Division or the United Nations Statistical Division. Over the years these organizations have gained great expertise in assessing the validity and reliability of national data. Adjustments can be made to any information that is obviously incorrect. These data compilations thus represent the best estimates of national populations and regional and global population structures and trends.

The term region is often confusing when applied to population studies. Sometimes it refers to groups of nations with shared boundaries and geographic similarities, such as the regions of South-East Asia, the Pacific or Asia. These supranational units are embedded in the various data sheets. Confusion arises from time to time when different organizations use different definitions for regions, such as the different collections of nations used by the World Health Organization and the World Bank to define regions in their operations. The historical reasons for such differences are understandable, but of little consequence to the policymakers and students who attempt to apply information about regions in their arguments about social and economic development. For them there would be great advantage to the use of standard regional units and consistent inclusion of individual nations in those standard regions. For a variety of historical and political reasons this is unlikely to be achieved in the short term.

Occasionally people write about regions with similar social characteristics such as the Islamic region, or the francophone regions of Africa. These regions are defined by common national characteristics, but pay little regard to differences within nations. This is undoubtedly a useful approach to marshal information above the national level, and it has the benefit of simplicity. To get a regional estimate you add up data from each component nation. The component nations are included if they have people with the selected characteristic, such as more than half the population adhering to a particular religion, or 80 per cent speaking a particular language. That is simple enough, but it is not likely to satisfy the concerns of the minority interests that are not recognized in this categorization, or the problem of nations changing categories over time as the populations with the selected characteristics become more or less numerous. For the time being, the definition and monitoring of such regions is likely to depend on the units of nations, rather than other geographic or social units.

Nations, though, are extremely varied in size, from the population billionaires of China and India, to the island microstates scattered across the oceans of the world. Among the larger nations there is great social, cultural and economic diversity. The use of regions defined as groupings of nations means that the true heterogeneity of the globe is understated. For this reason it is important to consider

regions smaller than nations, with characteristics that can be seen to cross national boundaries to reveal the realities of human variation.

The European Union has attempted to define subnational units for social analysis.[5] Called the *Nomenclature of Territorial Units for Statistics* (NUTS) they are intended as units of comparable population size for regional comparisons within and across nations. The regulation establishing the system sets a hierarchy of three levels of NUTS units with minimum and maximum population sizes for each level. Thus NUTS 1 is a unit with a minimum population of three million and a maximum of seven million; NUTS 2 has a minimum of 800,000 and NUTS 3 a minimum of 150,000. These may be either administrative or non-administrative units according to the political structures of each member state. The terms used to describe them follow local languages and terminologies. In Germany a NUTS 1 unit is called a *Länder,* while in the United Kingdom it is a *Government Office Region*. The analysis of those subnational units has the dual purpose of focusing policy on specific needs of relatively homogenous populations, and allowing identification of regions that share characteristics across as well as within nations.

One recent innovation in the analysis and presentation of data at the subnational level is the Indonesian website[6] titled *Improving Data for Decentralized Planning*. This website was developed collaboratively by staff from the BPS-Statistics Indonesia (*Badan Pusat Statistik*), the Demography Programme at the Australian National University and the Demographic Institute of the University of Indonesia. It was partially funded by the Australian Agency for International Development (AusAID). The design aimed to accomplish three main things. First, the website should be accessible to people working at the district (*Kabupaten/Kota*) level, as well as in the national and international research communities. To achieve this the site has table labels in Bahasa Indonesia and English, and there are training modules in Bahasa Indonesia to help local officials who are not familiar with demographic and social analysis techniques. Documentation of survey and census questionnaires is also available in two languages, and tables are downloadable in Microsoft Excel type spreadsheets for ease of analysis.

Second, the website aims to be comprehensive. Tables range from the basic demographic statistics, through a growing number of economic and social variables and indices, and even a set of population projections at the provincial level. Tables are regularly updated, and an effort is under way to include survey and census results stretching back to the 1970s.

Third, the website fosters cooperation. Analytical papers on relevant demographic topics are posted on the website, and users are invited to contact the webmaster and Statistics Indonesia staff with comments, questions or criticisms.

The Indonesian effort to look at district level data arose out of a change of governance that saw budgetary authority moving from the central to the district level of government. Even if this had not occurred, a nation of over 220 million people living on thousands of islands would have required data at the levels of small units to reveal the heterogeneity of Indonesian society and its economy. Decentralization made this all the more important because local governments need data for budgeting, planning and evaluation. Now it is likely that those same officials will come to recognize the importance of looking at data across districts and perhaps across national boundaries. For instance the annual problem of smoke haze is best understood by looking at patterns of subnational units across the entire region of Indonesia, Malaysia and the Philippines.

The same is true for most nations of Asia and the Pacific. We need to look both beyond and below the nation state in our efforts to understand population change. This will require a commitment by all nations to develop sharper tools to define hierarchies of units similar to the NUTS in Europe, and more open data distribution systems similar to the Indonesian website for decentralized planning. The key is not simply a system of geographical mapping, but rather a strong hierarchical system of units defined for data collection and analysis. This will only be achieved if nations make their statistical systems more open and accessible and commit themselves to discussions that go beyond narrow national interests.

Endnotes

1. http://www.prb.org/pdf06/06WorldDataSheet.pdf

2.http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTWDRS/0,,contentMDK:20227703~pagePK:478093~piPK:477627~theSitePK:477624,00.html

3. http://hdr.undp.org/

4. http://www.unescap.org/esid/psis/population/database/data_sheet/index.asp

5. http://europa.eu/scadplus/leg/en/lvb/g24218.htm or http://en.wikipedia.org/wiki/Nomenclature_of_Territorial_Units_for_Statistics

6. http://www.datastatistik-indonesia.com

Older Persons' AIDS Knowledge and Willingness to Provide Care in an Impoverished Nation: Evidence from Cambodia

One potentially effective route for the Government and NGOs to improve AIDS knowledge among Cambodian elderly generally − and to weaken the link between poverty and poor AIDS knowledge − would be to facilitate ownership of radios or televisions for those who do not have them.

By John Knodel and Zachary Zimmer*

Since the beginning of the global pandemic, assessing knowledge and attitudes regarding AIDS has been an important subject of research and for good

* John Knodel, Research Professor, Population Studies Center, University of Michigan, Ann Arbor, MI, United States of America, e-mail: jknodel@umich.edu and Zachary Zimmer, Professor, Department of Sociology, Senior Scholar, Institute of Public and International Affairs, University of Utah, Salt Lake City, UT, United States, e-mail: Zachary.zimmer@ipia.uath.edu.

reasons. Given the unusual features of HIV/AIDS, there is considerable potential for misunderstanding important aspects of the disease that could affect both behaviours related to risk exposure, as well as reactions to those known or believed to have contracted HIV. Most research on knowledge and attitudes has focused on young or prime aged adults. Far less common are systematic assessments of knowledge and attitudes among older persons, especially for developing countries, presumably because they are thought to be at less risk of exposure. In fact, older persons are also at risk of infection even if less so than prime age adults and their numbers will grow as effective treatments increasingly allow those infected at earlier ages to survive to old ages. Still, infected persons aged over 50 constitute a relatively modest share of the total caseload, especially in the developing world (Knodel, Watkins and VanLandingham, 2003).

Far more common are older persons who are affected by AIDS indirectly through the illness and death of their grown-up children. In many developing countries, older persons as parents, often assume important caregiving roles for their infected sons and daughters and provide living quarters and support when illness becomes debilitating (Knodel and VanLandingham, 2002; Knodel, forthcoming) . Since most adults who die of AIDS have at least one parent alive at the time of death, and because the parents tend to be in their 50s, 60s and 70s, the number of older parents who act as AIDS caregivers is very large. Older persons have considerable potential to contribute to the effort of dealing with the epidemic in other ways as well. As parents they have a high emotional stake in ensuring their grown children's well-being and thus a strong motivation to discourage risky behaviours leading to AIDS, encourage testing and encourage those who become HIV infected to seek treatment and comply with treatment regimes. That many older-aged parents co-reside or live in proximity to adult children, especially in the developing world, enhances their potential to exert such influence. For all theses reasons, adequately informing older persons about AIDS is important for efforts to combat and cope with the epidemic.

The present study examines knowledge and attitudes related to HIV/AIDS among persons aged 60 and over in Cambodia, the country with the highest HIV prevalence in Asia. Before presenting results, a brief analytical framework is presented that guides the analysis, as well as some relevant aspects about the country setting, and the data sources and measures used. The presentation of findings examines how age relates to AIDS knowledge and attitudes towards caregiving, the association of knowledge and willingness to provide care, and determinants of knowledge with special attention paid to the role of poverty and mass media exposure. The study ends with a discussion on the implications for efforts to deal with the epidemic in Cambodia.

Analytical framework

A crucial hypothesis addressed in this study   and one of considerable policy relevance for programmes dealing with the epidemic   is that better knowledge promotes favourable attitudes towards caregiving and subsequently willingness to provide care. This hypothesis is of particular interest with regard to older persons given their importance in providing informal caregiving of adults living with HIV/AIDS, especially in developing country settings. Figure 1 summarizes the conceptual framework that guides the present analysis. The framework first links several presumed predictors to AIDS knowledge and then focuses on the relationship between knowledge and willingness to provide care to a family member with AIDS.

Figure 1. Analytical framework
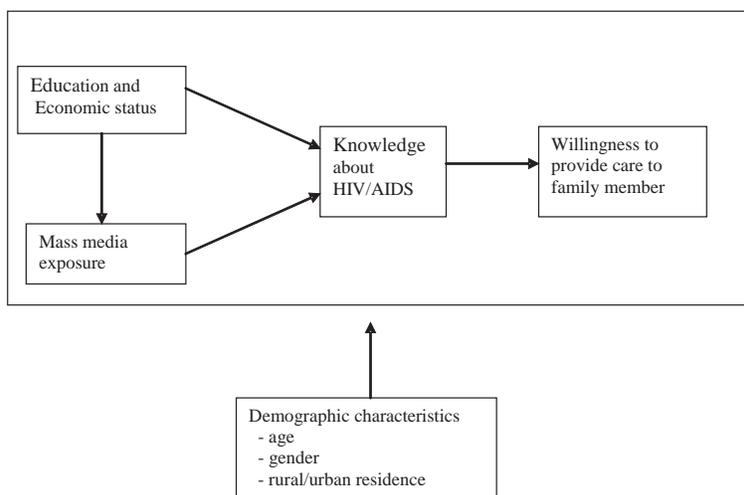
A virtually universal finding in previous research is a strong positive association between educational attainment and AIDS knowledge (e.g. United Nations, 2002). Economic status has also been linked to AIDS knowledge, based on the assumption that the poor have less access to information about health risks and perhaps a lower incentive to consider it important and act on it (Bloom, River Path Associates and Sevillal, 2002) . Moreover, given the association of poverty with social and political exclusion, informational activities may be framed and implemented in ways that are less relevant for persons at the lowest end of the

social and economic scale (Cohen, 2000). Thus, a positive association between both education and economic status and AIDS knowledge is expected.

Numerous studies have pointed to the importance of mass media, especially radio and television, as the primary source of information about HIV/AIDS for the general population. According to an analysis by the United Nations Population Division of 39 Demographic and Health Surveys (DHS) throughout the developing world, radio was the most often cited source of knowledge about AIDS (United Nations, 2002). This probably reflects the ability of large segments of the population even in very poor countries to possess low cost radios. Television was also found to be a very common source of information. In numerous studies in countries or settings where television is widespread (e.g. urban areas), it is often the most commonly cited source (Ayranci, 2005; Henderson and others, 2004; Im-em, VanLandingham, Knodel and Saengtienchai, 2001; Montazeri, 2005; Porter, 1993). Thus, mass media exposure is expected to have a positive influence on AIDS knowledge. At the same time, socio-economic status influences media exposure since those with higher education and with a better economic situation are more likely to own and use radios and televisions. The associations inside the main box therefore suggest a causal structure that leads from education and economic status, and mass media exposure, to AIDS knowledge, and to willingness to provide care. Education and economic status operate both independently and through media exposure.

Previous research has also shown that AIDS knowledge is typically associated with basic demographic characteristics including age, sex and place of residence. Cross-national analysis of DHS data indicates that in most countries awareness of AIDS is higher among men than among women and that urban residents are much more aware than rural residents (United Nations, 2002). Research in Thailand and the United States of America indicates that knowledge of AIDS declines with age, particularly among older persons (Leblanc, 1993).[1] Age, sex and place of residence are also likely to be associated with educational attainment, economic status and mass media exposure and may influence attitudes towards caregiving. Thus, they are incorporated into the multivariate analyses as control variables and are represented outside the main box to signify their simultaneous influence on all factors inside the box.

Setting

Cambodia is well known for the political and civil strife that engulfed the nation during the 1970s and culminated in the brief but devastating rule of the Khmer Rouge during which violence, starvation and disease killed about one

fourth of its population (Heuveline, 1998; Kiernan, 2003). In part as a legacy of this traumatic period and its aftermath, pervasive poverty continues to prevail throughout the country. Cambodia is classified by the United Nations as one of the world's least developed countries and ranks low on the Human Development Index with over three fourths of the population living on less than two dollars a day (Ministry of Planning, 2003). Relevant for the present study, 30 per cent of persons aged 60 and over live in households with no radio and 36 per cent in households with no television (Knodel, Kim, Zimmer and Puch, 2005). Consistent with high levels of poverty,social protection measures in Cambodia are underdeveloped and under-funded and the public health system is generally characterized as poorly functioning (Buehler, Wilkinson, Roberts and Catalla , 2006; Chan and Ear 2004). However, the health system's response to the AIDS epidemic has been remarkably aggressive and effective (Buehler, Wilkinson, Roberts and Catalla , 2006).

According to UNAIDS, adult prevalence of AIDS has declined to 1.6 per cent in 2005, down from a peak of 3 per cent in 1997, testifying to Cambodia's unusual success in combating the epidemic through an aggressive government programme (UNAIDS, 2006). Knowledge about HIV/AIDS is reasonably high among women of reproductive ages, as well as commercial sex clients (National Institute of Statistics, 2001; Hor, Detels, Heng and Mun, 2005). As is common in much of South-East Asia, older persons in Cambodia commonly live with adult children and depend on them for much of their support (Kato, 2000; Zimmer and Kim, 2001). Approximately four out of five Cambodians aged 60 and over co-reside with at least one child (Knodel, Kim, Zimmer and Puch, 2005). Given the lack of health and welfare services, elderly Cambodians have little choice but to depend on material and physical support from their families. Most adult children tend to either live with their parents or nearby with 60 per cent of those aged 18 and over residing within the same locality.[2] It is not surprising then that recent research indicates that older aged parents in Cambodia play a major role when an adult child becomes ill with AIDS (Knodel, Kim, Zimmer and Puch, 2006). They often share living quarters, provide care and pay for expenses related to the illness. Specifically, in over 60 per cent of cases in which a grown child died of AIDS, the child lived with parents during the terminal stage of illness. In 80 per cent of the cases, a parent was the main source of personal care and in over two thirds a parent helped pay for medical expenses. This high level of parental involvement reflects the lack of alternative sources of assistance, the extensive poverty and the common residential proximity between adult children and their parents that characterize Cambodia.

Data sources and measures

The main source of data for this study is the 2004 Survey of Elderly in Cambodia (SEC) involving 1,273 interviews with persons aged 60 and older. After weighting, the multistage probability sample is representative of Phnom Penh and the five most populous provinces that together constitute over 50 per cent of the Cambodian population. The complete questionnaire and details about sampling, weighting and respondent characteristics are provided elsewhere (Knodel, Kim, Zimmer and Puch, 2005). The study is also based on original analysis of the 2000 Cambodia Demographic and Health Survey (DHS), which interviewed over 15,000 women in reproductive ages, to permit comparisons of levels of knowledge among women within a broader age range.[3]

In addition to standard issues about economic, social and physical well-being common in surveys of elderly populations in the region, the SEC questionnaire included a section on awareness, knowledge and attitudes regarding AIDS. Respondents were asked a set of 15 questions to assess their knowledge. The questions dealt with both valid and invalid modes of transmission, prevention, treatment and detection. Seven of these questions as well as an open-ended question (allowing multiple answers) about what a person could do to avoid AIDS and a question about willingness to care for a relative with AIDS are identical to those in the 2000 DHS.[4] Additional questions in the SEC concerned the safety of sharing various items with a person infected with AIDS.

