Impact of community- and home-based interventions for improved newborn care practices in Nepal

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Abstract

Introduction: While infant and under-five mortality rates in developing countries have declined significantly in the past decades, newborn mortality rates have decreased much more slowly. Nepal is one of the few developing countries “on track” to achieve Millennium Development Goal (MDG) 4 to reduce child mortality by two thirds, with 48 percent reductions in under-five mortality, 39 percent reductions in infant mortality and 34 percent reductions in neonatal mortality in the last decade. Nevertheless, making further gains and achieving MDG 4 will be very difficult without a significant reduction in neonatal mortality. To address the challenge and making use of a cadre of lay health workers, the female community health volunteers (FCHVs), the Nepal Ministry of Health and Population (MOHP) developed a comprehensive program to improve neonatal health, the community-based newborn care package (CB NCP) and piloted this across ten districts in 2011.

Methods: This study focuses on two major research questions: if progress in neonatal health over time has been equitable for different geographical, socio-economic and ethnic groups in Nepal, and what impact the CB NCP pilot has had on essential practices to improve neonatal health, taking into account the socio-economic, cultural, geographic and health system context of Nepal. This study utilizes trend and equity analyses of neonatal mortality and a mixed-method quasi-experimental approach to answer these two research questions. Ten intervention districts were selected by the MOHP for pilot testing of CB NCP and ten comparison districts were selected using propensity score matching. Data from the Demographic and Health Survey (DHS) and the MOHP’s Management Information System (MIS) were analyzed using difference-in-differences (dind) and multivariable logistics regression analyses. Qualitative information obtained through focus group discussions and key informant interviews was analyzed using thematic analysis.

Results: The overall annual rate of reduction of neonatal mortality was 3.3 percent per annum (range 2.3 to 6.2) between 1996 and 2011. Rate difference (rd) and rate ratio (rr) for different population groups were relatively stable between 1996 and 2011. Both relative and absolute inequality was more pronounced for wealth (rd=21.4, rr=2.2 in 2011) than for mother's education, caste and ethnicity and geographic features (urban-rural, ecological regions, developmental regions).

Based on DHS data, improvements over time in relation to essential practices to improve neonatal health were observed for some indicators, but these changes were similar for intervention and comparison areas (antenatal care seeking (dind=9.22, p=0.383), delivery at health institution (dind=5.84, p=0.488), delivery assisted by a skilled birth attendant (dind=4.64, p=0.577), immediate newborn care practices (dind= -4.1, p=0.605), and postnatal care visits (dind=20.36, p=0.036)) and not statistically significant except for postnatal care visits within 48 hours. Multivariable regression analysis also did not reveal any significant improvement in aggregate outcomes (i.e. birth preparedness (adjusted odds ratio, aOR=0.8 [95% CI 0.4-1.7], antenatal care quality aOR=1.4 [0.9-2.1], antenatal care seeking aOR=1.0 [0.6-1.5], delivery by a skilled birth attendant aOR=1.5 [1.0-2.3], immediate newborn care aOR=1.1 [0.7 – 1.9] and postnatal care aOR=1.3 [0.9-1.9]). Analysis of MIS data generally confirms the result of the DHS analysis showing marginal or no additional improvement in intervention relative to comparison areas.

Based on MIS data, health providers' knowledge and skills in intervention districts were generally fair although there is some variation by service provider (e.g. 70% facility based health workers, 62% community based health workers and 57% FCHVs know all five essential newborn care practices) and between districts (e.g. 57% (range=18%-90%) of FCHVs know all five essential newborn care practices). This implies that training and supervision did have an impact on health providers. The availability of key medicines and supplies was usually good (e.g. average cotrimoxazole availability >87%).

Based on qualitative data, access to health services, as well as knowledge about better care for pregnant women, recently delivered women and newborns was found to be improving in both intervention and comparison districts. However some people were skeptical about some of the recommended practices (e.g. delayed bathing) due to their deep-rooted beliefs and thus continued traditional practices rather than to follow the recommendations. Distance to health facilities and FCHVs, lack of faiths in the medicines available in government facilities, and the financial burden associated with seeking care (e.g. travel cost) and following recommended practices (e.g. buying fruits and meat for the mother) still remained a concern for some families. A routine postnatal care visit is not felt necessary or valued.

Conclusions: Overall, this study indicates that there is a wide gap in the rate of neonatal mortality between different socio-economic groups and that the rate of progress is uneven, both in terms of absolute and relative inequalities. The fact that this study did not find the expected improvement in newborn care practices raises concerns about the quality and effectiveness of the CB NCP to date, although it is difficult to draw firm conclusions in view of very recent program implementation (where clear effects may only become visible after delay) and due to limited data quality. Nevertheless, there are some indications that the program should be revised in relation to some of its content and taking into account socio-cultural insights. It will be essential to continue careful monitoring as the program matures and as it is scaled up to other districts.

Abbreviations

AIDS	Acquired Immuno-deficiency Syndrome
ANC	Antenatal care
BPP	Birth Preparedness Package
CB IMCI	Community-based Integrated Management of Childhood Illness
CB NCP	Community-based Newborn Care Package
CHW	Community Health Worker
CHX	Chlorhexidine
CIH	Center for International Health
DDC	District Development Committee
DHS	Demographic and Health Survey
DIL	Daughter in Law
DOHS	Department of Health Services
FCHV	Female Community Health Volunteer
FGD	Focus Group Discussion
FHD	Family Health Division
FM	Frequency Modulation (radio signal)
FUT	Follow-up after Training
GON	Government of Nepal
HDI	Human Development Index
HF	Health Facility
HIV	Human Immuno-deficiency Virus
HMIS	Health Management Information System
HP	Health Post
HW	Health Worker
IMNCI	Integrated Management of Newborn and Childhood Illness
IMR	Infant Mortality Rate
KII	Key Informant Interview

LBI	Local Bacterial Infection
LBW	Low Birth Weight
LMU	Ludwig Maximilians University of Munich
LN	Natural logarithm
MCHW	Maternal and Child Health Worker
MDG	Millennium Development Goal
MIL	Mother in Law
MIS	Management Information System
MOHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
NFHS	Nepal Family Health Survey
NHDR	Nepal Human Development Report
NHIS	Newborn Health Information System
NLSS	Nepal Living Standard Survey
NMR	Neonatal Mortality Rate
NRS	Nepali Rupees
PHCC	Primary Health Care Center
PSBI	Possible Severe Bacterial Infection
PSU	Primary Sampling Unit
RDW	Recently Delivered Woman
SBA	Skilled Birth Attendant
SDIP	Safe Delivery Incentives Program
SHP	Sub-Health Post
STD	Sexual Transmitted Diseases
U5MR	Under-five Mortality Rate
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VDC	Village Development Committee
WHO	World Health Organization

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1. Introduction

1.1 Neonatal health: the global, regional and national situation

While infant and under-five child mortality rates in developing countries have declined significantly in the past decades, newborn mortality rates have decreased much more slowly. (Lassi et al., 2010) An estimated 18% to 37% of neonatal deaths could be averted through expanded coverage of cost-effective interventions if delivered through family or community approaches. The neonatal period is critical for human survival. The neonatal mortality rate is defined as the number of deaths that occur during the first 28 days of life per 1,000 live births in a given year and geographic area. Nepal is one of the few developing countries "on track" to achieve Millennium Development Goal (MDG) 4 to reduce child mortality by two thirds, with reductions in under-five mortality from 118 to 61 per 1,000 live births (48% reduction) and reductions in infant mortality from 79 to 48 per 1,000 live births (39% reduction) in the last decade. (MOH, 2002, MOHP, 2007b, MOHP, 2012, Pradhan et al., 1997, WHO/UNICEF, 2012) Over the same time period, the neonatal mortality rate decreased by only 34%, from 50 to 33 per 1,000 live births. (MOHP, 2012) As neonatal deaths are responsible for more than half of the overall under-five mortality and are difficult to prevent with the current set of maternal and child health interventions, achieving MDG 4 will be very difficult without a significant reduction in the neonatal mortality rate. (MOHP, 2012) **Table 1.1** shows the overall situation of neonatal mortality at global, regional and national levels, and reflects that the overall newborn survival situation in Nepal is worse compared to the regional and global average.

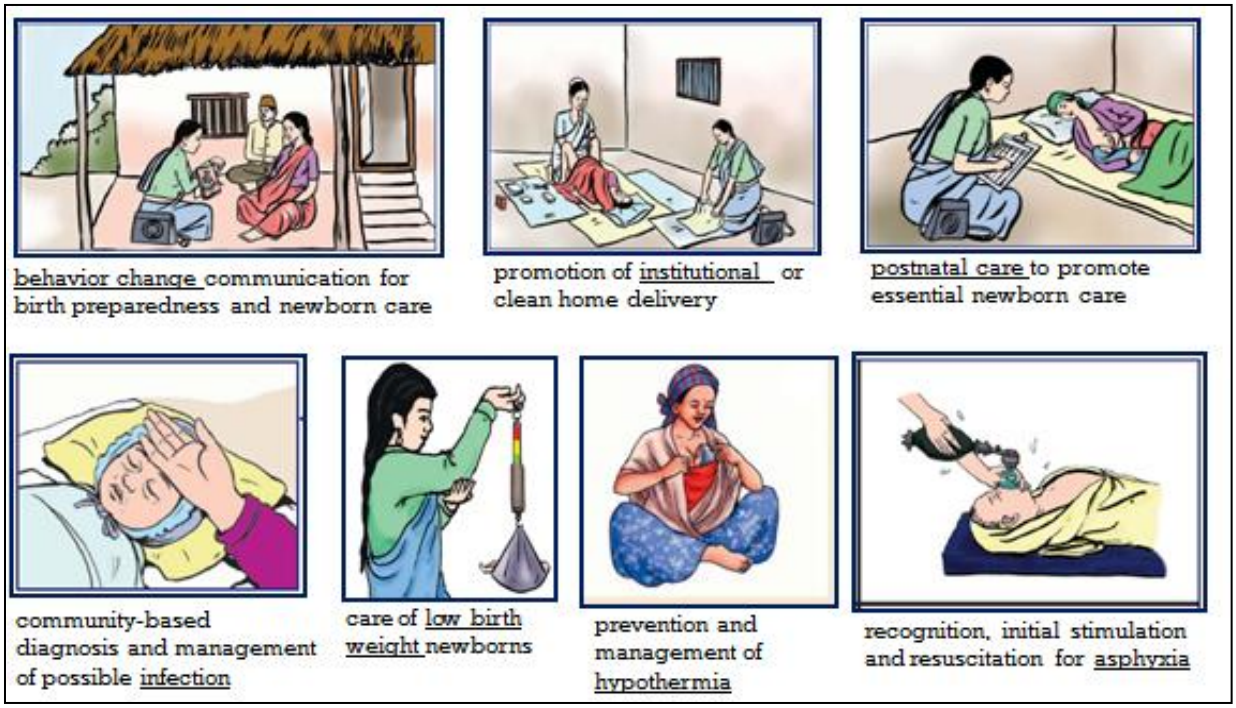
Table 1.1: Neonatal mortality at global, regional and national levels, 2011

Indicator	Global	South-East Asia	Nepal
Estimated number of neonatal deaths (numbers in thousands)	2,955	321	23
Neonatal mortality rate (per 1,000 live births)	22	14	33
Neonatal deaths as a share of under-five deaths (percent)	43	50	61
Data source	(UNICEF et al., 2012)	(UNICEF et al., 2012)	(MOHP, 2012)

1.2 Programs and policies in Nepal

In 2004, the Government of Nepal (GON) developed the National Neonatal Health Strategy with the aim to improve neonatal health and survival, and to provide strategic direction.(MOHP, 2004) Based on this strategy and considering both in-country and international evidence, in 2007 GON developed a set of key interventions to address the major causes of neonatal mortality, which were combined in the community-based newborn care package (CB NCP). As shown in **Figure 1.1**, the community-based newborn care package includes seven community- and home-based interventions: i) behavior change, ii) institutional delivery or clean home delivery, iii) postnatal care, iv) care of low birth weight newborns, v) management of newborn infections, vi) prevention of hypothermia, and vii) recognition of asphyxia, initial stimulation and resuscitation.

Figure 1.1: Interventions in community-based newborn care package (DoHS/MOHP, 2007)



Through training, mobilization and supervision of facility- and community-based health workers and female community health volunteers (FCHVs), this program aims to raise awareness and work towards increasing institutional delivery, clean home delivery and use of

skilled birth attendants, and improving the quality of antenatal, postnatal and essential newborn care services. Additionally, health messages are transmitted through mass media, such as local radio, and through social mobilization campaigns, such as street drama, in program districts. (Poudel et al., 2012)

Several other interventions targeted at newborns, such as the use of chlorhexidine for cord care (Hodgins et al., 2013, Mullany et al., 2006) and vitamin A supplementation (Khanal et al., 2012), are also implemented in Nepal but do not form part of CB NCP. Other programs with some components to improve newborn health include the Community-based Integrated Management of Childhood Illness (CB IMCI) (Dawson et al., 2008, Ghimire et al., 2010), the Birth Preparedness Package (BPP) (McPherson et al., 2006), and the Safe Delivery Incentives Program (SDIP) (Powell-Jackson et al., 2009). CB IMCI represents an established approach and is globally considered one of the best models for integrated delivery of care at family and community levels for the most common childhood illnesses (i.e. pneumonia, diarrhoea, malaria, malnutrition) during the first five years of life. BPP targets pregnant women, helping them and their families to be prepared for a safe delivery and for the arrival of the baby, and to recognize danger signs and seek care from a health provider when needed. It emphasizes the need to be ready for emergencies, such as the need for blood transfusion, caesarean section for complicated births, and the need to reduce delays in seeking care for severe maternal or neonatal illness (in particular newborn asphyxia, postpartum hemorrhage and severe bacterial infections). The main objective of the SDIP is to increase deliveries at health institutions (i.e. hospital, primary health care center, health post and sub-health post with birthing center) and thus to provide better care for mothers and newborns during and immediately after birth. An increased rate of institutional deliveries or safe home deliveries is expected to prevent newborns from dying due to birth asphyxia and severe bacterial infections.

In the context of the difficult geographic terrain and socio-cultural barriers to seeking care from the formal health system in Nepal, especially where maternal and child care is only available from male providers, a unique cadre of volunteers was developed. These FCHVs are local, mostly illiterate, usually married women, selected by local mothers' group. Depending on the local geography, each FCHV tentatively covers 50 to 200 households in her community and plays a vital role in all community-based maternal, newborn and child health programs. Currently, these volunteers are involved to inform, educate and provide basic maternal, newborn and child health services including classification and management of childhood diarrhoea, neonatal illness, provision of iron supplements, distribution of misoprostol to prevent postpartum hemorrhage, and administration of chlorhexidine for cord care. Though many (38%) of these FCHVs are illiterate, they perform as well as their literate colleagues. (MOHP, 2007a) These FCHVs are foundation of Nepal's health system and are critical for the delivery of community- and home-based interventions to improve newborn health. (Glenton et al., 2010, Pradhan et al., 2011)

1.3 Aims and objectives

The main aim of this study is to evaluate the impact of the community-based newborn care package on essential practices to improve neonatal health in view of recent trends in neonatal mortality and taking into account the socio-economic, cultural, geographic and health system context of Nepal.

