Childhood Illness and Mortality in Nepal: Trends and Determinants

DHS Further Analysis Reports No. 120

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Ministry of Health and Population

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Additional information about the 2016 NDHS may be obtained from the Ministry of Health and Population, Ramshahpath, Kathmandu; telephone: +977-1-4262543/4262802; internet: http://www.mohp.gov.np; and New ERA, Rudramati Marg, Kathmandu, P. O. Box 722, Kathmandu 44600, Nepal; telephone: +977-1-4413603; email: info@newera.com.np; internet: http://www.newera.com.np.

The DHS Program assists countries worldwide in the collection and use of data to monitor and evaluate population, health, and nutrition programs. Additional information about The DHS Program can be obtained from ICF, 530 Gaither Road, Suite 500, Rockville, MD 20850 USA; telephone: +1 301-407-6500, fax: +1 301-407-6501, email: info@DHSprogram.com, internet: www.DHSprogram.com.

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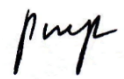
FOREWORD

The 2016 Nepal Demographic and Health Survey (NDHS) is the fifth nationally representative comprehensive survey conducted as part of the worldwide Demographic and Health Surveys (DHS) Program in the country. The survey was implemented by New ERA under the aegis of the Ministry of Health and Population (MoHP). Technical support for this survey was provided by ICF with financial support from the United States Agency for International Development (USAID) through its mission in Nepal and support for report production from the United Nations Population Fund (UNFPA).

The standard format of the survey final report included only a descriptive presentation of findings and trends, and did not include analytical methods that can ascertain the significance of change and association among variables. Although largely sufficient, the final report is limited, particularly in providing answers to "why" – answers that are essential in reshaping important policies and programs. After the dissemination of the NDHS 2016, the MoHP and its partners convened and agreed on key areas that are necessary for assessing progress, gaps, and determinants in high-priority public health programs being implemented by the MoHP. In this context, seven further analysis studies have been conducted by technical professionals from the MoHP and its partners who work directly on the given areas, with technical support and facilitation from research agencies.

The primary objective of the further analysis of the 2016 NDHS is to provide more in-depth knowledge and insights into key issues that emerged from the survey. This information provides guidance for planning, implementing, refocusing, monitoring, and evaluating health programs in Nepal. The long-term objective of the further analysis is to strengthen the technical capacity of local institutions and individuals for analyzing and using data from complex national population and health surveys to better understand specific issues related to country need.

The further analysis of the 2016 NDHS is the concerted effort of many individuals and institutions, and it is with great pleasure that I acknowledge the work involved in producing this useful document. The participation and cooperation of the members of the Technical Advisory Committee in the different phases of the survey are highly valued. I would like to extend my appreciation to USAID/Nepal for providing financial support for the further analyses. I would also like to acknowledge ICF for its technical assistance at all stages. My sincere thanks also go to the New ERA team for the overall management and coordination of the entire process. I would also like to thank the Public Health Administration Monitoring and Evaluation Division, as well as the Policy Planning and Monitoring Division, MoHP, for their efforts and dedication to the completion of this further analysis of the 2016 NDHS.



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ABSTRACT

This report documents levels, trends, and determinants of childhood illnesses (diarrhea, symptoms of acute respiratory infection (ARI, and fever), treatment or advice-seeking practices for childhood illnesses, and childhood mortality (neonatal and under-5 deaths) using data from 2006 and 2016 Nepal Demographic and Health Survey (NDHS). The findings from this study showed that between 2006 and 2016, the prevalence of diarrhea and symptoms of acute respiratory infection (ARI) among under-5 children declined by 4% and 3%, respectively, while the prevalence of fever increased by 4%. Over the decade, treatment or advice-seeking practices from the health facilities or providers for diarrhea, symptoms of acute respiratory infection (ARI), and fever showed significant improvement. However, children from poor households were less likely to seek treatment or advice from health facilities or providers.

Reductions in neonatal and under-5 mortality were documented in Nepal over the decade. In addition, multivariate analysis showed that smaller neonates and neonates who were not weighed at the time of birth were more likely to die in the neonatal period, while neonates born in Province 1 had a lower likelihood of dying compared to those from Province 7 (Sudurpashchim Province). For under-5 children, those who had not received immediate newborn care were more likely to die before their fifth birthday.

KEY WORDS: child illness, treatment seeking practice, neonatal mortality, under-5 mortality

ACRONYMS AND ABBREVIATIONS

ANC	antenatal care
aOR	adjusted odds ratio
ARI	acute respiratory infection
CBAC	community-based ARI control program
CB-IMCI	community-based integrated management of childhood illness
CB-IMNCI	community-based integrated management of neonatal and childhood illness
CI	confidence interval
DoHS	Department of Health Services
FCHV	female community health volunteers
GoN	Government of Nepal
NDHS	Nepal Demographic and Health Survey
NICU	neonatal intensive care unit
NMR	neonatal mortality rate
MoH	Ministry of Health
MoHP	Ministry of Health and Population
ORS	oral rehydration solution
SNCU	special newborn care unit
U5MR	under-5 mortality rate
UN IGCME	United Nations Inter-agency Group for Child Mortality Estimation
uOR	unadjusted odds ratio
WHO	World Health Organization

1 INTRODUCTION

1.1 Context

In 2015, The World Health Organization (WHO) estimated that pneumonia, diarrhea, malaria, injuries, and measles were major causes of deaths in the postnatal period, and prematurity, birth-related complications, and neonatal sepsis were the leading causes of neonatal deaths. Although substantial progress has been made in child survival in the last few decades, the United Nations Inter-agency Group for Child Mortality Estimation (UN IGCME) estimated that approximately 5.6 million children died before their fifth birthday in 2016 (UN IGCME 2017). Among those, 2.6 million (46%) died during the neonatal period. Globally, the under-5 mortality rate (U5MR) dropped from 64 deaths per 1,000 live births in 2006 to 41 in 2016. Likewise, neonatal mortality rates (NMR) also dropped from 26 per 1000 live births in 2006 to 19 per 1000 live births in 2016. Sub-Saharan Africa and Southern Asia were the geographic areas where 80% of the total under-5 deaths and neonatal deaths occur (UN IGCME 2017). According to the WHO, the leading causes of death among children under age 5 in 2016 were preterm birth complications, pneumonia, birth asphyxia, intrapartum complications, congenital anomalies, diarrhea, and malaria (WHO 2017). The discrepancy in child mortality was also observed by geography, sex, and socioeconomic status (UN IGCME 2017).

According to the Department of Health Services (DoHS) annual report 2016/17, diarrhea, upper respiratory tract infections, lower respiratory tract infections, fever (typhoid and para-typhoid), anemia, protein-energy malnutrition, pneumonia, injury, birth asphyxia, and sepsis were the top ten illnesses in under-5 children that lead to hospital admission in Nepal (DoHS 2016/17). The Nepal Demographic and Health Survey (NDHS) 2016 has explored the prevalence of fever, diarrhea, and symptoms of acute respiratory infection (ARI) in Nepal and reported that 21.0% of children had fever, 7.6% had diarrhea, and 2.4% had ARI symptoms 14 days before the day of the survey. According to the same report, the NMR of Nepal was 21 per 1,000 live births, while the under-5 mortality was 39 per 1,000 live births. The NDHS 2016 revealed that nearly a third of the causes of neonatal mortality in Nepal were respiratory and cardiovascular disorders (31%) and complications of pregnancy, labor, and delivery (30%), followed by infection specific to the perinatal period (16%), congenital malformations and deformations (7%), hypothermia (4%), sudden neonatal death (6%), disorders related to the length of gestation and fetal growth (2%), and others (5%) (MoH, New ERA, and ICF 2017).

1.2 Literature Review

Few studies have examined the determinants of childhood illnesses (diarrhea, symptoms of ARI, and fever), children's treatment or advice-seeking practice from health facilities or providers, and neonatal and under-5 deaths in Nepal.

1.2.1 Prevalence of diarrhea, symptoms of ARI, and fever

Prevalence of diarrhea in Nepal was found to be higher among children age 6-23 months, malnourished children, children from a household with unimproved water and sanitation facilities, children of poorer households, children of low-educated mothers, and mothers who do not practice proper hand washing (Budhathoki et al. 2016; Malqvist, Singh, and KC 2017). In addition, a 2016 epidemiological study found that diarrhea prevalence was higher among nonexclusively-breastfed children under 6 months of age, children of a nonformal working father, and children from a community where there were other children with diarrhea (Kalakheti, Panthee, and Jain 2016). A hospital-based study in Bharatpur, Nepal

(Yadav et al. 2013), reported that risk factors associated with the prevalence of ARI symptoms were associated with male gender, rural residency, overcrowding, history of ARI in any family member within 2 weeks of the interview, and a child's malnourished status. In addition, a cross-sectional study conducted in Gorkha district, Nepal, found that the prevalence of ARI symptoms was significantly associated with the crowding status of a house, type of the house, father's education, and the presence of moisture and coldness in the room (Maharjan and Sharma 2017). A study conducted in Dhulikhel hospital in 2014 found that an unclean cooking stove (smoked cooking stove) and parental smoking were significant determinants of pneumonia in under-5 children (Karki, Fitzpatrick, and Shrestha 2014). Education of parents and household wealth were also significant predictors of cough/fever prevalence in an equity analysis (Malqvist, Singh, and KC 2017). A multi-country study of Sub-Saharan Africa also revealed that children from wealthier households, a household with an improved toilet, and children who were protected against fever-related diseases were less likely to have a fever (Novignon and Nonvignon 2012). A study in rural Tanzania indicated that the oldest child (age 2-5) had lower odds of experiencing a fever, diarrhea, and ARI episodes compared to a child younger than age 1, while a child of a caregiver age 25-34 was less likely to experience diarrhea compared to a child of a caregiver age 15-24 (Kante et al. 2015).

1.2.2 Treatment or advice-seeking practice from health facilities or provider

A cross-sectional study conducted in Western Nepal revealed that family income, comorbidity, maternal education, and the mother's perception of the severity of the illness were significant predictors of seeking treatment or advice from health facilities or providers (Sreeramareddy et al. 2006). A 2015 multi-country analysis using DHS data reported that children younger than 24 months, male children, children of younger mothers, urban residents, and residence near a health facility (within 1.9 kilometers away from the residence) were more likely to seek treatment or advice from health facilities or providers for diarrhea, symptoms of ARI, and fever, while children of mothers with low/no education and those from poorer households were less likely to seek treatment or advice from health facilities or providers (Bennett et al. 2015). A study conducted in Lalitpur, Nepal, on the health-seeking behavior of mothers of sick children found that a significantly higher proportion of mothers with primary or higher education, male children, and children experiencing pneumonia sought treatment or advice from health facilities or providers (Shrestha 2015).

1.2.3 Neonatal mortality

A further analysis of three consecutive NDHS surveys – 2001, 2006, and 2011 – reported in 2006 that neonates of women with no education and a preceding birth interval of fewer than 2 years had higher odds of dying in the neonatal period; in 2011, neonates of a mother with no education, neonates born to a short-stature mother, and those from a household with indoor air pollution had higher odds of dying in the neonatal period (Paudel et al. 2013). A multilevel analysis of the 2006 NDHS data identified young maternal age, the presence of skilled birth attendants during delivery, prenatal care visits, and low parity were significant predictors of low neonatal death (Neupane and Doku 2014). Findings from a case-control study conducted in Chitwan, Nepal, showed that low birth weight, applying nothing on the cord, not wrapping the newborn immediately after birth, and neonates of women with no formal schooling were more likely to die during the neonatal period (Shah et al. 2015). Analysis of recent DHS data support these findings and add that application of an antiseptic to the umbilical cord, as well as antenatal care and skilled attendance at birth, was associated with reduced odds of newborn mortality among home births in Bangladesh and Nepal (Mallick, Yourkavitch, and Allen 2018).