To summarize overall AIDS knowledge, a score for each SEC respondent was calculated according to the percentage of correct answers to the 15 knowledge questions.[5] For example, a respondent who correctly answered 9 of the 15 questions received a score of 60 per cent. To permit comparisons between the SEC and DHS, a similar measure for respondents in each survey was calculated based on the seven knowledge questions that were common to both.[6] In addition, for both the DHS and SEC, it was determined whether, in response to the open-ended question on ways to avoid AIDS, the respondent could mention at least one valid way to avoid heterosexual transmission of HIV (the predominant mode of transmission in Cambodia). The measure of caregiving willingness was based on a single direct question that asked if the respondent would be willing to care for a relative with AIDS in the respondent's own household.

The main covariates examined in the analysis were age, gender, location, educational attainment, economic status and mass media exposure. Location was divided into three categories: urban (central Phnom Penh); peri-urban (peripheral parts of Phnom Penh province); and rural (those in provinces other than Phnom Penh, all of whom were living outside of urban districts). Respondents' economic

status was based on an interviewer assessment, which was divided into four categories ranging from above average to very poor.[7] Mass media exposure was based on two survey questions asking the frequency of watching television and of listening to the radio. Respondents were coded according to whichever one of the two they were most frequently exposed to.

Results

Age differentials. In order to examine the age pattern of AIDS knowledge and attitudes within a broad age range, the authors compared 2004 SEC results for women aged 60 and over with 2000 DHS results for women of reproductive age. DHS results were restricted to the same sample area covered by the SEC in order to increase comparability. Men were excluded since the DHS only interviewed women. Figure 2 presents results for three measures: the percentage who could mention at least one valid way to avoid heterosexual transmission of HIV, the average percentage of correct answers given by respondents to the knowledge questions common to the two surveys, and the percentage who state they are willing to provide care to a relative with AIDS in their own household.

Figure 2. HIV/AIDS knowledge and willingness to provide care among Cambodian women, by age group
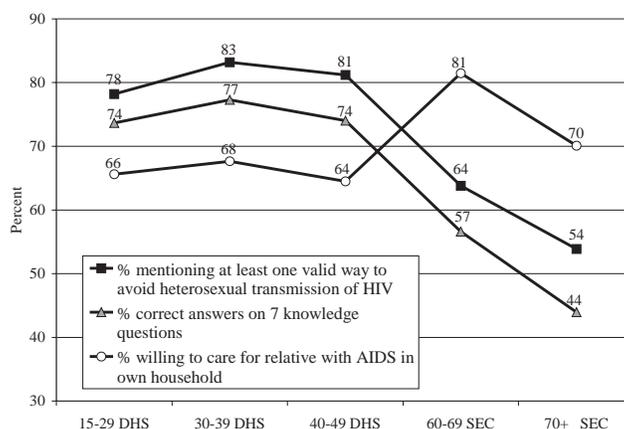
Source: 2000 Demographic and Health Survey and 2004 Survey of Elderly in Cambodia.

The two knowledge measures follow a very similar age pattern. The percentage of respondents who can mention a valid way to avoid heterosexual

transmission and the percentage of those who answered correctly to the knowledge questions do not vary greatly by age group within the reproductive ages but decline sharply with age for older women. Knowledge is therefore considerably lower among women above 60 years compared with women under the age of 50, while among older women it is substantially lower among those aged 70 and over than among those in their sixties. By contrast, the age pattern with respect to willingness to provide care to a relative with AIDS is very different. Although it is noteworthy that in both surveys the majority of women say they are willing to provide care, it is the older women who are more likely to express such willingness compared with their counterparts in their reproductive years. Among older women, however, lower levels of willingness are found among those 70 or older compared to those in their sixties. The percentage among those aged 70 and over is however, still higher than any of the three age groups shown for women of reproductive age.

It is to be noted that the two surveys were conducted four years apart and that knowledge and attitudes may have changed during this interval. Presumably knowledge should have increased and thus the lower knowledge of the older women who were interviewed later reinforces the impression that older ages are indeed associated with lower knowledge. By contrast, improving attitudes towards caregiving could possibly account for the higher levels of willingness among older women found by the SEC compared to the women of reproductive age who were interviewed earlier. There is no evidence, however, that this is the case.

A more detailed examination of the relationship between age with both AIDS knowledge and willingness to provide care among older Cambodians − based on the full SET sample that includes both men and women − is provided in figure 3. In this case, AIDS knowledge is measured by the percentage of correct answers to all 15 HIV/AIDS knowledge questions asked in SET. For both men and women, AIDS knowledge declines steadily with age. For example, the average percentage of correct answers among men declines from 70 per cent for those aged 60-64 to only 45 per cent for those aged 80 and over. For women, the decline is even slightly greater (from an average of 62 to only 30 per cent of correct answers). Moreover, for every age group, women average fewer correct answers than do men.

The decline in willingness is relatively modest through ages 75-79, but a sharper decline occurs thereafter, especially for women. The lower levels of willingness to provide care among those aged 80 and over perhaps reflects increased frailness associated with very advanced age and a related sense of physical inability to carry on tasks that would be required by caregiving. For all age groups shown except 60-64, men are more likely to say they are willing to provide care than women. This may reflect the fact that most older men in the sample are married (82 per cent) and

would thus have a spouse who can also help, while two thirds of the older women are widowed (Knodel, Kim, Zimmer and Puch, 2005). Also women may be more aware than men as most of the caregiving burden is likely to fall on them, even if they were married. (Knodel, Kim, Zimmer and Puch, 2006).
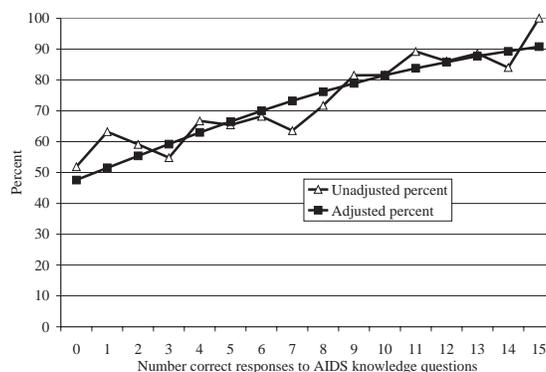
Figure 3. AIDS knowledge (percentage of correct answers to 15 questions) and percentage expressing willingness to provide care if a relative had AIDS, by age and gender, among persons aged 60 and over
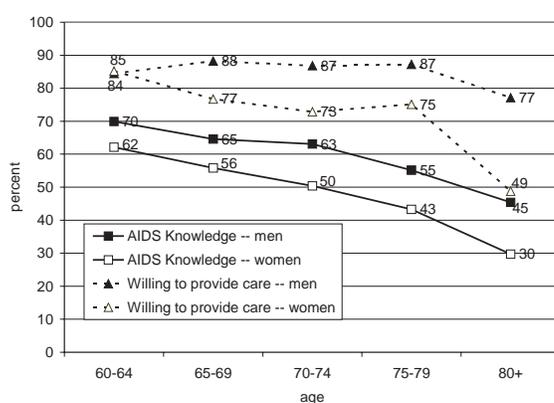
Source: 2004 Survey of Elderly in Cambodia.

Caregiving willingness and AIDS Knowledge. As already noted, the informal system of caregiving for persons with AIDS in Cambodia depends heavily on older parents. In many cases, a person with AIDS would have nowhere else to turn to if parents were unwilling to take on this responsibility. Results from the SEC indicate that many older Cambodians feel that parents should provide care if an adult child becomes ill with AIDS, especially if the child has no spouse. When asked who a non-married person with AIDS should turn to for care, 78 per cent of respondents said it should be their "parents". Most respondents (70 per cent) said a married person with AIDS should be cared for by the spouse but even for such cases, 16 per cent felt that parents would be the most appropriate caregivers. Interestingly, respondents who said they were willing to provide care to a family member were considerably more likely than those who did not to indicate parents as the appropriate caregiver both for non-married persons (85 per cent versus 51 per cent) and for married persons with AIDS (18 per cent versus 10 per cent). Such consistency between responses to the questions about willingness to provide care and endorsement of parental caregiving is an encouraging sign of response reliability.

**Figure 4. Percentage of people who are willing to care
for a person with AIDS by number of correct responses to 15 AIDS
knowledge questions**

In order to assess if knowledge about HIV/AIDS promotes willingness to care for a family member who is ill from the disease, the authors examined the association between the number of the 15 AIDS knowledge questions answered correctly in the SEC and an affirmative response to the survey question that asked about willingness. The association is shown in figure 4. The unadjusted percentage is simply based on a bivariate cross-tabulation and demonstrates the existence of a strong positive relationship. For instance, while about 50 per cent of those who did not answer any question correctly stated a willingness to provide care (N=52), the same is true of about 65 per cent of those who answered five questions correctly (N=52), about 82 per cent of those who answered ten correctly (N=136) and all of those who answered fifteen correctly (N=24). The adjusted percentage was based on a logistic regression equation that predicts the probability of caregiving willingness by number of correct answers (entered as a continuous variable), controlling for age, sex, residence, economic situation and education. Adjustment for these additional controls did little to alter the strong association between knowledge and willingness to provide care. Using the logistic curve, it was expected that a little less than 50 per cent of those without any knowledge, based on the 15 questions, were willing to provide care, other things being equal. This percentage rose steadily to about 90 per cent for those with full knowledge.

Poverty, media exposure and AIDS knowledge. Table 1 examines potential determinants of AIDS knowledge among older Cambodians, as measured by the average percentage of knowledge questions answered correctly in the 2004 SEC. In line with the analytical framework used, the respondent's economic situation and mass media exposure were included with additional controls introduced for educational attainment, gender, location and age.[8] Since the covariates were correlated, it was also useful to statistically adjust results to assess the net effect of each covariate. Thus in addition to unadjusted results, two sets of results statistically adjusted by multiple classification analysis (MCA) are shown. The first MCA model adjusts results net of all other covariates in the table, plus age, but excludes exposure to radio/TV. The second model adds exposure. Values of the *eta* and *beta* statistics are included in order to show strength of association between knowledge and each variable; *eta* refers to the strength of the bivariate associations while *beta* refers to the strength of associations holding constant the other covariates.

Table 1. HIV/AIDS knowledge by economic status, education, gender, location and exposure to mass media among persons aged 60 and over in Cambodia, 2004

| | Unweighted number of cases | Percentage of correct answers to 15 questions on HIV/AIDS | | |
| | | Unadjusted | Statistically adjusted[a] | |
			Model 1 (excluding mass media exposure)	Model 2 (including mass media exposure)
Total	1,242	57.6	57.6	57.6
Economic situation				
Very poor	91	44.7	48.5	51.6
Below average	407	55.6	56.5	57.1
About average	647	60.1	59.4	58.7
Above average	97	63.0	59.7	58.2
eta/beta		0.176	0.118	0.075
Statistical significance		***	***	*
Exposure to radio/TV				
Rarely or not at all	326	44.7	..	49.6
Weekly but not daily	159	59.5	..	58.8
Everyday	757	63.3	..	61.1
eta/beta		0.322	..	0.198
Statistical significance		***	..	***

.../

Table 1. *(Continued)*

	Unweighted number of cases	Percentage of correct answers to 15 questions on HIV/AIDS		
		Unadjusted	Statistically adjusted[a]	
			Model 1 (excluding mass media exposure)	Model 2 (including mass media exposure)
Education				
Never attended school	699	50.7	54.2	54.7
Pagoda only	157	60.0	59.0	58.9
Primary school	247	68.0	62.7	61.6
Beyond primary	139	75.4	65.9	64.9
eta/beta		0.342	0.166	0.140
Statistical significance		***	***	***
Gender				
Men	453	63.8	61.1	60.1
Women	789	53.3	55.2	55.8
eta/beta		0.203	0.113	0.083
Statistical significance		***	***	**
Location				
Urban	255	67.0	63.9	62.9
Peri-urban	205	62.5	60.6	60.2
Rural	782	56.1	56.6	56.7
eta/beta		0.137	0.090	0.077
Statistical significance		***	**	*

Notes: MCA results also adjust for age as a continuous variable.
[a] adjusted by MCA (Multiple Classification Analysis)
Significance levels: * = 0.05; ** = 0.01; *** = 0.001; n.s. = not significant at 0.05 level; n.a. = not applicable

The unadjusted results indicate strong associations between levels of AIDS knowledge and each of the covariates in the table. As expected from studies elsewhere, as well as from prior analysis of the Cambodia 2000 DHS, AIDS knowledge increases with economic status, exposure to radio or television, while educational attainment is higher for men than for women, and higher for urban than rural residents. For instance, those with a very poor economic situation answered an average of 45 per cent of the knowledge questions correctly compared to 63 per cent for those with an above average economic situation. All associations are statistically significant at the 0.001 level. Values of the *eta* statistic indicate the strongest relationships are with education and exposure to radio or television.

As results for model 1 show, adjusting for covariates effectively reduces the strength of associations. This is reflected both in lower values of the *beta* statistic compared to the *eta* values for the unadjusted results and in the reduction in the variation of the percentage of questions correctly answered to across categories of each determinant. For instance, when controlling for other covariates, those with a very poor economic situation answered an average of 49 per cent of questions correctly compared with 60 per cent for those with an above average situation, reducing the unadjusted difference of 18 to 11 percentage points. Still all covariates included, except for location, remain statistically significant at the 0.001 level.

When exposure to mass media is also included in the analysis, as shown in results for model 2, *beta* values decrease further, particularly with regards to the respondent's economic situation. The difference in the AIDS knowledge score between the very poor and those whose economic situation is above average is further reduced to less than 7 percentage points. Only education and mass media exposure remain statistically significant at the 0.001 level. Moreover, the net association between mass media exposure and knowledge is stronger than that between education and knowledge.

Discussion and conclusions

According to a recent United Nations study, information, education and communication (IEC) campaigns are the most commonly adopted policy to combat the AIDS epidemic (United Nations, 2005). Such IEC campaigns need to target not just persons thought to be at high risk of infection but also those who can influence the behaviour of risk-prone persons, as well as that of those who are likely to be the caregivers to persons who become ill with the disease. As noted above, older persons in Cambodia (and elsewhere in the developing world) are not only commonly the main caregivers for their sons and daughters who become infected but also have potential to influence their adult children to avoid risky behaviour. It is therefore of some concern that substantially less knowledge was found among Cambodian women aged 60 and over interviewed in the 2004 SEC than among women of reproductive age covered by the DHS four years earlier. Given the almost negligible risk of transmission through caregiving (Friedland, 1990) and the advent of effective anti-retroviral therapy, it is particularly disconcerting that under half (49 per cent) of older Cambodians deny that someone who gives care to a person with AIDS is likely to get infected as a result and that less than a third (32 per cent) affirm that there are modern medicines that can prolong the life of an HIV infected person.

Analysis of the Survey of Elderly in Cambodia and a supplemental survey, presented elsewhere, make clear that older aged parents commonly play a key role in the care of their grown sons and daughters living with AIDS (Knodel, Zimmer, Kim and Puch, 2006). Thus, the importance of improving AIDS knowledge among older Cambodians is underscored by the finding that willingness to provide care to a family member increases with the level of correct knowledge. One mechanism which may underpin this relationship is that correct knowledge reduces unfounded fear concerning risks of contagion associated with caregiving. This interpretation gains some support from the fact that willingness to care is more closely associated with knowledge dealing with casual transmission than with other aspects of HIV/AIDS.[9] Also, willingness to care is positively associated with the number of household items that respondents correctly indicated as safe to share with a person with AIDS (results not shown). Older persons therefore not only need correct knowledge about the inherent risk in caregiving and how to minimize them but also about how one does not contract AIDS so that they do not unnecessarily worry about contagion and avoid interaction with an infected family member (Im-Em, VanLandingham, Knodel and Saengtienchai, 2002).

