Trends and Determinants of Neonatal Mortality in Nepal

Further Analysis of the Nepal Demographic and Health Surveys, 2001-2011

Kathmandu, Nepal

March 2013

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This report is part of the MEASURE DHS program, which is designed to collect, analyze, and disseminate data on fertility, family planning, maternal and child health, nutrition, and HIV/AIDS. Additional information about the 2011 NDHS may be obtained from the Population Division, Ministry of Health and Population, Government of Nepal, Ramshahpath, Kathmandu, Nepal; telephone: (977-1) 4262987; and from New ERA, P.O. Box 722, Kathmandu, Nepal; telephone: (977-1) 4423176/4413603; fax: (977-1) 4419562; e-mail: info@newera.com.np. Information about the DHS program may be obtained from MEASURE DHS, ICF International, 11785 Beltsville Drive, Suite 300, Calverton, MD 20705, USA; telephone: 301-572-0200; fax: 301-572-0999; e-mail: reports@measuredhs.com; Internet: http://www.measuredhs.com.

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FOREWORD

The 2011 Nepal Demographic and Health Survey is the fourth nationally representative comprehensive survey conducted as part of the worldwide Demographic and Health Surveys (DHS) project in the country. The survey was implemented by New ERA under the aegis of the Population Division, Ministry of Health and Population (MoHP). Technical support for this survey was provided by ICF International with financial support from the United States Agency for International Development (USAID) through its mission in Nepal.

The standard format of the main report includes only a descriptive presentation of findings and trends, without using analytical statistical methods to ascertain the significance of change and causative association between variables. Though largely sufficient, the standard report is limited, hence, particularly in providing answers to 'why', which are very essential in re-shaping important policies and programs. Hence, following the dissemination of the NDHS 2011, MoHP and partners have convened and agreed on key areas that are very important to assess progress and gaps, and ascertain determinants, in high priority public health programs that MoHP is implementing. In this context, further analyses has been carried out by relevant technical professionals from MoHP and partners who are directly working on the given areas, with technical support and facilitation from research agencies.

The primary objective of the further analysis of 2011 NDHS is to provide more in depth knowledge and insights into key issues that emerged based on the data of 2011 NDHS, and this provides guidance in planning, implementing, re-focusing, monitoring, and evaluating health programs related to these issues in Nepal. The long term objective of the further analysis is to strengthen the technical capacity of the local institutions and individuals to analyze and use data from complex national population and health surveys to better understand specific issues per country need and situation. The further analysis includes topics on 'Maternal and Child Health in Nepal: The Effects of Caste, Ethnicity, and Regional Identity'; 'Trends and Determinants of Neonatal Mortality in Nepal'; 'Women's Empowerment and Spousal Violence in Relation to Health Outcomes in Nepal'; 'Sexual and Reproductive Health of Adolescents and Youth in Nepal: Trends and Determinants'; and 'Impact of Male Migration on Contraceptive Use, Unmet Need, and Fertility in Nepal'.

The further analysis of 2011 NDHS is the concerted effort of various individuals and institutions, and it is with great pleasure that I acknowledge the work that has gone into producing this useful document. The participation and cooperation that was extended by the members of the Technical Advisory Committee in the different phases of the survey is highly regarded.

I would like to extend my appreciation to USAID/Nepal, UK Department for International Development (DFID) and United Nations Population Fund (UNFPA) for providing financial support for the further analyses. I would also like to acknowledge ICF International Inc. for its technical assistance at all stages. Similarly, my sincere thanks go to the New ERA team for the overall management and coordination of the whole process. I also would like to thank the Population Division of the Ministry of Health and Population for its effort and dedication in the completion of this further analysis of 2011 NDHS.

Praveen Mishra
Secretary
Ministry of Health and Population

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The further analysis of 2011 Nepal Demographic and Health Survey (NDHS) was conducted under the aegis of the Population Division, Ministry of Health and Population of the Government of Nepal. The United States Agency for International Development (USAID), UK Department of International Development (DFID) and United Nations Population Fund (UNFPA) provided financial support and technical assistance was provided by ICF International through MEASURE DHS Project. Overall coordination, facilitation, administrative and logistic support was provided by New ERA, a local research firm with extensive experience in conducting such studies in the past.

I express my deep sense of appreciation to the technical experts in the different fields of population and health for their valuable input in the various phases of the study and providing valuable inputs towards finalizing the report. My sincere gratitude goes to all the members of Technical Advisory Committee for their time, support and valuable input. I would like to extend my sincere gratitude to Dr. Praveen Mishra, Secretary, Ministry of Health and Population for his guidance.

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Similarly, I greatly acknowledge the support received from Nepal Health Sector Support Program (NHSSP), Nepal Family Health Program (NFHP), Save the Children and other various institutions for the successful completion of this study.

Dr. Badri Pokhrel
Chief, Population Division
Ministry of Health and Population

ABBREVIATIONS AND ACRONYMS

ANC	antenatal care
aOR	adjusted odds ratio
BMI	body mass index
CI	confidence interval
DHS	Demographic and Health Survey
IMR	infant mortality rate
MOH	Ministry of Health (now MOHP)
MOHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
NMR	neonatal mortality rate
OR	odds ratio
SBA	skilled birth attendants
U5MR	under-five mortality rate
UNICEF	United Nation's Children's Fund
uOR	unadjusted odds ratio
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

This study analyzes data from three Demographic and Health Surveys in Nepal, carried out in 2001, 2006, and 2011. Data on births in the five years preceding these surveys were analyzed to examine trends in and determinants of neonatal mortality in Nepal. Log probability models were used to estimate neonatal mortality rates, and bivariate and multivariate logistic regression models were constructed to analyze determinants of neonatal deaths.

Despite substantial improvement in other health and survival indicators in Nepal, neonatal mortality declined only at a slow pace between 2001 and 2011. Neonatal mortality is higher among infants born to mothers in rural areas, least wealthy households, and socially disadvantaged castes and ethnic groups. Similarly, neonatal mortality rates are particularly high for babies born to mothers with no education or to mothers who are young (under age 20) or old (over age 35), who had a low body mass index, or are of short stature as well as babies with less than two-year birth intervals, those born to mothers with poor birth preparedness practices, or who had made few antenatal care visits, and babies who had poor immediate newborn care. Also, neonatal mortality is higher among babies born in households with indoor air pollution (using solid fuel and cooking inside the home) or in households without access to improved water and sanitation facilities, and among babies born to mothers who are not exposed to public health broadcast media.

In the study, mother's education, birth spacing, mother's stature, antenatal care visits, and exposure to indoor air pollution were significant predicators for neonatal mortality in Nepal during some survey years. Although findings on trends are sometimes lacking, possibly due to small sample sizes, recall bias, or other data limitations of the surveys, the results are consistent with previous in-country and international findings. To achieve further gains in neonatal survival, ongoing and upcoming programs should address determinants of neonatal mortality, and should focus on improving the utilization of maternal health care services.

Although Nepal is on track to achieve Millennium Development Goal 4 to reduce child mortality, reducing neonatal deaths is crucial to achieving further gains in child survival. Government and donors should focus their programs to address causes of neonatal deaths, primarily in the early neonatal period.

1 INTRODUCTION

1.1 BACKGROUND

Globally, each year an estimated 2.9 million babies die in their first month of life (UNICEF et al., 2012). Most of these deaths occur in developing countries such as Nepal. Between 1990 and 2011 the global neonatal mortality rate declined by 32 percent, from 32 deaths per 1,000 live births to 22 deaths per 1,000 live births (UNICEF et al., 2012). At the same time, the proportion of child deaths in the neonatal period increased and now stands at 41 percent globally (Bhutta et al., 2012). Leading causes of neonatal death are pre-term birth, severe infections, and asphyxia. Low birth weight is the leading indirect cause of neonatal mortality. The rate of neonatal mortality is known to be affected by various factors such as maternal characteristics, child and birth characteristics, socio-demographic characteristics of the household, and mothers' and other caregivers' health care seeking behaviors (Fort et al., 2008).

The Demographic and Health Survey (DHS) is a nationally representative, comprehensive survey conducted periodically in more than 90 countries. There have been four DHS surveys in Nepal, in 1996, 2001, 2006, and 2011 (Pradhan et al., 1997; MOH et al., 2002; MOHP et al., 2007; MOHP et al., 2012). Under the aegis of the Ministry of Health and Population (MOHP), New ERA implemented these surveys. ICF International (formerly Macro International) provided technical support. The United States Agency for International Development (USAID) provided financial support.

According to the results from these surveys, Nepal is currently on track to meet Millennium Development Goal 4 (reducing child mortality) and Goal 5 (improving maternal health) (WHO/UNICEF, 2012). Overall, the rate of reduction in under-five mortality is impressive. The rate of reduction is greatly disproportionate across age groups, however, with the slowest rate of decline among neonates (Pradhan et al., 2012).

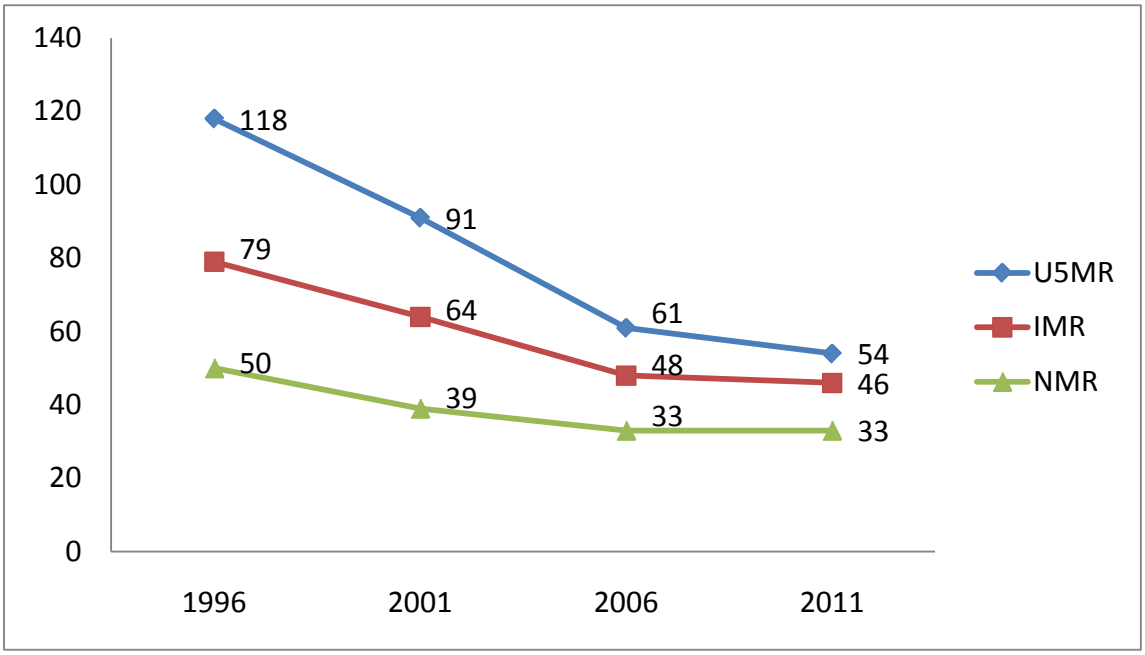
The 2011 Nepal Demographic and Health Survey (NDHS) found that the under-five mortality rate for the five-year period preceding the survey was 54 deaths per 1,000 live births. The infant mortality rate in the five years preceding the survey was 46 deaths per 1,000 live births. The neonatal mortality rate for the five-year period preceding the survey was 33 deaths per 1,000 live births.