1.2.4 Under-5 mortality

A further analysis of NDHS 2011 found that children of women age 20-24 and 25-29 had lower risk of dying before age 5 compared to children of women age 15-19. Similarly, female children, wanted births, and children of parents with some education had a lower risk of dying before completing their fifth birthday, while children of working women, tobacco smoking/chewing women, and women who were not using contraceptives had a higher risk of under-5 deaths (Sohail 2017). In addition, further analysis of NDHS 2011 identified children of unmarried women as having higher odds of under-5 deaths (Pathak 2017). A study that investigated inequalities in under-5 deaths in Nepal using DHS data from 1996 and 2011 revealed that under-5 mortality rates have decreased, although the hazard ratio (HR) has increased in this period for the poorest wealth quintile as compared to the highest wealth quintile (HR: 1.37 in 1996 to 2.54 in 2011) and for mothers with no education compared to mothers with higher education (HR: 2.55 in 1996 to 3.75 in 2011) (Sreeramareddy, Harsha Kumar, and Sathian 2013).

1.3 Nepal's Policies and Programs Aimed at Improving Child Health

Child health is one of the priority programs of the Government of Nepal (GoN). Previous national surveys showed that disparities exist in childhood morbidity and mortality, which are higher in marginalized communities, among the poor and uneducated, and those from a rural area (CBS 2015; Paudel et al. 2013). To ensure universal coverage of child health services and to reach children from the hard-to-reach communities, the Child Health Division (CHD) (now the Family Welfare Division) has developed and implemented various community-based programs: the community-based ARI and diarrhea control program (CBAC), the community based integrated management of childhood illness (CB-IMCI), the community based newborn care program (CB-NCP), the community based integrated management of neonatal and childhood illness (CB-IMNCI), an integration of CB-IMNCI and CB-NCP, and a free newborn care program. The GoN has also mobilized female community health volunteers (FCHVs) who provide services to those hard-to-reach communities. The GoN is also strengthening facility-based services by establishing and expanding special newborn care units (SNCU) and neonatal intensive care units (NICU) in the government hospitals (CHD 2015). Nepal has recently committed to improving child health in the international arena by endorsing the "Committing to Child Survival: A Promise Renewed" and the Sustainable Development Goals (SDGs) that strive to end preventable deaths. Nepal has targeted the reduction of under-5 mortality to 28 per 1,000 live births and the neonatal mortality rate to 12 per 1,000 live births by 2030 (MoH 2016; National Planning Commission 2017).

1.4 Rationale and Objective

Improving child mortality and morbidity is one of the government's commitments to the national and international communities. The GoN achieved its Millennium Development Goals (MDGs) target of reducing under-5 mortality to 54 deaths per 1,000 live births by 2015, although there is more work to be done to meet the SDGs target of reducing under-5 mortality to 28 deaths per 1,000 live births. Even more challenging is the goal of reducing neonatal mortality to below 12 per 1,000 live births from the current rate of 21 per 1,000 live births. In 2016, Nepal was successful in reducing neonatal mortality from the 2011 level, although the current NMR remains high compared to the global NMR (MoH, New ERA, and ICF 2017; UN IGCME 2017). Few studies were conducted to better understand the predictors of childhood illnesses, childhood treatment seeking practices, and mortality by using nationally representative data. A further analysis conducted on childhood illness in 2006 revealed that FCHVs were providing treatment to 2%–8% of illnesses and that a high proportion of urban and Terai residents received treatment from private providers. In addition, the analysis found no difference in receiving

treatment from government-owned health facilities by various characteristics (Quinley and Govindasamy 2007). Another further analysis that used the 2001, 2006, and 2011 NDHS data showed that neonatal mortality was higher among neonates born to mothers living in rural areas, least wealthy households, socially disadvantaged castes and ethnic groups, mothers with no education, mothers who are young, mothers whose age was greater than 35, mothers who had few antenatal checkup visits, poor birth preparedness practice, and babies who received poor immediate newborn care (Paudel et al. 2013).

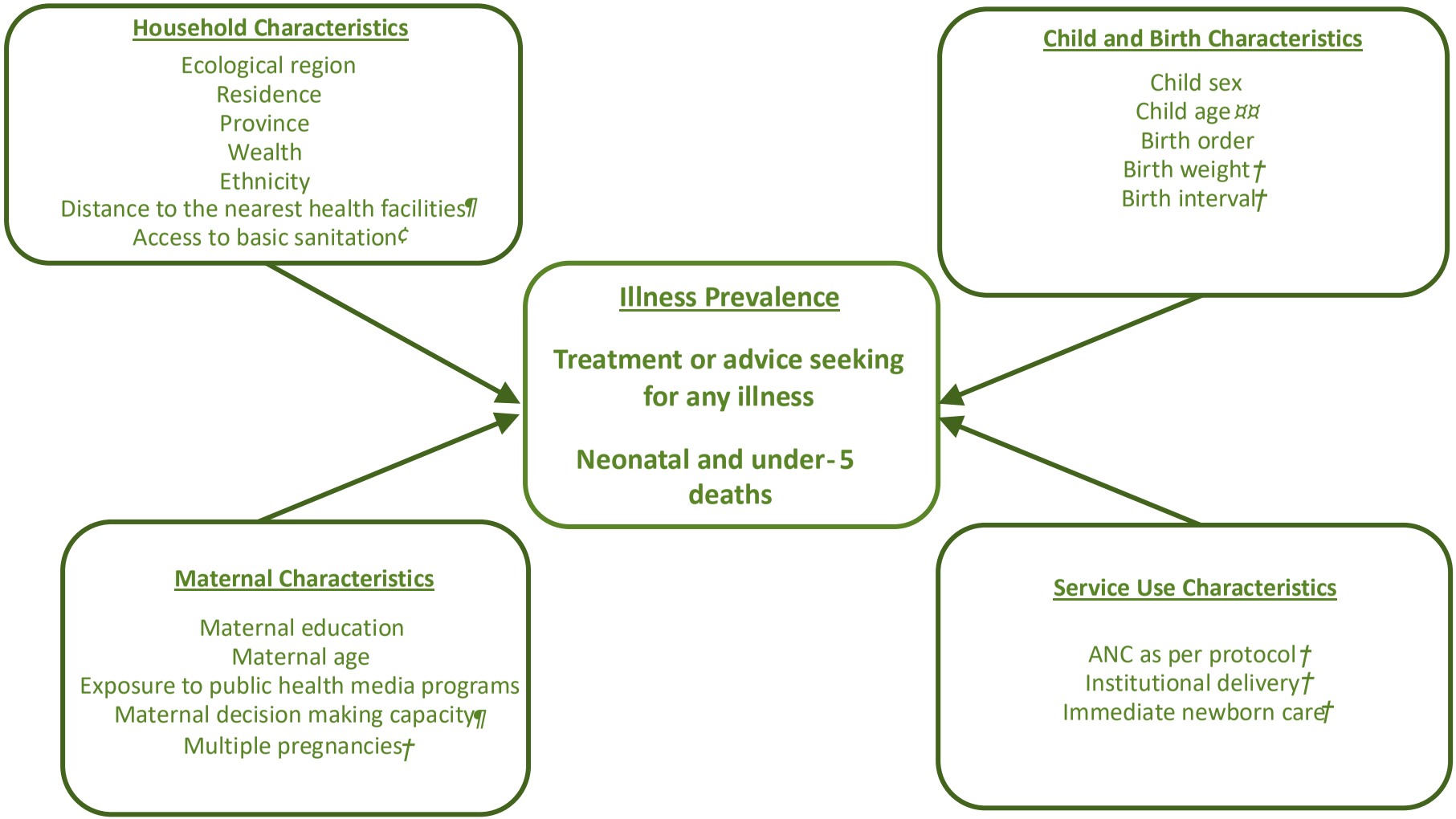
Nepal has undergone a political, administrative, social, and economic transformation in the last decade, as well as changes in disease prevalence, treatment-seeking behavior, and mortality. As a result, the determinants in 2006 or 2011 may not be the same as those in 2016. This study examines trends in six outcomes: diarrhea prevalence, ARI symptom prevalence, fever prevalence, treatment or advice sought from health facilities or other providers for any illness, and neonatal and under-5 death using NDHS 2006 and NDHS 2016. Data from NDHS 2016 were used to assess the determinants of childhood illness, treatment-seeking practice, and deaths. The findings are expected to help policymakers design interventions that further reduce newborn and under-5 deaths and disease prevalence, and also improve treatment or advice-seeking practices. Thus, the main objectives of the further analysis are:

- Describe the trends and determinants of major childhood illnesses (diarrhea, ARI, and fever)
- Examine factors that influence treatment-seeking practice for any childhood illnesses (either diarrhea or ARI or fever)
- Describe the trend and determinants of newborn deaths
- Describe the trends in under-5 children mortality and its determinants

1.5 Conceptual Framework

Various explanatory variables grouped by household characteristics, birth and child characteristics, maternal characteristics, and service use characteristics are included in this study. The conceptual framework below (Figure 1) was based on a literature review and consultations with experts from government agencies, nongovernment organizations, and academia.

Figure 1 **Conceptual framework of childhood illness and neonatal and under-5 mortality further analysis**



Note: Designated symbol indicates that the analysis of that variable was done only for that specific outcome.
(§: only deaths ¶: treatment and deaths only ¤¤: only for disease prevalence and treatment ¢: only disease prevalence).

2 DATA AND METHODS

2.1 Data

This further analysis used data from NDHS 2006 and NDHS 2016. The surveys included a nationally representative sample of women age 15-49 who also provided information on their birth histories and child health in the last 5 years preceding the survey. The primary objective of the survey was to provide current estimates of basic demographic and health indicators that included fertility levels and preferences, marriage, awareness and use of family planning methods, child health, nutrition, adult and child mortality, awareness and attitudes about HIV/AIDS, women's empowerment, and domestic violence. This report presents further analysis of the prevalence of childhood illnesses, their treatment or advice-seeking practices from health facilities or other providers, and childhood mortality. Details about the DHS, survey design, and sampling procedures are discussed in the final reports of the NDHS (MoH, New ERA, and ICF 2017; MoHP Nepal, New ERA, and Macro International Inc. 2007).

Data from NDHS 2006 and NDHS 2016 are used for trend analysis of six outcomes: (a) diarrhea prevalence, (b) ARI symptom prevalence, (c) fever prevalence, (d) treatment or advice sought from the health facilities or providers for any illness, (e) neonatal death, and (f) under-5 death. The NDHS 2016 data are used to examine levels and determinants of these six outcomes. Of 4,887 children age 0-59 months born to interviewed women, 371 children had diarrhea in the 2 weeks before the survey day, 118 children had symptoms of ARI in the 2 weeks before the survey day, and 1,034 children had a fever in the 2 weeks before the survey day. To analyze the treatment practice of sick children, 961 children (from 1,238) who visited health facilities for treatment of childhood illnesses (either diarrhea or ARI symptom or fever) were used in the analysis. A total of 10,150 live births in the 10 years before the survey were used to estimate neonatal and under-5 mortality rate for all variables except the maternal service use variables. All births that occurred in the previous 5 years (5,007 live births) were used to estimate mortality rates by place of delivery, while mortality rates for antenatal care and immediate newborn care were estimated from 3,935 live births (last births in the previous 5 years only). A total of 269 children died in the neonatal period, while 435 children died before their fifth birthday in the 10 years before the survey. In the calculation of the neonatal and under-5 mortality, a total of 3,935 live births (last births) in the 5 years before the survey were used.