A recent analysis of AIDS knowledge based on the 2000 Cambodia DHS found that lower levels of wealth were associated with poorer AIDS knowledge among women in reproductive age, even after the influence of education was taken into account (Bloom, River Path Associates and Sevilla, 2002). Results from the SEC also find an association between lower economic status and poorer knowledge among older Cambodians even after controlling for educational levels. However, the present analysis also indicates that lower exposure to mass media (radio and television) accounts for much of the association between poverty and poor AIDS knowledge. One very important reason why poorer Cambodian elderly have low mass media exposure, and hence poor knowledge of HIV/AIDS, is that many live in households with neither a television nor radio. According to the SEC, only 48 per cent judged as being very poor had a radio or TV in their household compared to 99 per cent of those judged to be above average economically. While the absence of a radio or television in a household does not preclude access (e.g. television can be viewed at a neighbour's home), it almost certainly decreases exposure. Thus, one potentially effective route for the Government and NGOs to improve AIDS knowledge among Cambodian elderly generally – and to weaken the link between poverty and poor AIDS knowledge – would be to facilitate ownership of radios or televisions for those who do not have them. The likely impact of such an approach is all the more enhanced by the fact that the Government of Cambodia is encouraging the mass media to provide information about HIV/AIDS to the broader public(*People's Daily*, 2006).

Most efforts to promote awareness and knowledge of AIDS have been oriented towards youth or prime age adults with little or no attempt to reach older persons (HAI, 2003). It is therefore not surprising that the present research, similar to that in settings as diverse as Thailand and the United States, finds that knowledge about HIV/AIDS is lower for older persons than younger adults and declines with advancing age among older persons themselves (Im-Em, VanLandingham, Knodel and Saengtienchai, 2002; Leblanc, 1993; McCraig and Winn, 1991). This situation should be remedied and future IEC campaigns on AIDS need to incorporate older persons as part of the target group in countries such as Cambodia where older persons play a critical role as caregivers and can potentially influence their adult children's risky behaviour.

The significance of the present findings may extend well beyond Cambodia. Many countries with high HIV/AIDS prevalence rates are characterized by extreme poverty and low levels of education, similar to Cambodia. Moreover, in those countries, persons ill with AIDS usually depend on informal care arrangements, typically within the family. Further testing of the associations found in the current study in other settings around the world would be an important task to add to the research agenda. If they confirm, as the Cambodian results indicate, that knowledge and awareness about AIDS are related to media exposure, and that, subsequently, willingness to provide care is strongly related to knowledge, then facilitating correct knowledge and understanding of the nature of the disease and its causes through the ownership of radios or televisions could be an important route towards encouraging care within the family, mediating the consequences of AIDS, and ultimately weakening the link between poverty and AIDS in the global fight against the disease.

Acknowledgements

Endnotes

1. Thailand results from original tabulations; for a description of the source, see Im-Em, VanLandingham, Knodel and Saengtienchai, 2002.

2. Original tabulation from the 2004 Survey of Elderly in Cambodia.

3. See National Institute of Statistics (2001) for a description of that survey.

4. Unlike the DHS, the SEC permitted "depends" as a pre-coded answer in addition to "yes", "no" and "don't know" for the seven identical knowledge questions. For two questions for which qualifications could legitimately alter what would otherwise be a correct yes-no answer "depends" was treated as correct.

5. The 30 respondents who had never heard of AIDS were treated as not knowing the correct answers to all knowledge questions.

6. For both surveys, respondents who indicated that they had never heard of AIDS were not asked the knowledge questions. For knowledge measures, these respondents were treated as not knowing each item. One difference between the two surveys, however, was that respondents in the DHS who said they knew no way to avoid AIDS were not asked 4 of the 7 common items while in the SEC they were asked all 7. Tabulations from the SEC indicated that some of these respondents who would have been skipped according to the DHS skip pattern gave correct answers to these items, although less so than those who said they knew a way to avoid AIDS. Thus, excluding these respondents would overstate knowledge levels while treating them as not knowing the correct answer would underestimate their knowledge. In order to be able to include these respondents in results for both surveys, the DHS results were adjusted by assigning respondents who said they did not know a way to avoid AIDS the same probability of a correct answer for each of the four skipped items as was found for their counterparts in the SEC.

7. The questionnaire allowed for an additional top category of well-off but since only two respondents were so classified they were combined with the above average category.

8. Age is entered as a continuous variable and thus not shown in the table. Its association with knowledge is highly statistically significant, both before and after statistical adjustment for other covariates.

9. For example, according to bivariate Pearson correlation coefficients, willingness to care (coded 0,1) is correlated 0.280 with the number of correct answers to the four knowledge items dealing with casual transmission compared to 0.197 with the number of correct answers to the 11 knowledge items not dealing with casual transmission.

References

Ayranci, U. (2005). "AIDS knowledge and attitudes in the Turkish population: an epidemiological study", *BMC Public Health*, No. 5, pp. 95-104.

Buehler, M., D. Wilkinson , J. Roberts and T. Catalla (2006). *Turning the Tide: Cambodia's Response to HIV & AIDS 1991-2005,* Phnom Penh: UNAIDS Country Office.

Bloom, D.E., River Path Associates and Jaypee Sevilla (2002). "Health, Wealth, AIDS and Poverty", Paper prepared for ADB/UNAIDS.

Chan, S. and S. Ear (2004). "Towards understanding social protection in Cambodia", *Cambodia Development Review*, vol. 8, No. 4, pp. 9-13.

Cohen, D. (2000). *Poverty and HIV/AIDS in sub-Saharan Africa*, UNDP HIV and development programme. Issues paper No. 27, New York: United Nations.

Cohen, J. (2003). "Two hard hit countries offer rare success stories", *Science*, No. 301, pp. 1658-1662.

Friedland, G. (1990). "Risk of transmission of HIV to home care and health care workers", *Journal of the American Academy of Dermatology*, No. 22, pp. 1171-1174.

HelpAge International (HAI) (2003). *HIV/AIDS and Ageing: A Briefing Paper*. HAI, London.

Henderson, S.J. and others (2004). "Older women and HIV: How much do they know and where are they getting their information?", *Journal of the American Geriatrics Society* , vol. 52, No. 9, pp. 1549-1553.

Heuveline, P. (1998). "Between one and three million: Towards the Demographic Reconstruction of a Decade of Cambodian History (1970-79)", *Population Studies-a Journal of Demography*, vol. 52, No. 1, pp. 49-65.

Hor L. B., R. Detels, S.H. Heng and P. Mun (2005) "The role of sex worker clients in transmission of HIV in Cambodia", *International Journal of STD & AID*S, vol. 16, No. 2, pp. 170-174.

Im-em W., M. VanLandingham, J. Knodel, C. Saengtienchai (2001). "Knowledge and attitudes of older people about HIV/AIDS in Thailand: A comparison with young adults", *PSC Research Report*, No. 01-464, University of Michigan, Population Studies Center, Ann Arbor, Michigan.

_____ (2002). "HIV/AIDS-related knowledge and attitudes: A comparison of older persons and young adults in Thailand", *AIDS Education and Prevention*, vol. 14, No. 3, pp. 246-262.

Kato, E.U. (2000). "Ageing in Cambodia: Tradition, change and challenges", In *Ageing in the Asia-Pacific Region*, Phillips D.R. (eds.), pp. 363-374, New York, NY : Routledge.

Kiernan, B. (2003). "The demography of genocide in Southeast Asia - the death tolls in Cambodia, 1975-79, and East Timor, 1975-80", *Critical Asian Studies,* vol. 35, No. 4, pp. 585-597.

Knodel, J. (forthcoming). "Parents of persons with AIDS: Unrecognized contributions and unmet needs", *Journal of Global Ageing.*

Knodel, J. and M. VanLandingham (2002). The impact of the AIDS epidemic on older persons. AIDS 2002, No.16 (suppl. 4), pp. S77-S83.

Knodel, J., S. Watkins and M. VanLandingham (2003). "AIDS and older persons: An international perspective", *Journal of Acquired Immunodeficiency*, Supplement 2, vol. 33, pp. S153-S165.

Knodel, J., S.K. Kim, Z. Zimmer and S. Puch (2005). "Older persons in Cambodia: A profile from the 2004 Survey of Elderly", Royal University of Phnom Penh and UNFPA, Phnom Penh. (Also available as Research Report 05-576, University of Michigan, Population Studies Center, Ann Arbor, Michigan).

_____ (2006). The Impact of AIDS on Older-age Parents in Cambodia, Research Report No. 06-594, University of Michigan, Population Studies Center, Ann Arbor.

Leblanc, A.J. (1993). "Examining HIV-related knowledge among adults in the United States", *Journal of Health and Social Behavior*, vol. 34, No. 1, pp. 23-36.

McCraig, L. and D. Winn (1991). "Knowledge about AIDS and HIV in the US adult population: influence of the local incidence of AIDS", *American Journal of Public Health*, vol. 81, No. 12, pp. 1591-1595.

Ministry of Planning, Cambodia (2003). *Cambodia Millennium Development Goals Report 2003*, Phnom Penh: Ministry of Planning.

Montazeri, A. (2005). "AIDS knowledge and attitudes in Iran: results from a population-based survey in Tehran", *Patient Education and Counseling*, No. 57, pp. 199-203.

National Institute of Statistics, Cambodia (2001). *Cambodia Demographic and Health Survey 2000*, Phnom Penh, Cambodia and Calverton, MD, National Institute of Statistics and OR Macro.

People's Daily (2006). Cambodia urges media to help raise public awareness on HIV/AIDS, Beijing: People's Daily.

Porter, S.B. (1993). "Public knowledge and attitudes about AIDS among adults in Calcutta", *AIDS Care*, vol. 5, No. 2, pp. 169-176.

UNAIDS (2006). *2006 Report on the Global HIV/AIDS Epidemic*, UNAIDS, Geneva.

United Nations (2002). *HIV/AIDS Awareness and Behaviour*, United Nations Population Division, New York.

United Nations (2005). *Population, Development and HIV/AIDS with Particular Emphasis on Poverty: the Concise Report*, United Nations Population Division, New York.

Zimmer, Z. and S.K. Kim (2001). "Living arrangements and socio-demographic conditions of older adults in Cambodia, *Journal of Cross-Cultural Gerontology*, vol. 14, No. 4, pp. 353-381.

The Inaccessibility
and Utilization of Antenatal
Health-Care Services in
Balkh Province of Afghanistan

*Inequality in the use of antenatal care persists due to lack of access to
health services which can be reduced by expanding outreach
health facilities in the remote communities*

By Abdullahel Hadi, M. Naeem Mujaddidi, Taufiqur Rahman
and Jalaluddin Ahmed*

More than 500,000 maternal deaths occur worldwide every year, of which a
quarter to a third of all deaths is the result of pregnancy-related complications (WHO,
2000). The regional variation in reproductive health outcome is also very wide as

* Abdullahel Hadi, Coordinator, Research and Evaluation Unit, BRAC Afghanistan, Kabul,
Afghanistan, e-mail: hadi_a1953@yahoo.com; M. Naeem Mujaddidi, Research Associate, Research
and Evaluation Unit, BRAC Afghanistan, Kabul, Afghanistan, e-mail:
mnayeem20042000@yahoo.com; Taufiqur Rahman, Programme Manager, BRAC Afghanistan,
Kabul, Afghanistan, e-mail: taufique_brac@yahoo.com and Jalaluddin Ahmed, Programme Head,
Health Programme, BRAC Bangladesh, Dhaka, Bangladesh, e-mail: jalaluddin_a2003@yahoo.com.

about 99 per cent of maternal deaths occur in developing countries. A woman living in Africa faces 200 times greater risk of dying from complications related to pregnancy than a woman living in an industrialized country (WHO, 2000).

The International Conference on Population and Development (ICPD) in 1994 viewed reproductive health in a broader development context (United Nations, 1995). Under the safe motherhood initiative, all pregnant women are expected to receive basic antenatal care. The package includes monitoring pregnancies for signs of complications, treating concurrent problems of pregnancy, providing iron supplements, tetanus toxoid immunization and counseling on preventive care and related issues. The purposes of providing such services was to identify signs of, or risk factors for, complicated pregnancies and identify the appropriate health provider (Vanneste and others, 2000; Magadi, Madise and Rodrigues, 2000; Matthews and others, 2001). While such care plays a critical role in establishing trust between the pregnant woman and health services provider (WHO, 1996; Matthews and others, 2001), it was suggested that unnecessary antenatal visits should be lowered to reduce the cost of services (Villar and Bergsjo, 1997).

Implementation of the recommendations of ICPD Programme of Action, however, was not simple and easy in most developing countries. The researchers and policy makers realized that the provision of expanded health services alone would not lead to increased utilization of antenatal care (Magadi, Madise and Rodrigues, 2000; Basu, 1990) as some women were more likely to use services than others, the other conditions remaining similar. Social structure and individual traits were found to have considerable influence in receiving antenatal health services (Matsumura and Gubhaju, 2001). Socio-economic factors such as access to the basic services, education, employment and communication also influenced the use of antenatal care (Prasad, 2000; Matsumura and Gubhaju, 2001).

Reproductive health services in Afghanistan

Health-care infrastructure is severely limited in Afghanistan owing to the civil war that spanned over two decades, a lack of awareness of the need for such services, poorly trained medical staff, and inadequate supplies of drugs and equipments in those health facilities (NRVA, 2004). According to an estimate, there was one medical doctor for every 50,000 people and only 29 per cent of the population had had access to health services in 2004 (UNDP, 2004). Maternal mortality rate was highest in the world with 1,600 per 100,000 live births (UNDP, 2004). Less than 15 per cent of deliveries were attended by skilled health workers (World Bank, 2005). Severe poverty, insecurity, inaccessibility to basic services and discrimination against women are widespread in Afghanistan.

Since 2003, the Government of Afghanistan has been implementing the Basic Package of Health Services (BPHS) with non-governmental organizations acting as implementing agencies (Afghanistan, 2005). Important components of this community-based health package include maternal and newborn health, child health and immunization, nutrition, communicable diseases, mental health, disability and the supply of essential drugs. BRAC, an international NGO, has been implementing the basic health services in Balkh province through hospitals, comprehensive health centres, basic health centres, mobile clinics and the health posts since 2004 in order to ensure access to basic health services for the population living in the province (BRAC, 2006).

The Government of Afghanistan and other agencies have already devoted considerable amount of resources for the promotion of reproductive health services in the country. It is not known whether such services were adequately utilized by pregnant women in most of the project communities. This study assesses the levels of and differentials in utilization of antenatal care services in the Balkh province of Afghanistan.

Data and methods

The data for this study came from a randomly selected household survey that provided information on the socio-demographic characteristics of households and utilization of health services during pregnancy. The database maintained by the Central Statistics Office (CSO) of the Government of Afghanistan was used as the sampling frame. Three-stage sampling procedure was employed to select women in the sample. First, six districts were selected at random out of all the districts in the province. Second, five villages (or clusters in urban areas) were chosen randomly from each selected district which constituted 30 villages or clusters distributed throughout the province. Finally, 15 households were selected in each village/cluster by systematic random sampling. Thus, the total sample size from this study was (30x15) or 450 households. All women in the selected households who had given birth during the last two years preceding the survey were considered eligible for the study. Data were collected by a team of female interviewers who were trained in survey research techniques. A total of 497 women were interviewed in August 2006.

The study focuses on the utilization of antenatal care as the outcome variable. The main independent variable was accessibility to health facilities. There were other variables in the analytical framework such as age and education of women, poverty level, participation in economic activities and region of residence.

The utilization of antenatal care was understood at two levels, namely adequate[1] and moderate.[2] Accessibility[3] was categorized into difficult to access and easier to access depending on the access to the health facilities. Age of women was categorized into four groups. Education of women was coded as illiterate, primary and higher. Poverty level was categorized as non-poor and poor. The women's involvement in economic activity was coded as involved and not involved. Residence was coded as urban and rural. This study has followed the cross-sectional approach that might have generated biased estimates. The influence of endogeneity or selection bias was adjusted by employing multivariate analyses (Aldrich and Nelson, 1984).

Table 1. Profile of sample women by their access to health facilities

Study variable	Accessibility [a]		All
	Difficult	Easier	
Percentage of women below 30 years old	42.0	31.9	35.4
Percentage with some education	33.1	31.6	32.1
Percentage living in poverty	76.9	61.3	66.7
Percentage economically avtive	62.2	27.1	39.0
Percentage living in urban area	..	47.2	31.1
Number	**169**	**326**	**495**

[a] Accessibility was categorized into difficult to access and easier to access. If a pregnant woman could reach the nearest health facility in less than three hours, she was categorized as having access to antenatal health-care services.