Specifically, the following research questions will be addressed:

1) Has progress in neonatal health over time been equitable for different geographical, socio-economic and ethnic groups in Nepal?

2) What impact does the community-based newborn care package have on essential practices to improve neonatal health, taking into account the socio-economic, cultural, geographic and health system context of Nepal?

1.4 Description of thesis

Research question 1 is addressed through trend and equity analyses of neonatal mortality. Absolute and relative inequalities for different socio-economic, geographic and ethnic groups are examined over time, using data from nationally representative surveys. Research question 2 is addressed through a mixed-method quasi-experimental approach. The impact of the community-based newborn care package on essential practices to improve neonatal health is assessed by comparing progress in propensity score-matched intervention and comparison areas, utilizing data from existing nationally representative surveys and from the Nepal Ministry of Health's management information system. The views of programme beneficiaries, important family and community members and service providers obtained through focus groups and key informants are used to distil factors that enable or restrain improvements in newborn health. Quantitative findings across multiple data sources and qualitative findings are triangulated to offer a holistic evaluation of the community-based newborn care package.

Chapter 1 provides an overview of the topic and research objectives; Chapter 2 reviews relevant evidence from both peer-reviewed and grey literature; Chapter 3 describes the study methodology including data sources, statistical analysis of quantitative data, thematic analysis of qualitative data and data triangulation. Chapter 4 focuses on the results with four sub-chapters on equity and trend analysis, impact based on the Demographic and Health Survey, impact based on the Ministry of Health's Management Information System, and enablers and barriers to improved neonatal health based on focus group discussions and key informant interviews. The discussion in Chapter 5 compares and contrasts findings from different sources, and locates these in the literature, and reviews programmatic and research implications; and Chapter 6 provides conclusions and a way forward.

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2. Literature review

2.1 Levels and trends of neonatal mortality

Globally, 2.9 million newborns died in 2011 (UNICEF et al., 2012). Between 1990 and 2011, the neonatal mortality rate has declined from 32 per 1,000 live births (4.3 million deaths) to 22 per 1,000 live births. Neonatal mortality is becoming increasingly important as the proportion of under-five deaths that occur during the neonatal period has increased from about 36 percent in 1990 to 43 percent in 2011 at the global level, and from 39 percent in 1990 to 50 percent in South-East Asia.(UNICEF et al., 2012) The trend is expected to continue as the decline in neonatal mortality is slower than the decline in under-five mortality. Of these neonatal deaths, nearly three quarters occur during the first week of life, and up to half in the first 24 hours, making these a critical period for intervention.(UNICEF et al., 2012)

In Nepal, every year nearly 23,000 babies are estimated to die in their first month of life. According to the most recent Nepal Demographic and Health Survey (NDHS) data, the current neonatal mortality rate is 33 per 1,000 live births and accounts for 61 percent of under-five deaths.(MOHP, 2012) The neonatal mortality rate has been stagnant between 2006 and 2011. Between 1996 and 2011, neonatal mortality fell by only 34 percent (from 50 to 33 deaths per 1,000 live births), whereas under-five mortality fell by 54 percent (from 118 to 54 deaths per 1,000 live births) and infant mortality by 42 percent (from 79 to 46 deaths per 1,000 live births). (MOHP, 2012, Pradhan et al., 1997) Over the past decade (2000-2010), Nepal's neonatal mortality rate declined by 3.6 percent per year, which is faster than the regional average (2.0%) but slower than annual progress for mortality of children aged 1–59 months (7.7%) and maternal mortality (7.5%). (Pradhan et al., 2012)

2.2 Determinants of newborn health

Globally, the leading causes of neonatal death are preterm birth (28%), severe infections (26%), and asphyxia (23%).(Lawn et al., 2005) Low birth weight is the leading indirect cause of neonatal mortality. Neonatal tetanus, an easily preventable cause, accounts for a smaller proportion (7%) of deaths.

Preterm births are babies born before the 37th week of pregnancy and these babies may have difficulty initiating breathing, sucking, fighting infection, and staying warm. (Beck et al., 2004) Globally, an estimated 15 million preterm births occur every year, and over 1.1 million of them die from various complications. While through special home-based care such as *kangaroo mother care* and antenatal steroids for mothers more than 75 percent of these deaths can be prevented, they do not reach most of the children in need. (World Health Organization, 2012)

Infection is another major cause of neonatal death that accounts for approximately one quarter of deaths globally. (Lawn et al., 2005) In settings where hygiene conditions are poor, newborns may become infected with bacteria or other organisms that can cause serious infections in the skin, umbilical cord, lungs, gastrointestinal tract, brain, or blood. (Beck et al., 2004) Prevention, timely detection and treatment of newborn infection are essential to saving newborn lives. A study in rural India demonstrated a 62 percent reduction in neonatal mortality through community-based identification and treatment of suspected neonatal infection (sepsis) by trained village health workers (Bang et al., 2005), and a similar home-based care approach in Sylhet, Bangladesh showed a 34 percent reduction in mortality. (Baqui et al., 2009) In Nepal, community health workers (CHWs) were trained and mobilized to use a simple algorithm to classify sick infants with possible bacterial infection, showing that they are able to assess and identify possible infections in neonates and young infants and to deliver appropriate treatment with antibiotics (90% treatment initiation, 93% treatment completion and 1.5% case fatality) thereby increasing neonatal survival. (Khanal et al., 2011) Compared to the early-neonatal period, where most neonates die from birth asphyxia, more neonates during the late-neonatal period die due to infections.

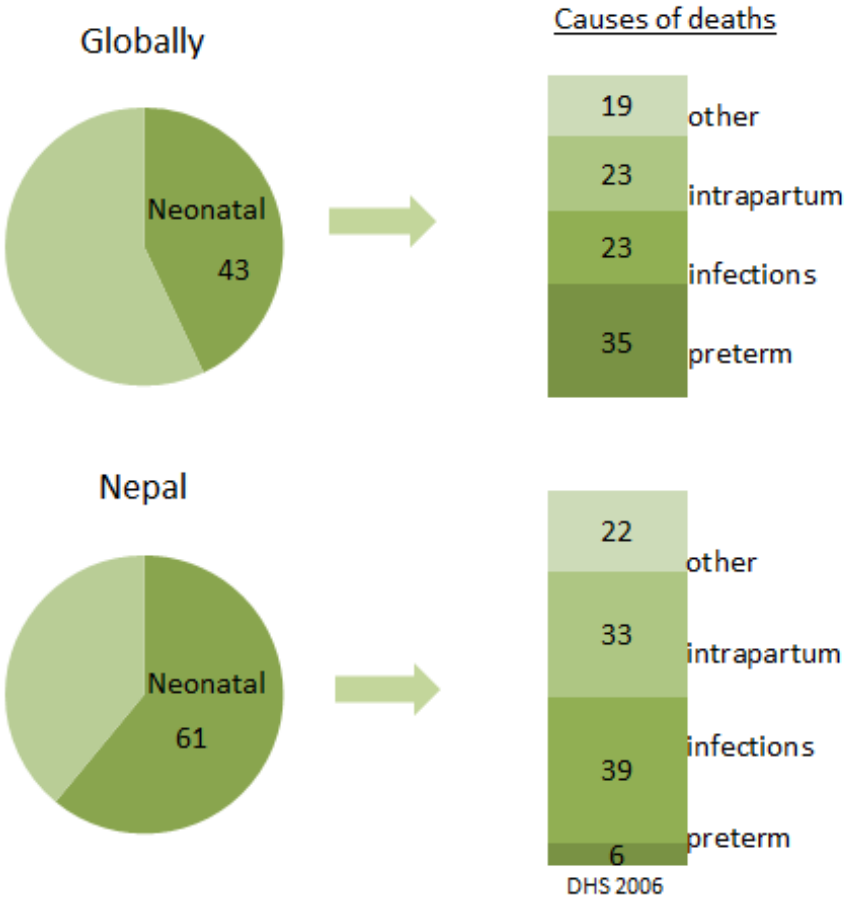
Birth asphyxia or intrapartum hypoxic events are defined as the failure to initiate or maintain regular breathing during and after birth that accounts for nearly a quarter of neonatal deaths. Newborn resuscitation programs include low-cost interventions such as drying, clearing the airways, stimulation and assisted stimulation as well as assisted ventilation with a self-inflating bag and mask. These interventions have proven to effectively reduce perinatal mortality by up to 30 percent in India (Goudar et al., 2013) Results from a study in Tanzania indicate a 47 percent reduction in neonatal mortality during the first 24 hours when health workers are trained to provide resuscitation support to hypoxiated babies. (Msemo et al., 2013)

These three main causes of neonatal mortality account for 90 percent of all newborn deaths. The relative proportions of these causes have not changed significantly over the past decade although preterm births are on the rise and infections appear to be decreasing (Liu et al., 2012).

Information about the causes of newborn deaths is limited in Nepal. Verbal autopsy of newborn deaths in the NDHS 2006 showed that major causes of newborn deaths in Nepal are infections (39%); birth asphyxia/birth injury (33%), congenital anomalies (8%), and pre-maturity or low birth weight (6%). A study conducted in Morang district (Khanal et al., 2011) reported that direct causes of deaths were infections (41%), birth asphyxia (37.2%), prematurity (11.5%), and low birth weight-related causes (6.9%); and a study in Dhanusa district (Manandhar et al., 2010) reported that the three leading causes of neonatal death were birth asphyxia (37%), severe infection (30%) and prematurity or low birth weight (15%). **Figure 2.2** shows the contribution of neonatal mortality to under-five mortality globally and in Nepal, as well as causes of neonatal mortality globally and in Nepal. Based on these figures, the relative importance of neonatal mortality is greater in Nepal than in other parts of the

world, and infection- and intrapartum-related causes are more pronounced causes of neonatal deaths in Nepal.

Figure 2.2: Global and national causes of neonatal deaths, and contribution of neonatal mortality to child mortality (MOHP, 2007b, MOHP, 2012, UNICEF et al., 2012)



Socio-demographic and cultural factors: A multivariable analysis of 2011 NDHS data suggests that neonatal mortality is statistically significantly associated with lack of maternal education, short maternal stature, fewer than four antenatal care visits and indoor air pollution from solid fuel use, but not with place of residence, wealth status, caste and ethnicity, maternal age at birth, birth order, and birth spacing. (Paudel et al., 2013) Short birth intervals, lack of proper cord care, lack of institutional delivery and delivery by someone other than a skilled birth attendant was significant in NDHS surveys conducted in 2006 and 2001, although they were not consistently significant in all NDHS surveys.

Generally, in developing countries, social exclusion, caste, maternal literacy, gender bias, ability to pay, and lack of basic prenatal, natal and postnatal services are the main socio-cultural determinants of newborn survival. (Garg and Gogia, 2009) In Nepal, many commonly practiced behaviors during the newborn period are unfavorable to the health and survival of newborns. In a study in rural southern Nepal, only about 57 percent of the babies were breastfed within 24 hours and 80 percent received pre-lacteal feeds within the first 2 weeks of life. Only 13 percent of the caretakers always washed their hands before caring for their infant. Massaging with mustard oil was nearly universal, 82 percent of the babies slept in a warmed room but skin-to-skin contact was rare (4.5%). (Karas et al., 2012)

2.3 Evidence on "what works"

Over two-thirds of annual newborn deaths could be prevented through high coverage with low-cost, low-tech maternal and newborn health interventions. (Lawn et al., 2005) A systematic review was conducted to assess the evidence in support of interventions to reduce neonatal mortality in low- and middle-income countries, and identified 31 community-based randomized controlled trials and 74 community-based non-randomized studies. The review indicates that highly effective and feasible interventions exist and that these could avert up to 72 percent of neonatal deaths if implemented at increased coverage. For example, tetanus toxoid immunization could result in a 33 to 58 percent reduction, clean delivery practices could result in a 58 to 78 percent reduction, breastfeeding could result in a 55 to 87 percent reduction and community-based pneumonia management could result in a 27 percent reduction. Substantial reductions in neonatal mortality can thus be achieved with an integrated, high-coverage program of universal outreach, family and community care. (Darmstadt et al., 2005)

Another systematic review, that covered five trials from South Asia to determine the effectiveness of home visits by community health workers, concluded that antenatal visits, visits during the neonatal period, and home-based treatment for illness and community

mobilization significantly reduced the risk of neonatal deaths (risk ratio 0.62, 95% CI: 0.44 – 0.87) as well as significantly improved immediate neonatal care practices (e.g. clean umbilical cord care, early breastfeeding and delayed bathing). The review also suggested a greater survival benefit when home visit coverage was ≥50 percent and preventive and curative interventions (e.g. injectable antibiotics) were integrated. (Gogia and Sachdev, 2010) **Table 2.1** summarizes recent systematic reviews and selected South Asian intervention studies of important approaches to reducing neonatal mortality and their effectiveness. South Asian studies are considered to offer more relevant evidence for Nepal, given similar geographical and socio-cultural context.

Table 2.1: Selected systematic reviews and South Asian studies of the effectiveness of facility-, community- and home-based interventions to reduce neonatal mortality

SN	Study title, type, location	Effectiveness	Reference
Systematic reviews			
1.	Neonatal resuscitation and immediate newborn assessment and stimulation for the prevention of neonatal deaths: a systematic review, meta-analysis and Delphi estimation of mortality effect	30 percent reduction [95% CI 16 – 41 percent] in intrapartum-related neonatal deaths by facility-based basic neonatal resuscitation	(Lee et al., 2011)
2.	Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review	38 percent reduction [95% CI 13 – 56 percent] in neonatal mortality among those who received home visit by community health workers	(Gogia and Sachdev, 2010)
3.	Community-based intervention packages for reducing maternal and neonatal morbidity and mortality and improving neonatal outcomes	24 percent reduction [95% CI 16 – 32 percent] in neonatal mortality by integrating maternal and newborn care in community settings	(Lassi et al., 2010)
South Asian intervention studies			
4.	Effect of a participatory intervention with women's groups on birth outcomes in Nepal, a cluster randomized controlled trial to measure effect of community-based participatory intervention to reduce neonatal mortality rates, Makawanpur, **Nepal**	30 percent [95% CI 6 – 47percent] reduction in neonatal mortality	(Manandhar et al., 2004)

5.	Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, **Bangladesh**: a cluster-randomised controlled trial	34 percent [95% CI 7 – 53 percent] reduction in home-care arm, no reduction in community-care arm	(Baqui et al., 2008)
6.	Topical applications of chlorhexidine to the umbilical cord for prevention of omphalitis and neonatal mortality in southern **Nepal**: a community-based, cluster-randomised trial	24 percent reduction [95% CI 4- 45 percent] in neonatal mortality in chlorhexidine application group compared to dry cord care group	(Mullany et al., 2006)
7.	Topical application of chlorhexidine to neonatal umbilical cords for prevention of omphalitis and neonatal mortality in a rural district of **Pakistan**: a community-based, cluster-randomised trial	38 percent reduction [95 % CI 15-55 percent] in neonatal mortality in neonates who received chlorhexidine cleansing	(Soofi et al., 2012)
8.	Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural **India**	62% reduction [95% CI not reported] in neonatal mortality in intervention area compared to control area	(Bang et al., 1999)
9.	Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, **India**: a cluster-randomised controlled trial	54 percent reduction [95% CI 40-65 percent] in neonatal mortality for essential newborn-care intervention arm and 52% reduction [95% CI 34-65 percent] for essential newborn care intervention plus ThermoSpot arm	(Kumar et al., 2008)
10.	Effect of implementation of Integrated Management of Neonatal and Childhood Illness (IMNCI) programme on neonatal and infant mortality: cluster randomized controlled trial Haryana, **India**	9 percent reduction [-3 to 20 percent] in neonatal mortality in intervention group compared to control group; significantly lower (14 percent, 95% CI 5 – 21 percent) for after-24 hour neonatal mortality	(Bhandari et al., 2012)
11.	Utilization of postnatal care for newborns and its association with neonatal mortality in **India**: an analytical appraisal	No association between check-up of newborns within 24 hours of birth and neonatal mortality	(Singh et al., 2012)

From **Table 2.1** in can be concluded that home- and community-based interventions can save a substantial number of neonatal deaths in the South-Asian setting. These interventions may include health awareness through communication, early diagnosis of illness, improving access to high-quality care for newborns, improving health systems, and community interactions. In countries like Nepal, where people primarily live in remote rural settings and strong socio-cultural beliefs exist, health services should be extended beyond the formal system to reach out to these newborns and their mothers and families in the home and community setting.