2.2 Analysis

Three different types of analyses were performed in this study: trend analysis, bivariate analysis, and multivariate analysis (binary logistic regression). Trend analysis is used to observe changes in the six outcome indicators over a 10-year period (2006 and 2016). The association between predictors (independent variables) and the outcome variable was evaluated using a chi-square test (bivariate analysis). A list of variables used in this analysis is presented in Table 1. After the bivariate analysis, independent variables were tested for multicollinearity. Independent variables with statistically significant association ($p < 0.05$) in the bivariate analysis (cross tabulation) and those that were not multicollinear were then considered for the multivariate analysis. Variables with high missing values were removed from the regression analysis. Illness prevalence, treatment or advice-seeking practice from health facilities or providers for childhood illnesses, and mortality were recoded as dichotomous variables to perform the logistic regression analysis. In addition to bivariate analysis, mortality rates were estimated using the synthetic cohort method (syncmrates function in Stata) among all births in the 10 years before the survey (Masset 2016). To examine determinants of neonatal and under-5 mortality,

only most recent births in the 5 years before the survey were included because information about maternal service use was available only for most recent births in the last 5 years before the survey.

All analyses in this study were conducted with Stata Standard Edition (SE) 15 (StataCorp 2017). The clustering effect was adjusted for all analyses after considering the DHS survey complexity and survey stratification. To adjust the different probabilities of selection of households across the sampling domains, sampling weights were applied. In this report, trends are presented in figures and the results of bivariate and multivariate analyses in tables. The variables with a statistically significant p-value ($p<0.05$) in the bivariate and multivariate analyses (adjusted odds ratio) are discussed in this report.

2.3 Variable Definitions

The definition of variables used in this study is shown in Table 1. Some variables were recoded or grouped to generate categories for the analysis. The raw household wealth index scores are categorized in two ways in the report. For the prevalence of childhood illnesses, treatment-seeking behavior and their determinants, wealth index is grouped into three equal categories (terciles) because of the insufficient sample size in these outcome variables, whereas wealth quintiles (five equal categories) are retained in the analyses of childhood mortality.

Table 1 Study variables and their operational definitions

Variables		Operational definition and Categories
Child Health Outcomes		
Outcomes	**Childhood illness**	Children under 5 ill with diarrhea/fever/Acute Respiratory Illness in the 2 weeks preceding the interview
	Neonatal mortality	The probability (expressed as a rate per 1,000 live births) of dying within the first month (deaths at ages 0 to 30 days), including reported at age zero months
	Under-5 mortality	The probability (expressed as a rate per 1,000 live births) of dying before reaching age 5 (deaths reported at ages 0 to 59 months)
	Treatment seeking from health facilities	Service was received from: a government hospital/clinic, primary health care center, health post/sub-health post, primary health center-outreach clinics, female community health volunteers, other public facilities, FPAN clinics, Marie Stopes clinics, other NGO facilities, private hospital/nursing home, private clinics, pharmacy, other private facilities, or other facilities
Household Characteristics		
Household wealth	**Wealth terciles**	Household wealth index grouped into terciles: poor (bottom 33.3%), middle (middle 33.3%), rich (top 33.3%)
	Wealth quintiles	Household wealth index grouped into quintiles: poorest (bottom 20%), poorer (20%), middle (middle 20%), richer (20%), richest (top 20%)
Water and sanitation	**Good access to improved water and sanitation**	Household has access to: water: piped into dwelling; piped to yard/plot/public tap/standpipe; piped to neighbor; tube well/borehole; protected well; protected spring; rainwater; bottled water; and sanitation: flush (piped to sewer/septic tank; pit latrine; unspecified); pit latrine (ventilated; with slab); composting toilet
	Poor access	Otherwise poor access to improved water and sanitation
Caste/ ethnicity[1]	**Disadvantaged ethnicity**	Individuals who belong to the following castes: Hill Dalit, Terai Dalit, Hill Janajati, Terai Janajati, other Terai Caste, and Muslim
	Advantaged ethnicity	Individuals who belong to the following castes: Hill Brahmin, Hill Chhetri, Terai Brahmin/Chhetri, Newar and others

(Continued…)

Table 1—Continued

Variables		Operational definition and Categories
Geographic location	**Residence**	Urban vs. rural
	Province	Residence in each of Nepal's 7 provinces. This study uses the nomenclature Province 1 – Province 7, since these are the province names that were in effect at the time of the 2016 survey.[1] For prior surveys, a variable is created placing households in each sampling area within the boundaries of current provinces based on its geographic coordinates.
	Ecological region	Mountain, Hill, and Terai
Maternal Characteristics		
Exposure to health programs on radio/TV	**Heard of at least one program**	If mothers had heard of one of the following programs: Jana swasthya radio karyakram, Jansankhya chetna ka sworeharu radio karyakram, Jeevan Chakra TV karyakram, Thorai bhaye pugi sari TV karyakram, Sathi sanga maan ka kura radio karyakram, Bhanchhin aama radio karyakram, Bhandai sundai radio karyakram and Navi malam radio/tv karyakram
	None (not heard)	Did not hear/watch any of the health programs listed
Pregnancy history	**Multiple pregnancy**	A pregnancy in which more than one fetus develops simultaneously in the womb (e.g., twins, triplets) vs. a singleton pregnancy in which only one fetus develops in the womb
Decision-making capacity	**Strong**	If mothers can make their own informed decisions on two or more of the following: to refuse sex, to use or to not use contraception, and about own health care
	Weak	If mothers can make no decision or only one of the following decisions: to refuse sex, to use or to not use contraception, and about own health care
ANC protocol	**ANC visits as per protocol of the Government of Nepal**	If women visited health facilities for antenatal checkups at 4th, 6th, 8th, and 9th months of pregnancy;
		Otherwise no ANC visit as per protocol
Education	**Some education**	Mother has either primary, secondary, or higher level of education;
	No education	Otherwise no education
Age	**Mother's age at the time of interview**	15-24 vs. 25-49 years
Child Characteristics		
Sex of child	**Sex of child**	Female vs. male
Birth weight	**Birth weight in grams**	Small: babies weigh less than 2,500 grams at birth
		Normal: babies weigh 2,500 grams to 3,499 grams at birth
		Large: babies weigh more than or equal to 3,500 grams at birth
		No weight: If baby's weight was not taken or mother didn't know her baby's birth weight
Birth order	**The order of births with twins counted as the same birth order**	First; 2nd to 3rd; 4th and above
Birth interval	**Birth intervals grouped by number of years since preceding birth**	First birth; 3 years or less; and more than 3 years
Service Use		
Newborn care practices	**Received all immediate newborn care**	Having all three of the following for a newborn baby: drying & wrapping, skin-to-skin contact, and immediate breastfeeding.
	Did not receive	Did not receive all

(Continued…)

[1] Province 4 has since changed its name to Gandaki Province (July 2018), Province 6 to Karnali Province (February 2018), and Province 7 to Sudurpashchim Province (September 2018). The remaining 4 provinces have not adopted permanent names as of the time of this publication.

Table 1—Continued

Variables		Operational definition and Categories
Distance to a health facility	**Time it takes to reach the nearest health facility (in minutes)**	Within 30 minutes vs. 30 minutes or more
Place of delivery	**Institutional delivery**	Newborn delivered at: government hospital/clinic, primary health care center, health post/sub-health post, primary health care-outreach clinics, Female Community Health Volunteers, other public facilities, FPAN clinics, Marie Stopes clinics, other NGO facilities, private hospital/nursing home, private clinics, pharmacy, shop, other private facilities, and other facilities.
	Elsewhere	Delivery of the newborn was not in any of the above-listed facilities

[1] See Appendix Table A1 for a complete list of caste and ethnicity based on 2001 Census.

2.4 Study Limitations

This study is based on cross-sectional data and is not intended to establish a causal relationship between the dependent and independent variables. Due to the small sample size, this study was unable to conduct a multivariate analysis of childhood illness treatment and compliance with oral rehydration solution (ORS) and zinc for diarrhea treatment. Since the data were collected based on respondent reports, there is the possibility of recall bias due to pain and traumatic experience where death was experienced, especially in the essential newborn care and weighing of babies immediately after birth.

3 RESULTS

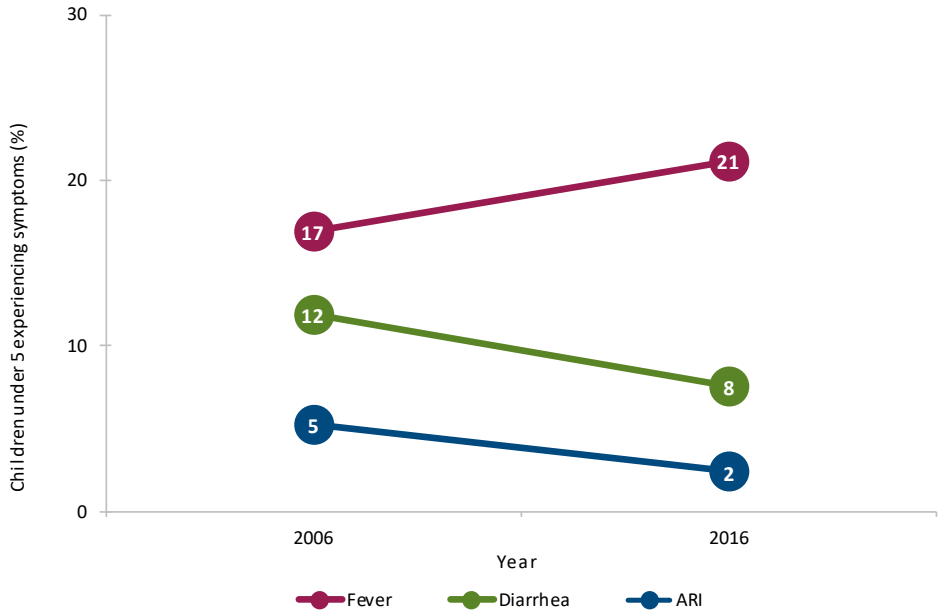
3.1 Childhood Illness: Trends and Determinants

This section presents the trends of major childhood illnesses and their determinants, and the determinants of treatment or advice-seeking practices from health facilities or other providers for those illnesses.

3.1.1 Trends in childhood illnesses

Symptoms of ARI, fever, and diarrhea are the major childhood illnesses captured in the NDHS. Figure 2 depicts the change in the prevalence of these major childhood illnesses in the decade from 2006 to 2016 in Nepal. In 2016 among children below 5 years of age, 8% had diarrhea, 2% had ARI-related symptoms, and 21% had a fever 2 weeks before the day of the survey. The figure below illustrates that the prevalence of ARI symptoms and diarrhea dropped significantly, although the prevalence of fever showed a sharp rise in 2016 (17% in 2006 to 21% in 2016).

Figure 2 Percentage of children under age 5 with symptoms of ARI, fever, and diarrhea 2 weeks before the surveys, Nepal DHS 2006-2016



3.1.2 Prevalence of childhood illnesses

Table 2 presents the prevalence of major childhood illness by household, child, and maternal characteristics. The prevalence of diarrhea significantly differed by the household's access to improved water and sanitation, the child's age, and the birth order of the child. The prevalence of diarrhea was higher among children from households with poor access to improved water and sanitation, children below age 2, and children with higher birth order. The symptoms of ARI were more common among children who reside in hilly areas, children from poor families, children living in a household with good access to improved water and sanitation, and children below age 2. For example, among children living in hilly areas, the ARI prevalence was 3.4% compared to 1.7% for children living on the Terai. In addition, Table 2 shows that prevalence of fever was higher among children in Province 1, children below age 2, male children, and the second- or third-born children. The prevalence of fever among

children in Province 1 (30.5%) was approximately twice as high compared to children in Province 4 (Gandaki Province, 14.7%) or Province 6 (Karnali Province, 15.5%).