Findings

Profile of women

The differentials in sociodemographic characteristics of sample women by accessibility to health facilities were considerable (table 1). About a third (35.4 per cent) of the women included in the study were under 30 years, the mean age being 32.8 years. The proportion of younger women was higher in the areas where access was categorized as difficult (42.0 per cent) than in areas where access was found relatively easier (31.9 per cent). Average female literacy rate was 32.1 per cent with a mean of 1.6 years of schooling. The literacy rate was marginally higher in areas that are difficult to access rather than easily accessible areas. Two third of the women studied were poor. The concentration of poverty was higher in areas that are not easily accessible (76.9 per cent) than easily (61.3 per cent). While 39 per cent of women were involved in economic activities other than usual household

chores, most of them (62.2 per cent) were found to live in relatively inaccessible areas. About 31.1 per cent of the women studied resided in urban areas but 47.2 per cent of the women who had easy access to health facilities lived in the urban areas. No urban clusters were found in areas that are not easily accessible.

Table 2. Use of antenatal health-care services by women's access to health facilities

Types of services received	Accessibility		All
	Difficult	Easier	
Weight measurement	20.1	41.1	33.9
Height measurement	8.3	28.8	21.8
Blood pressure measurement	27.8	48.8	41.6
Urine test	4.1	27.0	19.2
Blood test	2.4	25.2	17.4
Information about possible complications	7.7	43.6	31.3
Information about sources of help	10.1	47.9	34.9
Iron tablet/syrup	23.1	44.5	37.2
Tetanus injections	33.7	45.1	41.2
Moderate [a]	*22.5*	*55.5*	*44.2*
Adequate [b]	*7.1*	*39.3*	*28.3*

[a] If the woman received at least 3 of the 9 types of antenatal health-care services, she was categorized as "moderately served person".

[b] A woman was considered "adequately served" if she had received at least 5 of the 9 types of antenatal health-care services.

Use of antenatal care by accessibility, participation in economic activity and education

The differences in the utilization of antenatal care by accessibility, participation in economic activity and education of women are shown in tables 2 to 4. Of the nine types of services examined, the performance was found highest for monitoring blood pressure (41.6 per cent) and receiving tetanus injections (41.2 per cent) followed by taking iron tablets (37.2 per cent) and getting the information on the sources of potential support (34.9 per cent). Other services such as weight measurement (33.9 per cent) and counselling regarding possible complications (31.3 per cent) were also widely provided. Comparing two areas, the use of the various services was found higher in the easier than in difficult-to-access areas. Only 28.3 per cent of women adequately used (or received at least 5 out of 9 types) antenatal care services. The disparity in receiving adequate services was very wide

as 39.3 per cent of women living in the easily accessible areas compared with only 7.1 per cent of women living in the difficult-to-access areas received such services. The proportion of women who received moderate level of services (at least 3 of the 9 services) was estimated at 44.5 per cent in the areas studied. As expected, the use of services was much higher in the easier (55.5 per cent) than in the difficult-to-access (22.5 per cent) areas. The differences in estimates between the areas are statistically significant at <0.01.

Table 3. Use of antenatal health-care services by women's involvement in economic activities

| Types of services received | Economic activity | | P-value |
	Not involved	Involved	
Weight measurement	39.4	25.4	<0.01
Height measurement	24.8	17.1	<0.05
Blood pressure measurement	46.7	33.7	<0.01
Urine test	21.2	16.1	<0.10
Blood test	19.2	14.5	ns*
Information about possible complications	38.1	20.7	<0.01
Information about sources of help	40.1	26.9	<0.01
Iron tablet/syrup	41.4	30.6	<0.05
Tetanus injections	47.0	32.1	<0.01
Moderate	*51.7*	32.6	<0.01
Adequate	*32.8*	21.2	<0.01

*   ns = not significant.

The utilization of antenatal care (ANC) services was differentiated by the participation of women in economic activities (table 3). The use of each of the ANC services (except blood test) was significantly lower among women who were involved in economic activities than among those not economically active. This indicates that involvement in such activities might have created extra burden on them and reduced the time they had available for receiving such services. As a result, both the moderate and adequate level of services were significantly higher among women who were not economically active than among those who were involved in economic activities during pregnancy.

In order to gain a better understanding of the relationship between women's economic activity and access to ANC services, table 4 was calculated. It demonstrates that in rural areas, economically active women are

much less likely to access ANC services as compared with non-economically active women. The relationship is the opposite in urban areas, where economically active women are slightly more likely to access ANC services. Thus, the negative relationship between economic activity and use of services found in table 3 is a result solely of the situation in rural areas. It is possible that in rural areas, among women with at least six years of schooling, those who were economically active were more likely to use ANC services. Also among women with little or no education that economic activity is an impediment to the use of ANC services. In the absence of formal employment opportunities in rural areas, it may be postulated that rural women with little education who are working are doing so because they are compelled by low family income. The combination of low income, low education, rural residence and need to work meant that these women were much less likely to use ANC services than were those who were not economically active.

Table 4. Percentage of women economically active, by use of ANC services, educational level and residence

	Moderate		Adequate	
	Economically active	Not economically active	Economically Active	Not economically active
Education				
None	26.0	49.8	15.7	33.0
Grade 1-5	30.0	56.7	17.5	31.7
Grade 6 and beyond	69.2	54.5	53.8	33.3
Residence				
Rural	22.5	40.5	13.9	26.8
Urban	70.5	69.0	47.6	42.9

Education not only strengthened the ability of women to understand the options available to them and modified their attitudes to seek care, but also increased their ability to make good use of health services (World Bank, 1993; Cook and Fathalla, 1996). Although positively associated with the use of antenatal health services, the role of education on the use of services was weak and most of the relationships were not statistically significant (see table 5). The difference in the use of antenatal care by education at both moderate and adequate levels was weakly significant.

Table 5. Use of antenatal health-care services by education of women

Types of services received	Education		P-value
	Illiterate	**Literate**	
Weight measurement	31.1	37.1	<0.10
Height measurement	21.7	22.0	ns*
Blood pressure measurement	40.2	44.7	ns
Urine test	18.5	20.8	ns
Blood test	17.6	17.0	ns
Information about possible complications	29.8	34.6	ns
Information about sources of help	33.3	38.4	ns
Iron tablet/syrup	36.9	37.7	ns
Tetanus injections	37.2	49.7	<0.01
Moderate	*40.8*	*51.6*	*<0.05*
Adequate	*26.5*	*32.1*	*<0.10*

* ns = not significant.

Other correlates of the use of antenatal care

The influence of other socio-economic factors on the use of antenatal care is shown in table 6. Age of women appeared to be negatively associated with the use of services. By contrast, years of schooling had a significant positive influence at both moderate and adequate levels of services. While the use of services among the poor was lower than among non-poor, the differences were not statistically significant. The use of services appeared to be negatively associated with the involvement in economic activities. The utilization of antenatal care was much higher among women living in urban than among those living in rural areas. As found earlier, participation in economic activity and difficulty in accessing the health facilities had significant negative consequences on the use of antenatal care services.

Table 6. Socio-economic differentials in the use of antenatal services

Socio-economic factor	Use of services	
	Moderate	**Adequate**
All	**44.2**	**28.3**
Age (year)		
10 – 19	50.0	28.6
20 – 29	50.3	32.9

.../

Table 6. *(Continued)*

Socio-economic factor	Use of services	
	Moderate	**Adequate**
30 – 39	45.9	27.6
40 – 49	33.1	23.4
P-value	*<0.01*	<0.10
Education		
None	40.8	26.5
Grade 1-5	46.0	26.0
Grade 6 and beyond	61.0	42.4
P-value	*<0.01*	<0.05
Poverty		
Poor	43.3	27.0
Non-poor	46.1	30.9
P-value	*ns*	ns
Economic activity		
Active	32.6	21.2
Inactive	51.7	32.8
P-value	*<0.01*	<0.05
Residence		
Rural	32.6	21.1
Urban	70.1	44.2
P-value	*<0.01*	<0.01
Numbers	**495**	**495**

Factors predicting the use of antenatal care: Multivariate analysis

The net effects of the predictors on the use of antenatal care were estimated by using two models for both moderate and adequate levels of use (table 7). In model I, the effects of education of women and their involvement in economic activities were estimated controlling for the effects of age, poverty and residence. In model II, accessibility as a major predictor of use was added to understand the change of the odds ratios of the other predictors. Age of women appears to have negative effects on the use of antenatal care in both models for both levels of services although the effects were not statistically significant. Among other predictor variables, education of women raised the utilization of services after adjusting for the influence of confounding factors. The utilization of services was higher among non-poor respondents than among poor although the differences were not significant. Pregnant women not involved in economic activity were

significantly more likely to use the services than women who took part in such activities. Living in urban areas significantly (except model II of the adequate level) increased the likelihood of receiving services than living in rural areas. The effects of accessibility on health services, as found in the bivariate analysis, were also significant in both moderate and adequate levels as shown in model II of both levels. It should be pointed out that the effects of education and women's involvement in economic activity have remained significant at moderate level, even when the accessibility variable was added to the model.

Table 7. Odds ratios for selected predictors of the use of services

Predictor	Use of services			
	Moderate		Adequate	
	Model I	Model II	Model I	Model II
Age (year)				
10 – 19	1.00	1.00	1.00	1.00
20 – 29	0.90	0.96	1.15	1.29
30 – 39	0.68	0.67	0.83	0.81
40 – 49	0.38	0.36	0.69	0.61
Education				
None	1.00	1.00	1.00	1.00
Grade 1-5	1.36	1.57 [a]	1.06	1.32
Grade 6 and beyond	1.75 [a]	1.53	1.73 [a]	1.40
Poverty				
Poor	1.00	1.00	1.00	1.00
Non-poor	1.23	1.07	1.24	0.97
Economic activity				
Active	1.00	1.00	1.00	1.00
Inactive	1.89 [c]	1.53 [a]	1.59 [b]	1.06
Residence				
Rural	1.00	1.00	1.00	1.00
Urban	4.76 [c]	3.26 [c]	2.71 [c]	1.41
Accessibility				
Difficult		1.00		1.00
Easier		2.51 [c]		7.72 [c]
– 2 Log likelihood	591.2	579.2	550.5	511.4
Pseudo R squared	0.22	0.25	0.11	0.21

[a] = p< 0.10;   [b] = p< 0.05;   [c] = p< 0.01

Discussion

The utilization of antenatal care has remained low and significant accessibility-related inequality has persisted in the Balkh province of Afghanistan. Although it is not certain whether areas with easier access would lead to increased utilization of services in the remote villages (Magadi, Madise and Rodrigues, 2000), there were evidences that suggested that the lack of access not only reduced service utilization but also forced many pregnant women to seek alternative health care, not acceptable by any standard (Whitehead, Dahlgren and Gilson, 2001).

Regardless of the increasing availability of reproductive health services in recent years, poor women in the remote villages of the province continue to suffer from lack of access to services. This study clearly shows that inaccessibility, illiteracy, poverty and involvement of pregnant women in economic activities were major barriers to the use of antenatal care. It should be recognized, however, that the health status of the population could not be improved further without fundamental changes brought about to education, income and quality of life. As short-term measures, it would be appropriate to identify the constraints as well as policy options in connection with the provision of health services in remote communities.

Although poor women living in remote villages face worse reproductive health outcome than others, poverty and remoteness are not insurmountable barriers to the provision of health services if appropriate measures are taken and implemented (Hadi and Gani, 2005). This implies that grassroot development workers stimulate the demand for pregnancy-related care by mobilizing the communities through sustained awareness raising campaign. While the primary target of awareness raising programme should be pregnant women and their family members, other stakeholders and community leaders such as *shura*[4] members could also be included.

Demand creation should accompany the expansion of services in the outreach communities. BRAC has been running mobile clinic services in some villages with impressive success in other areas of the country. This network can be expanded to remote villages where health coverage has remained low. Given that reaching health facilities to receive antenatal care is often difficult for pregnant women particularly during the very cold season, it is suggested that expanding mobile clinic services would be a viable option to significantly raise the coverage and reduce the accessibility-related inequality in the use of antenatal care services.

Providing incentives to community health workers (CHW) was found to be very effective in raising their productivity in the Afghan context (Hadi and others,

2007). A carefully designed incentive scheme for grassroots community workers in the under-served areas is likely to help promote the antenatal care coverage.

Unlike the experience of other South-East Asian countries, the participation in economic activity significantly reduces the use of antenatal services in Balkh province. Although the use of services among working women was higher than among non-working women, especially better educated women living in urban areas, it is assumed that most of the economically active women were involved in informal sector as unpaid family workers, in addition to carrying out routine household chores. As a result, it may have been difficult for many pregnant women to visit health facilities during specific hours on stipulated days. More flexible timing based on the choice of pregnant women themselves, may have raised the coverage of the ANC services further.

Evidence suggests that the antenatal care could be significantly raised in Afghanistan where the accessibility-related barriers have been reduced (Egmond and others, 2004). The Government has also committed to ensuring health services in 95 per cent of districts in Afghanistan in its pursuit of the Millennium Development Goals (MDGs) while priority has been placed on improving the quality and availability of antenatal care (UNDP, 2005). The study, therefore, concludes that the expanded outreach services, focussing on poor women in inaccessible communities, can significantly improve the utilization of antenatal care in Afghanistan.

Endnotes

1. A woman was considered to be adequately served if she received at least 5 of the 9 types of antenatal health-care services.

2. If the woman received at least 3 of the 9 types of antenatal health services, she was regarded as moderately-well served person.

3. Accessibility was categorized into difficult to access and easier to access. If a pregnant woman could reach the nearest health facility in less than three hours, the woman was considered to have access to antenatal health-care services.

4. *Shura* is a traditional committee set up in each village that has the informal authority to administer the village.

References

Afghanistan (2005). *A Basic Package of Health Services for Afghanistan* (Kabul, Ministry of Public Health, Islamic Republic of Afghanistan).

Aldrich, J.H. and F.D. Nelson (1994). *Linear Probability, Logit and Probit Models* (Beverly Hills, Sage Publication).

Akhter, H.H. and others (1996). *A Cross-Sectional Study on Maternal Morbidity in Bangladesh* (Dhaka, BIRPERHT).

Basu, A.M. (1990). "Cultural influences on health care use: two regional groups in India", *Studies in Family Planning*, vol. 21, No. 5, pp. 275-286.

Bangladesh Rural Advancement Committee (BRAC) (2006). *Annual Report 2005* (Kabul, BRAC Afghanistan).

Cook, R.J. and M.F. Fathalla (1996). "Advancing reproductive rights beyond Cairo and Beijing" *International Family Planning Perspectives*, vol. 22, No. 3, pp. 115-121.

Egmond, K. and others (2004). "Reproductive health in Afghanistan: Results of a knowledge, attitude and practice survey among Afghan women in Kabul" *Disaster*, vol. 28, No. 3, pp. 269-282.

Hadi, A. and M.S. Gani (2005). "Socio-economic and regional disparity in the utilization of reproductive health services in Bangladesh". *Measuring Health Equity in Small Areas* (ed. Indepth Network), (London, Ashgate Publishers).

Hadi, A. and others (2007). "Raising institutional delivery in war-torn communities: Experience of BRAC in Afghanistan", *Asia-Pacific Family Medicine Journal*, vol. 6, No. 1 (in press).

Magadi, M.A, N.J. Madise and R.N. Rodrigues (2000). "Frequency and timing of antenatal care in Kenya: Explaining variations between women of different communities", *Social Science and Medicine*, vol. 51, No. 4, pp. 551-561.

Matthews, Z. and others (2001). "Antenatal care, care-seeking and morbidity in rural Karnataka, India: Results of a prospective study" *Asia-Pacific Population Journal*, vol. 16, No. 2, pp. 11-28.

Matsumura, M. and Bina Gubhaju (2001). "Women's status, household structure and the utilization of maternal health services in Nepal" *Asia-Pacific Population Journal*, vol. 16, No. 1, pp. 23-44.

National Risk and Vulnerability Assessment (NRVA) (2004). *The National Risk and Vulnerability Assessment 2003,* Rural Afghanistan. Kabul: Islamic State of Afghanistan and World Food Programme.

Prasad, P. (2000). "Health care access and marginalized social spaces. Leptospirosis in south Gujarat" *Economic and Political Weekly*, vol. 35, No. 41, pp. 3688-3694.