Over the last 15 years in Nepal, under-five mortality fell by 54 percent, from 118 deaths per 1,000 live births to 54 per 1,000 live births. Infant mortality declined by 42 percent over the same period, from 79 deaths per 1,000 live births in 1991-1995 to 46 per 1,000 in 2006-2010. By comparison, neonatal mortality decreased by 34 percent in this period, from 50 deaths per 1,000 live births in 1991-1995 to 33 per 1,000 in 2006-2010.

Because mortality rates among older children decreased faster than the neonatal mortality rate, neonatal mortality now accounts for a higher percentage of child deaths. In 1996 neonatal deaths constituted 63 percent

of all infant deaths and 42 percent of under-five deaths. In 2011 neonatal deaths accounted for 72 percent of infant deaths and 61 percent of under-five deaths.

Figure 1.1 Trends in childhood mortality (deaths per 1,000 live births), NDHS 1996-2011



1.2 RATIONALE OF THE STUDY

Further reduction in neonatal mortality is necessary to continue improvements in childhood survival. Yet, despite improvements in health care utilization, fertility rates, and other mortality-related indicators, neonatal mortality was stagnant between the last two DHS surveys in Nepal. Between 2006 and 2011 many other health indicators expected to have a positive impact on newborn mortality, such as antenatal care seeking, tetanus toxoid vaccination, and utilization of skilled birth attendants, have improved significantly. Improvements in some other indicators, such as completion of four antenatal care visits and postnatal care, have been steady but slow. Also, access to improved water and sanitation facilities has increased during this period (MOHP et al., 2012).

Between 2001 and 2011 Nepal has developed various newborn policies, strategies, and guidelines and has kept newborn health a high-priority program by the MOHP. In 2004 the Ministry endorsed the National Neonatal Health Strategy, and around the same time the National Safe Motherhood and Neonatal Long-term Plan was developed (Pradhan et al., 2012). These policy documents provide the necessary guidance for integrating newborn care into various ongoing programs such as Community-Based Integrated Management of Childhood Illness and Safe Motherhood programs. The Second Long-term Health Plan (1997-2017) and the Nepal Health Sector Plans (2005-2010 and 2010-2015) also have given newborn programs top priority (MOH, 2004; MOHP, 2010). Nepal is one of the few countries with designated champions for newborns within the government and other stakeholder organizations, who use local, regional, and global evidence to influence policy (Smith and Neupane, 2011). In the last decade Nepal has initiated various pilot projects to test the effectiveness of newborn

interventions. These include the use of chlorohexidine to prevent umbilical cord infection (Mullany et al., 2006), the use of community health workers to identify and manage newborn infections (Khanal et al., 2011) and promote essential newborn care practices (Hodgins et al., 2010), and the use of birth preparedness programs to improve newborn care practices (McPherson et al., 2006). Based on the evidence from these and other regional pilot studies, the Government of Nepal developed the Community-Based Newborn Care Package to address causes of neonatal deaths. This package was introduced in 2009 and gradually expanded to cover 35 districts by mid-2013 (Pradhan et al., 2011; Kc et al., 2011).

Various circumstances, such as home deliveries without skilled providers, delay in seeking care during illness, lack of preparedness of families and care providers, harmful cultural practices, and economic and geographic issues, contribute to neonatal death. In most rural communities in Nepal, health facilities are not fully equipped to provide adequate care for newborns, primarily due to lack of health workers with the skills and experience to manage newborn illness as well as lack of equipment, supplies, and medicines (Suvedi et al., 2012). Extending health services from health facilities to communities and homes is challenging but crucial.

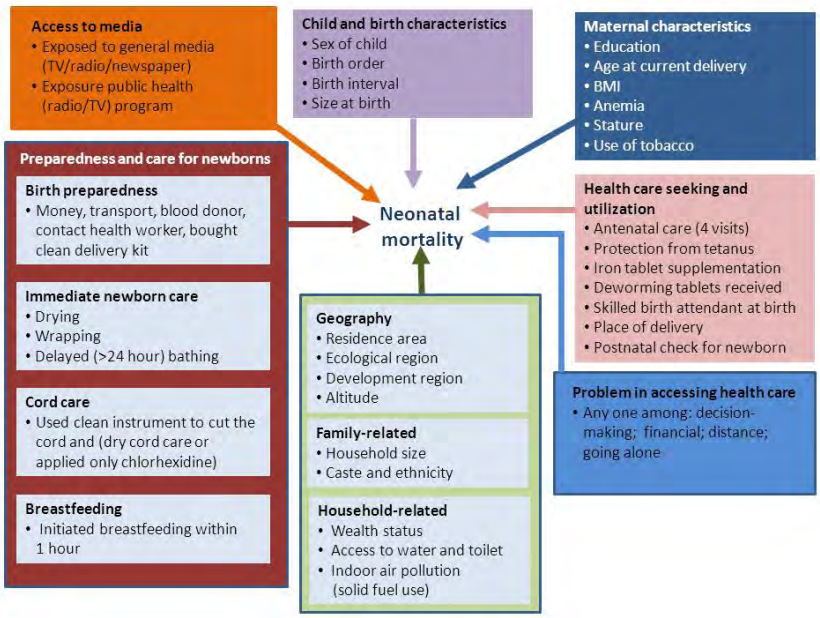
Social exclusion, caste, maternal illiteracy, negative parental attitudes arising from the social environment, gender bias, inability to pay for care, and lack of basic prenatal, natal, and postnatal services are the main contributors to poor newborn survival rates in developing countries (Bhutta et al., 2012; Darmstadt et al., 2005; Fort et al., 2008; Garg and Gogia, 2009; Kumar et al., 2008). Social determinants of health and inequitable access and use of health services are also major factors that impact newborn mortality in Nepal. Newborns of the lowest wealth quintile of households are much more likely to die than newborns of the wealthiest quintile of households—37 deaths per 1,000 live births compared with 19 per 1,000, respectively (MOHP et al., 2012). To bring about substantial reductions in neonatal mortality, programs should target those who are in greatest need.

During the last decade there have been remarkable improvements in non-health sectors in Nepal that affect newborn health and survival, primarily in education, transportation, and communication systems (UNDP, 2009). Despite these improvements, a favorable policy environment, the efforts of the champions for newborn health, and improvement in other health and non-health indicators, the neonatal mortality rate has remained stagnant. Utilizing the DHS data from 2001 to 2011, this paper explores possible reasons for stagnant neonatal mortality rates. The findings of this analysis may be helpful to understand the determinants of neonatal mortality in Nepal and to identify priority approaches to improve newborn survival.

1.3 CONCEPTUAL FRAMEWORK

Variables were grouped by household characteristics (nine variables), maternal characteristics (six variables), child and birth characteristics (four variables), birth preparedness and immediate care (six variables), health care seeking and utilization (seven variables), exposure to media (two variables), and problem in accessing health care (one variable). Based on a literature review and group brainstorming, the following conceptual framework was developed and used for the analysis:

Figure 1.2 Conceptual framework for factors affecting newborn mortality



The main body of this report covers the following factors associated with neonatal mortality: Area of residence, wealth status, caste and ethnicity, mother's education, maternal age at delivery, birth order, birth spacing, birth preparedness, immediate newborn care, cord care, maternal body mass index (BMI), maternal anemia, maternal stature, antenatal care visits, institutional delivery, delivery by skilled birth attendants, postnatal visit within three days of birth, problem in accessing health care, indoor air pollution, access to improved water and sanitation facilities, and exposure to public health media. Annex Table 3.2 presents detailed information on neonatal mortality rates for additional characteristics.

This paper is organized into four chapters. This first chapter explores the background and rationale of the study and provides a synthesis of available literature. Chapter 2 explains the methodology used for this further analysis and study limitations. Chapter 3 presents the results of the analysis. Chapter 4 includes discussion, presents the conclusions of the study, and explores the program implications of the findings.

2 METHODOLOGY

2.1 DATA

Data sets from the Nepal 2001, 2006, and 2011 DHS surveys are used to study the trend and determinants of neonatal mortality in Nepal. The samples for the DHS were selected as two-stage stratified random samples proportionate to the population size. Data from the Household Questionnaire and the Women's Questionnaire, administered to women age 15-49, are used in this analysis. Sample weights are applied to adjust for the different probabilities of selection of households across the sampling domains. Table 2.1 shows the size of the samples for the three surveys included in this analysis.

Table 2.1 Number of sample households, women respondents, and births, by survey year, NDHS 2001-2011

	DHS 2001	DHS 2006	DHS 2011
Number of households	8,602	8,707	10,826
Response rate (%)	*99.6*	*99.6*	*99.4*
Number of respondents (women age 15-49)	8,726	10,793	12,674
Response rate (%)	*98.2*	*98.4*	*98.1*
Number of all births in preceding five years	6,840	6,157	5,391
Number of most recent births in preceding five years	4,745	4,066	4,148
Approximate timeframe covered	1996-2000	2001-2005	2006-2010

In this analysis neonatal mortality is defined as the probability of death in the first month of life (0-30 days) per 1,000 live births for the period 1 to 60 months preceding the survey. The numerators are the number of deaths among live-born children at age 0-30 days, and the denominators are the number of live-born children in the 1-60 months preceding the survey. Due to incomplete exposure for death, births in the month of interview were excluded from the analysis.

2.2 VARIABLE DEFINITION

For this study selected variables are recoded and grouped into composite measures, and neonatal mortality is recoded as a dichotomous variable for logistic regression analysis.

- *Wealth status* is created by recoding five household wealth quintiles into three categories: "least wealthy" (lower 40 percent), "wealthiest" (upper 40 percent), and the middle 20 percent is kept as "middle."

- *Caste and ethnicity* reflects recoding into two composite groups—a disadvantaged group, comprising Hill Dalit, Terai Dalit, Hill Janajati[1], Terai Janajati, Other Terai castes, and Muslim, on one hand, and, on the other hand, a non-disadvantaged group, comprising Brahmin, Chhetri, Newar, Gurung, Magar, Thakali, and others.