Table 2 Prevalence of diarrhea, ARI symptoms, and fever disaggregated among under-5 children by various characteristics, Nepal DHS 2016

Variables	Diarrhea %	ARI symptoms %	Fever %	Total N
Household characteristics[1]				
Ecological region		**		
Mountain	5.1	2.9	16.4	*342*
Hill	6.4	3.4	21.6	*1,857*
Terai	8.7	1.7	21.4	*2,688*
Residence			**	
Urban	7.8	2.0	22.6	*2,649*
Rural	7.3	2.8	19.3	*2,238*
Province				
Province 1	7.2	3.3	30.5	*794*
Province 2	8.5	1.5	21.4	*1,310*
Province 3	8.9	2.4	22.5	*792*
Province 4	3.7	1.7	14.7	*379*
Province 5	8.1	2.9	17.4	*869*
Province 6	6.0	3.4	15.5	*322*
Province 7	6.0	2.6	17.8	*421*
Household wealth terciles		**		
Poor	7.3	3.3	19.4	*1,734*
Middle	7.9	2.4	22.6	*1,572*
Rich	7.5	1.3	21.6	*1,581*
Caste/ethnicity				
Advantaged	6.2	3.0	21.5	*1,543*
Disadvantaged	8.2	2.1	21.0	*3,344*
Access to improved water and sanitation	**	*		
Poor	9.1	1.9	21.7	*2,199*
Good	6.3	2.8	20.6	*2,688*
Child characteristics[1]				
Sex of child				
Male	7.6	2.7	23.6	*2,563*
Female	7.5	2.1	18.3	*2,324*
Age of child	**	**	**	
Under 2 years	10.3	3.5	23.7	*1,978*
2 years and above	5.7	1.7	19.4	*2,909*
Birth order	**		*	
First	6.2	2.5	20.8	*1,917*
2 to 3	7.8	2.4	21.9	*2,180*
4 and above	9.9	2.3	19.7	*790*
Maternal characteristics[1]				
Maternal education				
No education	8.5	2.1	19.8	*1,663*
Some education	7.1	2.6	21.9	*3,224*
Maternal age				
15 – 24 years	7.5	2.8	20.5	*1,973*
25 – 34 years	7.6	1.9	21.8	*2,510*
35 – 49 years	7.7	3.3	20.0	*404*
Exposure to public health media programs				
None	8.0	2.2	20.0	*2,641*
At least one	7.0	2.6	22.5	*2,246*
Total	**7.6**	**2.4**	**21.2**	***4,887***

** p < 0.01, * p < 0.05
[1] Refer to Table 1 for variable definitions.

3.1.3 Determinants of the prevalence of childhood illnesses

Variables that were significantly associated with the outcome variable for an individual illness in Table 2 were considered for the multivariate analysis.

Determinants of diarrhea

Table 3 shows that poor access to improved water and sanitation and child age were significantly associated with the prevalence of diarrhea. Household characteristics (ecological region, residence, province, household wealth, ethnicity status), child and birth characteristics (sex of child), and maternal characteristics (education, age, and exposure to public health media programs) were not statistically significant in the bivariate analysis and were excluded from the multivariate analysis. Children living in a house with poor access to improved water and sanitation were more likely to have diarrhea (aOR: 1.4, 95% CI: 1.1-1.9, $p < 0.01$) compared to children living in a house with good access to basic sanitation. Children above age 2 were less likely to have diarrhea (aOR: 0.5, 95% CI: 0.3-0.6, $p < 0.01$) compared to a child age 2 and below.

Table 3 Results from a multivariate logistic regression analysis of diarrhea, Nepal DHS 2016

Variables	aOR	95% CI
Household characteristics		
Access to improved water and sanitation		
Poor	1.4**	1.1 – 1.9
Good	Ref	
Child characteristics		
Age of child		
Under 2 years	Ref	
2 years and above	0.5**	0.3 – 0.6
Birth order		
1	0.7	0.6 – 1.0
2 to 3	Ref	
4 and above	1.2	0.9 – 1.7

** $p < 0.01$, * $p < 0.05$

The model includes only covariates with a significant bivariate association and therefore excludes the following additional variables: Household characteristics (residence, province, ethnicity status), child and birth characteristics (sex of child and birth order), and maternal characteristics (education, age, and exposure to public health media programs).

Determinants of ARI symptoms

The age of the child, household wealth status, and ecological region were significant predictors of the prevalence of ARI symptoms (Table 4). Household characteristics (residence, province, ethnicity status), child and birth characteristics (sex of child and birth order), and maternal characteristics (education, age, and exposure to public health media programs) were not statistically significant in the bivariate analysis (see Table 2) and were excluded from the multivariate analysis. Children who resided in the Terai region were less likely to experience symptoms of ARI (aOR: 0.5, 95% CI: 0.3-0.9, $p < 0.05$) compared to children who resided in hilly areas of the country. Similarly, children age 2 and above were less likely to have symptoms of ARI compared to children less than age 2 (aOR: 0.4, 95% CI: 0.3-0.7, $p < 0.01$). In addition, children from poor households were more likely to experience symptoms of ARI (aOR: 2.1, 95% CI: 1.2-3.7, $p < 0.01$) compared to children from rich households.

Table 4 Results from a multivariate logistic regression analysis of symptoms of ARI, Nepal DHS 2016

Variables	aOR	95% CI
Household characteristics		
Ecological region		
Mountain	0.7	0.4 - 1.3
Hill	Ref	
Terai	0.5*	0.3 - 0.9
Household wealth terciles		
Poor	2.1**	1.2 - 3.7
Middle	1.9*	1.1 - 3.5
Rich	Ref	
Access to improved water and sanitation		
Poor	0.6	0.4 - 1.0
Good	Ref	
Child characteristics		
Age of child		
Under 2 years	Ref	
2 years and above	0.4**	0.3 - 0.7

** p < 0.01, * p < 0.05

The model includes only covariates with a significant bivariate association and therefore excludes the following additional variables: Household characteristics (ecological region, residence, household wealth, ethnicity status), child and birth characteristics (birth order), and maternal characteristics (education, age, and exposure to public health media programs).

Determinants of fever

Province, sex of the child, and the child's age were statistically significant predictors of the prevalence of fever. Household characteristics (ecological region, residence, household wealth, ethnicity status), child and birth characteristics (birth order), and maternal characteristics (education, age, and exposure to public health media programs) were not statistically significant in the bivariate analysis (see Table 2) and were excluded from the multivariate analysis. Children from Province 1 were significantly more likely to have a fever (aOR: 2.0, 95% CI: 1.4-2.8, $p < 0.01$) compared to children from Province 7 (Sudurpashchim Province). Female children (aOR: 0.7, 95% CI: 0.6-0.8, $p < 0.01$) and children above age 2 (aOR: 0.7, 95% CI: 0.6-0.9, $p < 0.01$) were less likely to have fever compared to the male children and children below age 2 (Table 5).

Table 5 Results from a multivariate logistic regression analysis of the prevalence of fever, Nepal DHS 2016

Variables	aOR	95% CI
Household characteristics		
Province		
Province 1	2.0**	1.4 – 2.8
Province 2	1.2	0.9 – 1.7
Province 3	1.3	0.9 – 2.0
Province 4	0.7	0.5 – 1.2
Province 5	0.9	0.6 – 1.3
Province 6	0.8	0.6 – 1.2
Province 7	Ref	
Child characteristics		
Sex of child		
Male	Ref	
Female	0.7**	0.6 – 0.8
Age of child		
Under 2 years	Ref	
2 years and above	0.7**	0.6 – 0.9

(Continued…)

Table 5—Continued

Variables	aOR	95% CI
Birth order		
First	0.9	0.7 – 1.1
2 to 3	Ref	
4 and above	0.9	0.6 – 1.1

** p < 0.01, * p < 0.05

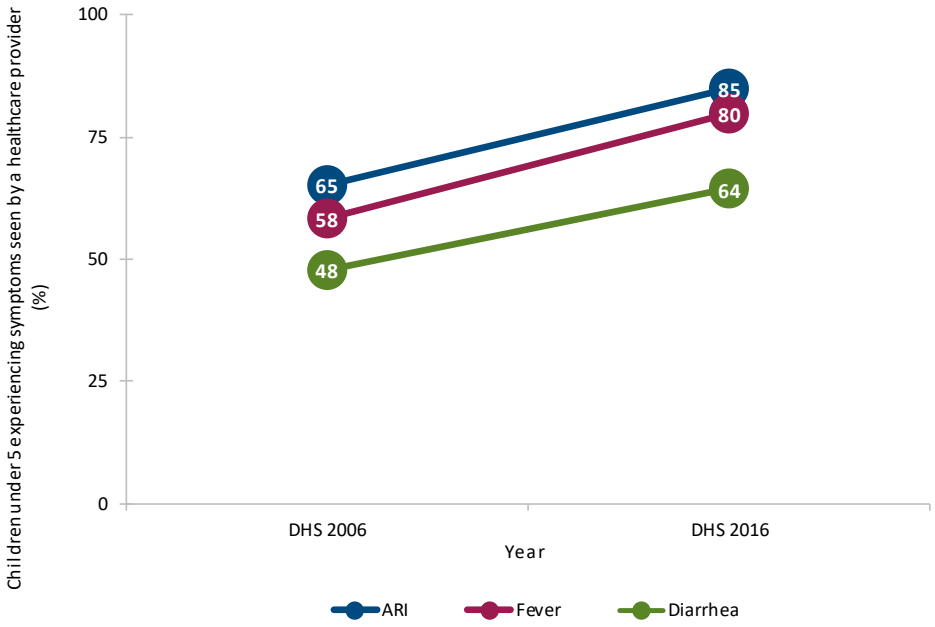
The model includes only covariates with a significant bivariate association and therefore excludes the following additional variables: Household characteristics (ecological region, residence, household wealth, ethnicity status), child and birth characteristics (birth order), and maternal characteristics (education, age, and exposure to public health media programs).

3.2 Treatment of Childhood Illnesses

3.2.1 Trends in treatment or advice seeking from health facilities or providers for major childhood illnesses

Results from NDHS 2006 and 2016 show that treatment or advice-seeking practices from health facilities or providers for the major illnesses has improved in the last decade (Figure 3). Sixty-four percent of under-5 children with diarrhea received treatment or advice from health facilities or providers in 2016, which is a 33% increase compared to 2006. Similarly, 85% of children with symptoms of ARI and 80% children with fever sought treatment or advice from health facilities or providers in 2016, which is a 31% and 38% increase respectively, as compared to 2006 (65% with symptoms of ARI and 58% with fever had sought service from health facilities in 2006). Among the illnesses, fewer children who were suffering from diarrhea had sought treatment or advice from health facilities or providers compared to other illnesses in both survey years.

Figure 3 Percentage of children under age 5 who had childhood illnesses (ARI, fever, and diarrhea) in the 2 weeks before the survey for whom advice or treatment was sought from health facilities or providers, Nepal DHS 2006-2016



Note: The health-seeking practice for children experiencing childhood illnesses reported here does not match with the NDHS 2006 report because the NDHS 2006 report excluded treatment or advice taken from pharmacy and clinics in the indicator "percentage of children under age 5 suffering from illness who took service from the health providers".

3.2.2 Treatment or advice-seeking practice from health facilities or providers for any Illness by various characteristics

In this analysis, treatment or advice-seeking practice from health facilities or providers for each childhood illness has not been presented in the main report because of the low sample size. However, a table that details the treatment practices has been added in Appendix Table A2.

Table 6 shows treatment practice by various characteristics. The ecological region, province, wealth status, the distance between children's home and government health facilities, and maternal age were significant determinants of seeking treatment or advice from health facilities or providers for childhood illnesses. There was a significantly higher proportion of children who reside in the Terai region, Provinces 1, 2, and 5, children from the middle wealth category, children living within 30 minutes from government health facilities, and children of young mothers (age 15-24) who had sought treatment or advice from health facilities or providers for any illnesses compared to other categories. Treatment or advice-seeking practice from health facilities or providers was lower among children who live in mountainous and hilly ecological regions, Province 3, poor households, and children of older mothers (age 35 and above) (see Table 6).