UNDP (2004). *Human Development Report 2004* (New York, UNDP).

_____ (2005). *Millennium Development Goals.* Islamic Republic of Afghanistan, Country Report 2005, (New York, UNDP).

United Nations (1995). *Report of the Fourth World Congress on Women* Document A.Conf. 177/20 (New York, United Nations).

Vanneste, A.M. and others (2000). "Prenatal screening in rural Bangladesh: from prediction to care", *Health Policy and Planning*, vol. 15, No. 1, pp. 1-10.

Villar, J. and P. Bergsjo (1997). "Scientific basis for the content of routine antenatal care: philosophy, recent studies, and power to eliminate or alleviate adverse maternal outcomes", *Acta Obstetrica et Gynecologica Scandinavica*, No. 76, pp. 1-14.

Whitehead, M., G. Dahlgren, and L. Gilson (2001). "Developing the policy response to inequities in health: a global perspective". In T. Evans, M. Whitehead, F. Diderichsen, A. Bhuiya and M. Wirth (eds). *Challenging Inequities in Health. From Ethics to Action* (New York, Oxford University Press).

World Bank (1993). *World Development Report 1993. Investing in Health* (Washington DC, Oxford University Press).

_____ (2005). *National Reconstruction and Poverty Reduction – the Role of Women in Afghanistan's Future* (Washington DC, The World Bank).

WHO (1996). *Care in Normal Birth: A Practical Guide* (Geneva, WHO/FRH/MSM 96-24).

_____ (2000). "Pregnancy exposes women in poor states to 200-fold risk of death, compared with rich ones, says WHO". *Populi*, vol.27, No. 2, p. 4.

Sociocultural and Geographical Disparities in Child Immunization in Nepal

Sociocultural background of children, their place of residence, parental education, household income, and access to health services do matter in terms of vaccination coverage in Nepal.

By Prem Bhandari, S.S. Shrestha and D.J. Ghimire*

Universal child immunization against vaccine-preventable diseases is recognized as one of the most cost-effective ways of reducing infant/child mortality in developing countries (Westly, 2003; Du Lou and Pison, 1996; Ministry of Health [Nepal], New Era, & ORC Macro, 2002; Department of Health Services/Nepal, 2000/2001). However, a considerable proportion of children

* Prem Bhandari, Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University, University Park, PA 16802, United States of America; e-mail: pbb115@psu.edu; Sundar S. Shrestha, Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University; e-mail: sss190@psu.edu and Dirgha J. Ghimire, Population Studies Center, University of Michigan; e-mail: nepdjg@isr.umich.edu.

living in many developing countries are deprived of receiving a complete course of immunization (Westly, 2003). In an effort to understand the key determinants of low prevalence of childhood immunization, previous studies have primarily focused on household structures (Gage, Sommerfelt and Piani, 1997; Bronte-Tinkew and Dejong, 2005); household economic resources (Bronte-Tinkew and Dejong, 2005); parental (particularly maternal) education (Desai and Alva, 1998; Streatfield, Singarimbun and Diamond, 1990); community contexts such as access to health services, community social structure and rural-urban residence (Pebley, Goldman and Rodriguez, 1996); access to health infrastructures and insurance (Gore and others, 1999), and political, institutional and organizational factors (Gauri and Khaleghian, 2002) as potential determinants. These studies have focused on Africa (e.g., Jamaica, Trinidad and Tobago), Central America (e.g., Guatemala) and North America and do not reflect the relevance of sociocultural backgrounds and geographical disparities existing in Nepal.

In a multi-ethnic, geographically diverse, economically underdeveloped and socially traditional society such as the one of Nepal, dissemination of knowledge and use of modern health-care technologies and services are found to be strongly correlated with individuals' socio-economic background and the geographical location of their residence (Justice, 1989; Pigg, 1996). In a recent study of Nepal, Matthews and Gubhaju (2004) found an important association between the location of women's place of residence and their ethnicity and the use of antenatal care. In addition, the disparities in social identity based on caste, ethnicity, region of origin (geographic) and gender also determine the access to and control over economic, political and cultural resources (Acharya and Bennet, 1981; Bista, 1991; Pradhan and Shrestha, 2005). Therefore, it is expected that sociocultural background of children and geographical locations they live in are important predictors of child immunization in Nepal.

Recently, the issue of sociocultural and geographical disparity in various aspects of socio-economic development, including health and well-being has received much attention in Nepal (viz. NPC, 2003; Pradhan and Shrestha, 2005; Norwegian Refugee Council/Global IDP Project, 2003; Asian Development Bank, 2002; NESAC, 1998; Lawati, 2001). Socioculturally, people are often discriminated against along caste/ethnicity and gender lines (Pradhan and Shrestha, 2005; Norwegian Refugee Council/Global IDP Project, 2003; Asian Development Bank, 2002; NESAC, 1998; Lawati, 2001). The Norwegian Refugee Council/Global IDP Project (2003), for example, reported a disproportionate distribution of wealth and power in favour of high caste individuals (e.g., Brahmin, Chhetri), while lower castes (also called *Dalits* or untouchables) and minority

ethnic groups (hill and terai ethnic groups) are disproportionately affected by widespread poverty, health problems and lack of public health awareness. Along gender lines, the same project also reported that women in Nepal face reduced opportunities and discrimination at all levels including medical care. The Asian Development Bank (2002) also noted the persistent gender-based exclusion with discrimination against women affecting their survival, health and educational opportunities, ownership of assets and mobility. Similarly, using the Demographic and Health Survey data from developing counties, Hill and Upchurch (1995) reported a gender gap in child immunization and its significant effect on mortality favouring boys.

Figure 1. Nepal: Ecological and political divisions
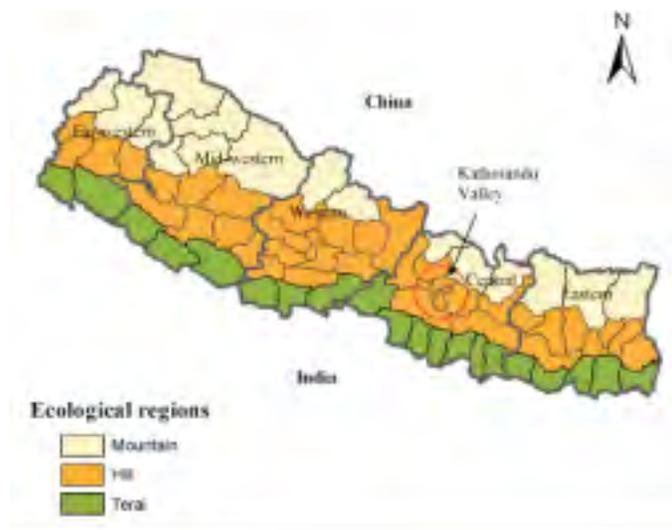
Geographical disparity in Nepal is another key issue of concern. Ecologically, Nepal can be divided into three prominent regions – the mountains, the hills and the Terai. The Terai region is flat and relatively accessible compared with the hills and the mountains. Geopolitically, the country is divided into five different regions – eastern, central (including the Kathmandu Valley where the capital city is located), western, mid-western and far-western (figure 1). An overwhelming majority of people live in rural areas. For instance, in 2004, only 16 per cent of them lived in urban areas. The Asian Development Bank (2002)

reported a wide gap in socio-economic development across politico-geographical regions, ecological zones and rural-urban areas of Nepal. Historically, the eastern region, particularly the eastern Terai and the central hills especially the Kathmandu Valley, have received much attention from the Government (Gurung, 1998). Ecologically, the mountain region is in most disadvantageous position owing to its rugged terrain compared with the hills and the Terai. Obviously, people living in rural areas have relatively limited access to modern health services and most children do not receive treatment when they get sick (NESAC, 1998). NESAC (1998) also reports a large rural-urban difference in child/infant mortality rate in the country.

Given this background, the present study examines whether children were disadvantaged in receiving immunization because of sociocultural factors such as caste, ethnicity, gender and place of residence (e.g., residence in the eastern or western region, in the hills, mountains or Terai, or residence in rural or urban areas of the country). In addition, this study also examined the effects of parental education and occupation, household economic status, perceived access to health services, and various child characteristics on immunization. Since childhood immunization is an important public service supposedly available free of cost to everyone, it is expected that no child is left behind in receiving immunization service due to his/her sociocultural (caste/ethnicity and gender) background, place of residence, and other socio-economic characteristics.

Significance

Reducing child mortality under the age of 5 by two thirds is one of the United Nations Millennium Development Goals (United Nations, 2005). The United Nations (2005) reported that almost 30,000 children die each day worldwide from preventable diseases before their fifth birthday. Most of these children live in developing countries, particularly in sub-Saharan Africa and South Asia. Achieving this particular Goal by 2015, therefore, requires a significant reduction in child mortality in sub-Saharan African and South Asian countries, where child mortality from communicable diseases predominates (United Nations, 2005). Nepal has a high level of infant and child mortality. For instance, infant mortality in Nepal was reported to be 64 deaths per 1,000 live births in 2005 (PRB, 2005). This has contributed to a high level of under-5 year mortality in the country, which was recorded at 91 deaths per 1,000 live births in 2002 (Westly, 2003; NPC, 2003). It is well recognized that most child deaths are attributed to easily preventable or treatable causes (United Nations, 2005; Bonanni, 1999; NESAC, 1998).

Universal immunization of infants before their first birthday against six vaccine-preventable diseases (tetanus, pertusis, measles, acute respiratory tract infection, polio, tuberculosis and diarrhoea) is one of the most cost-effective ways of reducing infant/child mortality in developing countries (Westly, 2003; Du Lou and Pison, 1996; Ministry of Health [Nepal], New Era, & ORC Macro, 2002; Department of Health Services/Nepal, 2000/2001). The 1990 World Summit for Children, therefore, sets a goal to achieve full immunization coverage of at least 90 per cent of children under the age of one by 2000. However, none of the countries in South Asia that are covered by the Demographic Health Surveys (Bangladesh, India, Nepal, and Pakistan) have met this target (Westly, 2003). In Nepal, only 60 per cent of the children were fully immunized by 12 months of age in 2001 (Ministry of Health [Nepal], New Era, & ORC Macro, 2002; Suvedi, 2003). Therefore, an understanding of the factors contributing to low childhood immunization against vaccine-preventable diseases and implementation of policies targeting appropriate groups at the local level is critical to achieve the related Millennium Development Goal by 2015.

Sociocultural disadvantages in childhood immunization

Caste/ethnicity and gender are two important loci of sociocultural structures of the Nepalese society (NESAC, 1998). Nepal is characterized by an admixture of various caste, sub-caste and ethnic groups. The 2001 census reported 100 such caste/ethnic groups in Nepal (Dahal, 2003; also see annex 3.1 for details regarding the ethnic/caste composition of Nepal based on the 2001 census). The hierarchical caste system is fundamental to the Hindu religion. High caste Hindus (e.g., Brahmin and Chhetri) are at the top of the social hierarchy and are presumed to be socioculturally, economically and politically advantaged as compared with other caste/ethnic groups (Dahal, 2003; Levine, 1987). Low caste Hindus (also called *Dalits* e.g., Kami, Sunar, Damai, Sarki) – considered as untouchables and positioned at the bottom of the social hierarchy – are historically disadvantaged in many respects. Ethnic categories (e.g., Gurung, Tamang, Magar, Newar also called *Janjatis*) basically Mongoloids may also have hierarchy within their system, but the social hierarchy is not as distinct as in other caste groups. Although discriminatory practices based on caste/ethnicity were legally abolished in 1962, such practices are pervasive in Nepal. It is believed that lower caste Hindus and ethnic minorities are discriminated upon or excluded from mainstream socio-economic development (NPC, 2003). Disparities can also be expected among ethnic groups in receiving immunization services owing to differences in access, information and cultural norms. Health services and immunization campaigns are usually based in communities that are relatively privileged.

Gender is equally important in the sociocultural system of Nepal. Since Nepal has a patrimonial societal structure, gender-based exclusion is persistent and deep-rooted (Asian Development Bank, 2002). The high value attached to sons compared with daughters are the root causes of gender-segregated discrimination resulting in differential involvement of men and women in terms of use and access to household productive resources, income, employment and household decision-making (NESAC, 1998; Pradhan and Shrestha, 2005; Norwegian Refugee Council/Global IDP Project, 2003; Asian Development Bank, 2002). Gender bias in nutrition and health is also well documented in India (viz, Das Gupta, 1987; Booth and Verma, 1992; Sen, George and Ostlin, 2002). It is reported that girls and boys, and women and men often do not receive equal treatment with regard to nutrition and health care, in favour of males.

A wide disparity in infant and child mortality between sons and daughters is reported in Nepal. There is significantly higher female child mortality in the country as compared with their male counterparts (NESAC, 1998; Ministry of Health [Nepal], New Era & ORC Macro, 2002). According to the 2001 Demographic Health Survey, the under-5 mortality for girls was estimated to be at 112.4; whereas, it was 104.8 for boys. As regards immunization, 67.5 per cent of male children aged 12-23 months received complete immunization as against 63.9 per cent of girls. Whether these differences still exist after accounting for other important factors such as household resources, parental education and sociocultural and geographic differences are, however, not clear.

Geographic disparity in childhood immunization

Another source of diversity in Nepal is geography. From an ecological perspective, the country is divided into three regions – the mountains, the hills and the Terai. These north-south ecological belts represent three major climatic regions. Significant differences are observed among these regions in terms of climate, biological production and physical infrastructure development. The climate in the Terai region varies from tropical to sub-tropical; whereas, it is mostly sub-tropical to alpine in the hills, and mostly alpine in the mountains. Physical infrastructure such as transportation and communication is relatively well developed in the Terai followed by the hills. The mountain region has little infrastructure development. Geopolitically, the country is divided into five different regions – eastern, central, western, mid-western and far-western. These political divisions, which extend from east to west, were created to even out the socio-economic disparities existing in the country. Only a small proportion of the population lives in urban areas.

Persistent inequalities across various geographical regions, ecological zones and rural urban areas are reported (Asian Development Bank, 2002). Historically, the eastern region, particularly the eastern Terai and the central hills (particularly the Kathmandu Valley) have received priority from the Government (Gurung, 1998). Ecologically, the Terai region is relatively privileged compared with the hills and the mountains in terms of infrastructure development, food production and access to public services. The mountain region is disadvantaged owing to its rugged terrain and poor production potential. The incidence of poverty is high in the mid- and far-western regions, rural areas, as well as in the mountains (Asian Development Bank, 2002; NESAC, 1998).

Disparity in child mortality is also observed across ecological and geopolitical regions and rural-urban areas of Nepal. According to the 2001 Demographic and Health Survey, the mountain region has an under-5 mortality of 157.4 followed by the Terai region (112.8) and the hill (93.9). In terms of geopolitical division, the under-5 mortality is estimated at 149.2, 111.0, 110.9, 104.8, and 83.7, for far-western, mid-western, central, eastern and western region of the country, respectively. Similarly, it is estimated at 111.9 in rural areas and 65.9 in urban areas. Comparable patterns have been reported in terms of receiving a complete course of vaccination by children. Therefore, this study also examines whether geographical differences in childhood immunization remain even after accounting for other factors.

Data and variables

This study utilized the 2001 Nepal Demographic and Health Survey data to examine sociocultural and spatial differences in childhood immunization. Two dependent variables are whether a child received: a) a complete course of immunization; and b) a complete course of each type of vaccine. A complete course of immunization constitutes eight vaccines: 1 dose of Bacillus of Calmette and Guérin (BCG) – a vaccine against tuberculosis; 3 doses of DPT – a mixture of three vaccines to immunize against diphtheria, pertussis and tetanus; 3 doses of polio; and 1 dose of measles.

The immunization outcome variable is differently used in various studies. Desai and Alva (1998) used this as a continuous measure, a count of the number of vaccinations received by the index child aged 12 months and over. Streatfield, Singarimbun and Diamond (1990), by contrast, used this variable as a dichotomy – whether a child received two or three DPT injections and three polio injections versus any less than that. Bronte-Tinkew and Dejong (2005) and Gage, Sommerfelt and Piani (1997) also used this variable as a dichotomy for children

aged 12-35 months receiving all eight vaccinations (BCG at birth, 3 doses of DPT and polio each, and 1 dose of measles) within 12 months of their birth. The authors followed the measure used by Bronte-Tinkew and Dejong (2005) and Gage, Sommerfelt and Piani (1997) as whether a child was fully immunized= '1,' versus '0' = otherwise for children of ages 12-23 months as used by the 2001 Nepal Demographic and Health Survey (Ministry of Health [Nepal], New Era, & ORC Macro, 2002).