2.4 Approaches to community- and home-based care

Nair and colleagues present a framework to categorize interventions and delivery strategy in a life-cycle approach that displays which intervention is better suited to be delivered in facility-based approach (e.g. institutional delivery, treatment of newborn illness) and which on community-based approach (e.g. partnership with traditional birth attendants, home-based antenatal and postnatal care) to improve newborn health. (Nair et al., 2010) We followed similar approach to define community- and home-based interventions for this study and in the following, two key approaches to community- and home-based care – home visits by community health workers and community mobilization – are described in more detail.

2.4.1 Home visits by community health workers

Studies have shown that home-based newborn care interventions can prevent 30–60% of newborn deaths in high-mortality settings under controlled conditions (**Table 2.1**). A variety of public health programs have established a mechanism for home visits by CHWs: to encourage women to make use of antenatal care; to attend delivery or to refer women in labor to health institutions or a skilled birth attendant; to conduct postnatal visits to identify and manage infants with low birth weight or at risk of birth asphyxia and sepsis; and, where needed, to encourage appropriate referral

for sick neonates or their mothers. A community-based trial in rural India was shown to reduce neonatal mortality by 70 percent. (Bang et al., 1999, Bang et al., 2005). Similarly, studies from other South Asian countries with varied program components and approaches showed improvements in care, in particular increased uptake of antenatal care, increased institutional delivery and better performance of essential newborn care. (Baqui et al., 2008, Bhutta et al., 2008, Kumar et al., 2008) Similar results are also reported from sub-Saharan Africa. (Nair et al., 2010)

Based on all this evidence and experience, WHO and UNICEF now recommend home visits during the first week of life by appropriately trained and supervised CHWs. (WHO/UNICEF, 2009) These home visits are targeted to promote and support early (within the first hour after birth) and exclusive breastfeeding; help to keep the newborn warm, in particular through skin-to-skin care; promote hygienic umbilical cord and skin care; assess danger signs and counsel on their prompt recognition by the family (i.e. not feeding well, reduced activity, difficult breathing, fever or feels cold, fits or convulsions) and immediate care seeking; promote birth registration and timely vaccination according to the national schedule; identify and support newborns who need additional care (e.g. low birth weight, sick, mother HIV infected), and, if feasible, provide home treatment for local infections and feeding problems. (WHO/UNICEF, 2009) Additional care for low birth weight (LBW) babies, particularly those who are born pre-term, is needed for keeping them warm, initiating early and exclusive breastfeeding, and preventing infections. The families of newborns identified as having severe illness during home visits should be assisted to seek hospital- or facility-based care.

2.4.2 Community mobilization

A cluster-randomized trial from rural Nepal suggested that regular meetings of women's groups to discuss a variety of perinatal health topics facilitated by a local

female community worker—trained in facilitation techniques but without a health care background—could reduce neonatal mortality rates by about 30 percent. (Manandhar et al., 2004) There were behavior changes in, for example, hygienic practices and care-seeking for problems, and also strategic initiatives such as maternal and child health funds and transport schemes. While similar approaches led to even greater reductions in neonatal mortality in India (Houweling et al., 2013), they were ineffective in Bangladesh (Azad et al., 2010). While the evidence for the effectiveness of such participatory approaches is considered very reliable, little is known about the mechanism of how they lead to reduced neonatal mortality. (Victora, 2013) Improvements in a range of maternal and child health outcomes as a result of community mobilization efforts are also reported in studies carried out in Bangladesh (Barnett et al., 2006), India (Barnett et al., 2008), and Malawi (Rosato et al., 2009, Rosato et al., 2006)

2.5 A socio-cultural perspectives

Neonatal mortality is known to be affected by various socio-cultural factors such as maternal characteristics, child and birth characteristics, socio-demographic characteristics of the household, and mothers' and other caregivers' health care seeking behaviors. (Fort et al., 2008) Childbirth and the neonatal period are culturally important times in the South Asian culture, and there is strong adherence to traditional practices affecting cleanliness in delivery, use of equipment to cut and tie the cord, and to the practices of immediate wiping, wrapping, breastfeeding and bathing. These practices are directly related to newborn health, illness and mortality. Additionally, cultural food taboos, restrictions in mobility, the concept of purity and pollution during the postnatal period, and limited decision-making power of young women affect women's nutritional status, care-seeking opportunities and the ability to practice healthy behaviors. (Kesterton and Cleland, 2009) The application of traditionally used, often unhygienic and ineffective substances on the freshly cut umbilical cord, such as mustard-

seed oil, cow dung, vermillion and ash, increases newborn susceptibility to infections, (Khanal et al., 2012) and these practices are common in some geographic areas and ethnic groups in Nepal. (Beun and Wood, 2003) In Nepal, massaging the newborn with mustard oil is nearly universal, and washing hands before caring for the newborn is uncommon (13.3%). (Gurung, 2008, Karas et al., 2012) A study in southern Nepal showed that nearly 6 percent of newborns were suffering from umbilical cord infection and the risk of infection was 29% and 62% higher in infants receiving topical cord applications of mustard oil and other unclean substances, respectively. Skin-to-skin contact between mother and child and hand washing by birth attendants and caretakers were associated with fewer infections. In the community, unhygienic newborn care practices lead to continued high risk for infections such as omphalitis. (Mullany et al., 2007)

The cultural nuances associated with pregnancy, child birth and neonatal care portray the period as a normal event rather than a medical condition requiring professional monitoring and support. As a result, families and communities believe that there is little reason to visit health professionals without a perceived threat to their wellbeing. Mothers-in-law play a central role in the decision to seek care or not to seek care. (Simkhada et al., 2010) The problem of limited care-seeking behavior may be further aggravated by the cursory nature of consultations in health facilities. (Finlayson and Downe, 2013) A mixed-method study in central Nepal documented that pregnancy is perceived as a normal event, and women work until the onset of labor. They are shy about birth and fear that wider knowledge of their state would bring shame. (Bennett, 1978) As a result, sick women and their babies face barriers to the recognition of illness and seeking care outside the household. Senior family members often decide to seek treatment once the problem is recognized.

Few qualitative studies (Beun and Wood, 2003, Manandhar, 2000, Mesko et al., 2003, Simkhada et al., 2010) exist that describe socio-cultural norms, behaviors and practices of

direct relevance to birth and newborn health in Nepal. Recent studies are lacking, however, many of the cultural practices described in the literature are deeply rooted in the society and still reflect the reality of rural Nepal. In the following, these are described in relation to specific practices to promote newborn care.

Birth preparedness: In Nepal, few preparations for childbirth are made for a number of reasons: As pregnancy is seen as a normal event, preparation for birth is considered unnecessary. Some taboos (e.g. preparations may cause bad luck) or an underestimation of the time and effort actually needed to manage preparations may result lack of preparedness. The expected mothers might be shy which may prevent them to make appropriate preparations . (Beun and Wood, 2003, Manandhar, 2000, Mesko et al., 2003) However, some food preparation e.g. rice, ghee, oil, and *jwano* (spice) are put aside during the last weeks of pregnancy for use just after birth, and chickens and goats are reared or raised for slaughter after delivery. (Beun and Wood, 2003)

Place of birth: Generally, when a woman delivers at home, she usually delivers in a heated, unventilated room, as delivery is believed to happen more easily and quickly if the mother is kept warm. (Beun and Wood, 2003) Family members are favored attendants, particularly mothers-in-law. (Mesko et al., 2003) With the recent rise in the rate of institutional delivery rates, these practices are expected to be changing.

Hand washing: Some of the recommended practices to prevent newborn infections such as hand-washing during and after delivery, is done more for ritual cleansing as delivery is considered a polluting process rather than to prevent infection. (Beun and Wood, 2003)

Immediate newborn care: After birth, attention is focused on the mother, and the newborn baby is left unattended until the mother has delivered the placenta. The umbilical cord is not

cut before the placenta has been delivered because it is popularly believed that it will otherwise be retained and move into the heart of the mother, causing her death. (Beun and Wood, 2003) After the placenta has been delivered, the cord is cut and the baby is either wiped with a cloth and bathed with warm water and soap or only wiped with a clean cloth. Massaging the newborn with oil to keep him or her warm is common. (Beun and Wood, 2003) The newborn baby is only breastfed after cutting the cord, cleaning and wrapping the baby, and cleaning and changing the mother's clothes, (Beun and Wood, 2003) which might delay the timely initiation of breastfeeding.

Food and care for postnatal mothers: Generally, the new mother is fed three or four times a day to restore her strength. Soup of *jwano* (spice) and other spices, such as pepper, ginger and *garam masala* (warm spices), are commonly prepared to stimulate breast milk production. (Beun and Wood, 2003) Women are sent to their maternal house as it is considered that they are looked after and treated better in their maternal home compared to the care and food provided in their in-laws' home. (Simkhada et al., 2010)

Care seeking: During the *sutkeri* (postnatal) period, mother and baby remain secluded for three to eleven days, and the mother-in-law is the key decision maker with respect to recognizing illness and deciding when and where to seek care. (Mesko et al., 2003, Simkhada et al., 2010) Postnatal seclusion, decision making authority, a tendency to wait-and-watch and the perceived expense of care are some of the barriers to seeking timely care. Local medicine shops are preferred to government health facilities as they offer more convenient opening hours, a location closer to home and reduced waiting time, and as they levy no consultation fees and provide better interactions with the provider. (Mesko et al., 2003) Illness during pregnancy and postnatal period is considered to be due to a wide range of factors such as witchcraft, sprits and supernatural events for which modern medicine is regarded as largely ineffective; as a result care seeking from a traditional healer to perform

spells or undertake animal sacrifice is common, (Manandhar, 2000) although the concept is changing with modernization, access to mass media and behavior change communication programs.

2.6 Summary

Globally, over two-thirds of newborn deaths could be prevented annually through high coverage with low-cost, low-tech maternal and newborn health interventions delivered through community mobilization, home visits by community health workers and education to promote essential newborn care. Their implementation in Nepal is challenged by the persistence of strong socio-cultural beliefs about care of newborns, taboos for birth preparedness and the restricted mobility of postnatal mothers.

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3. Study design, data sources and methods

3.1 Overview

3.1.1 Study design

As described in section 1.3, this study is concerned with two major research questions:

1) Has progress in neonatal health over time been equitable for different geographical, socio-economic and ethnic groups in Nepal?
2) What impact does the community-based newborn care package have on essential practices to improve neonatal health, taking into account the socio-economic, cultural, geographic and health system context of Nepal?

Research question 1 is addressed through trend and equity analyses of neonatal mortality. Research question 2 is addressed through a mixed-method quasi-experimental approach, which comprises two distinct components. **Table 3.1.1** provides an overview of analytical approaches, data sources, and level of analysis for each of the three major components of the study. Data sources and analytical approaches are described in detail in sections 3.2 and 3.3.

Table 3.1.1: Study components, data sources, level of analysis, and analytical approach

Study components	Data source	Level of analysis	Analytical approach
Trend and equity analysis	Demographic and Health Survey 1996-2011	National, 75 districts	Annual rate of reduction Relative difference (rate ratio) Absolute difference (rate difference)
Analysis of impact of community- and home-based interventions	Human Development Report 2004, NGO database 2011, District Profile 2007/08, Ministry of Health's Performance Ranking 2009	National, 75 districts	Propensity score matching
	Demographic and Health Survey 2011	20 districts (10 intervention, 10 comparison)	Difference-in-differences analysis Logistic regression analysis
	Management Information System 2011	Health Management Information System: 20 districts (10 intervention, 10 comparison)	Difference-in-differences analysis
		Newborn Health Information System: 10 intervention districts only	Descriptive analysis on training coverage Knowledge, skills of service providers, Availability of medicines and supplies
Analysis of enabling and restraining factors	Focus group discussions (10)	2 districts (1 intervention site, 1 comparison site, purposively selected)	Thematic analysis
	Key informant interviews (6)	2 districts (1 intervention site, 1 comparison site, purposively selected)	

As shown in **Table 3.1.1** different study components were undertaken at different levels of analysis. The trend and equity analysis used nationally representative DHS data for all 75 districts. The analysis of impact of community- and home-based interventions was conducted at the level of ten intervention districts and ten propensity score-matched comparison

districts, filtering DHS, Ministry of Health and Population's routine Health Management Information System (HMIS) and special Newborn Health Information System (NHIS) data for this purpose. The analysis of enabling and restraining factors purposively selected one intervention and one comparison district, located in close proximity and showing similar socio-economic and healthcare indicators; within each of these districts, one Village Development Committee (VDC) with low coverage of maternal and newborn care was purposively selected for in-depth qualitative investigation based on inputs in consultation with the District Public Health Office team and district HMIS data.

3.1.2. Study setting

Nepal is a South Asian land-locked country with an area of 147,181 square km and a population of 26.6 million. (Central Bureau of Statistics, 2012a) Nepal is largely mountainous with remote communities and diverse castes and ethnic groups with different cultures and languages. Difficult geographic conditions resulting in poor transportation facilities, an unstable political situation and limited opportunities for income generation resulting in high migration and displacement of youths have put tremendous strain on access to and utilization of basic services including health and education.

Nepal has three ecological zones – lowland Terai (Gangetic plain), mid-hills (610 to 4800 meters) and mountains (above 4800 meters). Of its total population, nearly 50% live in the Terai flat-land bordering India in the South; 43% in the mid-hills; and 7% in the mountains in the North. Almost 83% of the population is rural and many communities remain remote. The country is administratively divided into three ecological zones, five development regions, 14 administrative zones, 75 districts, 3,914 Village Development Committees (VDC) and 58 municipalities. (Central Bureau of Statistics, 2012b) District Development Committees (DDCs) and VDCs/Municipalities are the focal points of local government.