[1] Except for Gurung, Magar, Thakali.

- *Indoor air pollution* is defined as a household reported to cook inside the home using solid fuel (coal, lignite, charcoal, wood, and other traditional materials such as agricultural crop waste and animal dung).

- *Access to improved water and sanitation* is defined as a household with access to improved drinking water (piped into dwelling, public tap, tube-well, protected well, rain water, or bottled water) and improved toilet facilities (flush to sewer system or septic tank or pit latrine, ventilated improved pit latrine, pit latrine with slab, or composting toilet).

- *Birth preparedness* is categorized into two groups. Birth preparedness is defined as "better" if the respondent reported preparing for at least two of the following: money, transport, blood donor, contact with a health worker, and bought a clean delivery kit; otherwise, preparedness is categorized as "poorer."

- *Immediate newborn care* is defined as "better" if all three of the following were performed for the last birth: drying, wrapping, and bathing delayed for 24 hours. If fewer than three or none of these was performed, immediate newborn care is defined as "poorer." This information was asked only for the home delivery cases, therefore, in the case of institutional delivery, we assume that immediate newborn care was good and have recoded as such.

- *Proper cord care* is defined as using a clean instrument to cut the umbilical cord and applying nothing or only chlorhexidine on the newborn's umbilical cord. Data on use of chlorhexidine are available only in the 2011 survey. This information was asked only for the home delivery cases; therefore, in the case of institutional delivery, we assume cord care was proper and have recoded as such.

- *Problem in accessing health care* is defined by the respondent's report that seeking medical care would be a significant problem for at least one of the following reasons: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone.

- *Exposure to public health media* is defined as exposure to any of the following specific public health television or radio programs in the last few months before the survey: *Jana swasthya radio karyakram, Janasankhaya chetanaka swore haru radio karyakram, Hamro swastha radio karyakram, Ama radio* and *Ama TV karyakram, Hamro swastha TV karyakram, Jeevan chakra TV karyakram, Thorai bhaya pugi sari TV karyakram, Sathi sanga manka kura, Jeevan jyoti radio karyakram, Sewa nai dharma ho, Gyan nai shakti ho, Ek aapas ka kura, Desh paradesh,* and *Teli-swasthya karyakram.*

2.3 DATA ANALYSIS

Data analysis involved three stages. First, trends were analyzed in all recoded background variables among *all births* in the five years preceding each survey. Second, log probability models were used to calculate disaggregated neonatal mortality rates by each suitable study variable, among *all births* in the five years

preceding each survey. In these models, the probability of dying during the first month of life was calculated on the log scale, and results were then exponentiated[2]. Third, logistic regression analysis was carried out to determine the odds ratios and 95 percent confidence intervals among *most recent births* in the five years preceding each survey. All analysis was performed using Stata Standard Edition (SE) 12 (StataCorp, 2011). To account for the complex DHS sample design, analysis was performed using "svy" commands for all analysis, based on the sample stratification.

2.4 STUDY LIMITATIONS

The DHS data come from cross-sectional surveys, which collect information from respondents about past events, behaviors, and outcomes. Such self-reporting is subject to recall bias, but in the absence of a vital registry, is one of the best ways to obtain nationally representative estimates of neonatal mortality.

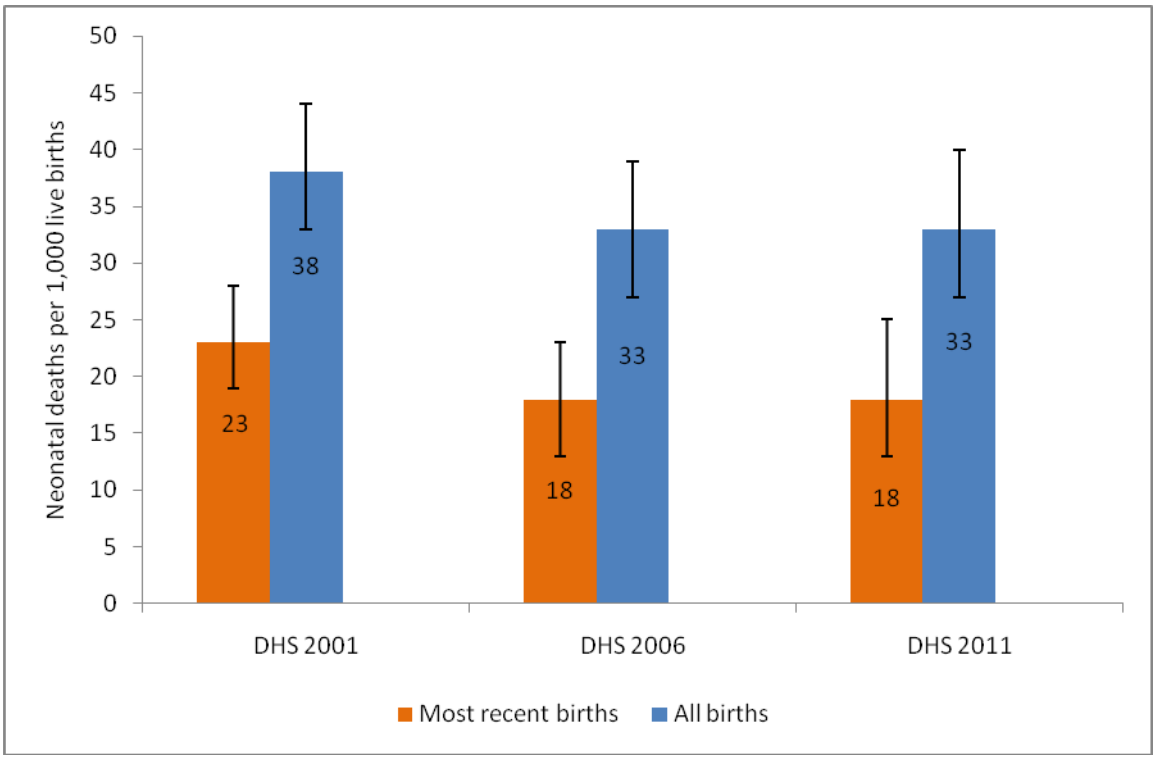
Over time there have been revisions in the DHS survey questionnaires and definition of some of the variables. The study team made all possible efforts to use data that are comparable across the three surveys. However, for some variables data are not complete and consistent in all three surveys (e.g., indoor air pollution, anemia). This limits the ability to analyze data across surveys and to identify trends.

Some of the information collected pertains to the time of the survey, and we assume that the situation was similar at the time of pregnancy. This assumption may not always be valid (e.g., anemia testing is done at the time of the survey; the reading might be different during pregnancy).

Most of the information in the DHS was collected for all births, but some information was collected only for most recent births within five years preceding the survey. Due to these data availability issues, part of the analysis is carried out among all births in the five years preceding the survey, and part, among most recent births only. For example, wherever possible, the distribution by background characteristics and neonatal mortality rates are calculated among all births rather than most recent births only. However, information on maternal service utilization (e.g., antenatal check-ups) and essential newborn care (e.g., delay of bathing, cord care) was collected only for most recent births. Therefore, to maintain comparability, the regression analysis was performed only for most recent births in all three surveys. Therefore, readers are advised to interpret the results with caution, especially when comparing data from different sections. As Figure 2.1 illustrates, in all three surveys there is a significant difference in neonatal mortality rates between all births in the preceding five years and most recent births. This observed difference is likely due to bias in the selection of the most recent birth sample, since this selection omits births with short spacing within the five-year period, and close spacing between births is associated with higher risk.

[2] Since confidence intervals around the neonatal mortality rates were estimated on the log scale and then exponentiated, the upper bound is further away than the lower bound.

Figure 2.1 Neonatal mortality, with 95 percent confidence intervals, among all births and most recent births during the five years preceding the surveys, NDHS 2001-2011



3 RESULTS

3.1 CHARACTERISTICS OF BIRTHS

Table 3.1 shows the percentage distribution, by background characteristics, of all births in the five years preceding the survey. As mentioned, some of the information (e.g., the number of antenatal care visits) was collected only for most recent births, and the denominator differs accordingly; these indicators are identified with footnotes. This chapter begins with an overview of births in the five years preceding the surveys according to place of residence, wealth status, caste and ethnicity, mother's education, maternal age at delivery, birth order, birth spacing, newborn care practices, maternal nutrition, service utilization, and other related variables (Table 3.1).

3.1.1 Background Characteristics

According to the 2011 survey, 91 percent of all births in the preceding five years occurred in rural areas, a slightly smaller percentage than in the 2001 survey, at 94 percent. In all three surveys nearly one-third of all births were among the wealthiest households, just over one-fifth were among middle households, and nearly one-half were among the least wealthy households (Table 3.1).

Education is one of the strongest influences on individuals' knowledge, attitudes, and behavior in various facets of life. There has been substantial improvement in educational level among women giving birth. In 2001, about one-quarter (26 percent) of births in the five years preceding the survey were to women who had at least primary education; in 2011, over one-half (53 percent).

In all three surveys more than 70 percent of all births occurred to women age 20-35. In the 2011 survey 44 percent of births were of second or third parity, a pattern consistent with that in previous surveys. Among non-first births, the proportion of births with at least two years of spacing has remained stagnant at around 78 percent over the three surveys.

3.1.2 Newborn Care Characteristics

Newborn care in Nepal has been improving recently. Compared with the 2006 NDHS findings, in the 2011 survey more women giving birth had "better" birth preparedness practices, having prepared at least two of the following—money, transport, blood donor, contacted health worker, and bought a clean delivery kit. In the 2011 survey 43 percent of births were to women who were "better" prepared, about twice the 22 percent reported in the 2006 survey.[3] Among babies born in the five-year periods preceding the survey, about half (49 percent) received "better" immediate newborn care in 2011 compared with about one-quarter (26 percent) in 2006. In 2011, 52 percent of babies had their cords cut with safe equipment and applied nothing, or only chlorhexidine was applied[4], compared with 34 percent in the 2006 survey.

[3] Information on birth preparedness practices, immediate newborn care, and cord care was not collected in the 2001 survey.
[4] use of chlorhexidine was reported only in the 2011 survey

3.1.3 Maternal Nutrition Characteristics

In all three surveys seven of every ten births in the last five years were to mothers of normal body mass index (BMI). There was some increase (from 3 to 10 percent) in births to obese or overweight mothers, and some decrease (from 25 to 20 percent) in births to low BMI mothers between the 2001 and 2011 surveys.

Both in the 2011 and 2006 surveys, four in ten of all births occurred to women who were anemic to some degree (mild to severe) at the time of the interview.[5] In all three surveys, one in seven of all births occurred to mothers of short stature (<145 cm).