Two broad categories of explanatory variables of interest include sociocultural backgrounds of children and their place of residence. Sociocultural variables included caste/ethnicity and gender. Children are grouped into five broad caste/ethnic groups: upper caste Hindu; low caste Hindu (or *Dalits*); hill ethnic groups, Terai ethnic groups and others (available upon request). High caste Hindu children are treated as the reference group as they are presumed to be privileged as compared to children from all other ethnic groups. Gender of a child is coded as '1' for boy and '0' for girl. Three different geographic variables relevant to Nepal are used. Those include (a) ecologicaly – the mountains (a reference category), the hill and the Terai; (b) geopolitical – eastern (a reference category), central, western, mid-western, and far-western; and (c) rural-urban residence (rural as a reference category). In addition, this study also examines the effects of child characteristics such as age, age-squared and birth order; parental characteristics such as mother's and father's education, their occupations, mother's report of distance to health facility; and household characteristics such as age and sex of the household head, and household wealth in order to net out the effects of sociocultural and geographical factors.

Analytical strategy

Logistic regression was used as a multivariate tool to analyse the data. Results are presented as odds ratios for ease of interpretation. For a continuous independent variable, an odds ratio greater than 1 indicates that the odds of a child being immunized increases when the independent variable increases; while an odds ratio of less than 1 indicates that the odds of a child being immunized decreases when the independent variable increases, as suggested by Menard (1995:49). For a categorical independent variable, "an odds ratio greater than 1 indicates an increased chance of an event occurring versus not, while an odds ratio less than 1 indicates a decreased chance of an event occurring versus not occurring" (Liao, 1994:15).

For a complete immunization model, first, the effects of sociocultural variables (Model I) and geographic variables (Model II) were estimated separately.

Then, both of these variables were included simultaneously in the equation to examine their overall effects (Model III). The full (or final) model (Model IV) estimated the effects of these variables net of child, parental and household characteristics. Similar strategy was followed to examine the sociocultural and geographical differences according to specific vaccine coverage. Only the results of the full model (similar to final or Model IV for complete immunization) that included all the variables used in the analysis are provided, however.

Results

Table 1 presents mean, standard deviation, minimum and maximum values for all the explanatory variables used in the analysis. The results in table 2 present the bivariate distribution of immunization coverage across sociocultural and geographic domains of interest. As presented in table 2, over two third of children (66 per cent) aged 12- 23 months received all eight vaccines (the complete course). Despite a remarkable achievement in immunization coverage in a short period of time, from 36 per cent in 1996 to over 60 per cent in 2001 (Westly, 2003), the present level of immunization coverage is still far below the target set by the 1990 World Summit for Children of covering at least 90 per cent of children under age 1 by 2000. When disaggregated by type of vaccine, 91 per cent of children received the full course of polio, followed by BCG (83 per cent), DPT (72 per cent), and measles (71 per cent) suggesting a differential use of vaccines by their types. There is a wide range in child immunization by type of vaccine (from 71 per cent measles to 91 per cent polio), which contributes to the low level of child immunization coverage in the country.

Table 1. Descriptive statistics of explanatory variables (N=1,213)

Explanatory variables	Mean	Standard Deviation	Min	Max
Sociocultural characteristics				
Ethnicity				
Upper caste Hindu (=0)	0.40	0.49	0	1
Lower caste Hindu *(Dalits)*	0.14	0.35	0	1
Hill (ethnic) Tibeto-Burmese	0.25	0.43	0	1
Terai ethnic	0.12	0.33	0	1
Others	0.09	0.28	0	1
Sex				
Male (=1)	0.49	0.50	0	1
Geographical characteristics				
Ecological				
Mountain (=0)	0.14	0.35	0	1

.../

Table 1 *(Continued)*

Explanatory variables	Mean	Standard Deviation	Min	Max
Hill	0.39	0.49	0	1
Terai	0.47	0.50	0	1
Geopolitical regions				
Eastern (=0)	0.22	0.42	0	1
Central	0.27	0.45	0	1
Western	0.15	0.36	0	1
Mid-western	0.15	0.36	0	1
Far-western	0.20	0.40	0	1
Rural-urban residence				
Urban (=1)	0.09	0.28	0	1
***Control*s**				
Child characteristics				
Age	17.51	3.42	12.00	23.0
Age-squared	318.38	119.94	144.00	529.0
Birth order	3.27	2.18	1	12
Parental characteristics				
Mother's education				
No education (=0)	0.71	0.45	0	1
Primary	0.15	0.36	0	1
Secondary or higher	0.14	0.35	0	1
Mother's occupation				
Self-employed (agriculture) (=0)	0.34	0.47	0	1
Not working	0.27	0.44	0	1
Else (Don't know, missing)	0.37	0.48	0	1
Partner's education				
No education (=0)	0.02	0.13	0	1
Primary	0.81	0.39	0	1
Secondary or higher	0.14	0.34	0	1
Else (don't know, missing)	0.05	0.23	0	1
Partner's occupation				
Self-employed (agriculture) (=0)	0.54	0.50	0	1
Professional/ business/ clerk/ service	0.24	0.43	0	1
Skilled manual	0.08	0.28	0	1
Unskilled manual	0.10	0.30	0	1
Else (Don't know, missing)	0.04	0.19	0	1
Mother's report of distance to health service				
Not a big problem	0.22	0.41	0	1
Small problem	0.22	0.41	0	1
A big Problem	0.53	0.50	0	1
Missing information	0.03	0.18	0	1
Household characteristics				
Sex of household head (female = 1)	0.11	0.31	0	1

.../

Table 1 *(Continued)*

Explanatory variables	Mean	Standard Deviation	Min	Max
Age of household head (years)	40.66	14.42	17	90
Wealth index				
Lowest quintile (=0)	0.27	0.45	0	1
Second quintile	0.22	0.41	0	1
Middle quintile	0.18	0.39	0	1
Fouth quintile	0.12	0.38	0	1
Highest quintile	0.15	0.36	0	1

Table 2. Share of childhood immunization coverage (N=1,213)

Variables	Vaccinations				
	All	BCG	DPT	Polio	Measles
Total	66.1	83.3	72.1	91.0	71.4
Sociocultural characteristics					
Caste/ethnicity					
Upper caste Hindu	67.8	81.4	72.1	90.9	73.3
Lower caste Hindu (*Dalit*)	62.1	82.8	69.0	88.5	69.0
Hill ethnic	72.3	86.7	78.0	91.3	76.3
terai ethnic	66.9	88.5	77.7	93.9	70.9
Others	46.7	76.6	52.3	90.7	53.3
Child's gender					
Male	67.8	85.1	74.1	91.7	73.3
Female	64.8	81.6	70.0	90.4	69.5
Geographical characteristics					
Ecological regions					
Mountain	64.4	78.2	67.2	85.6	73.0
Hills	68.4	81.0	74.5	89.7	71.7
terai	64.8	86.9	71.5	93.8	70.6
Geopolitical regions					
Eastern	73.7	91.1	80.4	95.6	78.5
Central	64.3	87.1	70.9	92.2	68.5
Western	64.3	84.3	72.4	93.5	67.0
Mid-western	66.1	81.4	72.1	86.9	74.9
Far-western	61.6	70.2	64.0	85.5	68.2
Rural-urban					
Rural	65.1	82.9	71.2	90.6	70.3
Urban	76.9	89.4	80.8	95.2	82.7

The findings revealed differences in childhood immunization by ethnicity (table 2). The complete immunization coverage ranged from 47 per cent among children belonging to the other minority groups (e.g., Bangali, Musalman, Rajbhar, Raute, Raji, and other minorities of the hill and Terai) to over 72 per cent for hill ethnic groups. However, contrary to the authors' expectations, high caste Hindu children were not always advantaged as compared with those of other ethnic groups. Over 72 per cent of children of hill ethnic group received complete course of immunization compared with only 68 per cent of those belonging to the high caste Hindu. The children of other minority groups (e.g., Bangali, Musalman, Rajbhar, Raute, Raji, and other minorities of the hill and Terai) seemed to be most disadvantaged. Interestingly, while about 91 per cent of the children of minority group received a polio vaccine, slightly over 52 per cent of them received a DPT and a measles vaccine. By gender, female children seemed to be disadvantaged in terms of receiving a complete course of immunization as well as receiving each type of vaccine. This distribution provides some indication of caste/ethnicity and gender disadvantages in childhood immunization coverage. Whether those differences still remain after accounting for other factors is important to understand and is described below.

The results of the multivariate logistic regression (table 3) suggest that caste/ethnicity does matter, although weakly, in receiving a complete course of immunization. Children of all other caste groups except those belonging to hill ethnic groups (e.g., Gurung, Magar, Newar) were found to be relatively disadvantaged compared with high caste Hindu groups (Model I, table 3). However, the difference was statistically significant only for those belonging to the other category (e.g., Bangali, Musalman, Rajbhar, Raute, Raji, and other minorities of the hill and Terai). Children belonging to this category were about 58 per cent less likely to receive a complete course of immunization compared with those belonging to the upper caste Hindu group (odds ratio = 0.412; p<0.000, Model I). These relationships are consistent even after controlling for the effects of geographic, child, parental and household characteristics (full model or Model IV). When the multivariate analysis was performed by disaggregating types of vaccines received by a child, a different scenario emerged (table 3). For instance, net of all other factors, while children belonging to the Terai ethnic group were found to be significantly more likely to receive DPT (odds ratio = 1.708; p<0.05), those belonging to lower caste Hindu were significantly more likely to receive a Measles vaccine (odds ratio = 1.427; p<0.10), whereas children of other minorities were significantly less likely to receive a DPT, a BCG and a measles vaccine compared with those of high caste Hindu. However, caste/ethnic groups were found to be indifferent in receiving a complete course of polio vaccine.

By gender, although male children were observed to be more likely to be fully immunized as compared with their female counterparts, the multivariate results did not show a strong evidence of gender bias against female children. However, by vaccine types, controlling for all other variables, males were significantly more likely to receive a DPT, a BCG, and a measles vaccine than female children.

The results of childhood immunization coverage by geographic regions revealed that a fewer proportion of children living in the mountains (64 per cent) were fully immunized compared with those living in the hills (68 per cent) and the terai (65 per cent). However, the coverage for measles vaccine was slightly greater in the mountains (73 per cent) than two other regions. Moreover, a fewer proportion of children were fully immunized in the western regions of Nepal compared with the eastern region. Results also show a rural disadvantage.

The multivariate results show a strong evidence of east-west (geopolitical) disadvantage in immunization coverage than by ecological (north-south) regions and rural-urban locations. Although the preliminary results (model II and Model III, table 3) indicated a strong rural-urban difference in using a complete course of vaccination favouring urban children, the difference was reduced and turned out to be statistically non-significant when other factors particularly parental education, household wealth and access to health services were controlled for. This could be because people living in urban areas are mostly educated and wealthy relative to their rural counterparts. Other reason could be the relative better access to health services in urban areas. Analysis performed by disaggregating vaccine types also revealed similar results.

By geopolitical regions, children who are living in the central (odds ratio = 0.615; p<0.01), western (odds ratio = 0.644; p<0.01), mid-western (odds ratio = 0.691; p<0.10), and far-western (odds ratio = 0.546; p<0.01) regions were significantly less likely to be fully immunized as compared with those living in the eastern region of the country, net of other geographic characteristics (Model II, table 3). With the exception of the mid-western region, the coefficients remained significant even after controlling for the effects of all other variables (Model IV), suggesting a strong evidence of eastern regional bias in vaccination coverage. Similar differences were observed by type of vaccine as well. Those results suggest an evidence of east-west rather than north-south or rural-urban disadvantage in childhood immunization coverage in Nepal.

In addition, the findings suggest that the effects of parental education, particularly those of mother's, were quite important in determining child immunization. The children of mothers with primary (odds ratio = 2.422; p<0.001)

Table 3. Odds ratio estimates predicting the effects of sociocultural and geographical factors on child (12-23 months) immunization in Nepal (N=1,213)

Variables	Full immunization				Immunization by type			
	Model I	Model II	Model III	Model IV	DPT	BCG	Polio	Measles
Sociocultural								
Ethnicity: Upper caste Hindu (=0)								
Lower caste Hindu (*Dalits*)	0.774		0.798	1.129	1.323	1.579	0.862	1.115
Hill (ethnic) Tibeto-Burmese	1.241		1.069	1.405	1.429	1.082	0.616	1.427+
Terai ethnic	0.843		0.915	1.151	1.708*	1.144	0.819	0.941
Others	0.412***		0.340***	0.564*	0.506*	0.413*	0.466	0.514*
Gender: Male (=1)	1.184		1.198	1..129	1.362*	1.443*	1.257	1.269+
Geographical characteristics								
Ecological: Mountain (=0)								
Hill		1.113	1.109	0.888	1.066	0.821	0.934	0.682+
Terai		0.924	1.151	0.782	0.842	1.288	1.754	0.804
Geopolitical region: Eastern (=0)								
Central		0.615**	0.591**	0.649*	0.591*	0.596+	0.517+	0.569**
Western		0.644*	0.629*	0.411***	0.406***	0.269***	0.337*	0.353***
Mid-western		0.691+	0.661+	0.961	0.787	0.488*	0.272**	1.121
Far-western		0.546**	0.499***	0.607*	0.418***	0.180***	0.198***	0.601
Rural-urban residence: Urban (=1)		1.901**	1.799**	0.715	0.258	0.757	1.172	0.946
Controls								
Child characteristics								
Age				1.105	0.963	1.236	0.748	1.057
Age-squared				0.999	1.002	0.994	1.015	1.000
Birth order				0.958	0.949	0.880***	0.946	0.960
Parental characteristics								
Mother's education: No education (=0)								
Primary				2.422***	2.728***	2.762**	1.900	1.927**
Secondary and higher				3.663***	6.487***	6.914**	4.245+	4.475***
Mother's occupation: Self-employed (agriculture) (=0)								

.../

Table 3. *(Continued)*

Variables	Full immunization				Immunization by type			
	Model I	**Model II**	**Model III**	**Model IV**	**DPT**	**BCG**	**Polio**	**Measles**
Not working				0.669+	0.782	0.732	0.746	0.709
Else (Don't know, missing)				0.790	0.622	0.648	0.361	0.995
Father's education: No education (=0)								
Primary				1.252	1.295	1.422+	1.679*	1.338+
Secondary and higher				2.061***	2.016***	1.992**	2.661**	1.930***
Else (Don't know, missing)				1.632	1.544	1.870	1.193	1.287
Father's occupation: Self-employed (agriculture) (=0)								
Professional/business/clerk/service				1.796***	1.912**	1.197	1.144	1.722**
Skilled manual				1.567	1.212	1.241	1.454	1.742+
Unskilled manual				1.117	1.093	0.942	1.554	0.871
Else (Don't know, missing)				2.922	2.069	1.452	1.564	2.078
Distance to health service (Not a problem = 0)								
Small problem				0.790	0.966	0.713	1.584	0.833
A big problem				0.466***	0.534**	0.364***	0.632	0.519**
Missing information				0.452+	0.390*	0.243**	-	0.515
Household characteristics								
Sex of household head (female = 1)				0.938	1.095	1.832+	0.843	1.166
Age of the household head (years)				0.997	0.999	1.004	0.997	0.997
Wealth index: Lowest quintile (=0)								
Second quintile				1.534*	1.478*	1.417	1.307	1.383+
Middle quintile				2.142***	2.043**	2.583**	2.120+	1.919**
Fourth quintile				2.370***	2.208***	1.774*	1.992+	2.186***
Highest quintile				1.543	1.468	1.212	1.257	1.069
Intercept	1.941***	2.715***	2.680***	0.544	2.127	1.778	31.130	1.382
Model Chi-square	26.007***	19.626**	45.199***	242.463***	245.930***	216.632***	146.937***	204.249***
Model degree of freedom	5	7	12	35	35	35	35	35
-2 Log likelihood	1527.254	1533.635	1508.062	1310.798	1191.364	875.892	586.233	1247.938
Pseudo R-square (%)	1.7	1.3	2.9	15.6	17.1	19.8	20.0	14.1
Per cent correctly classified/ predicted	66.7	66.1	67.6	71.1	75.2	83.8	91.0	74.7

t-statistic   *** = p<0.001;   ** = p<0.01;   * = p<0.05;   + = p<0.10

and secondary (odds ratio = 3.663; p<0.001) education were significantly more likely to receive a complete course of vaccination as compared with those whose mothers were illiterate. The effect of mother's education was observed to be linear, i.e., the odds of vaccination coverage increased with the increase of mother's education, which contradicts the findings of Streatfield, Singarimbun and Diamond (1990). These authors reported a nonlinear effect of mother's education on vaccination coverage in Indonesia, and found that the children of mothers with no education and those with secondary education were more likely to receive a complete course of vaccination than those of mothers with primary education. Moreover, the children whose fathers had completed secondary education were significantly more likely to have received a vaccine than those whose fathers had had no education.