Table 3.1.2: Key geographic, socio-economic and health indicators of Nepal

Area	147,181 sq km
Total Population[1] Men Women	26.6 million 12,927,431 13,639,378
Population density[1]	181 (person per sq km)
Population growth rate[1]	1.40 (percent annual)
Total fertility rate[2]	2.6 per woman
Median age at first marriage[2] Men Women	 21.6 yrs 17.5 yrs
Neonatal mortality rate[2]	33 / 1000 live births
Infant mortality rate[2]	46 / 1000 live births
Under five mortality rate[2]	54 / 1000 live births
Contraceptive prevalence rate [2]	48% (any modern methods)
Maternal mortality ratio[3]	281 /100,000 live births
Underweight children[2]	28.8%
Life expectancy at birth[1]	63 yrs
Literacy rate[1] Men Women	65% 70 % 45 %
Population using an improved drinking water source[2]	88.6%
Population with access to improved sanitation[2]	39.5%
Population living below the national poverty line[4]	25%

Source: [1](Central Bureau of Statistics, 2012a),
[2](MOHP, 2012),
[3](MOHP, 2007b)
[4](Central Bureau of Statistics, 2011)

Nepali culture is predominantly patriarchal, men are the primary decision makers, and women lag far behind in education, economic resources, opportunities, and involvement in non-agricultural activities. (Baral et al., 2010) In Nepal, the population growth rate and fertility rate are declining, which is partly due to the high migration rate among youths seeking employment outside the country. Health indicators still lag behind with disparities by sex, wealth status, and caste and ethnicity. (Pandey et al., 2013) More than 25% of the Nepalese population lives below the national poverty line; (Central Bureau of Statistics, 2011) adult literacy rate is 65% with a female literacy of 45%. Women have a lower status than men and gender inequalities are deeply rooted. Key indicators of Nepal are provided in **Table 3.1.2**.

Public sector health care delivery system is managed by the Ministry of Health and Population. The ministry has three departments (Health Services, Drug Administration and Ayurveda), five centers (HIV AIDS and Sexual Transmitted Diseases control; Health education, information and communication; Tuberculosis; Health Training; Public Health Laboratory), and professional councils (Medical, Nursing, Health Professional, Health Research). The Department of Health Services (DoHS) delivers preventive and curative health services, especially in the allopathic medical system, through a network of Central Hospital, Regional Health Service Directorate (5), District Health Offices/District Public Health Offices (75), Primary Health Care Centers (209), Health Posts (676), and Sub-Health Posts (3,129). (DOHS, 2011) In addition, Nepal has a strong cadre of more than 48,000 community-based health volunteers, known as Female Community Health Volunteers (FCHVs). These volunteers are un-paid, mostly illiterate (38%) local women selected by their communities and spend about 5 hours a week on average on their voluntary work (MOHP, 2007a). They receive 18 days of initial training as well as refresher training plus topic-specific refresher trainings on various health topics. Since the inception of the program in 1988, they have been mobilized in various programs to deliver home-based maternal and child care such as providing support for immunization, vitamin A distribution and recognition and management of diarrhea and pneumonia. (Glenton et al., 2010)

3.1.3 Community- and home-based interventions to improve newborn health

The intervention assessed in this study, the community-based newborn care package (CB NCP), aims to raise awareness and advocate for institutional delivery, clean delivery in case of home births, use of skilled birth attendants, and quality of antenatal, postnatal and essential newborn care services.

The Nepal Ministry of Health and Population (MOHP) working jointly with health sector donor and technical assistance partners developed the Community-based Newborn Care Package

(CB NCP) in 2007 to be delivered through FCHVs, CHWs and first level health facilities. Utilizing the decision making framework (Johnson-Masotti and Eva, 2005), the interventions were selected based on the amount of evidence for the impact of the intervention/strategy, feasibility of implementation at scale in Nepali context, and cost of implementation. Although these interventions were proven independently in different contexts, they were never tested as a "package" in the national health system setting of Nepal, nor was an assessment done on the effect of the package on the overall health system. (Pradhan et al., 2011)

The CB NCP comprises seven community- and home-based interventions: i) promote behavior change, ii) institutional delivery or clean home delivery, iii) postnatal care, iv) care of low birth weight newborns, v) management of newborn infections, vi) prevention of hypothermia, and vii) recognition of asphyxia, initial stimulation and resuscitation. These are promoted through training, mobilization and supervision of facility- and community-based health workers and FCHVs. Additionally, health messages are transmitted through mass media, such as local radio, and through social mobilization campaigns, such as street drama, in program districts. **Table 3.1.3** summarizes training duration and training approach for the three main categories of healthcare providers – facility-based health workers, community health workers and FCHVs – and describes the technical components covered in training. (Pradhan et al., 2011)

Table 3.1.3: Training components, duration and approach of community- and home-based interventions by category of service providers

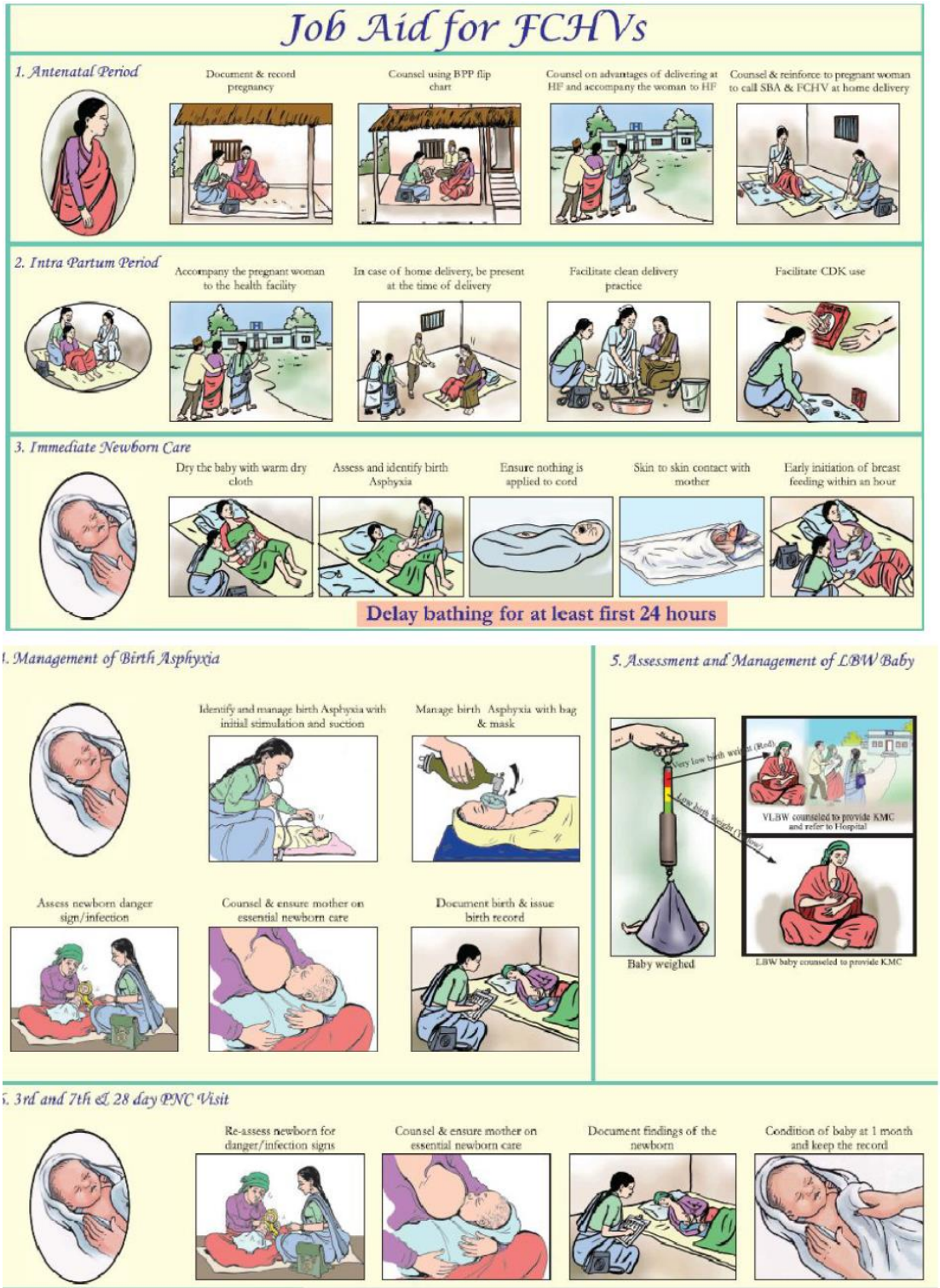
Category	Training days	Components	Training facility and trainer
Facility-based Health Workers (Medical Officer, Staff Nurse, Health Assistant, Auxillary Health Workers, Auxillary Nurse Midwives)	7	Essential newborn care, assessment and management of infected newborn, low birth weight babies, referral management of sick newborn and information management, program management, supervision and community mobilization	Usually trained at district or higher level hospital for clinical exposure, At least three with one master trainer, one skilled-birth-attendant trainer and the third trainer

Category	Training days	Components	Training facility and trainer
Community-based Health Workers (Village Health Workers, Maternal and Child Health Workers)	5	Essential newborn care, assessment and management of infected newborn, low birth weight babies, referral management of sick newborn and information, logistics management and supervision	Usually trained at district level hospital with clinical exposure One district level trainer, one health facility trainer and the third trainer
Female Community Health Volunteers	7	Birth preparedness, hand washing, clean delivery practices, essential newborn care, postnatal care, assessment and management of infection, low birth weight, hypothermia and birth asphyxia and information management, conducting mothers group meeting	Usually at the local health facility One district level trainer, one local health facility staff and one Village Health Worker/Maternal Child Health Worker from their area

Source: (Pradhan et al., 2011)

As shown in **Figure 3.1.2,** FCHVs are responsible for delivering most of these services at the community and/or home of the pregnant or recently delivered woman, and family members are expected to adopt behaviors as promoted by these volunteers (e.g. delayed bathing). (Pradhan et al., 2011) In this program, FCHVs are trained to provide community- and home-based antenatal care visits to promote birth preparedness, to encourage institutional delivery, to visit during or immediately after the delivery and during postnatal period, and to recognize newborn infection using a simple algorithm and to initiate antibiotic therapy. They are also equipped to identify and manage low birth weight in newborns using color-coded weighing scales, and to promote home-based essential newborn care practices, such as exclusive breastfeeding and skin-to-skin contact (commonly known as kangaroo mother care) to care for hypothermic babies and to refer them to higher levels of care where necessary. As a majority of births are happening at home, it was deemed necessary to train these volunteers to recognize asphyxia, and to perform the step-by-step approach of initial stimulation and support resuscitation using a self-inflating bag and mask. (Poudel et al., 2012)

Figure 3.1.2: Interventions in community-based newborn care package delivered through female community health volunteers Source: (Ministry of Health and Population)



3.1.4 Ethical consideration

The protocol for the study was reviewed and approved by the national Ethical Review Board of the Nepal Health Research Council (**Annex 1**). In addition, the Nepal DHS, which is a main source of data for this study, was reviewed and approved by the Ethical Review Board of the Nepal Health Research Council and the Institutional Review Board of ICF International in the United States. The protocol, together with the ethical clearance from the Nepal Health Research Council, was reviewed and cleared/granted waiver by the LMU Ethical Commission. Confidentiality of personal information was maintained throughout the research. All respondents were ensured of the anonymity and confidentiality of any information provided during interviews. Verbal consent was obtained from respondents using the informed consent form (**Annex 2**), after briefing them about the purpose of the study.

3.2 Data sources

This study draws on multiple data sources to analyze trends in neonatal mortality, to assess the impact of community- and home-based interventions on newborn care practices, and to examine how different factors enable or restrain improvements in neonatal health (see **Table 3.1.1)**.

3.2.1 Nepal Demographic and Health Survey

The Demographic and Health Survey (DHS) provides nationally representative data on health and demographic indicators on fertility, health care behavior and practices, childhood mortality, nutrition, and knowledge of HIV/AIDS that is comparable across different countries and over time. It uses a multi-stage cluster random survey to ensure national representativeness. (Corsi et al., 2012, MEASURE DHS, 2013) The Nepal DHS samples were stratified by urban and rural areas. Within each stratum, the primary sampling unit (PSU) was defined as the enumeration block of the latest Population Census (stage 1). PSUs were selected from the Population Census sample frame, using probability

proportionate to size. Subsequently, a complete household listing was done to provide the sampling frame for stage 2. Systematic sampling of households (e.g. 35 in urban areas and 40 in rural areas per PSU in DHS 2011) was done. All women aged 14-49 years in selected households were interviewed (except in the 1996 NFHS where only married women of reproductive age were interviewed). Since the 2011 NDHS sample is a two-stage stratified cluster sample, sampling weights were calculated based on sampling probabilities separately for each sampling stage, taking into account non-proportionality in the allocation process for domains and urban-rural strata. Weights were calculated for each stage of the selection probability and the final weight is the product of each of the compound weights. (MOHP, 2012) Trained enumerators collect information from households and respondents after obtaining verbal informed consent. More details on the sampling methodology and overall strengths and limitations of DHS data are available separately. (Corsi et al., 2012, MOH, 2002, MOHP, 2007b, MOHP, 2012, Pradhan et al., 1997) For this PhD project, Nepal DHS datasets were downloaded from the MEASURE DHS website (www.measuredhs.com).

Table 3.2.1 shows the sample size and response rate for each survey.

Table 3.2.1: Number of households, women of reproductive age and births by survey year

Parameters	NFHS 1996	NDHS 2001	NDHS 2006	NDHS 2011
Total households	8,082	8,602	8,707	10,826
Response rate (%)	*99.6*	*99.6*	*99.6*	*99.4*
Total women aged 15-49 years	8,429	8,726	10,793	12,674
Response rate (%)	*98.2*	*98.2*	*98.4*	*98.1*
Total births in last ten years	14,259	14,044	11,531	11,225
Approximate timeframe covered	1986-1995	1991-2000	1996-2005	2001-2010

3.2.2 Management Information System

The Management Information System (MIS), owned by the Ministry of Health and Population, is a system or process that provides information about service utilization, morbidity and mortality, treatment outcomes, stock situation of essential medicines and commodities; it is primarily based on health facility records. For the purposes of this PhD project, relevant MIS

data sources include data on regular service delivery statistics throughout the country (health management information system or HMIS) (DOHS, 2011) as well as the newborn care package-specific reporting system that exists only in pilot districts (known as newborn health information system or NHIS). During the process of this study, the Ministry of Health and Population and key development partners working in this program carried out an assessment of the community-based newborn care package. (CHD/MOHP, 2012) This assessment drew on some of the analysis from this study (difference-in-differences analysis using DHS data) and this study utilized the MIS data used in that assessment.

3.2.3 Focus group discussions and key informant interviews

A focus group discussion (FGD) is a qualitative method to obtain in-depth information on concepts, perceptions and ideas of a relatively homogenous group of 6 - 12 persons. (Bender and Ewbank, 1994, Dawson et al., 1993, Mack, 2005, Winch et al., 2000) A key informant interview (KII) is a semi-structured interview with people who have specialized knowledge about the topic that one wishes to understand or explore. (Mack, 2005) These methods were used in this PhD project to understand socio-cultural practices, including decision making and health care seeking for newborns, to assess perceptions about the health care system in the area of newborn care, and to provide more in-depth insights to help with the interpretation of quantitative findings. As shown in **Table 3.1.1** and described in section 3.1, FGDs and KIIs were conducted within two purposively selected VDCs, one in each of the purposively selected intervention and comparison districts. In each VDC, FGDs were conducted with one FCHV group, two recently delivered women (RDW) groups (one from a community located close to the health facility and another from a community located relatively far from the health facility), one mothers-in-law group and one fathers-in-law group. All CHWs and a school teacher (preferably a female teacher at a secondary school with a young child) from the selected village were interviewed as key informants.