3.1.4 Health Care Utilization Characteristics

There has been remarkable improvement in the use of antenatal care services between 2001 and 2011. In 2001 only 14 percent of births were to mothers who had made at least four antenatal care (ANC) visits. The percentage rose to 29 percent in 2006 and then to 50 percent in the 2011 survey.

Similarly, the proportion of births taking place at health institutions doubled from each survey to the next, from 9 percent in 2001 to 18 percent in 2006 and to 35 percent in 2011. The improvement in the share of deliveries assisted by skilled birth attendants (SBA) also is encouraging—from 11 percent in 2001 to 19 percent in 2006 and 36 percent in 2011.

A postnatal visit within three days followed up less than half (45 percent) of most recent births in the five years preceding the 2011 survey. The rate was even lower in previous surveys, at 23 percent in 2006 and 25 percent in 2001.

In all three surveys respondents were asked whether or not each of the following factors would pose a significant problem for them in seeking medical care: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone. In the 2011 survey, 78 percent of women who gave birth reported facing at least one of those problems, a proportion that was similar to 2006 and slightly higher than in 2001

3.1.5 Environment and Media Related Characteristics

The surveys collected information about the type of fuel used for cooking and the place of cooking. Indoor air pollution is defined as use of solid fuel (coal, lignite, charcoal, wood, or other traditional materials such as agricultural crop waste or animal dung) and cooking inside the dwelling. In the 2011 survey 58 percent of births were in households with indoor air pollution, compared with 70 percent in 2006.[6]

Access to improved water supply and sanitation facilities is still poor in Nepal. This fact has impacts on everyone's health, including that of newborns. A household described as having access to improved water and sanitation facilities has both an improved source of drinking water (piped into dwelling, public tap, tube well, protected well, rain water, or bottled water) and an improved toilet facility (flush to sewer system or septic tank or pit latrine, ventilated improved pit latrine, pit latrine with slab, or composting toilet). Of births in the five

[5] Anemia tests were not performed in the 2001 survey

[6] Although information on the use of solid fuel is available, information on cooking place—whether inside the home or outside—is not available in the 2001 survey and thus is not included in this analysis.

years preceding the survey, in the 2011 survey 23 percent were from households with access to improved water supply and sanitation facilities, compared with 13 percent in the 2006 survey and 14 percent in the 2001 survey. The 2011 and 2006 surveys collected information on exposure to several specific public health television and radio programs.[7] In 2011, 40 percent of births were to women who had watched or listened to at least one of these programs, compared with 50 percent in 2006.

[7] The television and radio programs the survey asked about were: Jana swasthya radio karyakram, Janasankhaya chetanaka swore haru radio karyakram, Hamro swastha radio karyakram, Ama radio and Ama TV karyakram, Hamro swastha TV karyakram, Jeevan chakra TV karyakram, Thorai bhaya pugi sari TV karyakram, Sathi sanga manka kura, Jeevan jyoti radio karyakram, Sewa nai dharma ho, Gyan nai shakti ho, Ek aapas ka kura, Desh paradesh, and Teli-swasthya karyakram.

Table 3.1 Background characteristics

Trend in selected socio-economic and health indicators among *all births* to women age 15-49 in the five years preceding the surveys, NDHS 2001-2011

		DHS 2011		DHS 2006		DHS 2001	
		Percent	N (weighted)	Percent	N (weighted)	Percent	N (weighted)
Background variables							
Residence:	Urban	9.4	510	12.2	684	6.5	457
	Rural	90.6	4,918	87.8	4,906	93.5	6,587
Wealth status:	Highest 40 percent	31.3	1,698	32.7	1,826	32.6	2,300
	Middle 20 percent	21.2	1,150	20.4	1,141	19.9	1,400
	Lowest 40 percent	47.5	2,580	46.9	2,622	47.5	3,344
Caste and ethnicity:	Non-disadvantaged	32.8	1,780	36.4	2,033	37.8	2,665
	Disadvantaged[1]	67.2	3,648	63.6	3,557	62.2	4,379
Mother's education:	Primary or higher	52.7	2,861	39.5	2,208	25.6	1,805
	No education	47.3	2,567	60.5	3,382	74.3	5,239
Age at birth:	20-35 years	72.5	3,936	71.3	3,987	72.4	5,098
	<20 years or >35 years	27.5	1,493	28.7	1,602	27.6	1,946
Birth order:	2nd or 3rd	43.9	2,382	42.4	2,367	39.9	2,808
	1st or 4th or more	56.1	3,046	57.6	3,223	60.2	4,236
Birth spacing: ¥	More than two years	78.7	2,816	78.1	3,041	77.1	4,132
	Less than two years	21.3	762	21.9	853	22.9	1,226
Newborn care							
Birth preparedness[2]: §	Better	42.5	1,743	21.6	862	na	
	Poorer	57.5	2,357	78.4	3,238	na	
Immediate newborn care[3]: §	Better	48.7	1,974	25.7	1,018	na	
	Poorer	51.3	2,077	74.3	2,949	na	
Proper cord care[4]:	Yes	52.0	2,155	34.3	1,393	na	
	No	48.0	1,989	65.7	2,664	na	
Maternal nutrition							
BMI: ⋊	Normal (18.5-25)	70.5	1,844	69.0	1,831	71.4	5,017
	Low (<18.5)	19.6	513	25.3	1,405	25.1	1,772
	Overweight/obese (>25)	9.8	257	5.7	319	3.4	242
Anemia[5]: ⋊	No	62.1	1,066	59.6	3,288	na	
	Yes	37.9	978	40.4	2,231	na	
Stature: ⋊	Normal (>145 cm)	87.4	2,286	85.7	4,763	84.8	5,960
	Short (<145 cm)	12.6	331	14.3	793	15.2	1,071
Service utilization							
ANC 4+ visits: §	Yes	50.3	2,063	29.5	1,182	14.3	668
	No	49.7	2,037	70.5	2,831	85.7	4,016
Institutional delivery:	Yes	35.2	1,880	17.7	971	9.0	625
	No	64.8	3,463	82.3	4,532	91.0	6,296
Delivery by SBA[6]:	Yes	35.9	1,918	18.7	1,028	10.8	750
	No	64.1	3,424	81.3	4,464	89.2	6,172
Postnatal visit: §	Yes	44.9	1,841	22.9	919	24.8	1,172
	No	55.1	2,258	77.1	3,091	75.2	3,557
Problem in accessing health care[7]:	No	21.8	1,183	22.5	1,260	14.5	1,024
	Yes	78.2	4,245	77.5	4,330	85.5	6,020
Other							
Indoor air pollution[8]:	No	42.3	2,297	30.4	1,697	na	
	Yes	57.7	3,131	69.6	393	na	
Improved water and sanitation[9]:	Yes	22.6	1,224	12.8	717	14.1	996
	No	77.4	4,204	87.2	4,873	85.9	6,048
Exposed to public health media:	Yes	40.2	2,183	49.7	2,776	na	
	No	59.8	3,245	50.3	2,814	na	

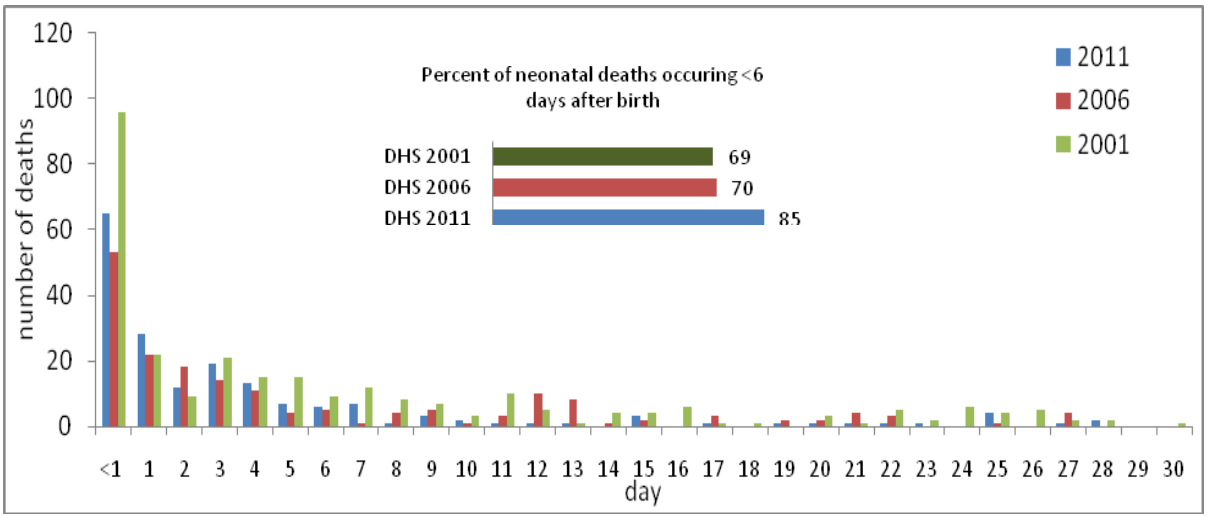
[1] Disadvantaged: Hill Dalit, Terai Dalit, Hill Janajati (except for Gurung, Thakali, Magar), Terai Janajati, Other Terai Caste, or Muslim
[2] Birth preparedness: at least two of the following preparations is defined as "better" and less than two is defined as "poorer": money, transport, blood donor, contact with health worker, and bought clean delivery kit
[3] Immediate newborn care: having all three of the following is defined as "better" and having less than three is defined as "poorer": drying, wrapping, and delayed bathing
[4] Proper cord care: use of clean instrument and applied nothing or only chlorhexidine on the cord
[5] Skilled birth attendants: doctor, nurse or midwife
[6] Anemia: <12.0 g/dl for non-pregnant and <11.0g/dl for pregnant women
[7] Problem accessing health care: difficulty due to at least one of the following: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone
[8] Indoor air pollution: cooking inside the home using solid fuel
[9] Access to improved water and sanitation: households with access to both improved drinking water and improved toilet facility
§ Among most recent births
⋊ Anthropometry was collected in every second household in the 2011 survey, so estimates are based on a subset of all women
¥ First-born babies (34% in 2011, 30% in 2006, and 24% in 2001) were excluded from the birth spacing calculation

3.2 TIME OF NEONATAL DEATH

Globally, most newborn deaths occur in the early neonatal period (deaths between 0-6 days), and as neonatal mortality declines, the proportion of deaths that occur in the early neonatal period typically increases. Analysis of the three surveys finds a similar pattern in Nepal. Figure 3.1 shows the distribution of all neonatal deaths by

age at death (in days) for the three surveys. The proportion of early neonatal deaths increased between the 2001 and 2011 surveys. Early neonatal deaths accounted for 69 percent of neonatal deaths in 2001, 70 percent in 2006, and 85 percent in 2011. In the 2011 survey 35 percent of all newborn deaths were in the first day. (Annex table A.1 shows the distribution of neonatal deaths by age at death in days and by survey year.)