Household income also influenced child immunization coverage. The results revealed that children living in wealthy households were significantly more likely to be fully immunized than those living in the lowest quintile (poorest households). These results are consistent with the findings of Bronte-Tinkew and Dejong (2005) in their study of Jamaica and Trinidad and Tobago. However, surprisingly, children from wealthiest households (belonging to highest quintile of wealth index) were significantly not different from those belonging to the lowest quintile in terms of receiving a complete course as well as a specific type of vaccine. In addition, the access to health service was an important contributing factor of child immunization in Nepal. Children of mothers who perceived the distance to health service as a big problem were least likely to be immunized compared with those whose mothers did not perceive it as a problem.

Discussion and implications

This study examined whether children in Nepal were socioculturally and geographically disadvantaged in receiving immunization. These issues are quite important in the context of the widely discussed sociocultural (particularly caste/ethnicity and gender) and geographic disparities (ecological, geopolitical, and rural-urban) in the socio-economic development of the country. Since childhood immunization is an important public service which should be globally available free of cost to everyone, it was expected that no child would be left behind in receiving immunization owing to her/his sociocultural background, geographic place of residence and other reasons.

The results, however, indicated some evidence of caste/ethnicity disadvantages. Children of other minority groups (e.g., Bangali, Musalman, Rajbhar, Raute, Raji, and other minorities of the hill and Terai) were found to be

less likely to be fully immunized compared with those children of upper caste Hindu families. However, children of all other ethnic groups seemed to be equally likely to be fully immunized as those of upper caste Hindu. These findings slightly depart from others. For instance, Matsuda (2002) reported no significant difference in the frequency of immunization use among mothers by caste in Nepal. Similarly, Niraula (1994:151) reported no difference by caste/ethnicity in using health services in the hill villages of Nepal and mentioned that "contrary to expectation, caste is not important." These results suggest a need for further understanding of possible reasons of caste/ethnicity disadvantages in childhood immunization existing among a couple of minority ethnic groups.

By gender, although male children seemed to be more likely to be fully immunized compared with female children, the statistical difference was weak to support the gender bias argument. Bronte-Tinkew and Dejong (2005) also reported a similar result from Jamaica, Trinidad and Tobago. However, when the analysis was performed by type of vaccine, a statistically significant difference was observed between a male and a female child in receiving a DPT, BCG and a measles vaccine, favouring boys, thus, leaving a little room for the gender bias argument.

Geographically, the differences in child immunization coverage were strong among political division (east-west) as compared with ecological domain (north-south) and rural-urban locations. Children living in the eastern region of Nepal were relatively advantaged as compared with those living in the western part of the country. Particularly, those living in the western, far-western and central regions were relatively disadvantaged in receiving a complete course of immunization, as well as a specific course of vaccine compared with children living in the eastern region.

Rural-urban difference in childhood immunization coverage was not important, however. Although the bivariate results showed a strong rural-urban difference so that children living in urban areas were about two times more likely than their rural counterparts to be fully immunized, the difference disappeared after controlling for important variables such as parental education, household wealth and perceived access to health services, perhaps suggesting that rural-urban difference was mediated through these factors. It could be because relatively more educated and economically affluent people live in urban areas, are aware of the benefits of immunization, and can afford the direct and indirect costs associated with it. The hill-Terai (north-south) difference was also statistically not significant. It is interesting to note that despite the high level of coverage for polio vaccine (over 85 per cent across sociocultural and geographic domains), the

coverage for other vaccines is low across sociocultural and geographic domains. What factors might have contributed to such a differential coverage of vaccines across sociocultural and geographic domains remains to be seen.

Parental education is quite important in improving child health (Glewwe, 1996; Cleland, 1989) and, thus, in determining childhood immunization coverage (Streatfield, Singarimbun and Diamond, 1990). The education of parents, particularly of mothers', in consistent with this notion, played a significant role in increasing child immunization coverage. This is a strong evidence for putting more emphasis on women's education in developing countries such as Nepal. Moreover, campaigns related to immunization could also enhance the knowledge of vaccination in a situation where a large number of mothers are illiterate. The findings also revealed that household income, in fact, does matter in child immunization despite the fact that vaccines are provided free of cost and assumed to be available everywhere. These results again confirm the findings of Bronte-Tinkew and Dejong (2005) that children living in wealthy families were more likely to be immunized than those living in poor families. Nevertheless, the perceived access to health services was an important contributing factor of child immunization, thus, suggesting the need for an increased access to vaccination coverage. This implies that access to service is still a barrier to immunization in Nepal although vaccines are provided through mobile clinics and immunization campaigns are organized to promote vaccination coverage.

In conclusion, sociocultural background of children, their place of residence, parental education, household income, and access to health services do matter in terms of vaccination coverage in Nepal. From a policy perspective, focus on ethnic communities particularly minorities (e.g., Bangali, Musalman, Rajbhar, Raute, Raji, and minorities of the hill and Terai) would minimize the gap across caste/ethnicity in childhood immunization coverage. Although these minority groups do not constitute a significant proportion of the population of Nepal, the present finding strongly suggests focusing on them for their well-being. Similarly, putting more emphasis on a girl child in providing DPT, BCG and measles vaccines would, to some extent, help reduce the possible gender gap in specific vaccine coverage. Moreover, provision of specific vaccines in the western part of Nepal may reduce the east-west gap in immunization coverage. For example, the coverage for most vaccines is relatively low in the far-western region and there is a wide gap between the eastern and the western regions of the country. At the same time, the reason why the coverage for vaccines such as DPT, measles and BCG is different across sociocultural and geographic domains, despite a high level of acceptance of polio, is another important question that needs attention. Finally,

putting more emphasis on parental education, particularly illiterate women from economically vulnerable households, and increasing the access to services is expected to help increase the immunization coverage. This should ultimately reduce the child mortality occurring from vaccine-preventable diseases in Nepal.

References

Acharya, M. and L. Bennet (1981). *The Status of Women in Nepal: The Rural Women of Nepal*, Kathmandu: Tribhuvan University.

Asian Development Bank (2002). "Poverty reduction in Nepal: Issues, findings, and approaches", http://www.adb.org/Documents/Reports/Poverty_Reduction_NEP/ poverty_analysis.pdf (retrieved on September 20, 2005).

Bista, D. B. (1991). *Development and Fatalism: Nepal's Struggle for Modernization,*

Calcutta: Orient Longman Limited.

Bonanni, P. (1999). "Demographic impact of vaccination: A review", *Vaccine,* vol. 17, pp. S120-S125.

Booth, B. and M. Verma (1992). "Decreased access to medical care for girls in Punjab, India: The roles of age, religion, and distance", *American Journal of Public Health,* vol. 82, pp. 1155-1157.

Bronte-Tinkew, J. and G. F. Dejong (2005). "Do household structure and household economic resources predict childhood immunization? Evidence from Jamaica and Trinidad and Tobago", *Population Research and Policy Review,* vol. 24, pp. 27-57.

Cleland, J. (1989). "Maternal education and child survival: Further evidence and explanations", paper presented at the Rockefeller Foundation Health Transition Workshop, Australian National University, Canberra, 15-19 May.

Dahal, D. R. (1995). Ethnic cauldron, demography and minority politics: A case study of

Nepal, In Dhruba Kumar, ed. *State, Leadership and Politics in Nepal.* Kathmandu.

Dahal, D. R. (2003). "Social composition of the population of caste/ethnicity and religion", *Population Monograph of Nepal 2003*. Central Bureau of Statistics, Kathmandu, Nepal.

Das Gupta, M. (1987). "Selective discrimination against female children in rural Punjab, India", *Population and Development Review,* vol. 13, No. 1, pp. 77-100.

Department of Health Services/Nepal. (2000/2001). "Annual report." His Majesty's Government of Nepal, Ministry of Health, Kathmandu, Nepal.

Desai, S. and S. Alva (1998). "Maternal education and child health: is there a strong causal relationship?", *Demography,* vol. 35, No. 1, pp. 71-81.

Du Lou, A. D. and G. Pison (1996). "The role of vaccination in the reduction of childhood mortality in Senegal", *Population: An English Selection,* vol. 8, pp. 95-121.205.

Gage, A. J., A. E. Sommerfelt and A. L. Piani (1997). "Household structure and childhood immunization in Niger and Nigeria", *Demography,* vol. 34, No. 2, pp. 295-309.

Gauri, V. and P. Khaleghian (2002). "Immunization in developing countries: its political and organizational determinants", *World Development,* vol. 30, No. 12, pp. 2109-2132.

Glewwe, P. (1996). "How does schooling of mothers improve child health? Evidence from Morocco", Living Standards Measurement Study Working Paper No. 128, The World Bank, Washington, D.C.

Gore, P. and others (1999). "Predictors of childhood immunization completion in a rural population", *Social Science & Medicine,* vol. 48, pp. 1011-1027.

Gurung, H. (1998). "*Nepal: Social Demography and Expressions*", Kathmandu: New Era.

Hill, K. and D. M. Upchurch (1995). "Gender differences in child health: Evidence from the Demographic and Health Surveys", *Population and Development Review,* vol. 21, No. 1, pp. 127-151.

Justice, J. (1989). *Policies, Plans, and People: Foreign Aid and Health Development,* University of California Press.

Lawati, M. L. (2001). "Racial discrimination toward the indigenous people in Nepal. A non-government report for the third world conference against racism (WCAR)", paper presented at the National Conference on the NPC in Kathmandu, 26 April 2001. (http://www.mtnforum.org/resources/library/lawom01a.htm, accessed on 11 September 2005).

Levine, N. E. (1987). "Caste, state, and ethnic boundaries in Nepal", *The Journal of Asian Studies,* vol. 46, No. 1, pp. 71-88.

Liao, T. F. (1994). "*Interpreting Probability Models: Logit, Probit, and Other Generalized Models*", California, London, New Delhi: SAGE Publications.

Matsuda, D. (2002). "Beliefs about immunization and children's health among childbearing mothers in Nepal", Unpublished Senior Honors Thesis Submitted to the Program in Human Biology, Stanford University.

Matthews, S. A., and B. Gubhaju (2004). *Contextual Influences on the Use of Antenatal Care in Nepal,* DHS Geographic Studies 2. Calverton, Maryland USA: ORC Macro.

Menard, S. (1995). "*Applied Logistic Regression Analysis*", California: Sage Publications, International Educational and Professional Publisher.

Ministry of Health [Nepal], New Era, & ORC Macro (2002). "*Demographic and Health Survey 2001*", Calverton, Maryland, USA: Family Health Division, Ministry of Health; New ERA; and ORC Macro.

Nepal South Asia Centre (NESAC) (1998). "*Nepal Human Development Report 1998*", Nepal South Asia Centre, Kathmandu, Nepal.

Niraula, B. B. (1994). "Use of health services in hill villages in central Nepal", *Health Transition Review,* vol. 4, pp. 151-166.

Norwegian Refugee Council/Global IDP Project (2003). "Profile of internal displacement: Nepal", Compilation of the Information Available in the Global IDP Database of the Norwegian Refugee Council. Geneva, Switzerland.

National Planning Commission (NPC) (2003). "*The Tenth Plan. Poverty Reduction Strategy Paper 2002-2007*", His Majesty's Government of Nepal, National Planning Commission, Kathmandu.

Pampel, F. C. (2000). "*Logistic Regression a Primer",* California: Sage Publications, International Educational and Professional Publisher.

Pebley, A.R., N. Goldman and G. Rodriguez (1996). "Prenatal and delivery care and childhood immunization in Guatemala: Do family and community matter?", *Demography,* vol. 33, pp. 231-247.

Pigg, S. L. (1996). "The credible and the credulous: The question of "villagers' beliefs" in Nepal", *Cultural Anthropology,* vol. 11, No. 2, pp. 160-201.

Population Reference Bureau (2005). "*2005 World Population Data Sheet*", Population Reference Bureau, Washington, D.C.

Pradhan, R. and A. Shrestha (2005). "Ethnic and Caste Diversity: Implications for Development", Working Paper Series No. 4, Nepal Resident Mission, Asian Development Bank.

Sen, G., A. George and P. Ostlin (2002). "Engendering Health Equality: A Review of Research and Policy", Working Paper Series, vol. 12, No. 2, Harvard Center for Population and Development Studies.

Streatfield, K., M. Singarimbun and I. Diamond (1990). "Maternal education and child immunization", *Demography,* vol. 27, No. 3, pp. 447-455.

Suvedi, B. K. (2003). "Immunization programme of Nepal: An update", *Kathmandu University Medical Journal,* vol. 2, No. 3, pp. 238-243.

United Nations (2005). "*The Millennium Development Goals Report 2005*", UN Millennium Development Goals (MDG). United Nations. (http://www.un.org/milleniumgoals/)

Westly, S. B. (2003). "Child survival and healthcare in developing countries", *Asia-Pacific Population and Policy,* East-West Center, Population and Health Studies, No. 67 (www.eastwestcenter.org).

Impacts of Bio-social Factors on Morbidity among Children Aged Under-5 in Bangladesh

Morbidity, clearly, is not a simple problem with a single solution. Multiple and interrelated determinants come into play and therefore a series of approaches and policies have to be evolved to deal with such kind of health hazard.

By Md. Israt Rayhan, M. Sekander Hayat Khan and Md. Shahidullah*

Stretching over 147,570 square kilometres of land and with a population exceeding 131 million, Bangladesh is the world's ninth most populous country. It is also one of the most densely populated (834 persons per sq. km.) (BBS, 2001).

* Md. Israt Rayhan, Lecturer, Institute of Statistical Research and Training (ISRT), University of Dhaka, Dhaka-1000, Bangladesh, e-mail: israt677@yahoo.com; M. Sekander Hayat Khan Ph.D., Professor, Institute of Statistical Research and Training (ISRT), University of Dhaka, Dhaka-1000, Bangladesh; and Md. Shahidullah, Assistant Professor, Institute of Statistical Research and Training (ISRT), University of Dhaka, Dhaka-1000, Bangladesh.

Over-population and poverty are pervasive in Bangladesh and causing hazards such as morbidity. Children aged under five years, whom are naturally innocent, vulnerable and dependent on their parents often suffer from viral and infectious diseases. The future of a nation is linked to the well-being of its children, which depends to a large extent on children's health status. The aim of this study is to examine the prevalence of morbidity among children aged under-5 (0-59 months) in Bangladesh and to determine the factors causing such morbidity.

Morbidity impedes the body's metabolism and retards its immune response. The poor appetite of a malnourished child leads to a fall in dietary intakes and may dictate a morbid condition. Morbidity reveals impairment in the immuno-competence of an organism and may cause death at an early stage of life.