Table 3.2.3: Description of two villages selected for qualitative study

Korak VDC, Chitwan district **[Intervention area]**	Sarikhet Palase VDC, Makawanpur district **[Comparison area]**
• Remote hilly village • 1,600 households, 7,603 population • Majority of disadvantaged population (Chepang 40%, Tamang 50%, Dalits 5%) • Birthing center is 4-5 hours walking distance away, <10% births at health facility • 1 Sub Health Post, 4 Community Health Workers and 10 FCHVs • Few international organizations/NGOs (UNICEF)	• Relatively remote, hilly village • 1,650 households, 10,497 population • Majority of disadvantaged population (Tamang 65%, Chepang 14%, Dalits 8%) • Birthing center has been running for two years, ~ 20% births at health facility • 1 Sub Health Post, 3 Community Health Workers and 9 FCHVs • Few international organizations/NGOs (MIRA/ICH)

Source: HMIS, VDC profile

Separate FGD and KII guidelines were developed for each group of respondents (**Annex 3**) and translated into Nepali language. The FGDs and KIIs were facilitated by the investigator or trained persons, respecting gender and cultural sensitivities, and were audio-taped after obtaining verbal consent.

3.2.4 District-level information from multiple sources

Primarily for propensity score analysis, information was gathered from various published reports or profiles as well as internal databases of the Ministry of Health and Population. This information served to populate the following variables at the level of the 75 districts of Nepal. i) Human Development Index (HDI) value (with 4 components) represents a district's development need, ii) donor presence is focused only on the donors involved in the CB NCP at this moment (United States Agency for International Development, United Nations Children Fund and Save the Children) and directly measures the donors' district preference, iii) percentage of rural population (as of 2001 census, as 2011 census data was not available at the time of analysis), iv) Ministry of Health and Population's district performance rank (based on selected process (e.g. fund expenditure rate) and outcome indicators (e.g. immunization rate) as a proxy for a district's leadership abilities and a district's interest in implementing new initiatives, and v) road density as a measure of access and ability to monitor the program. **Table 3.2.4** shows key parameters used in propensity score analysis and their respective data source:

Table 3.2.4: District-level secondary data by source

Parameter	Source
Geography – *terai*, hill, mountain	District Profile of Nepal 2007/08 (Intensive Study and Research Centre of Nepal, 2009)
HDI component – life expectancy at birth (absolute value) HDI component – adult literacy (absolute value) HDI component – mean years of schooling (absolute value) HDI component – gross domestic product (GDP) per capita (absolute value)	Nepal Human Development Report 2004 (United Nations Development Program, 2004)
Donor presence – USAID, UNICEF, Save the Children (0= none, 3=all)	Reports from the organizations, NGO database 2011 (obtained through personal communication)
Percentage of rural population – percentage of rural population relative to total population	Census 2001(Central Bureau of Statistics, 2012a)
Ministry of Health and Population's district performance rank score	MoHP database 2009 (obtained through personal communication)
Road density – road in k.m. per square k.m. area	District Profile of Nepal 2007/08 (Intensive Study and Research Centre of Nepal, 2009)

3.3 Data analysis

3.3.1 Analysis of time trends and inequalities

Time trends in neonatal mortality, which is defined as the number of deaths per 1,000 live births occurring during the first month of life, were assessed using data for the NFHS 1996 and the NDHS 2001, 2006 and 2011. The neonatal mortality rate was calculated based on a true cohort log probability approach (Paudel et al., 2013) for babies born during the 10 years preceding the survey. In addition to calculating national averages, neonatal mortality was disaggregated by various socio-demographic parameters: child sex, place of residence (i.e. urban, rural), ecological zone (i.e. mountain, hill, terai or flatland), development region (i.e. Eastern, Central, Western, Mid-Western, Far-Western), maternal education (i.e. no education, primary education, secondary or higher education), wealth quintile, and caste and ethnicity.

To assess magnitude and trends in inequalities, rate differences (highest – lowest) as absolute measures of inequality and rate ratios (highest / lowest) as relative measures of inequality were calculated for each of the four survey periods. The rate ratio is unit-less and independent of average levels and scale, whereas the rate difference depends on both average levels and scale. (Evans et al., 2001, Houweling et al., 2007, Moser et al., 2007) These two commonly used measures of inequality are easy to understand, but comparisons are limited to two extreme groups rather than covering the full population spectrum. (Mackenbach and Kunst, 1997) Reporting both absolute and relative measures of inequality is recommended to increase transparency, reduce systematic reporting biases, and improve the evidence base for policies aimed at reducing health inequalities. (King et al., 2012)

The annual rate of change is commonly used to describe trends in increment (e.g. improved coverage) or reduction (e.g. reduced mortality rate), and to make projections of rates into the future. The annual rate of reduction (ARR) (Liu et al., 2012) in neonatal mortality was calculated as

$$ARR = \frac{LN(NMR_{t1} / NMR_{t0})}{(t1 - t0)} \times 100$$

where LN is the natural logarithm, NMR_{t1} is the neonatal mortality rate in 2011 (t1), and NMR_{t0} is the neonatal mortality rate in 1996 (t0). All analyses were conducted in Stata Special Edition version 12. (Stata Corporation, 2011)

3.3.2 Propensity score calculation

The propensity score, defined as the conditional probability of being treated given the covariates, can be used to balance the covariates in the two groups, and therefore reduce this potential source of bias (Austin, 2011, D'Agostino, 1998, Rosenbaum and Rubin, 1983). Propensity score matching simplifies the problem of matching on a large numbers of covariates by collapsing the covariates into a single scalar—the propensity score—and then matching treatment and control communities using a one-dimensional match on the

propensity score. (Arnold et al., 2010) In order to estimate the propensity score, one must model the distribution of the treatment indicator variable given the observed covariates. Once estimated the propensity score can be used to reduce bias through matching, stratification (sub-classification), regression adjustment, or some combination of all three. Propensity score matching essentially uses statistical techniques to construct a comparison group by identifying for every possible observation under intervention a non-intervention observation that has the most similar characteristics possible; this technique has been widely used to estimate the effects of health interventions, where randomized controlled trials are not feasible. (Mueller et al., 2011)

Propensity score matching was used to identify 10 comparison districts that would have been as likely to be selected for the CB NCP pilot, as those 10 intervention districts where the CB NCP was actually piloted. Based on insights into the processes leading to the CB NCP pilot, the factors listed in **Table 3.2.4** were selected as those of greatest relevance to the selection of intervention districts. As the CB NCP pilot was limited to hill and *terai* districts, mountain districts were excluded from the propensity score calculation, limiting the propensity score analysis to the remaining 47 districts.

Three different propensity score commands available in Stata Special Edition version 12 (Stata Corporation, 2011) were explored (nnmatch, psmatch2, and pscore). Finally, *psmatch2* was used as it (a) keeps effect size estimation and propensity score estimation separate (unlike *nnmatch*), (b) does one-on-one matching without replacement (i.e. every comparison district is only used once), (c) produces the same propensity score as *pscore* but identifies a control district for each intervention district based on the nearest-neighbor method, and (d) provides more detailed output and options than *pscore.*

After the set of comparison districts were selected, we checked for balance in the distribution of matching variables between the intervention area (10 districts pooled) and comparison area (10 districts pooled); we also examined balance in the distribution of selected general health indicators. Statistical tests for the difference between intervention and comparison

areas were not possible for matching variables as they came from multiple secondary sources. For the general health indicators derived from the DHS, differences between the intervention and comparison areas were assessed for statistical significance using Chi-square tests.

3.3.3 Difference-in-differences analysis

Difference-in-differences analysis estimates the counterfactual for the change in outcome for the intervention group over a given time period by calculating the change in outcome for the comparison group over the same time period. (Gertler and World Bank., 2011) This method allows us to take into account any differences between the intervention and comparison groups as a result of changes over time rather than as a consequence of the intervention itself. Difference-in-differences has been frequently used in quasi-experimental impact evaluation of large-scale health and development programs. (Baird et al., 2011, Bryce et al., 2010, Kamiya et al., 2013, Lim et al., 2010)

Here, difference-in-differences were calculated for outcome variables related to births occurring pre-intervention and for births happening post-intervention, using DHS 2011 data. Individual and aggregate outcome variables and their definition are shown in **Table 3.3.3**. As the intervention took place at different points in time in different intervention districts, birth filters for DHS and HMIS data analysis were customized by district by taking the end date of the FCHVs' CB NCP training as a cutoff date; births taking place during the CB NCP training period were excluded from analysis in both intervention districts and their matched comparison districts. A detailed description of the timeframe of implementation and cut-off dates for analysis is provided in **Table 4.4.2**. Key outcome variables were measured for pre-intervention [T_0] and post-intervention period [T_1] based on DHS 2011 and difference-in-differences analysis was conducted using Ordinary Least Square (OLS) regression. (Gertler and World Bank., 2011)

Table 3.3.3: Definition and categorization of outcome variables

SN	Aggregate outcome	Individual outcome	Codes
1)	**Quality of antenatal care**		
	Better (any four individual outcomes) Poorer (less than four or none)	a) Blood pressure measured at least once during last pregnancy	Yes = 1, No = 0
		b) Urine sample take at least once during last pregnancy	Yes = 1, No = 0
		c) Blood sample taken at least once during last pregnancy	Yes = 1, No = 0
		d) Told about things to look out for that might suggest problems with the pregnancy	Yes = 1, No = 0
		e) Told where to go in case of problems with the pregnancy	Yes = 1, No = 0
2)	**Care seeking during antenatal period**		
	Better (all individual outcomes) Poorer (either one not fulfilled)	a) ANC visit: at least four antenatal visits during last pregnancy	Yes = 1, No = 0
		b) Tetanus toxoid: at least two in last pregnancy	Yes = 1, No = 0
		c) Iron tablets: At least 90 tablets in last pregnancy	Yes = 1, No = 0
3)	**Birth preparedness**		
	Better (any two individual outcomes) Poorer (less than two or none)	a) Saved money beforehand for last delivery	Yes = 1, No = 0
		b) Arranged for transport beforehand for delivery	Yes = 1, No = 0
		c) Found blood donor beforehand for delivery	Yes = 1, No = 0
		d) Contacted health workers beforehand to help for last delivery	Yes = 1, No = 0
		e) Bought safe delivery kit beforehand for last delivery	Yes = 1, No = 0
		f) Arranged food beforehand for last delivery	Yes = 1, No = 0
		g) Arranged cloths beforehand for last delivery	Yes = 1, No = 0
4)	**Skilled attendant at birth** Yes No	Yes = delivery by a doctor, nurse, or midwife No = delivery by others	Yes = 1, No = 0
5)	**Immediate newborn care**		
	Better (any three individual outcomes) Poorer (less than three or none)	a) bathing the newborn only after 24 hours post-birth	Yes = 1, No = 0
		b) wiping the newborn with a soft, dry cloth immediately after birth	Yes = 1, No = 0
		c) initiation of breastfeeding within one hour of birth	Yes = 1, No = 0
		d) not applying anything on the cord stump or only chlorhexidine	Yes = 1, No = 0
6)	**Postnatal visit** Yes No	Yes = at least one visit/checkup within 48 hours of birth No = no visit within 48 hours of birth	Yes = 1, No = 0

For difference-in-differences analysis of DHS data for intervention versus comparison areas, both individual and aggregate outcome variables (i.e. birth preparedness, antenatal care

seeking and quality, delivery care, immediate newborn care, and postnatal care) were selected.

3.3.4 Descriptive analysis of MIS data

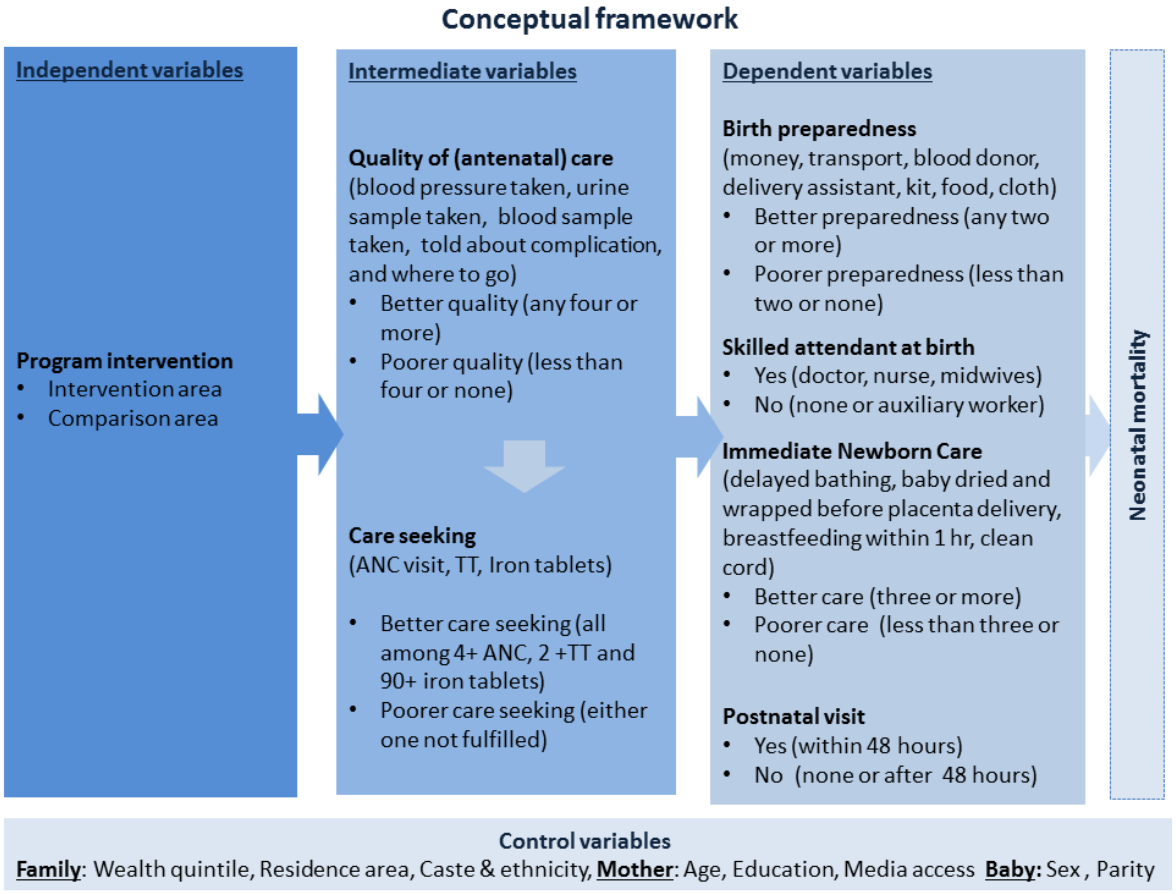
A similar approach to assess the difference between intervention and comparison areas before and after intervention was undertaken for filtered data from national HMIS for 10 intervention and 10 propensity score matched comparison districts. NHIS data from 10 intervention districts were analyzed in Microsoft Excel to assess newborn service coverage and quality indicators before and after the intervention, primarily focusing on indicators not available from the DHS data (e.g. newborns treated for infections or managed for birth asphyxia).