Table 6 **Treatment from health facilities or providers for any illness among children under 5 by various characteristics, Nepal DHS 2016**

Variables	%	95% CI	p-value
Household characteristics[1]			
Ecological region			
Mountain	61.6	48.6 – 73.2	***
Hill	67.8	59.5 – 75.1	
Terai	85.7	82.4 – 88.4	
Residence			
Urban	79.4	72.9 – 84.5	
Rural	75.3	69.5 – 80.3	
Province			
Province 1	81.7	74.3 – 87.4	***
Province 2	85.9	81.3 – 89.6	
Province 3	63.9	49.7 – 76.0	
Province 4	67.6	57.0 – 76.6	
Province 5	82.7	76.0 – 87.9	
Province 6	68.2	61.2 – 74.4	
Province 7	70.5	57.7 – 80.8	
Household wealth terciles			
Poor	67.5	59.6 – 71.5	***
Middle	88.7	81.6 – 89.2	
Rich	81.2	71.6 – 87.9	
Caste/ethnicity			
Disadvantaged	80.6	77.0 – 83.8	
Advantaged	70.9	60.2 – 79.8	
Distance to nearest public health facilities			
Within 30 minutes	82.5	78.2 – 86.0	***
30 minutes and more	73.0	67.1 – 78.2	
Child characteristics[1]			
Sex of child			
Male	79.3	75.8 – 82.5	
Female	75.4	66.0 – 82.9	
Age of child			
Under 2 years	76.3	70.0 – 81.6	
2 years and above	78.9	74.9 – 82.5	

(Continued...)

Table 6—Continued

Variables	%	95% CI	p-value
Birth order			
First	79.3	72.9 – 84.6	
2 to 3	79.2	74.5 – 83.2	
4 and above	69.3	59.8 – 77.4	
Maternal characteristics[1]			
Maternal education			
No education	74.5	69.2 – 79.2	
Some education	79.1	74.2 – 83.3	
Maternal age			
15 – 24 years	82.8	77.7 – 86.9	
25 – 34 years	75.5	69.0 – 81.0	*
35 – 49 years	66.0	54.1 – 76.2	
Exposure to public health media programs			
At least one	80.1	75.9 – 83.7	
None	75.1	67.2 – 81.6	
Decision making capacity			
Weak	81.8	74.3 – 86.5	
Strong	77.6	72.8 – 81.7	
Total	**77.6**	**73.5 – 81.3**	

[1] Refer to Table 1 for variable definitions.
*** p<0.001, ** p < 0.01, * p < 0.05

3.2.3 Determinants of treatment or advice-seeking practices from health facilities or providers for illness

The ecological region, province, wealth status, distance to the government health facilities, and maternal age were statistically significant variables in the bivariate analysis (cross-tabulation). These variables were then considered for the multivariate analysis. Only wealth status and maternal age were statistically significant predictors of treatment or advice-seeking practice from health facilities or providers for any childhood illness in the multivariate analysis. Results show that children from poor households (aOR: 0.4, 95% CI: 0.3-0.7, p < 0.01) were less likely to seek treatment or advice from health facilities or providers compared to children from rich households, while women age 15-24 (aOR: 1.5, 95% CI: 1.0-2.2, p < 0.05) were more likely to seek treatment or advice from health facilities or providers compared to women age 25-34 (Table 7).

Table 7 Results from a multivariate logistic regression analysis for treatment or advice-seeking practices from health facilities or providers for any illnesses, Nepal DHS 2016

Variables	aOR	95% CI
Household characteristics		
Ecological region		
Mountain	0.9	0.5 – 1.6
Hill	Ref	
Terai	1.4	0.8 – 2.5
Province		
Province 1	1.6	0.7 – 3.6
Province 2	1.4	0.6 – 3.2
Province 3	0.7	0.3 – 1.6
Province 4	0.9	0.4 – 2.2
Province 5	1.6	0.7 – 3.4
Province 6	1.3	0.6 – 2.6
Province 7	Ref	

(Continued…)

Table 7—Continued

Variables	aOR	95% CI
Household wealth terciles		
Poor	0.4**	0.3 – 0.7
Middle	1.0	0.5 – 1.8
Rich	Ref	
Distance to the nearest public health facilities		
Within 30 minutes	Ref	
30 minutes and more	0.8	0.5 – 1.1
Maternal characteristics		
Maternal age		
15 – 24 years	1.5*	1.0 – 2.2
25 – 34 years	Ref	
35 – 49 years	0.6	0.4 – 1.2

** p < 0.01, * p < 0.05

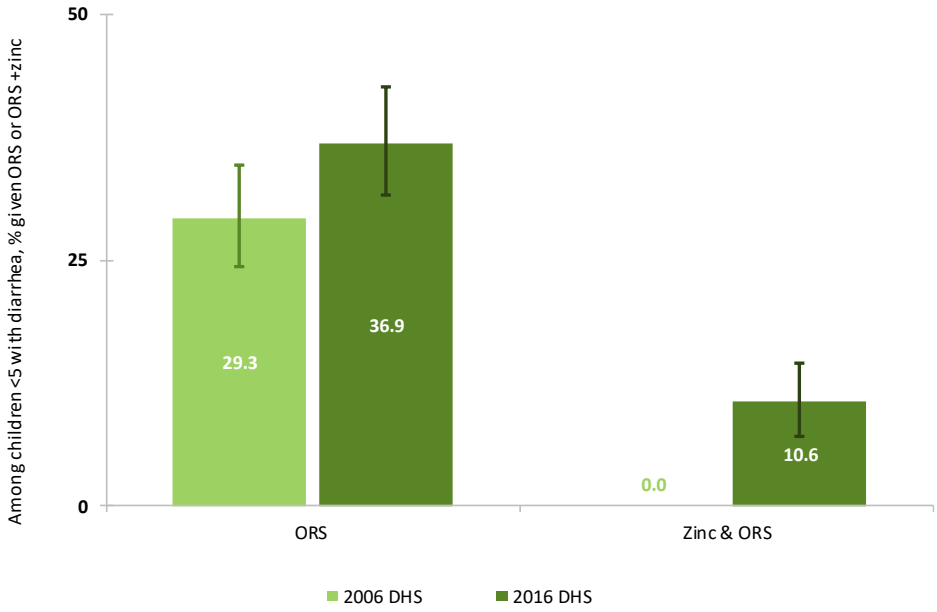
The model includes only covariates with a significant bivariate association and therefore excludes the following additional variables: Household characteristics (residence, ethnicity status), child and birth characteristics (sex of child, age of child, and birth order), and maternal characteristics (education, exposure to public health media programs, and decision-making capacity).

3.3 Oral Rehydration Solution and Zinc Treatment

3.3.1 Trends in diarrhea treatment with both oral rehydration solution (ORS) and zinc

According to the CB-IMNCI treatment guidelines, every childhood diarrheal case should be treated with ORS and zinc (CHD 2015). Zinc has been included in the treatment protocol of childhood diarrhea since 2005. The figure below (Figure 4) shows the trend of diarrhea treatment practices in Nepal in 2006 and 2016. In 2016, 11% of children age 5 and below with diarrhea were treated with both ORS and zinc compared to nearly no children with diarrhea in 2006. Thirty-seven percent of children with diarrhea were given ORS in 2016 compared to 29% in 2006.

Figure 4 Percentage given fluid from an ORS packet and ORS and zinc among children under age 5 who had diarrhea in the 2 weeks before the survey, Nepal DHS 2006-2016



The distribution of children under age 5 who received both zinc and ORS treatment among those who had diarrhea in the 2 weeks before the survey across study characteristics is shown in Appendix Table A3. In 2016, a higher proportion of children who sought advice or treatment from the government health

facilities were treated with both ORS and zinc compared to home treatment and treatment in private health facilities (data not shown).

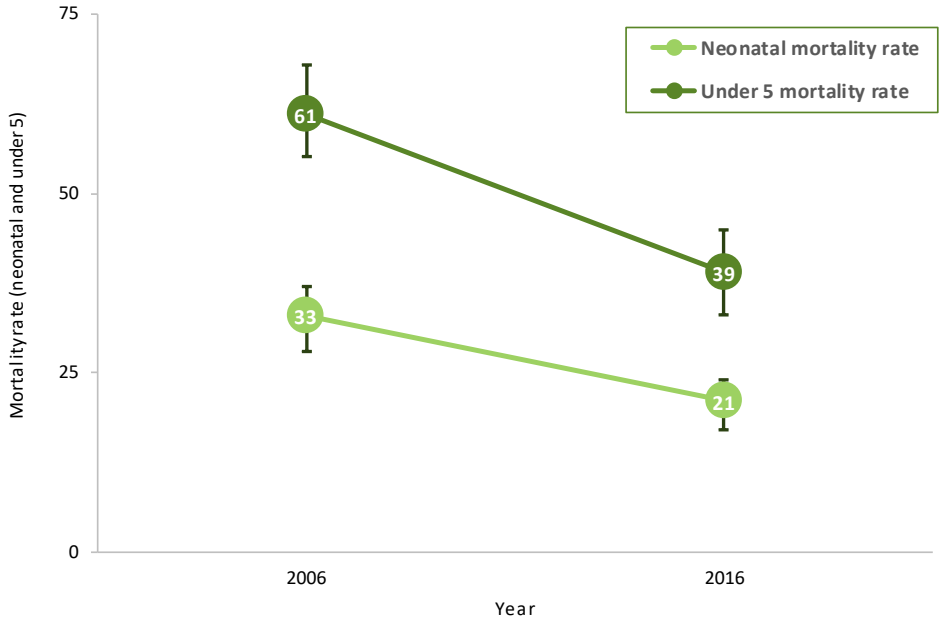
3.4 Neonatal and Under-5 Mortality: Trends and Determinants

This section presents the levels and trends in neonatal and under-5 mortality rates by various characteristics, as well as the determinants of neonatal and under-5 mortality.

3.4.1 Trends in neonatal and under-5 mortality

The NMR of Nepal was 21 deaths per 1,000 live births in 2016, a significant reduction from 33 deaths per 1,000 live births in 2006. Similarly, the under-5 mortality rate was 39 deaths per 1,000 live births in 2016, a significant reduction from 61 deaths per 1,000 live births in 2006.

Figure 5 Trends in childhood mortality, Nepal DHS 2006-2016



3.4.2 Neonatal mortality

Neonatal mortality rate

The NMR was estimated for live births in the 10 years before the survey. The estimate showed that the NMR was highest in the mountain region, Province 5, rural areas, and in the poorest wealth category. Male neonates, those with birth weight less than 2,500 grams and unweighed/other weight babies, neonates born later, and neonates born with a birth interval of less than 3 years had the highest NMR. Maternal factors were also significant in neonatal mortality. For example, neonates born to women with no education, women younger than age 25, women who have not heard at least one public health media program, and multiple pregnancies (twin, triple or more babies in one pregnancy) had the highest NMR. The NMR also differed by maternal service use during the prenatal, natal, and postnatal period and by place of delivery. However, the lowest NMR was observed in Province 4 (Gandaki Province), the richest wealth quintile, neonates with normal weight at birth, and those born in a 3-year gap. Similarly, neonates born to women who had experienced ANC visits per GoN protocol and neonates who had received immediate newborn care had significantly lower NMR (less than half) as compared to their counterparts (Table 8).