Figure 3.1 Distribution of reported neonatal deaths by age at death in days (weighted count)



3.3 NEONATAL MORTALITY BY BACKGROUND CHARACTERISTICS

Table 3.2 shows neonatal mortality among all births in the five-year periods preceding the surveys by background characteristics, with 95 percent confidence intervals. Some of the information on newborn care and utilization of maternal health care (e.g., ANC visit) was collected only for most recent births, and, thus, the denominator differs from other variables; this is noted in footnotes.

3.3.1 Background Characteristics

Consistently in all three surveys, neonatal mortality has been higher in rural areas than in urban areas. In the 2011 survey the neonatal mortality rate was 34 deaths per 1,000 live births in rural areas among births in the five years preceding the survey, whereas in urban areas the rate was 23 deaths per 1,000 live births. Also, the neonatal mortality rate is higher among middle and least wealthy households than among the wealthiest households. There is a wide gap in neonatal mortality between disadvantaged and non-disadvantaged caste and ethnic groups in all three surveys. In the 2011 survey the neonatal mortality rate was 36 deaths per 1,000 live births among babies born into disadvantaged caste and ethnic groups and 26 deaths per 1,000 live births among babies born in non-disadvantaged caste and ethnic groups.

Mother's education also plays a major role in the neonatal mortality rate, with 38 deaths per 1,000 live births among mothers with no education compared with 28 deaths per 1,000 live births among mothers with at least primary education, in the 2011 survey. Mother's age also plays a role. In the 2011 survey neonatal mortality was 40 deaths per 1,000 live births among those born to younger or older mothers (<20 years or >35 years) compared with 30 deaths per 1,000 live births among mothers age 20-35.

Also, in the 2001 and 2006 surveys, the neonatal mortality rate was higher for first or fourth or higher birth order than for second or third births, but in 2011 there was little difference in the neonatal mortality rate

between these two categories (Table 3.2). As for birth spacing, neonatal mortality reported in the 2011 survey was 54 deaths per 1,000 live births among those with less than two years of birth spacing but 23 deaths per 1,000 live births among those with more than two years of spacing. Among first births the rate was 39 deaths per 1,000 live births.

3.3.2 Newborn Care Characteristics

Information on newborn care was collected only for most recent births in the five years preceding the survey. Thus, the neonatal mortality rate stratified by newborn care variables should be compared with the overall neonatal mortality rates for most recent births in the five years preceding the survey, which were 18 deaths per 1,000 live births in 2011, 18 in 2006, and 23 in 2001 (Figure 2.2).

Only the 2011 and 2006 surveys contain information on newborn care. Among births to mothers who were better prepared to give birth, the neonatal mortality rate in the 2011 survey was 13 deaths per 1,000 live births, while among births to women who were poorly prepared the rate was higher, at 22 deaths per 1,000 live births. Neonatal mortality among babies who received good immediate newborn care was 12 deaths per 1,000 live births in the 2011 survey compared with 18 among babies who did not receive good immediate care. Cord care practices also affect neonatal mortality rates. Among those who had good cord care, the neonatal mortality rate was 18 deaths per 1,000 live births in 2011 compared with 20 deaths per 1,000 live births among those who did not have good cord care. The difference was similar in the 2006 survey (Table 3.2).

3.3.3 Maternal Nutrition Characteristics

Neonatal mortality rates are calculated for key indicators related to maternal nutrition. As in the earlier surveys, in 2011 neonatal mortality was higher among babies born to women of short stature (67 deaths per 1,000 live births) than among those born to women of normal stature (30 deaths per 1,000 live births). In all three surveys, neonatal mortality was lower among babies whose mother was obese or overweight, compared with babies whose mother had a normal or low BMI. Surprisingly, the neonatal mortality rate in 2011 was lower among anemic mothers (31 deaths per 1,000 live births) than among non-anemic mothers (36 deaths per 1,000 live births), a pattern also seen in 2006.

3.3.4 Health Care Utilization Characteristics

Some information on maternal health care utilization was collected for most recent births only, and some for all births in the five years preceding the survey. In the 2011 survey the neonatal mortality rate was 13 deaths per 1,000 live births among those whose mothers had made at least four antenatal care visits, much lower than the rate of 24 deaths per 1,000 live births among those whose mothers had fewer than four antenatal visits, among most recent births. The pattern was similar in the earlier surveys. Also, neonatal mortality among babies born to a mother who had a postnatal visit within three days of birth was 17 deaths per 1,000 live births, compared with a rate of 19 among those who had not had a postnatal visit, among most recent births in the five years prior to the survey.

The neonatal mortality rate in the five years preceding the survey among those who were delivered at a health institution was 26 deaths per 1,000 live births, lower than the rate of 36 deaths per 1,000 live births among those

who were delivered elsewhere. Similarly, neonatal mortality among those who were born with the assistance of skilled birth attendants was 27 deaths per 1,000 live births but was 36 among those whose births were not assisted by skilled birth attendants. For the most part these patterns are similar to those in the earlier surveys.

Neonatal deaths were more common among those whose mothers had a problem accessing health care—in the 2011 survey 35 deaths per 1,000 live births compared with 26 deaths per 1,000 live births among those whose mothers did not have such problems. The pattern is consistent in all three surveys.

3.3.5 Environment and Media-Related Characteristics

In the 2011 survey the neonatal mortality rate among babies born in a household with indoor air pollution was higher (at 37 deaths per 1,000 live births) than among babies born into a household without indoor air pollution (at 27 deaths per 1,000 live births). The pattern is consistent in all three surveys. In addition, in all three surveys the neonatal mortality rate was higher for births in households without access to improved water supply and sanitation facilities—for example, in the 2011 survey 34 deaths per 1,000 live births compared with 28 in households with such improvements.

Neonatal mortality rates also were calculated according to mothers' exposure to any of the public health radio or television programming. Neonatal mortality is lower among births to those exposed to public health media (27 deaths per 1,000 live births in 2011 and 29 in 2006) than among those not exposed to public health media (37 deaths per 1,000 live births in 2011 and 35 in 2006).

Table 3.2 Neonatal mortality rate by background characteristics

Neonatal mortality rate among births in the five years preceding the surveys, by background characteristics, NDHS 2001-2011

		DHS 2011		DHS 2006		DHS 2001	
		NNMR	[95% CI]	NNMR	[95% CI]	NNMR	[95% CI]
Background variables							
Residence:	Urban	23	[14-39]	26	[18-37]	26	[16-41]
	Rural	34	[27-41]	32	[27-41]	39	[33-46]
Wealth status:	Wealthiest	27	[18-39]	24	[17-31]	33	[25-43]
	Middle	41	[28-61]	46	[32-60]	44	[34-58]
	Least wealthy	33	[26-41]	33	[25-41]	39	[32-49]
Caste and ethnicity:	Non-disadvantaged	26	[19-35]	28	[21-39]	35	[28-45]
	Disadvantaged[1]	36	[28-46]	35	[27-44]	40	[33-48]
Mother's education:	Primary or higher	28	[21-37]	23	[17-31]	33	[25-44]
	No education	38	[29-50]	39	[31-49]	40	[34-47]
Age at birth:	20-35 years	30	[23-38]	27	[22-34]	32	[26-39]
	<20 years or >35 years	40	[29-56]	46	[33-62]	55	[45-67]
Birth order:	2nd or 3rd	32	[23-46]	21	[15-28]	31	[25-39]
	1st or 4th or more	33	[26-42]	41	[33-51]	43	[36-52]
Birth spacing:	Less than two years	54	[34-87]	38	[26-55]	56	[42-74]
	More than two years	23	[17-31]	24	[18-32]	28	[23-34]
	First births	39	[29-51]	44	[33-59]	51	[41-65]
Newborn care							
Birth preparedness[2]: §	Better	13	[8-21]	14	[7-27]	na	
	Poorer	22	[15-31]	18	[13-25]	na	
Immediate newborn care[3]: §	Better	12	[8-19]	16	[9-26]	na	
	Poorer	18	[13-27]	13	[9-19]	na	
Proper cord care[4]: §	Yes	18	[13-24]	18	[13-25]	na	
	No	20	[12-32]	15	[8-27]	na	
Maternal nutrition							
BMI: ⌘	Normal (18.5-25)	36	[26-50]	33	[26-46]	36	[30-43]
	Low (<18.5)	35	[20-62]	31	[23-43]	47	[37-61]
	Overweight/obese (≥25)	21	[7-60]	27	[11-65]	16	[5-47]
Anemia[5]: ⌘	No	36	[21-61]	34	[26-46]	na	
	Yes	31	[21-44]	30	[23-38]	na	
Stature: ⌘	Normal (>145 cm)	30	[22-39]	30	[25-37]	35	[30-42]
	Short (<145 cm)	67	[38-119]	43	[29-65]	54	[41-72]
Service utilization							
ANC 4+ visits: §	Yes	13	[8-19]	8	[4-17]	10	[5-22]
	No	24	[16-36]	22	[16-29]	25	[20-31]
Institutional delivery:	Yes	26	[19-36]	29	[18-46]	21	[12-36]
	No	36	[28-47]	33	[27-41]	39	[34-46]
Delivery by SBA[6]:	Yes	27	[20-37]	30	[19-47]	23	[14-36]
	No	36	[27-46]	33	[27-40]	40	[34-46]
Postnatal visit: §	Yes	17	[11-27]	31	[20-50]	29	[21-42]
	No	19	[13-27]	17	[12-23]	40	[34-50]
Problem in accessing health care[7]:	No	26	[16-43]	24	[16-37]	30	[20-44]
	Yes	35	[28-43]	35	[28-43]	40	[34-47]
Other							
Indoor air pollution[8]:	No	27	[19-39]	23	[17-32]	15	[8-28]
	Yes	37	[29-47]	36	[29-46]	40	[35-47]
Improved water and sanitation[9]:	Yes	28	[19-40]	22	[12-40]	34	[25-47]
	No	34	[27-43]	34	[28-42]	39	[33-46]
Exposed to public health media:	Yes	27	[21-35]	29	[22-40]	na	
	No	37	[28-47]	35	[27-46]	na	

[1] Disadvantaged: Hill Dalit, Terai Dalit, Hill Janajati (except for Gurung, Thakali, Magar), Terai Janajati, Other Terai Caste, or Muslim
[2] Birth preparedness: at least two of the following preparations is defined as "better" and less than two is defined as "poorer": money, transport, blood donor, contact with health worker, and bought clean delivery kit
[3] Immediate newborn care: having all three of the following is defined as "better" and having less than three is defined as "poorer": drying, wrapping, and delayed bathing
[4] Proper cord care: use of clean instrument and applied nothing or only chlorhexidine on the cord
[5] Skilled birth attendants: doctor, nurse, or midwife
[6] Anemia: <12.0 g/dl for non-pregnant and <11.0g/dl for pregnant women
[7] Problem accessing health care: difficulty due to at least one of the following: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone
[8] Indoor air pollution: cooking inside the home using solid fuel
[9] Access to improved water and sanitation: households with access to both improved drinking water and improved toilet facility
§ Among most recent births
⌘ Anthropometry was collected in every second household in the 2011 survey, so estimates are based on a subset of all women.