3.3.5 Logistic regression analysis

The conceptual framework underlying the selection of outcome variables for logistic regression analysis, using DHS data, is depicted in **Figure 3.3.5.** Logically, implementation of the program is expected to impact different intermediate variables, primarily quality of care (i.e. quality of antenatal care, as measured in the DHS) and care seeking practices (i.e. antenatal checks, tetanus toxoid vaccination and consumption of iron, as measured in the DHS). In turn, these are expected to result in changes in dependent variables, in particular greater birth preparedness (as measured through respondent's preparation for money, transport, blood donor, health worker and safe delivery kit in the DHS), the presence of a skilled birth attendant during delivery (i.e. doctor, nurse or midwife), improved immediate newborn care practices (encompassing delayed bathing, drying, wrapping, skin-to-skin contact immediately after birth) and greater attendance at postnatal check-up within 48 hours. As these outcomes are likely to be affected by the socio-economic and individual characteristics of the family, mother and the child, they were controlled in the analysis (e.g. wealth status, area of residence and caste and ethnicity for family; age, education and access to media for mothers; and sex and parity for the child). These variables were found to

be affecting neonatal care and mortality in other studies and are available in DHS, therefore selected as control variables. Although, neonatal mortality is the final outcome of interest, we could not measure difference between intervention and comparison area due to limited sample size available in our dataset.

Figure 3.3.5: Conceptual framework for regression analysis



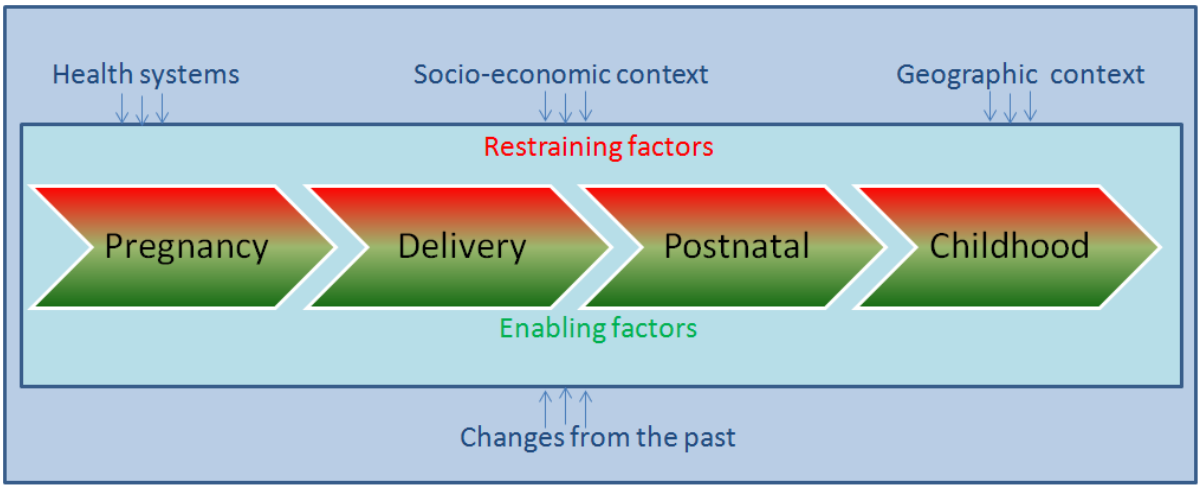
Unlike for difference-in-differences analysis, where each outcome variable was assessed separately, logistic regression analysis was undertaken for aggregate variables (**Figure 3.3.5**). The analysis was carried out controlling for key background variables for the family (i.e. wealth quintile, residence area, caste and ethnicity), mother (i.e. age, education, media access) and newborn (i.e. sex, parity). The analysis was done using Stata Special Edition 12. (Stata Corporation, 2011)

3.3.6 Thematic analysis of qualitative data

All FGDs were transcribed in Nepali, and translated into English before conducting thematic analysis. The PhD candidate listened to the audio-tapes and verified that the information was properly transcribed and translated into English. All audio tapes, original notes, expanded notes and translated notes were stored in a secure, locked place. Any personal information that could lead to the identification of an individual was erased.

The data were subsequently analyzed using thematic analysis. (Braun and Clarke, 2006, Ziebland and McPherson, 2006) FGDs for different groups (i.e. RDWs, MILs, FILs, FCHVs) and KIIs were analyzed individually and examined separately for intervention and comparison areas. The texts were read several times to develop line-by-line codes. Once the transcripts were coded, line-by-line codes were grouped to identify major themes. Drawing on an *a priori* developed life course framework of relevant practices that affect newborn health (**Figure 3.3.6**) these major themes were grouped as "enabling" and "restraining" factors for behaviors and practices during pregnancy, delivery and the postnatal periods. The findings for individual FGDs are presented in graphical charts **(Annex 5)**.

Figure 3.3.6: Life course framework of practices that affect newborn health



The results were also summarized narratively, drawing on relevant quotations to illustrate typical issues, as well as to reflect minority views. Findings from the qualitative analysis were compared and contrasted between intervention and comparison areas.

3.4 Data triangulation between different data sources and types of inquiry

Findings from different data sources (DHS vs. HMIS vs. NHIS) and different types of enquiry (quantitative vs. qualitative) are initially presented separately. Subsequently, key findings from each are tabulated to examine where the different analyses point in the same direction or diverge. Where findings from multiple sources point to similar conclusions, this lends strength to the reliability of the findings, although the strengths and weaknesses of each data source must be taken into consideration. Qualitative data are likely to offer an important source of explanation for the impact of the CB NCP or the lack thereof. This process of triangulation enhances overall quality of the research and improves reliability of findings.

3.5 Summary

Research question 1 is addressed through trend and equity analyses of neonatal mortality, using DHS data. Research question 2 is addressed through a mixed-method quasi-experimental approach, utilizing data from different sources (DHS 2011, MoHP's HMIS, NHIS) and conducting FGDs (RDWs, MIL, FIL, FCHVs) and KIIs (school teachers, CHWs). Quantitative data were analyzed to estimate changes post-intervention, using difference-in-differences and logistic regression analysis in propensity score-matched intervention and comparison areas. Qualitative data were analyzed using thematic analysis to explore factors that enable or restrain improvements in neonatal health in Nepal.

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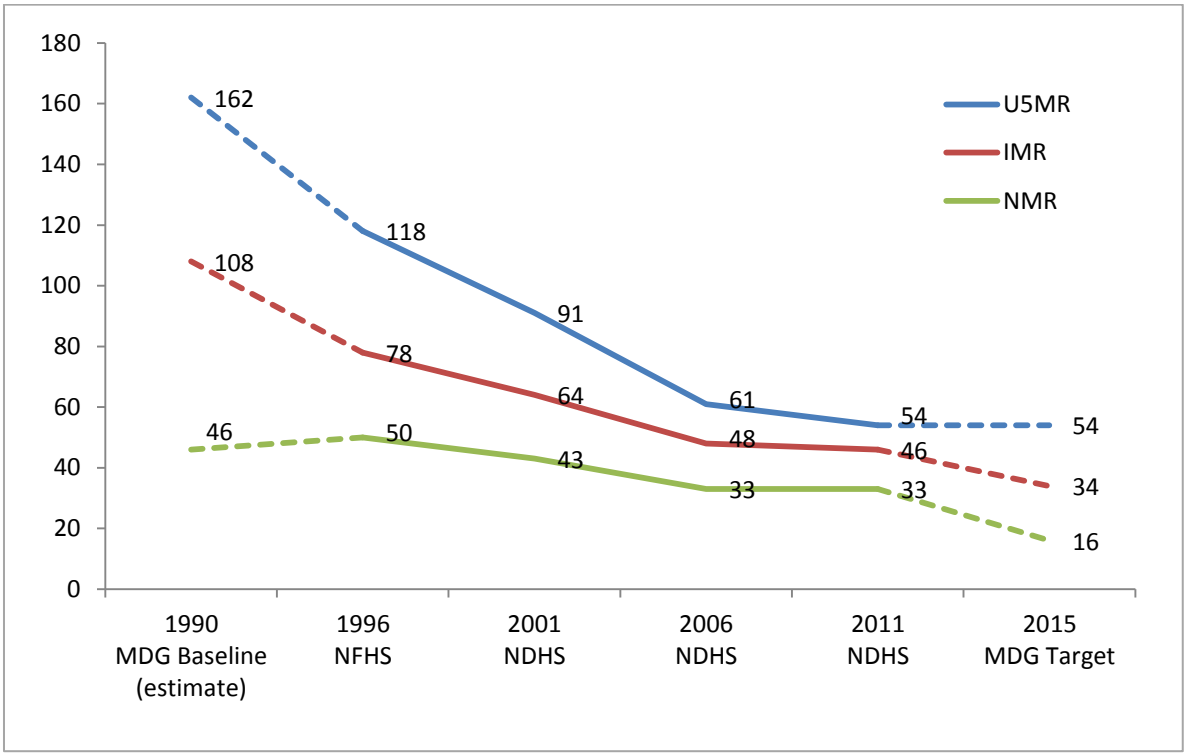
4. Findings

4.1 Time trend and equity analysis

The most recent estimates for neonatal, infant and under-five mortality in Nepal are 33, 46 and 54 per 1,000 live births respectively, for the period 2006-2011. (MOHP, 2012) The overall rate of reduction in childhood mortality between 1990 and 2011 is impressive; however, there are stark differences in the annual rate of reduction for under-five, infant and neonatal mortality (5.2, 3.6 and 2.8 percent per annum respectively for the five-year period preceding the survey). As shown in **Figure 4.1.1**, the country had already achieved the MDG 4 target for under-five mortality by 2011, but reductions in infant and neonatal mortality are a must if childhood survival is to improve further.

Figure 4.1.1: Trends in childhood, infant and neonatal mortality in Nepal for 1990 to 2011 in relation to MDG baselines for 1990 and MDG targets for 2015



Note: Estimates of child, infant and neonatal mortality are based on the five-year period preceding the surveys. The MDG baseline is not survey-based but was estimated based on backward extrapolation of trends. Neonatal mortality does not form part of the MDG indicators, and the values for MDG baseline and MDG target are taken from the Nepali national health plan.
U5MR: Under five mortality rate; IMR: Infant mortality rate; NMR: Neonatal mortality rate; MDG: Millenium Development Goal; NFHS: Nepal Family Health Survey; NDHS: Nepal Demographic and Health Survey

Table 4.1.1 shows inequalities in newborn mortality by child sex, geographical location (as measured by urban-rural residence, ecological region and development region) and socio-economic status (as measured by maternal education, wealth status and caste and ethnicity); these inequalities are evident in all four surveys. Male neonates from rural areas, living in mountain areas and the Far-Western region, born to mothers with no education and into families belonging to the lower wealth quintile and to a marginalized caste or ethnic group (*Dalit and Janajati)* are dying more frequently than their counterparts.

Table 4.1.1: Neonatal mortality rate for the 10-year period preceding the survey, by child sex, geographical location and socio-economic characteristics*

Parameter	***Neonatal mortality rate***				***Annual rate of reduction (1996-2011)***
	NFHS 1996	NDHS 2001	NDHS 2006	NDHS 2011	
Child sex					
Male	65.1	51.8	38.6	36.9	3.8
Female	49.6	42.6	36.8	33.1	2.7
Rate difference	*15.5*	*9.2*	*1.8*	*3.8*	*na*
Rate ratio	*1.3*	*1.2*	*1.0*	*1.1*	*na*
Residence					
Urban	43.2	35.9	24.6	25.3	3.6
Rural	58.5	48.1	39.6	36.2	3.2
Rate difference	*15.3*	*12.2*	*15.0*	*10.9*	*na*
Rate ratio	*1.4*	*1.3*	*1.6*	*1.4*	*na*
Ecological region					
Mountain	70.8	63.7	58.9	45.6	2.9
Hill	50.3	41.9	28.6	32.9	2.8
Terai	61.7	49	41.4	35.1	3.8
Rate difference	*20.5*	*21.8*	*30.3*	*12.7*	*na*
Rate ratio	*1.4*	*1.5*	*2.1*	*1.4*	*na*
Development region					
Eastern	56.7	50.1	32.5	29.3	4.4
Central	55.5	47.6	34.8	36.7	2.8
Western	52.0	38.9	34.5	37.0	2.3
Mid-western	63.0	40.3	55.9	33.6	4.2
Far-western	67.0	63.8	39.7	40.9	3.3
Rate difference	*15.0*	*24.9*	*23.4*	*11.6*	*na*
Rate ratio	*1.3*	*1.6*	*1.7*	*1.4*	*na*

Parameter	***Neonatal mortality rate***				***Annual rate of reduction (1996-2011)***
	NFHS 1996	NDHS 2001	NDHS 2006	NDHS 2011	
Maternal education					
No education	59.5	51.1	43.3	40.3	2.6
Primary	51.6	41.1	34.1	33.6	2.9
Secondary or higher	41.6	24.3	20.3	26.2	3.1
Rate difference	*17.9*	*26.8*	*23.0*	*14.1*	*na*
Rate ratio	*1.4*	*2.1*	*2.1*	*1.5*	*na*
Wealth status					
Poorest	56.4	48.5	42.7	35.6	3.1
Poorer	63.4	56.0	37.6	40.0	3.1
Middle	65.8	46.9	46.9	39.2	3.5
Richer	53.3	47.2	30.4	36.9	2.5
Richest	47.0	32.1	26.3	18.6	6.2
Rate difference	*18.8*	*23.9*	*20.6*	*21.4*	*na*
Rate ratio	*1.4*	*1.7*	*1.8*	*2.2*	*na*
Caste and ethnicity					
Brahmin, Chhetri, Newar	52.6	43.9	33.1	31.0	3.5
Dalits	58.1	51.6	43.9	36.4	3.1
Janajati	51.7	47.9	34.0	34.6	2.7
Other	72.2	49.2	44.5	42.6	3.5
Rate difference	*20.5*	*7.7*	*11.4*	*11.6*	*na*
Rate ratio	*1.4*	*1.2*	*1.3*	*1.4*	*na*
National	**57.5**	**47.2**	**37.7**	**35.1**	**3.3**

*In each survey, the groups with the highest and lowest neonatal mortality were used to calculate rate differences and rate ratios. Please note some fluctuation between years in terms of the groups performing best or worst.

Annual rate of reduction: The overall average annual rate of reduction in neonatal mortality for the period 1996 to 2011 is 3.3 percent per year. The rate of reduction is greatest for the richest wealth quintile (6.2 percent per annum), and is also substantially above average for the Eastern development region (4.4 percent per annum) and the Mid-Western development region (4.2 percent per annum). Neonates living in the Western development region (2.3 percent per annum), or born into the richer wealth quintile (2.5 percent per annum), into a *Janajati* family (2.7 percent per annum) or to mothers with no education (2.6 percent per annum) show particularly low average annual rates of reduction.

Absolute inequalities based on rate differences in 2011: In Nepal, differences in neonatal mortality are most pronounced for wealth (21.4 between the wealth quintiles with highest and lowest neonatal mortality rates). Interestingly, neonatal mortality is higher among poorer and middle quintile families than among poorest quintile families. Differences in neonatal mortality rate are also relatively stark for maternal education (14.1 between a child born to a mother with secondary or higher education and a child born to a mother with no education). Differences are moderate for the three geographical indicators (10.9 for urban compared to rural areas, 12.7 for mountain compared to hill areas, 11.6 for the Far-Western compared to Eastern region), as well as caste and ethnicity (11.6 for Brahmins, Chhetris and Newars compared to others; others include diverse castes and ethnic groups that could not be disaggregated due to small sample sizes). Interestingly, absolute differences in neonatal mortality are not very pronounced for males compared to females (3.8).