Table 8 Neonatal mortality rate among births in the 10 years before the survey, Nepal DHS 2016

Characteristics	NMR[1]	95% CI	p-value
Household characteristics[2]			
Ecological zone			
Mountain	34.5	22.5 – 46.5	
Hill	22.5	18.4 – 26.7	
Terai	28.4	23.2 – 33.7	
Province			
Province 1	21.9	13.7 – 30.0	
Province 2	29.9	22.9 – 36.9	
Province 3	16.9	9.9 – 23.9	
Province 4	15.1	8.2 – 21.9	
Province 5	30.2	20.6 – 39.7	
Province 6	29.4	20.9 – 37.8	
Province 7	41.1	32.1 – 50.0	*
Residence			
Urban	21.4	17.4 – 25.5	
Rural	32.8	27.1 – 38.6	**
Household wealth quintiles			
Poorest	26.2	16.5 – 35.9	
Poorer	28.3	19.3 – 37.4	
Middle	15.5	9.5 – 21.3	
Richer	22.3	13.7 – 30.8	
Richest	8.3	-0.4 – 17.0	***
Caste/ethnicity			
Disadvantaged	29.2	24.5 – 33.8	
Advantaged	21.1	15.9 – 26.2	
Distance to the nearest public health facility			
Within 30 minutes	23.1	17.3 – 28.9	
30 minutes or more	30.1	25.8 – 34.3	
Child and birth characteristics[2]			
Sex of child			
Male	32.9	28.2 – 37.6	
Female	20.0	15.7 – 24.3	***
Child's birth weight			
Smaller (< 2500 grams)	28.9	15.1 – 42.7	
Normal (2500–3499 grams)	9.8	5.1 – 14.4	
Larger (3500 grams or more)	10.9	4.5 – 17.3	
Not weighed	33.1	23.0 – 43.3	***
Birth order			
First	28.9	23.0 – 34.8	
2 to 3	19.5	15.1 – 23.9	
4 and above	38.4	27.3 – 49.4	***
Birth interval			
First birth	29.5	22.8 – 36.2	
3 years or less	33.4	27.5 – 39.2	
More than 3 years	15.6	11.2 – 20.1	***
Maternal characteristics[2]			
Maternal education			
No education	36.3	30.2 – 42.5	
Some education	19.3	15.0 – 23.6	***
Maternal age			
15 – 24 years	32.5	24.9 – 40.1	
25 – 49 years	24.9	21.0 – 28.7	
Multiple pregnancy			
Yes	199.7	137.7 – 261.8	
No	24.4	20.8 – 28.1	***

(Continued…)

Table 8—Continued

Characteristics	NMR[1]	95% CI	p-value
Exposure to public health media programs			
None	33.0	27.1 – 38.8	***
At least one	18.3	14.1 – 22.4	
Decision–making capacity			
Weak	31.8	21.9 – 41.7	
Strong	26.0	22.1 – 29.8	
Health service use characteristics			
ANC visits as per Government of Nepal protocol[3]			
Yes	7.5	2.7 – 12.3	
No	14.0	7.5 – 20.4	
Place of delivery			
Institutional	16.5	11.4 – 21.6	*
Elsewhere	29.5	17.9 – 33.8	
Immediate newborn care[4]			
Not received	13.5	9.1 – 17.9	*
Received	4.5	1.0 – 8.0	
Total	**26.7**	**23.3 – 29.6**	

[1] NMR is the probability (expressed as a rate per 1,000 live births) of dying within the first 30 days for the 10 years preceding the survey.
[2] Refer to Table 1 for variable definitions.
[3] Calculated among all births in the previous 5 years.
[4] Calculated among most recent birth in the previous 5 years.
*** p < 0.001, ** p < 0.01, * p < 0.05

Determinants of neonatal death

Among the independent variables listed in Table 8, birth order of the child, place of delivery, and multiple pregnancies were not considered for the multivariate analysis because birth order and place of delivery were highly correlated with other variables, and the multiple pregnancies variable had a disproportionately high number of cases in one category. The results from multivariate analysis (see Table 9) show that province, distance to the nearest government health facility, and child's weight at birth were significantly associated with neonatal death. Neonates weighing less than normal weight (2,500 gram to 3,499 gram) at birth (aOR: 4.7, 95% CI: 1.6-13.4, $p < 0.01$) were more likely to die in the neonatal period compared to neonates with normal birth weight. There was an association between not being weighed at birth and neonatal death (aOR: 6.0, 95% CI: 1.6-22.5, $p < 0.01$). Neonates from Province 1 (aOR: 0.1, 95% CI: 0.0-0.9, $p < 0.05$) and those residing more than 30 minutes away from the health facilities (aOR: 0.4, 95% CI: 0.2-0.9, $p < 0.05$) were less likely to die in the neonatal period compared to their counterparts (Table 9).

Table 9 **Results from a multivariate logistic regression analysis of neonatal death among the last birth in the last 5 years before the survey, Nepal DHS 2016**

Variables	aOR	95% CI
Household characteristics[1]		
Ecological region		
Mountain	0.8	0.3 – 2.4
Hill	Ref	
Terai	1.6	0.5 – 5.0
Residence		
Urban	Ref	
Rural	1.8	0.9 – 3.6
Province		
Province 1	0.2*	0.0 – 0.9
Province 2	0.3	0.1 – 1.4
Province 3	0.9	0.3 – 3.0
Province 4	0.3	0.1 – 2.1
Province 5	0.7	0.2 – 2.4
Province 6	0.9	0.3 – 3.2
Province 7	Ref	
Household wealth quintiles		
Poorest	1.4	0.1 – 20.7
Poorer	2.2	0.2 – 23.5
Middle	2.8	0.3 – 28.0
Richer	3.4	0.3 – 30.3
Richest	Ref	
Caste/ethnicity		
Disadvantaged	0.7	0.2 – 2.7
Advantaged	Ref	
Distance to the nearest public health facilities		
Within 30 minutes	Ref	
30 minutes and more	0.4*	0.2 – 0.9
Child and birth characteristics[1]		
Child sex		
Male	Ref	
Female	0.8	0.4 – 1.6
Birth size		
Smaller (< 2500 grams)	4.7**	1.6 – 13.4
Larger (3500 grams or more)	1.1	0.2 – 5.7
Not weighed	6.0**	1.6 – 22.5
Normal (2500-3499 grams)	Ref	
Birth interval		
First birth	1.1	0.4 – 3.3
Less than 3 years	0.9	0.3 – 2.6
3 years or more	Ref	
Maternal characteristics[1]		
Maternal education		
No education	1.1	0.4 – 2.7
Some education	Ref	
Maternal age		
15 – 24 years	1.4	0.7 – 2.5
25 – 49 years	Ref	
Exposure to public health media programs		
None	0.6	0.3 – 1.6
At least once	Ref	
Decision-making capacity		
Weak	1.3	0.6 – 3.0
Strong	Ref	
Health service use characteristics[1]		
ANC visits as per Government of Nepal protocol		
No	1.3	0.6 – 3.0
Yes	Ref	
Immediate newborn care		
Not received	2.6	0.8 – 8.1
Received	Ref	

** p < 0.01, * p < 0.05

[1] Refer to Table 1 for variable definitions.

3.4.3 Under-5 mortality

Under-5 mortality rate

The U5MR was highest in poorer households, the mountain region, Province 7 (Sudurpashchim Province), and rural areas, while the lowest U5MR was reported in Province 4 (Gandaki Province) and the richest households. The highest U5MR was observed in children whose preceding birth interval was less than 3 years. Children born to mothers with no education and who were not exposed to any public health media programs had higher U5MR compared to other respective counterparts. The U5MR was double among children who had not received immediate newborn care compared to children who had received immediate newborn care (Table 10).

Table 10 Under-5 mortality rate among births in the 10 years before the survey, Nepal DHS 2016

Variables	U5MR[1]	95% CI	p-value
Household characteristics[2]			
Ecological region			
Mountain	62.6	45.3 – 79.9	
Hill	38.3	33.1 – 43.6	**
Terai	49.1	42.2 – 56.0	
Province			
Province 1	35.7	25.9 – 45.6	
Province 2	52.2	42.9 – 61.4	
Province 3	35.6	23.5 – 47.6	
Province 4	27.0	16.6 – 37.4	***
Province 5	45.2	34.9 – 55.5	
Province 6	58.0	47.2 – 68.8	
Province 7	69.4	58.7 – 80.2	
Residence			
Urban	39.0	33.2 – 44.7	***
Rural	54.5	47.6 – 61.4	
Household wealth quintiles			
Poorest	44.4	33.5 – 56.6	
Poorer	47.4	34.5 – 60.3	
Middle	34.2	24.3 – 44.3	***
Richer	40.2	27.5 – 53.0	
Richest	5.5	5.5 – 38.0	
Caste/ethnicity			
Disadvantaged	49.5	43.5 – 55.5	
Advantaged	38.5	31.4 – 45.6	
Distance to the nearest public health facilities			
Within 30 minutes	42.3	34.6 – 49.9	
30 minutes and more	49.7	43.3 – 56.2	
Child and birth characteristics[2]			
Sex of child			
Male	49.6	44.0 – 55.1	
Female	42.4	35.7 – 49.0	
Birth interval			
First birth	48.4	40.8 – 56.0	
3 years or less	59.7	50.6 – 68.8	***
More than 3 years	27.3	21.2 – 33.4	
Maternal characteristics[2]			
Maternal education			
No education	59.7	52.8 – 66.7	***
Some education	34.9	28.9 – 40.8	

(Continued…)

Table 10—Continued

Variables	U5MR[1]	95% CI	p-value
Maternal age			
15-24 years	50.0	40.6 – 59.3	
25-49 years	44.1	38.6 – 49.6	
Exposure to public health media programs			
None	55.7	49.2 – 62.2	***
At least one	33.1	27.4 – 38.9	
Decision-making capacity			
Weak	63.0	48.9 – 77.1	
Strong	43.1	38.3 – 48.0	
Health service use characteristics[2]			
ANC visits as per Government of Nepal protocol			
Yes	19.0	10.0 – 28.0	
No	25.3	16.6 – 34.0	
Institutional delivery[3]			
Institutional	32.4	23.5 – 41.4	*
Elsewhere	45.2	33.7 – 56.6	
Immediate newborn care[4]			
Not received	26.9	18.7 – 35.0	*
Received	11.8	5.2 – 18.4	
Total	**46.1**	**41.0 – 51.1**	

[1] U5MR is the probability (expressed as a rate per 1,000 live births) of dying between 0 and 59 months for the 10 years preceding the survey.
[2] Refer to Table 1 for variable definitions.
[3] Calculated among all births in the last 5 years.
[4] Calculated among most recent birth in the last 5 years.
*** p < 0.001, ** p < 0.01, * p < 0.05

Determinants of under-5 deaths

Results from the multivariate logistic regression analysis showed that the U5MR was significantly associated with the distance to the nearest health facility, decision-making capacity of mothers, and the immediate newborn care received by the child. There was an association between not receiving essential newborn care services and under-5 death (aOR: 2.4, 95% CI: 1.3-4.7, $p < 0.01$); those who did not receive immediate newborn care were nearly twice as likely to die before reaching their fifth birthday. This result needs to be interpreted with caution as there may be some confounding in the relationship between essential newborn care and under-5 deaths: some of these deaths may be early neonatal deaths that occurred even before the opportunity to receive newborn care, rather than a lack of newborn being followed by under-5 death. Under-5 children of women with weak decision-making capacity were more likely to die before completing their fifth birthday (aOR: 1.9, 95% CI: 1.1-3.5, $p < 0.05$) compared to children of women with strong decision-making capacity. However, children who reside 30 minutes or more from the nearest government health facility were less likely to die before their fifth birthday (aOR: 0.4, 95% CI: 0.2-0.7, $p < 0.05$) compared to those who reside less than 30 minutes from a government health facility (Table 11).