A follow-up study on causes of death among children, implemented within the context of the 1993-1994 BDHS found that 23 per cent of infant deaths and 25 per cent of deaths among children aged 1-4 occurred as a result of ARI (Baqui and others, 1997). Kabir, Shahadat and Akhter (1997) observed morbidity differentials by place of residence, region of residence, level of income, possession of land, level of household education, building materials, and access to safe drinking water in Bangladesh. Their study revealed that morbidity of children declines with the increase in the level of education of parents, and whether children living in houses built in cement had a lower prevalence of morbidity compared with children who lived in mud houses. Islam, Chowdhury and Yusuf (1996) investigated the patterns of morbidity in Bangladesh by children's immunization status, classified as fully immunized (having received all recommended vaccinations[1]) and partially immunized. Their study revealed that the diseases affected a smaller percentage of children having been fully vaccinated. Empirical studies of child morbidity have often found that morbidity was more strongly correlated with age, education of parents, ethnic group etc. Oni, Schumann and Oke (1991) conducted a 12-month diarrhoeal disease surveillance in a sample of 351 children under 3 years of age in a low-income traditional area of Ilorin, Nigeria to determine whether socio-demographic characteristics, including age of the child, sex, parity, mother's education, occupation, mother's age and household kitchen, were associated with the incidence of acute diarrhoea. Bi-variate and multi-variate analyses were used to determine the association. Results indicated that the age of the child had a significant association with diarrhoea. Declerque, Tsui and Mangani (1988) using cross-sectional survey data, collected in Bas Zaire from the mothers of 1,200 urban and 1,670 rural children born in the previous 5 years, found maternal age and birth order as determinants of diarrhoeal and other child morbidities through a multi-variate analysis.

Materials and Methods

This study utilized the data extracted from a nationally representative survey the 1999-2000 Bangladesh Demographic and Health Survey (BDHS). The survey was conducted between 10 November 1999 and 15 March 2000. Information on 6,430 children aged under-5 was available in the BDHS data file collected from 242 rural *Mauzas*[2] and 99 urban *Mahallas.*[3]

Based on the available information, this study examined the influences of the following: (a) demographic factors: sex of child, mother's age at birth of child, number of living children under five years of age, previous birth interval, age of child; (b) socio-economic factors: place of residence, mother's education, mother's occupation, father's education, father's occupation, type of housing, religion, household possessions, mass-media exposure; (c) dietary factor: breastfeeding status; (d) environmental factors: household drinking water source, type of toilet facility; and (e) health-care and immunization factors: antenatal care, vaccination coverage, vitamin A supplementation.

Bi-variate analysis was performed to determine the differentials of morbidity among children aged under-5, according to any prevailing risk factors. Pearson's chi-square test of independence was performed to test the existence of significant association between morbidity and selected risk factors. The significant variables (p<0.05) observed in bi-variate analysis were subsequently included in multi-variate analysis. Cox's linear logistic regression model is efficient with acceptable degree of precision for a binary dependent variable. This study considered binary dependent variables and hereby applied Cox's linear logistic regression model (Cox, 1970) for multi-variate analyses. The model used is given by:

$$P_i = \frac{\exp\left(\beta_0 + \sum_{j=1}^{p} \beta_j X_{ij}\right)}{1 + \exp\left(\beta_0 + \sum_{j=1}^{p} \beta_j X_{ij}\right)}$$

Where i =1, 2,………, n; j = 1, 2,…………, p.

Here, P_i is the probability of success of binary dependent variable on i[th] risk factor. β_0 and β_j ·s are regression coefficients, which are to be estimated. X_{ij} indicates j[th] category of ith risk factor.

Three different models had been considered in this study. The fitted model 1 considered prevalence of acute respiratory infection (ARI) as dependent variable and it was coded as '1' if children were classified as ill with ARI during the two

weeks preceding the survey, otherwise it was '0'. The fitted model 2 considered prevalence of diarrhoea as a dependent variable and was coded as '1' if children were classified as ill due to diarrhoea two weeks prior to the survey, otherwise it was '0'. The fitted model 3 considered prevalence of fever as dependent variable and was coded as '1' if children were classified as ill due to fever during two weeks preceding the survey, otherwise it was '0'. The study considered 21 independent variables (risk factors) in bi-variate analysis. Significant risk factors depicted from bi-variate analysis were considered for multi-variate modeling to assess the net effect of each factor on morbidity among children aged under five. Significant variables ($p < 0.05$) found from bi-variate analyses were included in table 1, 2 and 3. Table 4, 5 and 6 presents the variables found to be significant in the multi-variate analyses. 'SPSS' statistical software was used for data analyses.

Results

Table 1. Differentials of ARI among children aged under-5 by significant biosocial factors

Risk factors	Total number of cases	Prevalence of ARI	p-value*
Age of child (in months)			
< 6	771	23.4	<0 .05
6-11	541	22.7	
12-23	1,316	23.7	
24-35	1,299	17.3	
36-47	1,223	15.0	
48-59	1,280	12.8	
Residence			
Urban	1,059	16.3	< 0.05
Rural	5,371	18.9	
Type of housing			
Made of raw materials	4,246	19.9	< 0.001
Made of tin	1,269	17.2	
Made of brick/cement	915	13.4	
Watched TV/ listen to radio once a week			
No	4,499	19.9	<0 .01
Yes	1,931	15.1	
Duration of breastfeeding			
< 12 months	1,640	22.0	< 0.01
12-23 months	1,867	20.1	
24+ months	2,923	15.7	

.../

Table 1. *(Continued)*

Risk factors	Total number of cases	Prevalence of ARI	p-value*
Vaccination coverage[1]			
Partially completed	3,174	20.7	<0 .001
Completed	3,206	16.8	
Total	**6,430**	**18.5**	

* Based on [2] statistics measuring the significant association between risk factors and ARI.

[1] Complete vaccination coverage means for an individual to have received BCG, Measles and all three doses of DPT and POLIO vaccines. Partial vaccination coverage means any dose of the above-cited four vaccines is missing.

Age of child was found to be significantly associated with ARI. The relationship between a child's age and the incidence of ARI as shown in table 1 was curvilinear; 23.4 per cent of children below the age of six months suffered from ARI, while the prevalence rate increased at age interval 6-23 months. After that it subsequently diminished and in 48-59 months interval, it decreased to 12.8 per cent. The prevalence of ARI among children aged under-5 was significantly higher in rural areas (18.9 per cent) than in urban areas (16.3 per cent). Type of housing had a highly significant relationship with the prevalence of ARI. Children living in houses made of raw materials had the highest proportion of ARI, whereas the lowest proportion (13.4 per cent) lived in brick or cement-made houses. Children whose mothers watched television and listened to the radio once a week had lower rate of ARI (15.1 per cent) than those children whose mother did not enjoy any television or radio broadcasting (19.9 per cent). Table 1 shows that the 22 per cent of children who had ARI were breastfed less than 12 months while the percentage to those who were breastfed for 24 or above months was 15.7 per cent. Prevalence of ARI was significantly (p<0.001) higher among children (20.7 per cent) who didn't complete the vaccination course than those who completed the entire course (16.8 per cent).

Table 2 shows that the relationship between a child's age and prevalence of diarrhoea was curvilinear and highly significant. The proportion of children suffering from diarrhoea was highest among children aged 6 to 23 months (11.8 per cent) and lowest in age group 48-59 months (2.3 per cent). Incidence of diarrhoea was found to be inversely proportional to the length of breastfeeding. Table 2 shows that 6.5 per cent children who suffered from diarrhoea were breastfed for less than 12 months, while the proportion of children suffering from the same condition and who were breastfed for 24 or above months was only 4 per cent. Prevalence of diarrhoea was significantly (p<0.01) higher (7 per cent) among

children who did not complete vaccination coverage than among those who completed the entire vaccination course (5.2 per cent).

**Table 2. Differentials of diarrhoea among children aged under-5
by significant biosocial factors**

Risk factors	Total number of cases	Prevalence of diarrhoea	p-value*
Age of child (in months)			
< 6	771	3.4	< .001
6-11	541	11.8	
12-23	1,316	11.8	
24-35	1,299	5.6	
36-47	1,223	3.8	
48-59	1,280	2.3	
Duration of breast feeding			
< 12 months	1,640	6.5	< .05
12-23 months	1,867	9.2	
24+ months	2,923	4.0	
Vaccination coverage		7.0	< .01
Partially completed	3,174		
Completed	3,206	5.2	
Total	**6,430**	**6.1**	

Based on x^2 statistics measuring the significant association between risk factors and diarrhoea.

The association between a child's age and the prevalence of fever was highly significant. Prevalence of fever was the highest (37.5 per cent) in the age group 6-12 months and lowest (21.4 per cent) among children aged between 48-59 months old. Mother's education was significantly (p<0.001) associated with fever. Table 3 shows that 27.5 per cent of children of illiterate mothers suffered from fever, whereas the proportion was 24.8 per cent for children whose mother had completed secondary or higher level education. 29.9 per cent children with fever had been breastfed for less than 12 months, it's proportion fell to 24.6 per cent for children who were breastfed for 24 months or more. Prevalence of fever was higher (2.5 per cent) among children who did not receive the full vaccination coverage than among those who completed the course.

Table 3. Differentials of fever among children aged under-5 by significant biosocial factors

Risk factors	Total number of cases	Prevalence of fever	p-value*
Age of child (in months)			
< 6	771	26.6	
6-11	541	37.5	
12-23	1,316	34.0	<0 .001
24-35	1,299	27.1	
36-47	1,223	22.5	
48-59	1,280	21.4	
Mother's education			
None	3,007	27.5	
Primary level	1,876	29.1	<0 .001
Secondary or Higher level	1,547	24.8	
Duration of breast feeding status			
< 12 months	1,640	29.9	
12-23 months	1,867	29.8	< 0.05
24+ months	2,923	24.6	
Vaccination coverage			
Partially completed	3,174	28.5	<0 .05
Completed	3,206	26.0	
Total	**6,430**	**27.3**	

Based on ^{2} statistics measuring the significant association between risk factors and fever.

Among the explanatory variables considered in the logistic regression model age of child, type of housing and exposure to TV/radio were found significant for the prevalence of ARI. Table 4 shows that children aged 6-11 months, 24-35 months, 33-47 months and 48-59 months were, respectively, 0.90, 0.72, 0.62 and 0.49 less likely to be affected by ARI than children aged below six months. By contrast, children aged between 12-23 months faced 1.32 times greater risk of suffering from ARI. Children living in houses made of raw materials and tin sheets were, respectively, 1.38 and 1.24 times more likely suffer from ARI, compared with children lived in cement/brick houses. Children whose mothers watched television or listen to the radio once a week at least faced 0.79 times less risk of contracting ARI than those children whose mother did not watch or listen to television/radio broadcasts.

Table 4. Logistic regression analysis to identify the risk factors of ARI among children aged under-5

Risk factors	Estimated (β) coefficient	S.E. of estimate	p-value	Odds ratio
Age of child (in months)				
<6 (r)	..	..	<0.001	1.000
6-11	-0.111	0.146		0.895
12-23	0.280	0.223		1.324
24-35	-0.333	0.211		0.716
36-47	-0.486	0.210		0.615
48-59	-0.710	0.211		0.492
Type of housing				
Made of raw materials	0.322	0.128	<0.05	1.380
Made of tin	0.212	0.141		1.236
Made of brick/cement	..	..		1.000
Watched TV/listen radio once a week				
No (r)	..	..	<0.05	1.000
Yes	-0.245	0.094		0.787

Note: 'r' represents reference category.

Table 5. Logistic regression analysis to identify the risk factors of diarrhoea among children aged under-5

Risk factors	Estimated (β) coefficient	S.E. of estimate	p-value	Odds ratio
Age of child (in months)				
<6 (r)	..	..	<0.001	1.000
6-11	1.058	0.127		1.519
12-23	-0.054	0.195		1.491
24-35	-1.059	0.185		0.908
36-47	-1.474	0.185		0.724
48-59	-2.013	0.185		0.677
Vaccination coverage				
Partially completed	0.226	0.116	<0.05	1.253
Complete	..	..		1.000

Note: 'r' represents reference category.

Age of child and vaccination coverage were found significant for the prevalence of childhood diarrhoea among the variables considered in the logistic regression model. Table 5 showsthat children aged 12-23 months, 24-35 months, 36-47 months and 48-59 months faced, respectively, 0.95, 0.35, 0.23 and 0.13 times less risk of diarrhoea compared with children aged 6 months or younger. By contrast, children aged 6-11 months had 2.88 times higher risk of suffering from this condition. Diarrhoea prevalence was highest among children aged 6-23 months, a period during which solid or semi-solid food is introduced. Children who did not receive the complete vaccination course were 1.25 times more likely to suffer from diarrhoea compared with children who had been vaccinated.

Table 6. Logistic regression analysis to identify the risk factors of fever among children aged under-5

Risk factors	Estimated (β) coefficient	S.E. of estimate	p-value	Odds ratio
Age of child (in months)				
<6 (r)	..	..	<0.001	1.000
6-11	0.418	0.127		1.519
12-23	0.399	0.195		1.491
24-35	-0.097	0.185		0.908
36-47	-0.323	0.185		0.724
48-59	-0.389	0.185		0.677
Mothers' education				
None (r)	..	..	<0.05	1.000
Primary level	0.145	0.072		1.156
Secondary or higher level	-0.084	0.091		0.919

Note: 'r' represents reference category.

Logistic regression analysis shows age of child and mother's education to be significant for the prevalence of fever among children aged under-5. Table 6 shows that children aged 24-35 months, 36-47 months and 48-59 months were, respectively, 0.91, 0.72 and 0.68 times less likely to suffer from fever than children 6 months old or younger. But children aged 6-11 months and 12-23 months, respectively, faced 1.52 and 1.49 times higher risk of fever. Children whose mothers attended secondary or higher level education were 0.92 times less likely to have a fever than children whose mother was illiterate.

Discussion

This present study reveals that age of child is a significant factor in the prevalence of ARI, diarrhoea and fever among children aged under-5. Prevalence of morbidity was highest among children aged 6-23 months when they are weaned off breast milk and introduced to solid food. Educated mothers tend to make better use of health services and provide better child-care, including feeding. The analysis shows that children whose mothers attended secondary or higher level of education were less likely to suffer from fever than children whose mother was illiterate. Type of housing appeared as an important risk factor for ARI among children aged under-5. Children living in houses built with raw materials and tin more commonly suffered from ARI compared with children who lived in houses built with cement/brick. Children living in houses built of cement enjoyed better socio-economic status, which in turn ensures better health.

Morbidity, clearly, is not a simple problem with a single solution. Multiple and interrelated determinants come into play; a series of approaches and policies therefore have to be evolved to deal with such kind of health hazard. Emphasis should be placed on parents' education and encourage them to provide better child-care. Vaccination coverage and precautions can protect babies from a substantial risk of morbidity. Integrated health services programmes might be organized for women in the setting of village meetings. Governments may wish to design well thought child care programmes to ensure easy access to health information and health education for parents. Community involvement, NGOs and use of media of mass communication with coverage of necessary health-care information may prove to be useful for improving health status of children under-5 years of age.

Endnotes

1. Completed vaccination coverage means receiving BCG, measles and all three doses of DPT, Polio vaccines

2. *Mauza* is the geographical expression of a unit of landmass for revenue settlement and revenue collection, whereas, within a *mouza* there could be more than one village.

3. *Mahalla* is the smallest administrative unit in urban areas consisting several households.

References

Baqui, Abdullah H. and others (1997). "Causes of deaths in Bangladesh: Results of a nation-wide verbal autopsy study", *Special Research Report*. Dhaka: International Center for Diarrheal Disease Research, Bangladesh.

Bangladesh Bureau of Statistics (BBS), (August, 2001). *Population census 2001 preliminary report,* Dhaka, Bangladesh.

Cox, D.R. and E.J. Snell (1970). *The Analysis of Binary Data*. Chapman & Hall/CRC.

Declerque J., A.O. Tsui and N. Mangani (1988). "Maternal and socio-demographic correlates of child morbidity in Bas Zaire: The effects of maternal reporting", *Social Science and Medicine*, vol. 26, No.7, pp. 701-713.

Islam M.N., M.M. Islam, N. Chowdhury and H.K.M. Yusuf (1996). "Assessment of health intervention program and maternal and child health in Bangladesh", *Population and Development and Evaluation Unit (PDEU), Implementation Monitoring and Evaluation Division (IMED)*, Ministry of Planning, Government of the People's Republic of Bangladesh and Department of Statistics, University of Dhaka, Dhaka-1000, Bangladesh.

Kabir M., Hossain M. Shahadat and Salma Akhter (1997). "Socio-economic correlates of under five morbidity and mortality in Bangladesh", *Bangladesh Bureau of Statistics* (BBS).

Oni G.A., D.A. Schumann and E.A. Oke (1991). "Diarrheal disease morbidity, risk factors and treatments in a low socio-economic area of Ilorin, Kwara State, Nigeria, *Journal of Diarrheal Disease Research*, International Center for Diarrheal Disease Research, Bangladesh, September, vol. 9, No. 3, pp. 250-257.