3.4 REGRESSION ANALYSIS FOR NEONATAL MORTALITY

Tables 3.3 shows unadjusted and adjusted odds ratios for neonatal mortality by socio-demographic characteristics, among *most recent births* in the five-year periods preceding the surveys. In the adjusted model, all socio-demographic characteristics presented in Table 3.3 are included[8]. Table 3.4 shows unadjusted and

[8] The model also controls for the neonate's month of birth (coefficient not shown), in order to control for any seasonality.

adjusted odds ratios for neonatal mortality by behavioral and environmental characteristics, among *most recent births* in the five-year periods preceding the surveys. In Table 3.4, the adjusted model controls for the same socio-demographic characteristics presented in Table 3.3. The adjusted results in Table 3.4 demonstrate whether the behavioral and environmental indicators of interest remain significant predictors of neonatal death, after adjusting for key socio-demographic characteristics.

3.4.1 Background Characteristics

In the bivariate analysis, rural residence, mother's lack of education, mother's old or young age at the baby's birth, and short birth spacing are associated with greater odds of neonatal mortality in at least one survey. After adjusting for socio-demographic characteristics, only mother's lack of education remains a significant predictor of neonatal mortality, according to the 2011 survey results. Among births in the five years preceding the 2011 survey, neonates born to mothers without education have twice the odds of neonatal death, compared with babies whose mothers had at least primary education. According to both the 2001 and 2006 surveys, babies born after a short birth interval (under two years) have roughly twice the odds of neonatal death, compared with babies born after an interval of at least two years. While the associations between caste and ethnicity, birth order, and neonatal mortality are not significant, the odds ratios are in the expected direction, such that being socially disadvantaged, and being a first or high order birth, are associated with greater risk. There is no consistent pattern in neonatal mortality by the wealth status of households.

Table 3.3 Logistic regression analysis for neonatal mortality by socio-demographic characteristics

Bivariate and multivariate logistic regression results by socio-demographic characteristics for neonatal mortality among *most recent births* in the five years preceding the surveys, NDHS 2001-2011

		DHS 2011		DHS 2006		DHS 2001	
		uOR	aOR	uOR	aOR	uOR	aOR
Background variables							
Residence:	Urban (reference)						
	Rural	1.2	1.0	1.7	1.3	2.4**	2.0
Wealth status:	Wealthiest (reference)						
	Middle	1.7	0.7	1.3	0.7	1.1	0.9
	Least wealthy	1.0	1.3	1.1	0.8	1.3	1.0
Caste and ethnicity:	Non-disadvantaged (reference)						
	Disadvantaged[1]	1.6	1.4	1.9	1.5	1.0	1.1
Mother's education:	Primary or higher (reference)						
	No education	1.8	1.9**	2.6**	2.7**	1.4	1.7
Age at birth:	20-35 years (reference)						
	<20 years or >35years	1.0	1.0	1.3	1.2	1.7**	1.4
Birth order:	2nd or 3rd (reference)						
	1st or 4th or more	1.1	1.2	1.5	1.4	1.5	1.6
Birth spacing:	More than two years (reference)						
	Less than two years	1.9	1.9	2.0**	2.1**	1.6	1.8**
	First births	1.5	1.0	1.8	1.0	1.5	1.0

** p<0.05
uOR=unadjusted odds ratio; aOR=adjusted odds ratio (Adjusts for all background variables presented in this table, as well as month of birth)
[1] Disadvantaged: Hill Dalit, Terai Dalit, Hill Janajati (except for Gurung, Thakali, Magar), Terai Janajati, Other Terai Caste, or Muslim

3.4.2 Newborn Care Characteristics

In the bivariate analysis, birth preparedness and proper cord care are significantly associated with neonatal mortality in at least one survey. Babies whose mothers were poorly prepared for the birth have 1.7 times greater odds of dying in the first month of life, according to the 2011 DHS, compared with babies whose mothers were better prepared for the birth. After adjusting for socio-demographic characteristics, only proper cord care remains significantly associated with neonatal death, such that babies who did not receive proper cord care have

greater odds of dying in the first month of life; however, this association is only significant in the 2001 survey. No consistent pattern was observed between immediate newborn care and neonatal death.

3.4.3 Maternal Health Characteristics

Newborn health is affected by maternal health. We assessed the effect of maternal BMI, maternal anemia, and maternal short stature (<145 cm) on newborn survival. According to the 2011 survey, the odds of neonatal death are higher for babies whose mother is of short stature, compared with babies whose mother is of normal stature. This association remains significant after controlling for socio-demographic characteristics. While we expected neonatal mortality to be higher among anemic mothers, and among mothers with low BMI, the analysis did not provide evidence of this association.

3.4.4 Health Care Utilization

In the bivariate analysis, antenatal care, delivery in an institution, and delivery by a skilled birth attendant are significantly associated with neonatal survival in at least one survey. The association between antenatal care and neonatal mortality is particularly consistent across all three surveys. According to the 2011 survey data, after adjusting for socio-demographic characteristics, having less than four antenatal visits remains a significant predictor of neonatal death, such that babies born to mothers with fewer than four ANC check-ups have 1.8 times greater adjusted odds of dying, compared with babies whose mothers had at least four visits.

While the adjusted odds of neonatal mortality are higher among babies who were not delivered at a health institution, and among babies whose births were not assisted by skilled birth attendants according to the 2001 survey, these associations are not significant in the two more recent surveys, in 2006 and 2011. The analysis did not find a significant association between postnatal care or reported problems accessing health care and neonatal mortality; this lack of association could be due to sample size and other data limitations on these variables in the surveys.

3.4.5 Environment and Media-Related Characteristics

Exposure to indoor air pollution is significantly associated with higher risk of neonatal mortality. This association remains significant after controlling for other socio-demographic characteristics, according to the 2011 survey data, such that babies in households with indoor air pollution have twice the odds of neonatal death. In the 2011 survey a mother's exposure to public health media significantly reduces the odds of newborn death, though the association is not significant in the adjusted model. No consistent pattern was found between household access to improved water and sanitation facilities, and neonatal mortality.

Table 3.4 Logistic regression analysis for neonatal mortality by behavioral and environmental characteristics

Bivariate and multivariate logistic regression results by behavioral and environmental characteristics for neonatal mortality among *most recent births* in the five years preceding the surveys, NDHS 2001-2011

		DHS 2011		DHS 2006		DHS 2001	
		uOR	aOR	uOR	aOR	uOR	aOR
Newborn care							
Birth preparedness[1]:	Better (reference)						
	Poorer	1.7**	1.6	1.3	1.2	na	na
Immediate newborn care[2]:	Better (reference)						
	Poorer	1.5	1.7	0.8	0.6	na	na
Proper cord care[3]:	Yes (reference)						
	No	1.1	1.0	1.2	0.7	4.5**	4.1**
Maternal nutrition							
BMI:	Normal (reference)						
	Low	1.4	1.2	1.0	0.9	1.0	0.9
	Overweight/obese	1.0	1.1	1.1	1.7	0.6	0.9
Anemia[4]:	No (reference)						
	Yes	1.0	1.23	0.9	1.0	na	na
Stature:	Normal (>145 cm) (reference)						
	Short (<145 cm)	4.6**	4.3**	1.3	1.2	1.5	1.5
Service utilization							
ANC 4+ visits:	Yes (reference)						
	No	1.9**	1.8**	2.8**	2.3	2.5**	2.1
Institutional delivery:	Yes (reference)						
	No	1.3	1.3	1.1	0.7	4.5**	3.8**
Delivery by SBA[5]:	Yes (reference)						
	No	1.3	1.3	1.0	0.6	3.0**	2.6**
Postnatal visit:	Yes (reference)						
	No	1.1	1.1	0.8	0.5	0.9	0.8
Problem in accessing health care[6]:	No (reference)						
	Yes	1.5	1.3	1.6	1.2	1.2	0.9
Other							
Indoor air pollution[7]:	No (reference)						
	Yes	2.0**	2.5**	1.4	1.3	na	na
Improved water and sanitation[8]:	Yes (reference)						
	No	1.3	1.1	1.1	0.9	1.0	0.8
Exposed to public health media:	Yes (reference)						
	No	1.8**	1.5	1.2	0.8	na	na

** p<0.05

uOR=unadjusted odds ratio; aOR=adjusted odds ratio (adjusted for area of residence, wealth status, caste and ethnicity, mother's education, mother's age at delivery, birth spacing, and month of birth)

[2] Birth preparedness: at least two of the following preparations is defined as "better" and less than two is defined as "poorer": money, transport, blood donor, contact with health worker, and bought clean delivery kit

[3] Immediate newborn care: having all three of the following is defined as "better" and having less than three is defined as "poorer": drying, wrapping, and delayed bathing

[3] Proper cord care: use of clean instrument and applied nothing or only chlorhexidine on the cord

[4] Skilled birth attendants: doctor, nurse, or midwife

[5] Anemia: <12.0 g/dl for non-pregnant and <11.0g/dl for pregnant women

[6] Problem accessing health care: difficulty due to at least one of the following: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone

[7] Indoor air pollution: cooking inside the home using solid fuel

[8] Access to improved water and sanitation: households with access to both improved drinking water and improved toilet facility

4 DISCUSSION AND CONCLUSIONS

4.1 SUMMARY OF FINDINGS

Overall, the study indicates that after controlling for key socio-demographic characteristics, neonatal mortality was significantly associated with no maternal education, short maternal stature, fewer than four ANC visits, and indoor air pollution in 2011, and was significantly associated with short birth intervals and no maternal education in 2006. In 2001, when women were not asked about four of the factors examined in later surveys,[9] neonatal mortality was significantly associated with shorter birth spacing, lack of proper cord care, lack of institutional delivery, and delivery by someone other than a skilled birth attendant. Over the period covered by the three surveys, some of these indicators have improved (e.g., exposure to indoor air pollution), while others have not (e.g., birth spacing).