Table 11 **Results from a multivariate logistic regression analysis of under-5 deaths among the last birth in the 5 years before the survey, Nepal DHS 2016**

Variables	aOR	95% CI
Household characteristics[1]		
Ecological region		
Mountain	1.4	0.5 – 3.8
Hill	Ref	
Terai	0.9	0.4 – 1.8
Residence		
Urban	Ref	
Rural	1.3	0.7 – 2.2
Province		
Province 1	0.3	0.1 – 1.1
Province 2	0.7	0.2 – 2.0
Province 3	1.0	0.4 – 2.6
Province 4	0.4	0.1 – 1.3
Province 5	0.8	0.3 – 2.1
Province 6	1.0	0.4 – 2.3
Province 7	Ref	
Household wealth quintiles		
Poorest	0.9	0.3 – 3.5
Poorer	1.8	0.6 – 4.6
Middle	1.4	0.5 – 4.3
Richer	2.1	0.7 – 6.1
Richest	Ref	
Caste/ethnicity		
Disadvantaged	0.8	0.4 – 1.8
Advantaged	Ref	
Distance to nearest public health facilities		
Within 30 minutes	Ref	
30 minutes and more	0.4**	0.2 – 0.7
Child and birth characteristics		
Sex of child		
Male	Ref	
Female	1.3	0.7 – 2.2
Birth interval		
First birth	1.4	0.6 – 3.1
Less than 3 years	1.5	0.7 – 3.1
More than 3 years	Ref	
Maternal characteristics[1]		
Maternal education		
No education	1.1	0.5 – 2.2
Some education	Ref	
Maternal age		
15-24 years	1.0	0.4 – 1.6
25-49 years	Ref	
Exposure to the public health media programs		
None	1.0	0.5 – 1.9
At least one	Ref	
Decision-making capacity		
Weak	1.9*	1.1 – 3.5
Strong	Ref	
Service use characteristics[1]		
ANC as per protocol		
No	1.3	0.8 – 2.3
Yes	Ref	
Place of delivery		
Elsewhere	0.9	0.5 – 1.9
Institutional	Ref	
Immediate newborn care		
Not received	2.4**	1.3 – 4.7
Received	Ref	

** p < 0.01, * p < 0.05;
[1] Refer to Table 1 for variable definitions.

4 DISCUSSION

This analysis examined the trends and determinants of major childhood illnesses, their treatment seeking practices, and childhood mortality in Nepal, using Nepal DHS 2006 and 2016 data.

The prevalence of diarrhea was 8% in 2016, a 4% reduction from 2006. The prevalence of symptoms of ARI was 2% in 2016, a 3% reduction from 2006. However, the prevalence of fever increased in the same period by 4%, from 17% in 2006 to 21% in 2016. Notably during the same period, key determinants of health also improved, such as availability of improved toilet facilities (38% increase), protected source of drinking water and use of clean fuel (both 13% increment) (MoH, New ERA, and ICF 2017; MoHP Nepal, New ERA, and Macro International Inc. 2007), suggesting that enabling factors such as improved water and sanitation and the increased use of clean fuel might have an effect on the reduction of diarrhea and ARI (Yadav et. al. 2013).

Eighty-one percent of children with either diarrhea or symptoms of ARI or fever had sought treatment or advice from health facilities or other providers, which was a 21% increase in 2016 compared to 2006. The improvement in treatment or advice-seeking practice was similar for all the individual illnesses. The socioeconomic conditions and health facility factors such as human resource availability, commodities, and infrastructure have improved in the decade (DoHS 2006/07, 2016/17; MoH, New ERA, and ICF 2017), and this might have had an impact on advice or treatment seeking practices.

The coverage of both zinc and ORS in 2006 was negligible because zinc was only included in the diarrhea treatment protocol in 2005 (CHD 2015). The 73% of the diarrhea cases who had sought advice or treatment had received advice or treatment from private health facilities. This might have resulted in low treatment with both ORS and zinc because private practitioners are not oriented to the use of these medicines for diarrheal disease (MoH, New ERA, and ICF 2017). This suggests that standardized treatment protocol needs to be developed for child health programs that include practices in the private sector.

The neonatal and under-5 survival rates improved between 2006 and 2016. The NMR decreased to 21 per 1,000 live births in 2016 from 33 per 1000 live births in 2006. Similarly, the U5MR decreased from 61 per 1,000 live births in 2006 to 39 per 1,000 live births in 2016. Various strategies were adopted by the Government of Nepal in the last decade to improve neonatal survival. These included the community-based newborn care program with evidence-based interventions in the management of major causes of neonatal deaths, and a maternity incentive program to increase institutional delivery, which could have also helped in reducing neonatal deaths. Additionally, socioeconomic status has improved in the same period, along with the treatment seeking behavior for maternal and childhood illnesses (Bishai et al. 2014). In Nepal, the share of neonatal sepsis in neonatal death decreased in 2016 compared to 2006 (MoH, New ERA, and ICF 2017; MoHP Nepal, New ERA, and Macro International Inc. 2007). This reduction might be due to improved sanitation and the introduction of the chlorhexidine program. Pooled analysis of DHS data from Bangladesh and Nepal indicates that the odds of newborn death were 80% lower among babies with antiseptic placed on the cord compared with dry cord care (Mallick, Yourkavitch, and Allen 2018). Under-5 mortality decreased from 61 per 1,000 live births in 2006 to 39 per 1,000 live births in 2016. The reduction in the U5MR might also be due to a reduction in neonatal mortality because more than half of the under-5 deaths occurred in the neonatal period. Other factors that contributed to the reduction in childhood deaths may be improving health-seeking practices, scaling up of the child-survival interventions, targeting under-5 diseases through the integrated management of childhood illness, equipping health facility capacity with trained staff,

improving the availability of well-functioning equipment, and providing essential medicines (DoHS 2016/17; MoH, New ERA, and ICF 2017).

The findings from this study also showed that childhood diarrhea was more prevalent in households with poor access to improved water and sanitation and among children where a household was practicing open defecation (MoH, New ERA, and ICF 2017). The reason may be inadequate hand-washing practices before feeding children and after defecation, and improper stool disposal (Azage and Haile 2015; Bawankule et al. 2017; Larsen et al. 2017; Mihrete, Alemie, and Teferra 2014). In Nepal, among under-5 children with diarrhea, disaggregation by age showed that the prevalence of diarrhea in children age 6-11 months old was nearly twice as high (15.2%) as the national diarrhea prevalence (MoH, New ERA, and ICF 2017). Children's exposure to the external environment and the introduction of complementary foods starts during this period, which might have an effect on the prevalence of diarrhea in this age group (Budhathoki et al. 2016). A multi-country analysis showed that a 6% reduction in the prevalence of diarrhea was possible if both water and the toilet facility were improved, although improvement in either water or sanitation alone did not show a significant association with diarrhea prevalence (Fuller et al. 2015). To reduce diarrhea prevalence, both drinking water and household sanitation must be improved, along with handwashing behavior.

Geographical difference was observed in the prevalence of symptoms of ARI. For example, children living in the Terai (flat land) had lower odds of having ARI symptoms than those living in the Hill area. This study also found a higher prevalence of ARI symptoms among children of the poor households. This might be due to overcrowding, poor housing conditions such as lack of ventilation, and use of wood or straw as a cooking fuel (Bourke 2012; Nirmolia et al. 2018). The results also showed that 21% of children had fever 2 weeks before the survey day and that the prevalence of fever has increased significantly over time. This might be due to the difference in the month of data collection. In 2016, DHS data collection started in peak winter and ended in rainy/summer season (February to August 2006), whereas in 2016 data collection started during the rainy season and ended in winter (June 2016 to January 2017) (MoH, New ERA, and ICF 2017; MoHP Nepal, New ERA, and Macro International Inc. 2007). In this study, children from Province 1, female children, and children age 2 or younger had higher odds of having a fever than other children.

Findings in this study showed that household wealth status and maternal age were significantly associated with seeking treatment or advice from health facilities or providers for children suffering from any illness (diarrhea or fever or symptoms of ARI). Children from poor households were less likely to seek treatment or advice from the health facilities or providers compared to children from the rich households. Fifty-eight percent of children from poor households with diarrhea, 76% of children with symptoms of ARI, and 69% children with fever had received treatment or advice from the health facilities or providers, which is lower than the national treatment or advice-seeking practice for those diseases (see Appendix Table A3). In 2016, the majority of sick under-5 children had sought advice or treatment from private health facilities or providers in Nepal. For example, 74% of children with diarrhea who sought treatment from health facilities had sought treatment from private health facilities, which was similar to the pattern of treatment seeking practice for the other two childhood morbidities (MoH, New ERA, and ICF 2017). According to the NDHS 2016, the majority of children had sought treatment or service from a private health facility, particularly from pharmacies. The high cost of treatment in the private facility might have further limited advice- or treatment seeking practice of the poor people. The finding that children in poor households were less likely to seek treatment or advice from health care providers suggests the need for an equitable health care service. In addition, children of young mothers (age 15-24) were more likely to seek treatment or advice from health facilities or

providers for these illnesses compared to women age 25-34. Older women might not have sought advice or treatment from the health facilities or providers because of their past experience with health facilities while seeking treatment or advice or because of poverty (Lungu et al. 2016).

Inequality in child survival was observed by various background characteristics in this study. The neonatal and under-5 mortality rates were highest in the mountainous ecological region, rural areas, and for those in the poorest wealth quintile. Neonates from Province 1 and neonates whose household was more than 30 minutes away from the government health facilities were less likely to die than their counterparts. According to the DoHS annual report, only half of the health facilities (2,029/4,131) were providing delivery services including immediate newborn care. Zonal hospitals, regional hospitals, maternity hospitals, and teaching hospitals at a district level or above provide comprehensive emergency obstetric and newborn care, and account for only 3% of the total health facilities in Nepal (123/4,131) (DoHS 2016/17). The level and quality of the government health facilities were not analyzed in this study. In addition, the majority of newborn deaths occurred in the Terai area where health facilities are easily accessible. The service type, capacity, and availability in the nearest government and private health facility would give a clearer picture of the impact of health facilities on neonatal mortality. A study in Ethiopia showed that neonates with low birth rate had a higher risk of dying during the neonatal period (Debelew, Afework, and Yalew 2014). This study also found that low-birth neonates and those that were unweighed were more likely to die before the first month of life. However, it is possible that some infants were not weighed because they died immediately on the first day of life. Some studies of neonatal mortality exclude deaths occurring in the first day of life to account for this possible confounding (Mallick, Yourkavitch, and Allen 2018); however doing so comes at a cost in terms of sample size.

World Vision International and the Nossal Institute for Global Health estimated that extra community-based postnatal care for low-birth-weight babies could reduce neonatal mortality by 20%-40% (World Vision and The Nossal Institute for Global Health 2008). According to the NDHS 2016, 45% of neonates who died during the neonatal period were born in a health facility. The findings of this analysis suggest that additional investigation is needed regarding the condition of the mother and child when reaching the health facility for delivery, health facilities preparedness, the quality of service in health facilities, and the exposure to harmful practices among babies who died in an institution. The NDHS 2016 report also indicated that 60% of neonatal deaths had occurred in the Terai region and around one-quarter deaths in Province 2. Province 2 has poor prenatal, newborn, and postnatal service use (MoH, New ERA, and ICF 2017). This suggests that interventions designed to address the problem in Province 2 and Terai area of the country should consider the high proportion of neonatal deaths and low maternal service use.

Results in this study showed that distance to government health facilities and immediate care received after birth are significant predictors of under-5 deaths. The NDHS 2016 reported that higher proportions of sick under-5 children sought treatment from private health facilities, including pharmacies, as compared to government health facilities (MoH, New ERA, and ICF 2017). A similar result was shown in the cross-sectional study done by Save the Children in 2017 (CHD and Save the Children 2017). This suggests that geographic access to private health facilities should also be examined to understand the role of geographic accessibility in reducing under-5 deaths. Adding a question about the distance to private health facilities in the survey questionnaire could provide more clarity about the effect of distance from home to a health facility on treatment or advice-seeking practices for childhood illnesses as well as mortality. Other factors, such as harmful treatment practices, late arrival to the health facility, and health facilities' lack of readiness to provide under-5 services might have played a role in under-5

deaths. This needs to be further explored. Children who did not receive immediate newborn care after birth were more likely to die, which suggests that neonatal care should be enhanced to reduce under-5 deaths. However, since the data were collected based on respondent reports, there is the possibility of recall bias due to pain in case of traumatic experience where death was experienced, especially in the essential newborn care and weighting of babies immediately after birth. Additionally, it is possible that, as with weighing infants, neonatal death preceded the opportunity for newborn care, rather than resulting from lack of care being followed by neonatal or under-5 death.