Relative inequalities based on rate ratios in 2011: Overall, relative inequalities in neonatal mortality show similar results, with wealth status showing the greatest inequalities (2.2 for the richest wealth quintile compared to the poorer wealth quintile). Maternal education (1.5 for children born to mothers with no education compared to children born to mothers with secondary or higher education), geographical features (1.4 for urban-rural, Far-Western compared to Eastern and mountain compared to hill regions) and caste (1.4 for Brahmins, Chhetris and Newars compared to others) show very similar relative inequalities. Relative inequalities are barely present for male versus female neonates.

Changes over time: No clear and consistent pattern emerges in the reduction of absolute and relative inequalities in neonatal mortality based on the range of variables assessed. For most variables, rate differences and rate ratios are relatively stable with some fluctuation (i.e. urban-rural residence, development region, caste and ethnicity) or stark fluctuation (i.e. ecological region, maternal education) between years. For most comparisons, the groups with the highest and lowest neonatal mortality rates remain the same across comparisons;

with caste and ethnicity, there is substantial variation between years. Findings for child sex and wealth status stand out: For child sex, rate differences and rate ratios were much more pronounced in 1996 and have shown a steady decline since then. No clear gradient for neonatal mortality emerges across wealth quintiles; the richest wealth quintile performs best across all four surveys but the worst performance is observed for either the poorer or middle wealth quintile rather than the poorest. Overall, rate differences are relatively stable over time whereas the rate ratio increased from 1.4 in 1996 to 2.2 in 2011 between wealth quintiles with the highest and lowest mortality rates.

4.2 Propensity score matching

Propensity score matching simplifies the problem of matching on large numbers of covariates by collapsing the covariates into a single scalar—the propensity score—and then matches treatment and control communities using a one-dimensional match on the propensity score. We applied propensity score matching to select 10 comparison districts for 10 intervention districts, using each comparison district only once. As shown in **Figure 4.2**, this led to the identification of Baglung, Sindhuli, Syangja, Dhanusha, Jhapa, Lalitpur, Udayapur, Makwanpur, Surkhet, and Kanchanpur as comparison districts.

Figure 4.2: Intervention and propensity score-matched comparison districts

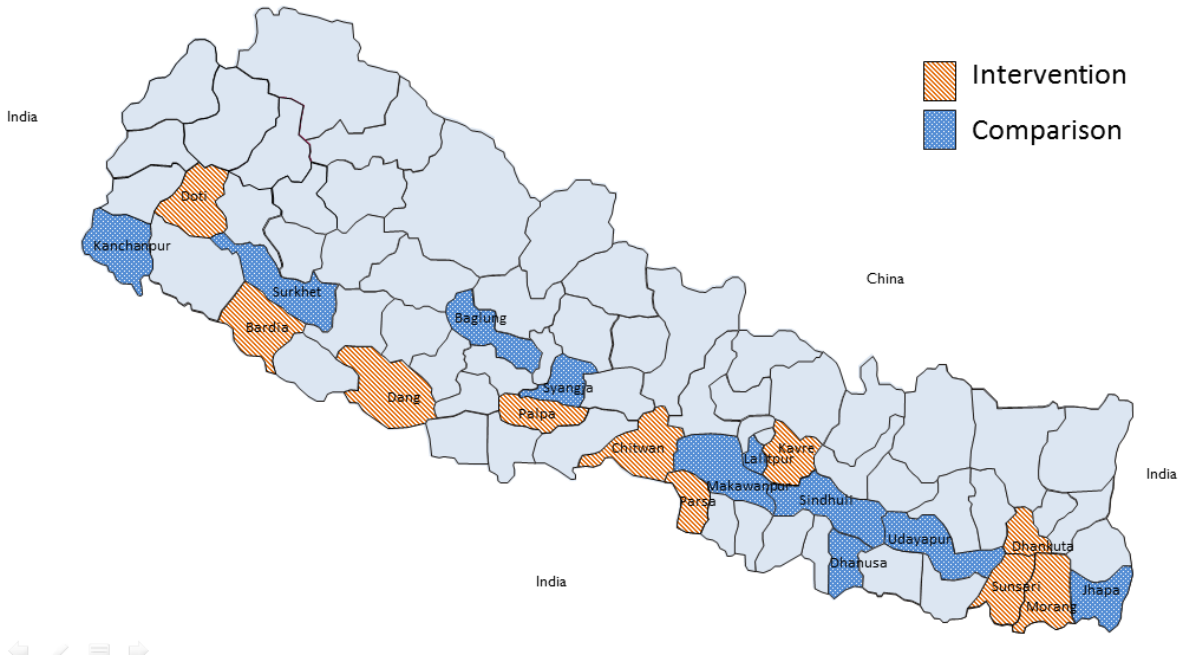


Table 4.2.1: Average value of matching variables by intervention and comparison area

Indicator	Intervention area	Comparison area	t	p-value
Human Development Index: life expectancy	61.23	62.88	-0.76	0.457
Human Development Index: adult literacy	51.40	54.38	-0.73	0.475
Human Development Index: school enrollment	2.77	2.88	-0.33	0.742
Human Development Index: gross domestic product	1293.6	1315.2	-0.15	0.883
Urban Population (percentage)	16.79	17.85	-0.25	0.803
District rank score (average score)	74.25	73.77	0.28	0.781
Road density (km/sq km)	0.251	0.258	-0.07	0.941
Donor presence (average)	1.3	1.4	0.25	0.806

Once the set of comparison districts were identified, all analysis was performed for the pooled set of 10 intervention versus 10 comparison districts as the NDHS data is not representative for all variables at the level of individual districts. We then examined balance between intervention and comparison areas for matching variables **(Table 4.2.1)** using a t-test. All variables used to calculate the propensity score were balanced between intervention and comparison areas, as indicated by non-significant t-tests.

Table 4.2.2: Population and health indicators

Basic population and health indicators for intervention and comparison areas

	Intervention area	Comparison area	Data source
Administrative units			
Districts	10	10	District Profile
Village Development Committees	539	517	District Profile
Municipalities	16	13	District Profile
Population	4,904,285	4,452,369	Census 2011
Expected pregnancy	141,659	128,174	HMIS
Expected live births	127,486	115,362	HMIS
Health facilities			
Hospital	14	11	HMIS
PHCCs	39	39	HMIS
HPs	87	89	HMIS
SHPs	435	456	HMIS
Private health institutions	49	38	HMIS
Birthing centers	203	183	FHD database
Population per birthing center	24,159	24,330	
Female Community Health Volunteers	6,903	7,378	HMIS
Population per FCHV	710	603	

In addition, we also examined whether districts are comparable in relation to population size, health facilities and coverage of health volunteers. While this should not have influenced why certain districts were chosen for the CB NCP pilot, these variables do influence many of the outcome variables of interest. As shown in **Table 4.2.2**, the comparison area is mostly comparable to the intervention area based on selected administrative, population and health facility indicators; as these variables were derived from many different data sources, statistical tests could not be performed.

4.3 Analysis of impact based on Demographic and Health Survey

4.3.1 Characteristics of births

Table 4.3.1 shows the distribution of background characteristics before intervention period. It also compares outcome variables among most recent births in the five years preceding the survey by intervention and comparison areas. In both groups, a majority of children are from rural areas, disadvantaged families, and born to a mother with at least primary education.

Table 4.3.1 illustrates that the respondents from the intervention and comparison areas are comparable based on their area of residence, educational status, antenatal care visits, sex of the child and the parity of the child. More mothers from the comparison area are found to be delivering at the recommended age (20-35 years) than in the intervention area (77 vs. 68 percent), and the difference is statistically significant (p=0.022). Importantly, intervention and comparison areas are balanced in relation to aggregate outcomes of interest, i.e. birth preparedness, antenatal care (ANC) quality, ANC care-seeking, immediate newborn care and postnatal care within 48 hours (see **Figure 3.3.4**). Delivery by a skilled birth attendant is more common in the intervention area (47%) than in the comparison area (31%), and the difference is statistically significant (p= 0.007).

Table 4.3.1: Background characteristics and aggregate outcomes of interest

Background characteristics and aggregate outcomes of interest for *most recent births* to women aged 15-49 in the five years preceding the survey by intervention and comparison areas, before intervention period

Background characteristic		Intervention area		Comparison area		χ^2	p-value
		Percent	N (weighted)	Percent	N (weighted)		
Family related							
Residence	Urban	13.98	75	14.37	50	0.02	0.929
	Rural	86.02	459	85.63	297		
Wealth status	Richer	47.97	256	24.78	86	44.09	**0.003**
	Middle	20.61	110	23.49	82		
	Poorer	31.43	168	51.73	180		
Caste and ethnicity	Non-disadvantaged	25.98	138	29.39	102	1.05	0.673
	Disadvantaged[1]	74.02	395	70.61	245		
Mother related							
Mother's education	Primary or higher	63.52	339	54.97	191	24.82	0.072
	No education	36.48	194	45.03	156		
Age at birth	20-35 years	68.08	363	76.96	267	6.92	**0.022**
	<20 years or >35 years	31.92	170	23.04	80		
Exposure to public health media	Yes	48.60	259	34.57	120	14.34	0.101
	No	51.40	274	65.43	227		
Child related							
Sex	Male	54.29	289	50.97	177	1.98	0.187
	Female	45.71	244	49.03	170		
Parity	Second or third	43.53	232	48.95	170	2.12	0.211
	First or fourth or more	56.47	301	51.05	177		
Outcomes of interest							
Birth preparedness[2]	Better	6.22	33	4.85	17	0.63	0.568
	Poorer	93.78	500	95.16	330		
ANC quality[3]	Better	35.96	192	29.03	101	3.87	0.195
	Poorer	64.04	341	70.97	246		
ANC care seeking[4]	Better	33.65	179	26.41	92	4.39	0.218
	Poorer	66.35	354	73.59	255		
Delivery by SBA[5]	Yes	46.65	249	31.24	108	17.61	**0.007**
	No	53.35	284	68.76	239		
Immediate newborn care[6]	Better	74.36	392	64.25	218	8.63	0.091
	Poorer	25.64	135	35.75	121		
Postnatal care within 48 hours	Yes	33.69	180	26.80	93	3.97	0.097
	No	66.31	353	73.20	254		

[1] Disadvantaged: hill dalit, terai dalit, hill janajati, terai janajati, other terai caste, or Muslim

[2] Overall birth preparedness: is defined as "better" if at least any two preparations are arranged, and as "poorer" if less than two or no preparation among: money, transport, blood donor, identified health worker, bought safe deliver kit

[3] Overall ANC quality is defined as "better" if at least four of following five items were fulfilled and "poorer" if less than four items were fulfilled: blood pressure, urine sample, blood sample, told about pregnancy complication and told about where to go in complication

[4] Overall ANC care seeking is defined as better if all of the following were fulfilled and "poorer" if any of these were not fulfilled: ANC four or more visits, iron tablets (>90 tablets) taken, at least two doses of tetanus toxoid taken

[5] Skilled birth attendant includes doctor, nurse and midwife

[6] Overall immediate newborn care has been defined as "better" if at least three of the following were fulfilled and "poorer" if less than three were fulfilled among: delayed bathing, dried, wrapped, placed in belly or breast, applied nothing or only Chlorhexidine and initiated breastfeeding within one hour of birth

4.3.2 Findings of difference-in-differences analysis

This section presents the findings from the difference-in-differences analysis of DHS data for all individual and aggregate outcomes under the major categories (i.e. birth preparedness, antenatal care, delivery care, immediate newborn care and postnatal care).

a) Birth preparedness

Table 4.3.2a shows the distribution of birth preparedness practices of the most recent births in the five years preceding the survey by intervention and comparison areas, and before and after the intervention period. The table also shows the difference in differences and the level of significance. For almost all of these birth preparedness practices, there is not much progress after the intervention period, and the progress in the intervention area is no more pronounced than in the comparison area. Saving money for birth is the most common preparation, but greater improvement was observed in the comparison area than in the intervention area. Arranging for transport, identifying a blood donor and arranging for a health worker to assist with delivery were neither common nor did they show major improvement after intervention. None of the observed changes between intervention and comparison areas are statistically significant.

Table 4.3.2a: Birth preparedness

Birth preparedness for *most recent births* to women age 15-49 in the five years preceding the survey by intervention and comparison areas

Birth preparedness		Intervention area			Comparison area			Diff. of differences	p-value
		Before (n=533)	After (n=168)	Diff.	Before (n=347)	After (n=104)	Diff.		
Saved money	Yes	37.6	39.65	2.05	27.97	37.26	9.29	-7.24	0.419
	No	62.4	60.35		72.03	62.74			
Arranged transport	Yes	3.85	6.71	2.86	3.67	7.62	3.95	-1.09	0.835
	No	96.15	93.29		96.33	92.38			
Found blood donor	Yes	0.68	1.38	0.7	0.00	0.00	0.00	0.70	na
	No	99.32	98.62		100	100			
Identified health worker	Yes	1.16	0.65	-0.51	0.24	0.02	-0.22	-0.29	0.622
	No	98.84	99.35		99.76	99.98			
Bought safe delivery kit	Yes	1.16	0.65	-0.51	2.39	0.24	-2.15	1.64	0.167
	No	98.84	99.35		97.61	99.76			
At least one[1] preparation	Yes	42.41	44.61	2.20	31.52	39.12	7.60	-5.40	0.575
	No	57.59	55.39		68.48	60.88			
Overall birth preparedness[2]	Better	6.22	8.43	2.21	4.84	6.00	1.16	1.05	0.810
	Poorer	93.78	91.57		95.16	94.00			

[1] At least one among: money, transport, blood donor, identified health worker, bought safe deliver kit

[2] Overall birth preparedness: is defined as "better" if at least any two preparations are arranged, and as "poorer" if less than two or no preparation among: money, transport, blood donor, identified health worker, bought safe deliver kit

b) Antenatal care

Table 4.3.2b shows the distribution of antenatal care practices and the quality of services received for the most recent births in the five years preceding the survey by intervention and comparison areas. Generally, there is improvement after the intervention period in most of these antenatal care coverage, utilization and quality-related indicators. Except for the practice of counseling about pregnancy complications, which showed greater improvement in intervention areas (difference-in-differences=16.23, p=0.150) and where to go in case of complications (difference-in-differences=14.03, p=0.164), all other indicators either improved more rapidly in the comparison area or showed similar progress in both areas. Four or more antenatal care visits did improve substantially, from 52 to 64 percent in the intervention area and from 40 to 56 percent in the comparison area. The difference-in- differences was not significant in any of these indicators.