Interpretation of these findings is difficult in some instances, such as the lack of association between postnatal care visits and neonatal mortality. Although international literature suggests that postnatal home visits can prevent 30 to 60 percent of newborn deaths (WHO/UNICEF, 2009), this analysis could not identify an impact of postnatal visits on neonatal mortality. This might be due to collinearity, data limitations, or to the actual quality of the visits. Although the proportion of newborns receiving at least one postnatal visit has increased since 2001 (from 25 to 45 percent), most of these visits are to women who delivered at health institutions. Delivery at health institutions or with assistance by a skilled birth attendant is increasing in Nepal, primarily after introduction of the *Aama* Program in 2005 and associated incentives for institutional delivery for both providers and consumers (DOHS, 2012). While institutional delivery and delivery assisted by SBAs are significantly associated with newborn mortality rates in 2001, we did not find significant associations in the 2006 or 2011 surveys. Further analysis and research are needed to explore whether increased delivery at health institutions or assisted delivery by SBAs really has an impact on newborn mortality in Nepal. Program managers should be careful to check that, in the focus on rapid service expansion, quality of care has not been compromised.

Antenatal care visits are associated with neonatal survival after adjusting for key socio-demographic characteristics; this finding is significant in the 2011 survey. Unadjusted odds ratios indicate that across all three survey years, the factor most consistently associated with neonatal mortality was having had fewer than four ANC visits, although the relationship between ANC and neonatal mortality appears to have attenuated over time. As more and more women are making four or more antenatal care visits, we can expect to see some impact on neonatal mortality in years to come. Programs should be attentive, however, to ensure that women are not getting just a perfunctory “contact” with a provider but instead are getting the “content” required by quality standards.

Maternal education is significantly associated with neonatal survival. Our analysis confirms that newborns born to a mother without education are more likely to die than those born to a mother with at least primary level of

[9] Women were not asked about birth preparedness, immediate newborn care, indoor air pollution, and were not tested for anemia.

education, even after controlling for other socio-demographic characteristics. This confirms the observation that the health sector should collaborate with other sectors to have an impact on health outcomes.

Birth spacing is another factor associated with newborn survival. This analysis demonstrates that newborns born with less than two years of spacing have twice the odds of neonatal mortality, compared with newborns born with at least two years of spacing. Programs should focus on educating mothers and their families about the importance of birth spacing for better health outcomes for their newborn and for mothers.

This study could not establish a significant association between newborn mortality and birth preparedness, immediate newborn care, or proper cord care. These questions were only asked about the most recent birth in the past five years, which may have resulted in an overly limited sample size. Many expected that the 2011 survey would show some impact of the ongoing community-based newborn care package on neonatal mortality. However, we consider it too early to expect to see the impact of the program at the outcome level, as the program was first rolled out in a handful of districts in 2009 and had not been fully functional in many of those districts at the time of the survey. Because the newborn mortality rate is calculated for the five years preceding the survey (that is, 2006-2010 for the 2011 survey), most of the births or pregnancies actually occurred before the newborn care package interventions, thus diluting any recent effect.

The findings concerning the effect of improved water and sanitation and of exposure to public health media are not statistically significant or consistent among the surveys. In 2011, however, indoor air pollution was significantly associated with neonatal mortality, even after controlling for other key socio-demographic characteristics. The proportion of households with indoor air pollution has decreased, but efforts to save newborns from the harmful effects of indoor air pollution should be increased.

4.2 OVERALL CONCLUSION

As neonatal death is a relatively rare event and the data available in these surveys have some limitations, several associations were not statistically significant in this analysis. However, this study clearly indicates the need to promote the coverage and quality of antenatal care visits, and the need to focus on newborn care as a part of routine delivery care to promote newborn survival. Also, health programs should collaborate with non-health sectors (e.g., the education sector for mothers' literacy, the environment sector for indoor air pollution) to improve newborn survival in Nepal. Maternal stature is another factor strongly affecting newborn survival. Improvement there needs inter-generational efforts through health and nutrition interventions. Our analysis demonstrates the gap in neonatal mortality between different socio-economic groups and underlines the need for equity-focused interventions at all levels. As verbal autopsy is not a part of the 2006 and 2011 DHS surveys, we could not analyze whether there has been any change in the immediate causes of neonatal deaths in Nepal over this time frame.

4.3 PROGRAM AND RESEARCH IMPLICATIONS

The following are major program and research implications arising from the findings of the study:

- There is a wide gap in the rate of neonatal mortality between different socio-economic groups. To reduce neonatal mortality, programs should address areas and populations with higher neonatal

mortality rates (e.g., rural areas, households with the least wealth, and disadvantaged caste and ethnic groups).

- Neonatal health is affected by other health and non-health programs (e.g., birth spacing through family planning, mother's education through literacy programs, reduction of indoor air pollution through environmental programs). Inter-sectoral approaches would promote a synergistic effect on multiple health and development outcomes.

- This study focuses on distant determinants of neonatal mortality. Further research is needed to better understand the immediate causes of neonatal deaths, and the findings from such studies should be used to appropriately focus program efforts.

- The fact that this study did not find the expected effects of some interventions may raise concerns about the quality of some ongoing programs. Further examination of the quality and focus of those programs is needed to assure robust effects on health outcomes.

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ANNEXES

Annex 1

Table A.1 Distribution of reported neonatal deaths by age at death in days and the percentage of early neonatal deaths (deaths occurred at ages 0-6 days), for the five-year periods preceding the surveys (weighted), Nepal DHS 2001–2011

Day	Age at death (in days)		
	2011	2006	2001
<1	65	53	96
1	28	22	22
2	12	18	9
3	19	14	21
4	13	11	15
5	7	4	15
6	6	5	9
7	7	1	12
8	1	4	8
9	3	5	7
10	2	1	3
11	1	3	10
12	1	10	5
13	1	8	1
14	0	1	4
15	3	2	4
16	0	0	6
17	1	3	1
18	0	0	1
19	1	2	0
20	1	2	3
21	1	4	1
22	1	3	5
23	1	0	2
24	0	0	6
25	4	1	4
26	0	0	5
27	1	4	2
28	2	0	2
29	0	0	1
30	0	0	0
Total newborn deaths	178	181	270
Early neonatal[11] deaths	150	128	187
Early neonatal deaths (%)	85	70	69
Deaths on day 1 (%)	37	29	36

[10] Total "n" may not add-up due to rounding effect

[11] ≤6days / ≤30days

Annex 2 Detailed Tables

Table A2.1 Background characteristics

Percentage distribution of *all births* in the five years preceding the surveys by background characteristics, Nepal DHS 2001-2011

Background characteristic	NDHS 2011		NDHS 2006		NDHS 2001	
	Percent	Number of births	Percent	Number of births	Percent	Number of births
Household characteristics						
Residence						
Urban	9.4	510	12.2	684	6.5	457
Rural	90.6	4,918	87.8	4,906	93.5	6,587
Ecological zone						
Mountain	8.0	433	8.7	487	7.7	542
Hill	39.3	2,136	40.8	2,281	41.3	2,911
Terai	52.7	2,859	50.5	2,822	51.0	3,591
Development region						
Eastern	23.6	1,278	21.5	1,201	22.9	1,612
Central	31.7	1,721	32.7	1,828	33.0	2,325
Western	18.7	1,016	18.5	1,035	18.1	1,273
Mid-western	14.8	802	12.7	710	15.2	1,073
Far western	11.3	611	14.6	816	10.8	761
Wealth status						
Least wealthy	47.5	2,580	46.9	2,622	47.5	3,344
Middle	21.2	1,150	20.5	1,141	19.9	1,400
Wealthiest	31.3	1,698	32.7	1,826	32.6	2,300
Caste and ethnicity						
Disadvantaged[1]	67.2	3,648	63.6	3,557	62.2	4,379
Non-disadvantaged	32.8	1,780	36.4	2,033	37.8	2,665
Household size						
Small: fewer than 5 members	46.0	2,499	41.6	2,327	35.1	2,472
Big : more than 5 members	54.0	2,929	58.4	3,263	64.9	4,572
Altitude						
High	28.07	1,524	34.8	1,944	30.1	2,120
Moderate	13.96	758	14.3	798	20.0	1,401
Low	57.97	3,147	51.0	2,849	50.0	3,523
Indoor air pollution						
Yes	57.7	3,131	69.6	393	91.4	6,440
No	42.3	2,297	30.4	1,697	8.6	604
Access to improve water and toilet facilities						
Yes	22.6	1,224	12.8	717	14.1	996
No	77.4	4,204	87.2	4,873	85.9	6,048
Maternal characteristics						
Mother's education						
No education	47.3	2,567	60.5	3,382	74.4	5,239
Primary or higher	52.7	2,861	39.5	2,208	25.6	1,805
Maternal age at current birth						
20-35 years	72.5	3,936	71.3	3,987	72.4	5,098
Younger (<25) or older (>35)	27.5	1,493	28.7	1,602	27.6	1,946
Maternal BMI ⌘						
Low BMI (<18.5)	19.6	513	25.3	1,405	25.2	1,772
Normal BMI (18.5-25)	70.5	1,844	69.0	1,831	71.4	5,017
Obese or overweight (>25)	9.8	257	5.7	319	3.4	242
Maternal anemia° ⌘						
Anemia	37.9	978	40.4	2,231	na	na
No anemia	62.1	1,066	59.6	3,288	na	na
Maternal stature ⌘						
Short stature (<145 cm)	12.6	331	14.3	793	15.2	1,071
Normal stature (>145 cm)	87.4	2,286	85.7	4,763	84.8	5,960
Use of any kind of tobacco						
No	87.1	4,726	80.4	4,497	73.7	5,191
Yes	12.9	702	19.6	1,093	26.3	1,853
Child and birth characteristics						
Sex						
Female	48.6	2,636	49.2	2,752	50.5	3,557
Male	51.4	2,792	50.8	2,838	49.5	3,487
Birth order						
First	34.0	1,843	30.2	1,687	23.8	1,677
Second or third	43.9	2,382	42.3	2,367	39.9	2,808
Fourth or more	22.1	1,203	27.5	1,535	36.3	2,559
Birth interval						
More than five years	17.7	632	11.9	463	9.4	505
Two to five years	61.0	2,184	66.2	2,578	67.7	3,627
Less than two years	21.3	762	21.9	853	22.9	1,226
Size at birth						
Average or bigger	84.0	4,486	80.8	4,437	78.8	5,457
Small or very small	16.0	857	19.2	1,054	21.2	1,464
Birth preparedness and immediate newborn care						
Birth preparedness[2] §						
Better	42.5	1,743	21.6	862	na	na
Poorer	57.5	2,357	78.4	3,238	na	na

Table A2.1 Background characteristics

Percentage distribution of *all births* in the five years preceding the surveys by background characteristics, Nepal DHS 2001-2011