4.1 Conclusions and Recommendations

In the last decade, the prevalence of diarrhea and symptoms of ARI have decreased while the prevalence of fever has increased. Overall, childhood illness was lower among the children age 2 and below compared to children above age 2. Prevalence of diarrhea was higher in a household with poor access to improved water and sanitation. The symptoms of ARI were more prevalent in the mountain region. Preventive measures should focus on these inequities. The trend of receiving treatment from the health facilities (private or government) has improved in this period, although the poor population of the society are still lagging behind in seeking treatment or advice from health facilities or other providers. Program managers should identify underserved areas, explore the health facility and community gaps, and address issues that are hindering the poor population from seeking treatment or advice. This study showed that birth weight was a significant determinant of neonatal mortality. Neonatal health care programs should particularly focus on the survival of the low-birth-weight babies, and antenatal care programs may emphasize maternal nutrition during pregnancy. Under-5 death was more likely in children who have not received immediate newborn care, with 50% of the under-5 mortality a consequence of neonatal deaths. Improving immediate newborn care can likely reduce the under-5 death rate.

Strategies to reduce geospatial disparity and increase intersectoral coordination in addressing issues like water and sanitation services to improve child health need to be considered. Efforts to reduce newborn mortality by scaling up interventions, such as Kangaroo mother care (continuous skin-to-skin contact between mother and baby, exclusive breast milk feeding, and early discharge from hospital) along with immediate breastfeeding to avert low-birth-weight-related neonatal deaths, need to be expanded. In addition, trends disaggregated by geospatial and case/ethnicity characteristics should be monitored comparatively to ensure equitable progress.

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APPENDICES

Appendix Table A1 Caste and ethnic groups with regional divisions, Nepal 2001 Census

	Main Ethnic Groups	Ethnic Groups with Regional Divisions (11) and Social Groups (103), 2001 Census
Caste Group	**1. Brahmin/Chhetri**	**1.1 Hill Brahmin** Hill Brahmin
		1.2 Hill Chhetri Chhetri, Thakuri, Sanyasi
		1.3 Terai/Madhesi Brahmin/Chhetri Madhesi Brahmin, Nurang, Rajput, Kayastha
	2. Terai/Madhesi Other	**2.1 Terai/Madhesi Other** Kewat, Mallah, Lohar, Nuniya, Kahar, Lodha, Rajbhar, Bing, Mali, Kamar,Dhuniya, Yadav, Teli, Koiri, Kurmi, Sonar, Baniya, Kalwar, Thakur/Hazam, Kanu, Sudhi, Kumhar, Haluwai, Badhai, Barai, Bhediyar/Gaderi
	3. Dalits	**3.1 Hill Dalit** Kami, Damai/Dholi, Sarki, Badi, Gaine, Unidentified Dalits
		3.2 Terai/Madhesi Dalit Chamar/Harijan, Musahar, Dushad/Paswan, Tatma, Khatwe, Dhobi, Baantar, Chidimar, Dom, Halkhor
Adibasi/Janajatis	**4. Newar**	**4.1 Newar** Newar
	5. Janajati	**5.1 Hill/Mountain Janajati** Tamang, Kumal, Sunuwar, Majhi, Danuwar, Thami/Thangmi, Darai, Bhote, Baramu/Bramhu, Pahari, Kusunda, Raji, Raute, Chepang/Praja, Hayu, Magar, Chyantal, Rai,Sherpa, Bhujel/Gharti, Yakha, Thakali, Limbu, Lepcha, Bhote, Byansi, Jirel, Hyalmo, Walung, Gurung, Dura
		5.2 Terai Janajati Tharu, Jhangad, Dhanuk, Rajbanshi, Gangai, Santhal/Satar, Dhimal, Tajpuriya, Meche, Koche, Kisan,Munda, Kusbadiya/Patharkata, Unidentified Adibasi/Janajati
Others	**6. Muslim**	**6.1 Muslim** Madhesi Muslim, Churoute (Hill Muslim)
	7. Other	**7.1 Other** Marwari, Bangali, Jain, Punjabi/Sikh, Unidentified Others

Source: Bennett, L., Dahal, D.R., and Govindasamy, P. (2008).

Appendix Table A2 Percentage of children under age 5 with childhood illness (diarrhea, ARI, and fever) for whom advice or treatment was sought by background characteristics, Nepal DHS 2016

Variables	Diarrhea			ARI			Fever		
	%	95% CI	*N*	%	95% CI	*N*	%	95% CI	*N*
Household characteristics									
Ecological zone		**						***	
Mountain	70.1	46.7 – 86.3	*18*	67.2	40.9 – 85.8	*10*	60.6	44.6 – 74.7	*56*
Hill	44.9	25.6 – 65.7	*120*	82.0	68.7 – 90.4	*62*	69.7	63.3 – 75.4	*402*
Terai	74.0	67.0 – 80.0	*234*	92.8	80.9 – 97.5	*46*	88.7	85.1 – 91.5	*576*
Province		**						***	
Province 1	65.7	49.8 – 78.7	*57*	77.7	50.4 – 92.2	*26*	84.7	77.6 – 89.9	*242*
Province 2	68.2	56.8 – 77.8	*112*	100.0		*20*	89.4	83.8 – 93.2	*281*
Province 3	32.1	12.0 – 62.2	*71*	88.9	64.2 – 97.3	*19*	68.8	58.8 – 77.4	*179*
Province 4	73.4	51.2 – 87.9	*14*	87.6	52.0 – 97.9	*7*	66.7	53.6 – 77.5	*56*
Province 5	82.4	70.3 – 90.2	*71*	86.9	66.1 – 95.7	*25*	82.3	74.5 – 88.1	*151*
Province 6	83.3	64.8 – 93.1	*19*	77.5	57.4 – 89.8	*11*	61.8	51.8 – 70.8	*50*
Province 7	65.9	49.9 – 78.9	*26*	69.8	47.1 – 85.7	*11*	70.6	55.9 – 82.0	*75*
Residence									
Urban	59.8	43.0 – 74.6	*207*	89.7	79.0 – 95.3	*55*	82.5	77.7 – 86.4	*600*
Rural	70.2	61.0 – 78.1	*165*	80.7	68.0 – 89.2	*63*	76.1	69.9 – 81.3	*434*
Household wealth terciles								***	
Poor	60.6	50.1 – 70.2	*134*	76.9	62.0 – 87.2	*41*	67.0	60.7 – 72.8	*352*
Middle	71.7	61.4 – 80.2	*119*	84.3	69.7 – 92.6	*42*	88.6	84.2 – 92.0	*324*
Rich	61.4	38.7 – 80.1	*119*	95.0	80.0 – 98.9	*35*	84.3	76.5 – 89.8	*359*
Disadvantaged	70.5	63.8 – 76.5	*275*	85.8	75.6 – 92.2	*72*	82.6	78.7 – 85.9	*708*
Advantaged	47.0	23.2 – 72.1	*96*	83.5	71.3 – 91.2	*46*	73.7	66.4 – 79.9	*326*
Distance to the nearest public health facilities					*			**	
Within 30 minutes	66.8	56.1 – 75.9	*169*	92.7	83.1 – 97.1	*55*	84.8	80.1 – 88.6	*522*
30 minutes and more	62.5	48.3 – 74.8	*203*	78.1	64.9 – 87.3	*63*	74.6	69.5 – 79.1	*512*
Child and birth characteristics									
Child									
Male	71.9	64.0 – 78.6	*197*	83.9	72.0 – 91.3	*68*	80.7	76.7 – 84.2	*607*
Female	56.1	37.5 – 73.1	*175*	86.4	73.5 – 93.5	*50*	78.5	71.4 – 84.2	*427*
Child age					***				
Under 2 years	66.6	51.2 – 79.2	*205*	93.4	85.5 – 97.2	*68*	77.4	71.6 – 82.2	*469*
2 years and above	61.7	51.9 – 70.6	*167*	73.2	59.6 – 83.5	*50*	81.8	77.8 – 85.2	*565*

(Continued…)

Appendix Table A2—Continued

Variables	Diarrhea			ARI			Fever		
	%	95% CI	*N*	%	95% CI	*N*	%	95% CI	*N*
Maternal characteristics									
Maternal education									
No education	58.4	47.9 - 68.1	*142*	85.5	71.1 - 93.4	*35*	77.5	71.3 - 82.7	*327*
Some education	68.2	53.6 - 79.8	*230*	84.7	73.9 - 91.5	*83*	80.8	77.2 - 84.0	*707*
Maternal age					***			**	
15 - 24 years	70.5	58.9 - 79.9	*149*	90.5	80.4 - 95.7	*56*	85.3	80.4 - 89.2	*406*
25 - 34 years	62.3	42.7 - 78.5	*191*	89.4	78.1 - 95.2	*48*	77.5	72.8 - 81.6	*547*
35 - 49 years	48.7	31.5 - 66.3	*31*	44.7	19.3 - 73.3	*13*	67.3	53.8 - 78.4	*81*
Exposure to public health media programs									
None	72.2	64.4 - 78.9	*213*	85.5	72.6 - 92.9	*59*	81.5	76.9 - 85.3	*529*
At least one	54.0	35.3 - 71.6	*158*	84.3	72.4 - 91.7	*59*	78.0	72.1 - 82.9	*505*
Decision-making capacity									
Weak	75.5	61.1 - 85.8	*60*	82.8	59.0 - 94.0	*19*	82.5	74.8 - 88.2	*154*
Strong	62.7	50.0 - 73.9	*305*	85.3	75.6 - 91.6	*99*	79.9	76.1 - 83.2	*870*

*** p < 0.001, ** p < 0.01, * p < 0.05

Appendix Table A3 Use of both ORS and zinc for the treatment of childhood diarrhea by various characteristics, Nepal DHS 2016

Variables	%	95% CI	*N*	p-value
Household characteristics				
Urban/Rural				
Urban	10.3	6.0 - 16.9	*206*	
Rural	10.2	6.1 - 16.4	*165*	
Caste/ethnicity				
Disadvantaged	8.1	5.1 - 12.9	*275*	
Advantaged	16.3	8.0 - 30.3	*96*	
Distance to the nearest health facilities				
Within 30 minutes	9.9	5.7 - 16.7	*169*	
30 minutes and more	10.5	6.5 - 16.5	*203*	
Child and birth characteristics				
Child sex				
Male	12.3	8.0 - 18.5	*197*	
Female	7.9	4.4 - 13.6	*174*	
Child's age				
Under 2 years	7.4	4.2 - 12.6	*205*	
2 years and above	13.8	8.7 - 21.0	*167*	
Birth order				
1 to 3	9.1	5.6 - 14.5	*241*	
3 & above	12.3	7.1 - 20.3	*130*	
Maternal characteristics				
Maternal education				
No education	7.6	4.2 - 13.4	*142*	
Some education	11.9	7.8 - 17.6	*230*	
Maternal age				
15 – 24 years	7.6	4.4 - 12.8	*149*	
25 – 49 years	12.0	7.5 - 18.6	*222*	
Exposure to public health media programs				
None	7.9	4.7 - 12.9	*213*	
At least once	13.4	7.7 - 22.2	*158*	
Service use characteristics				
Place of treatment				
Public	34.8	22.6 - 49.3	*55*	
Private	9.8	5.8 - 16.2	*183*	***
No/traditional	0.7	0.1 - 3.3	*133*	

*** p < 0.001, ** p < 0.01, * p < 0.05