# Neonatal mortality in Nepal: A multilevel analysis of a nationally representative

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**Abstract** *Objectives:* This study investigated individual, community and district level factors associated with neonatal mortality among a national sample of Nepalese women.

*Methods:* Data were drawn from the 2006 Nepalese Demographic and Health Survey on women aged 15–49 who delivered within three years prior to the survey ($N = 4136$). Multilevel logistic regression models with three levels were fitted to assess the influences of measured individual, community and district level variables on neonatal mortality.

*Results:* The total neonatal mortality in three years preceding the survey was 4.5 deaths per 100 live births ($N = 190$), with neonatal mortality rate (NMR) = 46 per 1000 live births. Having a partner with no formal education, being in the middle on the wealth index and residing in less developed district were associated with neonatal death in bivariate analysis. Women who were assisted by skilled personnel during delivery were less likely to have neonatal death (adjusted OR for no assistance = 2.26, 95% CI = 1.19–4.26). Having prenatal care with skilled attendant was associated with less likelihood of neonatal death (adjusted OR for no care = 1.75, 95% CI = 1.17–2.62). Older women, mother's education, parity and wealth index were associated with neonatal mortality. Considerable variations in neonatal mortality at community and district levels were found.

*Conclusions:* These findings emphasize the need for interventions at the individual level with regard to access and utilization of healthcare in order to reduce the neonatal mortality in Nepal.

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## 1. Introduction

Neonatal mortality is a global public health burden mostly concentrated in low- and middle-income

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countries. In low- and middle-income countries, where skilled professionals attend to fewer than half of the deliveries and where each year 60 million births occur outside health facilities [1], the burden of neonatal morbidity and mortality remains high [2]. Newborn deaths, that is deaths in the first four weeks of life (neonatal period), account for 41% of all child deaths before the age of five [3]. The first week of life is the riskiest week for newborns [3] and yet many low- and middle-income countries do not have comprehensive postnatal care programs to reach mothers and babies at this critical time [3].

Maternal and child health programs are beginning to place greater emphasis on newborn survival [4], but missed opportunities remain even in existing programs. There are, for example, midwives who are not trained and equipped for simple newborn care and neonatal resuscitation. Significant reductions have been seen in child mortality rates in Nepal over the last decades, but the neonatal mortality is still high compared with other low- and middle-income countries [5]. Similarly, maternal mortality rates are also high due to weak health care system with limited access to emergency obstetric care, lack of skilled attendants and the overall poor status of women. In developing countries, high neonatal mortality rates are due in part to lack of community awareness of appropriate care of the newborn [6]. In Nepal, primary and secondary care is deficient [7]. Most women have no antenatal care and most deliveries occur at home [8]. Most stillbirths and neonatal deaths also occur at home [9]. Thus, many might be avoided with changes in prenatal and newborn care practices.

Recent reviews of the evidence have shown that many neonatal deaths, especially early neonatal deaths (deaths within the first week of birth), can be prevented through evidence-based interventions [4,10], such as family-community care and an immediate neonatal care package [10], which require clinically trained providers. Darmstadt et al. [10] estimated that a skilled birth care package could reduce neonatal mortality by 20—30%. To adopt a focused, evidence-based approach to reduce neonatal mortality in Nepal, a clear understanding of the associated factors is necessary. In this paper, existing 2006 Demographic and Health Survey (DHS) data from Nepal were used to assess the factors associated with neonatal mortality. This study also investigated whether community and district-level factors have any influence on neonatal mortality.

## 2. Subjects, materials and methods

### 2.1. Data sources

The data for this study were adopted from the 2006 Nepal Demographic Health Survey (NDHS) conducted by the Department of Health Services, Population Division of the Ministry of Health and Population, and implemented by New ERA, a local research organization. Macro International Inc. provided technical assistance through its MEASURE DHS project. This study employed a nationally representative sample from households. A total of 10,973 women were identified as eligible for the individual interview, but the interviews were completed for 10,793 ever-married women aged 15—49, yielding a response rate of 98%. The present analysis is restricted to the 4136 women who had given birth within three years preceding the survey.

#### 2.1.1. Description of the survey

The NDHS 2006 survey used the sampling frame from the 2001 census (Center Bureau of Statistics, 2001). Each of the 75 districts in Nepal is subdivided into Village Development Committees (VDCs), and each VDC is then divided into wards. The primary sampling unit (PSU) for the 2006 NDHS was a ward, sub-ward, or group of wards in rural areas, and sub-wards in urban areas. The sample for the survey was based on a two-stage sampling. At the first stage of sampling, 260 PSUs (82 in urban areas and 178 in rural areas) were selected using systematic sampling with probability proportional to size. A complete household listing operation was then carried out in all the selected PSUs to provide a sampling frame for the second stage selection of households. At the second stage of sampling, systematic samples of about 30 households per PSU on the average in urban areas and about 36 households per PSU on the average in rural areas were selected in all the regions in order to provide statistically reliable estimates of key demographic and health variables. The total sample is weighted, and a final weighting procedure was applied to provide estimates for the different domains, and for the urban and rural areas of the country as a whole. There was no need for ethical clearance for the current analysis.

### 2.2. Measurement of variables

#### 2.2.1. Neonatal mortality

The neonatal mortality rate presented in this study was computed from information gathered in the