Background characteristic	NDHS 2011		NDHS 2006		NDHS 2001	
	Percent	Number of births	Percent	Number of births	Percent	Number of births
Immediate newborn care[3] §						
Better	48.72	1,974	25.7	1,018	na	na
Poorer	51.28	2,077	74.3	2,949	na	na
Proper cord care[4] §						
Clean cord care	52.0	2,155	34.3	1,393	na	na
Unclean cord care	48.0	1,989	65.7	2,664	na	na
Initiation of breastfeeding					na	na
Within one hour of birth	39.7	1,612	49.6	1978	42.6	1,975
More than one hour	60.3	2,448	50.4	2,006	57.4	2,665
Health care seeking and utilization						
Antenatal care visits §						
Four or more visits	50.3	2,063	29.5	1,182	14.3	668
Fewer than four visits	49.7	2,037	70.5	2,831	85.7	4,016
Protection by tetanus toxoid §						
Yes	72.3	2,966	63.8	2,559	45.1	2,117
No	27.7	1,134	36.2	1,454	54.9	2,574
Received iron tablets §						
More than 90 tablets	55.9	2,293	28.7	1,151	5.7	266
None or fewer than 90 tablets	44.1	1806	71.3	2,862	94.3	4,421
Received deworming tablets §						
Yes	55.1	2,260	20.0	804	na	na
No	44.9	1,840	80.0	3,209	na	na
Overall ANC care §						
Good ANC	20.8	864	1.3	53	na	na
Poor ANC	79.2	3,280	98.7	4,004	na	na
Delivery assisted by skilled birth attendant[5]						
Yes	35.9	1918	18.7	1,028	10.8	750
No	64.1	3,424	81.3	4,464	89.2	6,172
Delivery at health institution						
Yes	35.2	1,880	17.7	971	9.0	625
No	64.8	3,463	82.3	4,532	91.0	6,296
Postnatal check for newborn within 3 days) §						
Yes	29.8	1,222	4.3	138	15.3	723
No	70.2	2,878	95.7	3,094	84.7	4,005
Barriers to access to health care						
Yes	78.2	4,245	77.5	4,330	85.5	6,020
No	21.8	1,183	22.5	1,260	14.5	1,024
Exposure to media						
Exposed to general media						
At least weekly	54.5	2,959	32.4	1,811	42.0	2,957
Less than weekly	45.5	2,469	67.6	3,778	58.0	4,087
Exposed to public health media						
At least weekly	40.2	2,183	49.7	2,776	na	na
Less than weekly	59.8	3,245	50.3	2,814	na	na

[1] Disadvantaged: Hill Dalit, Terai Dalit, Hill Janajati (except for Gurung, Thakali, Magar), Terai Janajati, Other Terai Caste, or Muslim
[2] Birth preparedness: at least two of the following preparations is defined as "better" and less than two is defined as "poorer": money, transport, blood donor, contact with health worker, and bought clean delivery kit
[3] Immediate newborn care: having all three of the following is defined as "better" and having less than three is defined as "poorer": drying, wrapping, and delayed bathing
[4] Proper cord care: use of clean instrument and applied nothing or only chlorhexidine on the cord
[5] Skilled birth attendants: doctor, nurse, or midwife
[6] Anemia: <12.0 g/dl for non-pregnant and <11.0g/dl for pregnant women
[7] Problem accessing health care: difficulty due to at least one of the following: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone
[8] Indoor air pollution: cooking inside the home using solid fuel
[9] Access to improved water and sanitation: households with access to both improved drinking water and improved toilet facility

§ *Among most recent births*
ϰ Anthropometry was collected in every second household in the 2011 survey, so estimates are based on a subset of all women

Table A2.2 Neonatal mortality by background characteristics

Neonatal mortality rate (NMR) among *all births* in the five years preceding the surveys, by background characteristics, Nepal DHS 2001-2011

Background characteristic	NDHS 2011		NDHS 2006		NDHS 2001	
	NMR	95% CI	NMR	95% CI	NMR	95% CI
Household characteristics						
Residence						
Urban	23	14-39	26	18-34	26	16-41
Rural	34	27-41	33	27-41	39	34-46
Ecological zone						
Mountain	38	24-60	50	32-78	51	39-68
Hill	32	26-40	26	19-35	32	25-41
Terai	32	23-45	35	26-46	41	33-51
Development region						
Eastern	30	21-41	33	23-47	46	35-61
Central	37	24-58	28	19-43	38	28-51
Western	32	23-45	32	21-51	28.	20-41
Mid-western	25	18-35	47	32-71	30	19-46
Far- western	38	27-55	28	16-48	50	40-64
Wealth status						
Least wealthy	33	26-41	33	25-43	39	32-49.
Middle	41	28-61	46	32-66	44	34-58
Wealthiest	27	18-39	24	17-33	33	25-43
Caste and ethnicity						
Disadvantaged[1]	36	28-46	35	27-44	40	33-48
Non-disadvantaged	26	19-35	28	21-39	35	28-45
Household size						
Small: fewer than 5 members	37	29-46	34	26-44	51	42-63
Big : more than 5 members	29	22-39	31	25-40.	31	26-38
Altitude						
High	36	28-46	30	21-46	35	28-43
Moderate	34	24-47	34	24-48	33	21-52
Low	31	23-43	34	25-45	42	34-52
Indoor air pollution						
Yes	37	29-47	36	29-46	40	35-47
No	27	19-39	23	17-32	15	08-28
Access to improve water and toilet facilities						
Yes	28	19-40	22	12-40	34	25-47
No	34	27-43	34	27-42	39	33-46
Maternal characteristics						
Mother's education						
No education	38	29-50	39	31-49	40	34-47
Primary or higher	28	21-37	23	17-31	33	25-44
Maternal age at current birth						
20-35 years	30	23-38	27	22-34	32	26-39
Younger (<25) or older (>35)	40	29-56	46	33-62	55	45-68
Maternal BMI ⌘						
Low BMI (<18.5)	35	20-62	31	23-43	47	37-61
Normal BMI (18.5-25)	36	26-50	33	26-41	36	30-43
Obese or overweight (>25)	21	7-60	27	11-65	16	5-47
Maternal anemia[6] ⌘						
Anemia	31	21-44	30	23-38	na	na
No anemia	36	21-61	34	26-46	na	na
Maternal stature ⌘						
Short stature (<145 cm)	67	38-119	43	29-65	54	41-72
Normal stature (>145 cm)	30	22-39	30	25-37	35	30-42
Use of any kind of tobacco						
No	33	27-42	32	26-40	37	32-45
Yes	28	19-42	34	23-50	40	30-53
Child and Birth Characteristics						
Sex						
Female	35	27-44	33	26-42	32	26-40
Male	31	23-41	31	24-40	44	36-54
Birth order						
First	39	29-51	44	33-59	51	41-65
Second or third	32	23-46	21	15-28	31	25-39
Fourth or more	24	17-36	38	27-52	38	29-49
Birth spacing						
Less than two years	54	34-87	38	26-55	56	42-74
More than two years	23	17-31	24	18-32	28	23-34
First births	39	29-51	44	33-59	51	41-65

Table A2.2 Neonatal mortality by background characteristics

Neonatal mortality rate (NMR) among *all births* in the five years preceding the surveys, by background characteristics, Nepal DHS 2001-2011

Background characteristic	NDHS 2011		NDHS 2006		NDHS 2001	
	NMR	95% CI	NMR	95% CI	NMR	95% CI
Size at birth						
Average or bigger	29	23-38	26	21-34	32	27-39
Small or very small	51	38-70	57	43-77	58	46-74
Birth preparedness and immediate newborn care						
Birth preparedness § [2]						
Better	13	8-21	14	7-27	na	na
Poorer	22	15-31	18	13-25	na	na
Immediate newborn care § [3]						
Better	12	8-19	16	9-26	na	na
Poorer	18	13-27	13	9-19	na	na
Proper cord care[4]						
Clean cord care	20	13-29	17	12-23	na	na
Unclean cord care	17	12-24	20	12-31	na	na
Initiation of breastfeeding						
Within one hour of birth	12	08-18	19	13-27	24	18-30
More than one hour	7	04-12	10	6-18	21	16-28
Health care seeking and utilization						
Antenatal care visits §						
Four or more visits	13	08-19	8	4-17	10	5-22
Fewer than four visits	24	16-36	22	16-30	25	20-31
Protection by tetanus toxoid §						
Yes	14	9-22	11	7-16	18	13-25
No	28	19-41	30	21-42	27	20-36
Received iron tablets §						
More than 90 tablets	15	11-22	1	0-6	23	19-29
None or fewer than 90 tablets	22	14-34	19	14-25	No	no death
Received deworming tablets §						
Yes	13	09-19	17	9-31	na	na
No	24	15-38	18	14-24	na	na
Delivery assisted by skilled birth attendant[5]						
Yes	15	10-23	30	19-47	23	14-36
No	20	14-29	33	27-40	40	34-46
Delivery at health institution						
Yes	15	10-24	29	18-46	21	12-36
No	20	14-29	33	27-41	39	34-46
Postnatal check for newborn within 3 days) §						
Yes	16	08-31	42	16-115	29	21-42
No	19	14-26	17	12-23	40	34-50
Barriers to access to health care						
Yes	26	16-43	24	16-37	30	20-44
No	35	28-43	35	28-43	40	34-47
Exposure to media						
Exposed to general media						
At least weekly	31	25-39	34	24-49	35	28-44
Less than weekly	34	25-48	32	25-39	41	34-49
Exposed to public health media						
At least weekly	27	21-35	29	22-40	na	na
Less than weekly	37	28-47	35	27-46	na	na

[1] Disadvantaged: Hill Dalit, Terai Dalit, Hill Janajati (except for Gurung, Thakali, Magar), Terai Janajati, Other Terai Caste, or Muslim
[2] Birth preparedness: at least two of the following preparations is defined as "better" and less than two is defined as "poorer": money, transport, blood donor, contact with health worker, and bought clean delivery kit
[3] Immediate newborn care: having all three of the following is defined as "better" and having less than three is defined as "poorer": drying, wrapping, and delayed bathing
[4] Proper cord care: use of clean instrument and applied nothing or only chlorhexidine on the cord
[5] Skilled birth attendants: doctor, nurse, or midwife
[6] Anemia: <12.0 g/dl for non-pregnant and <11.0g/dl for pregnant women
[7] Problem accessing health care: difficulty due to at least one of the following: getting permission to go for treatment, getting money for treatment, distance to a health facility, and not wanting to go alone
[8] Indoor air pollution: cooking inside the home using solid fuel
[9] Access to improved water and sanitation: households with access to both improved drinking water and improved toilet facility
§ *Among most recent births*
ϰ Anthropometry was collected in every second household in the 2011 survey, so estimates are based on a subset of all women