Table 4.3.2b: Antenatal care

Antenatal care practice and quality of services for *most recent births* to women age 15-49 in the five years preceding the survey by intervention and comparison areas

Antenatal care		Intervention area			Comparison area			Diff. of differences	p-value
		Before (n=533)	After (n=168)	Diff.	Before (n=347)	After (n=104)	Diff.		
Antenatal care by skilled provider	Yes	62.6	69.62	7.02	53.37	64.47	11.1	-4.08	0.607
	No	37.4	30.38		46.63	35.53			
Antenatal care visits, four or more	Yes	52.35	64.49	12.14	40.77	55.73	14.96	-2.82	0.813
	No	47.65	35.51		59.23	44.27			
Iron tablets taken	Yes	78.49	87.18	8.69	76.69	80.04	3.35	5.34	0.305
	No	21.51	12.82		23.31	19.96			
Blood pressure measured[1]	Yes	75.8	85.41	9.61	71.45	81.04	9.59	0.02	0.998
	No	24.2	14.59		28.55	18.96			
Urine sample taken[1]	Yes	54.06	64.97	10.91	42.49	46.65	4.16	6.75	0.351
	No	45.94	35.03		57.51	53.35			
Blood sample taken[1]	Yes	41.95	48.65	6.70	36.47	41.97	5.50	1.20	0.897
	No	58.05	51.35		63.53	58.03			
Told about pregnancy complications[1]	Yes	64.46	77.90	13.44	56.86	54.07	-2.79	16.23	0.150
	No	35.54	22.10		43.14	45.93			
Told about where to go in complications	[1]Yes	65.51	78.18	12.67	55.11	53.75	-1.36	14.03	0.164
	No	34.49	21.82		44.89	46.25			
Antenatal care quality – at least one[2]	Yes	35.96	43.75	7.79	29.03	30.91	1.88	5.91	0.524
	No	64.04	56.25		70.97	69.09			
Overall ANC care seeking[3]	Better	33.65	49.66	16.01	26.41	33.2	6.79	9.22	0.383
	Poorer	66.35	50.34		73.59	66.8			
Overall ANC quality[4]	Better	47.35	59.94	12.59	34.87	37.78	2.91	9.68	0.290
	Poorer	52.65	40.06		65.13	62.22			

[1]These information were asked only for the women who received antenatal care, thus it was assumed that those who didn't receive care didn't receive these services as well
[2]At lease one among blood pressure, urine sample, blood pressure, told about pregnancy complication and told about where to go in complication
[3]Overall ANC care seeking is defined as better if all of the following were fulfilled and "poorer" if any of these were not fulfilled: ANC four or more visits, iron tablets (>90 tablets) taken, at least two doses of tetanus toxoid taken
[4]Overall ANC quality is defined as "better" if at least four of following five items were fulfilled and "poorer" if less than four items were fulfilled: blood pressure, urine sample, blood sample, told about pregnancy complication and told about where to go in complication

c) Delivery care

Table 4.3.2c shows the distribution of delivery care practices for the most recent births in the five years preceding the survey by intervention and comparison areas. After the intervention period, the percentage of deliveries at health institutions remarkably improved from 43 to 60 percent in the intervention area and from 30 to 42 percent in the comparison area. The difference in the rate of increase in the intervention area was nearly 6 percentage points greater, however the result is not statistically significant (p=0.488). Similarly, there was improvement in the deliveries attended by skilled birth attendants (doctor, nurse and midwife)

with an almost equal percentage increase (~5 percent) between intervention and comparison areas, and the difference is not significant (p=0.577).

Table 4.3.2c: Delivery care

Delivery care practice for *most recent births* to women age 15-49 in the five years preceding the survey by intervention and comparison areas

Delivery care		Intervention area			Comparison area			Diff. of differences	p-value
		Before (n=533)	After (n=168)	Diff.	Before (n=347)	After (n=104)	Diff.		
Delivery at health institution	Yes	42.86	60.25	17.39	30.49	42.04	11.55	5.84	0.488
	No	57.14	39.75		69.51	57.96			
Delivery attended by SBA[1]	Yes	46.65	57.7	11.05	31.24	37.62	6.38	4.67	0.577
	No	53.35	42.3		68.76	62.38			

[1] SBA (Skilled Birth Attendant): includes doctor, nurse and midwife

d) Immediate newborn care

Table 4.3.2d shows the distribution of immediate newborn care practices for the most recent births in the five years preceding the survey by intervention and comparison areas. Improving immediate newborn care is one focus of the CB NCP and the data suggests that there has been improvement in almost all of these indicators in both the intervention and the comparison area after the intervention period. Some of the indicators did improve more rapidly in the comparison area than in the intervention area (e.g. wrapping a newborn in a cloth was nearly 13 percent more common in the comparison area, while others did show greater improvement in the intervention area (e.g. bathing after 24 hours improved with 6 more percentage points in the intervention area than in the comparison area). However, these differences are not statistically significant.

Table 4.3.2d: Immediate newborn care

Immediate newborn care practice for *most recent births* to women age 15-49 in the five years preceding the survey by intervention and comparison areas

Immediate newborn care		Intervention area			Comparison area			Diff. of differences	p-value
		Before (n=533)	After (n=168)	Diff.	Before (n=347)	After (n=104)	Diff.		
Bathed after 24 hours[1]	Yes	58.05	74.91	16.86	46.74	57.62	10.88	5.98	0.492
	No	41.95	25.09		53.26	42.38			
Dried before placenta delivered[1]	Yes	75.29	83.85	8.56	70.59	74.19	3.6	4.96	0.601
	No	24.71	16.15		29.41	25.81			
Wrapped in cloth[1]	Yes	80.21	82.57	2.36	71.3	86.59	15.29	-12.93	0.072
	No	19.79	17.43		28.7	13.41			
Placed in belly or breast[1]	Yes	49.58	66.3	16.72	41.64	57.35	15.71	1.01	0.888
	No	50.42	33.7		58.36	42.65			
Applied nothing or only CHX on the cord[1]	Yes	71.22	87.53	16.31	65.87	72.94	7.07	9.24	0.277
	No	28.78	12.47		34.13	27.06			
Initiated breastfeeding within one hour[1]	Yes	47.75	51.21	3.46	40.48	53.64	13.16	-9.7	0.228
	No	52.25	48.79		59.52	46.36			
Overall immediate newborn care[2]	Better	74.36	85.9	11.54	64.25	79.89	15.64	-4.1	0.605
	Poorer	25.64	14.1		35.75	20.11			

[1]These information was asked only for home births and it was assumed that these practices were followed in case of institutional deliveries.

[2]Overall immediate newborn care has been defined as "better" if at least three of the following were fulfilled and "poorer" if less than three were fulfilled among: delayed bathing, dried, wrapped, placed in belly or breast, applied nothing or only Chlorhexidine and initiated breastfeeding within one hour of birth

e) Postnatal care

Table 4.3.2e shows the distribution of postnatal care practices for the most recent births in the five years preceding the survey by intervention and comparison areas. One focus of the program is to promote an immediate newborn check-up and to identify any health problems in a timely manner. The analysis showed that the percentage increment of newborns that were checked within 48 hours of birth was higher in the intervention area than in the comparison area after intervention (difference-of-difference = 20.36); the difference is statistically significant (p=0.036).

Table 4.3.2e: Postnatal care for newborn

Postnatal care for newborn among *most recent births* to women age 15-49 in the five years preceding the survey by intervention and comparison areas

Postnatal newborn care		Intervention area			Comparison area			Diff. of differences	p-value
		Before (n=533)	After (n=168)	Diff.	Before (n=347)	After (n=104)	Diff.		
Checked within 48 hours	Yes	33.69	44.65	10.96	26.8	17.4	-9.4	20.36	**0.036**
	No	66.31	55.35		73.2	82.6			

4.3.3 Findings of Logistic regression analysis

This section presents the findings from the logistic regression analysis of DHS data for all aggregate health outcomes (i.e. birth preparedness, antenatal care, delivery care, immediate newborn care and postnatal care) as described in the conceptual framework (**Figure 3.3.4**).

Table 4.3.3 shows the unadjusted and adjusted odds ratios for improved newborn care practices, among the most recent births in the five years preceding the survey. Unadjusted odds ratios suggest that birth preparedness is 1.3 times better, antenatal care quality is 1.8 times better, antenatal care seeking is 1.5 times better, delivery by skilled birth attendants is 2.0 times better, immediate newborn care is 1.6 times better and postnatal care visits are 1.7 times better in the intervention area compared to the comparison area, however, the results are not statistically significant for birth preparedness, antenatal care seeking, and immediate newborn care.

When these outcomes are adjusted for key background characteristics (i.e. wealth quintile, area of residence, caste and ethnicity, mother's age, mother's education, access to public health media, baby's sex and parity), the overall effect sizes decrease for all variables with odds ratios ranging from 0.8 (for birth preparedness) to 1.5 (for delivery by skilled birth attendants); none of the odds ratios are statistically significant, except for skilled birth attendant which is marginally significant.

Table 4.3.3: Logistic regression analysis

Bivariate and multivariate logistic regression results for maternal and newborn care practices among *most recent births* in the five years preceding the surveys in intervention districts as compared to comparison districts (reference category)

	Odds ratio	
	Unadjusted [95% CI]	Adjusted[1] [95% CI]
Better birth preparedness[2]	1.3 [0.6 – 3.0]	0.8 [0.4 – 1.7]
Better antenatal care quality[3]	1.8 [1.1 – 2.9]	1.4 [0.9 – 2.1]
Better antenatal care seeking[4]	1.5 [0.9 – 2.7]	1.0 [0.6 – 1.5]
Delivery by skilled birth attendant[5]	2.0 [1.2 – 3.3]	1.5 [1.0 – 2.3]
Better immediate newborn care[6]	1.6 [0.9 – 2.8]	1.1 [0.7 – 1.9]
Postnatal care within 48 hours	1.7 [1.1 - 2.6]	1.3 [0.9 – 1.9]

[1] Adjusted for wealth quintile, area of residence, caste and ethnicity, mothers age, mothers education, access to public health media, baby's sex and parity

[2] Overall birth preparedness: is defined as "better" if at least any two preparations are arranged, and as "poorer" if less than two or no preparation among: money, transport, blood donor, identified health worker, bought safe deliver kit

[3] Overall ANC quality is defined as "better" if at least four of following five items were fulfilled and "poorer" if less than four items were fulfilled: blood pressure, urine sample, blood sample, told about pregnancy complication and told about where to go in complication

[4] Overall ANC care seeking is defined as better if all of the following were fulfilled and "poorer" if any of these were not fulfilled: ANC four or more visits, iron tablets (>90 tablets) taken, at least two doses of tetanus toxoid taken

[5] Skilled birth attendant includes doctor, nurse and midwife

[6] Overall immediate newborn care has been defined as "better" if at least three of the following were fulfilled and "poorer" if less than three were fulfilled among: delayed bathing, dried, wrapped, placed in belly or breast, applied nothing or only Chlorhexidine and initiated breastfeeding within one hour of birth

4.4 Analysis based on Management Information System data

This section utilizes data from HMIS (information for 10 intervention and 10 comparison districts), NHIS (information for 10 intervention districts only) as well as the CB-NCP database at the program's secretariat based in the Child Health Division of the Nepal Ministry of Health and Population (information for 10 intervention districts). It provides an overview of training coverage and quality, health provider's knowledge and skills, the availability of key commodities and health care utilization.

4.4.1 Training coverage and quality, provider's knowledge and skills, and availability of key commodities

Information on training coverage and quality is relevant only in intervention districts and information on provider's knowledge and skills as well as availability of key commodities for newborn care is only available for intervention districts through the newborn health information system. Following sections will provide information on these areas only for intervention districts.

a) **Training coverage and quality:** Data from 10 intervention districts (in **Table 4.4.1a**) shows the start and end dates of training, the number of health workers trained and the supporting agency by district. The data shows that there is variation in the start date of the training in different pilot districts (as early as May 2009 and as late as April 2010) and training completion time (3 months to 14 months). In all districts, the training was offered to all health workers and FCHVs from rural areas; some districts also covered health workers in urban areas. Even though there are issues of non-attendance and turn-over during the training period, generally more than 90 percent of health workers were trained in each district (actual figures do not exist due to the lack of reliable data on the total number of health workers in the district at the time of training).

Table 4.4.1a: CB NCP Training Coverage

District specific training start and end dates, number of health workers trained and supporting agency

District	Training start date (month/year)	Training end date (month/year)	# CHWs trained	# FCHVs trained	# facility-based HWs trained	Supporting agency
Bardiya	5/2009	12/2009	56	842	132	SAVE
Chitwan	4/2010	7/2010	74	340	136	UNICEF
Dang	11/2009	4/2010	62	840	179	UNICEF
Dhankuta	4/2010	7/2010	60	315	91	GON
Doti	6/2009	7/2010	84	653	127	CARE
Kavre	11/2009	7/2010	128	923	244	UNICEF
Morang	4/2010	7/2010	114	594	184	GON
Palpa	4/2010	7/2010	93	585	130	GON
Parsa	5/2009	7/2010	132	999	231	PLAN
Sunsari	5/2009	2/2010	99	981	161	PLAN
TOTAL	--	--	902	7072	1615	

SAVE: Save the Children; GON: Government of Nepal; UNICEF: United Nations Children Fund; CARE: CARE International; PLAN: Plan International

b) Providers' knowledge: Data from 10 intervention districts are gathered from the CB-NCP follow-up after training (FUT) exercise, which was conducted in each district at 3-12 months following the completion of the CB NCP training. The FUT gathered information on the skills and knowledge of health cadres including health facility workers, community health workers (CHWs, i.e. Village Health Workers (VHWs) and Maternal Child Health Workers (MCHWs)) and FCHVs. The FUT also assessed logistical variables related to commodities and equipment. Almost all facilities and most health facility workers and CHWs were assessed through the FUT but only ten to twenty percent of FCHVs were included in most districts. A common set of assessment tools and analytical techniques were used across the intervention districts although the application of these methods may have varied somewhat between districts. The FUT scores should be interpreted with some caution; the criteria for achieving a "correct" score for knowledge or skills was quite rigorous and the low scores that were achieved may not be indicative of the ability of health workers to provide a given service.

As shown in **Table 4.4.1b**, health providers' knowledge about five essential newborn care messages was found fairly high [70 (range 43-95) for HWs, 62 (range 46-82) for CHWs and 57 (range 18-90) for FCHVs]. Knowledge about the correct dose of cotrimoxazole to treat newborn infections was better than knowledge about the five essential newborn care (ENC) messages.

Table 4.4.1b Health providers' knowledge

Percentage of health providers with correct knowledge on essential newborn care and dose of cotrimozale paediatric tablets to treat newborn babies with infections

District	Know all 5 ENC messages[1]			Know correct dose of Cotrim P[2]		
	HW	CHW	FCHV	HWs	CHWs	FCHVs
Bardiya	76	56	80	98	95	97
Chitwan	43	46	49	58	78	69
Dang	95	80	90	93	90	97
Dhankuta	87	57	37	89	96	86
Doti	na	na	na	82	95	84
Kavre	62	56	18	91	92	82
Morang	86	82	84	91	94	97
Palpa	70	59	61	90	87	59
Parsa	51	51	38	86	88	53
Sunsari	59	67	55	98	95	97
Mean (unweighted)	**70**	**62**	**57**	**88**	**91**	**82**

Data source: Assessment of the community-based newborn care package (August 2012)

[1]Five ENC messages: immediate drying; maintain skin-to-skin; apply nothing on cord; immediate breastfeeding; delay bathing

[2] Correct dose of cotrim P: half tablet of cotrim P twice daily for five days for 0-28 days

c) Providers' skills: As shown in **Table 4.4.1c**, health providers' skills in relation to hand washing and managing birth asphyxia were assessed during the FUT either using actual demonstration (in case of hand washing) or through simulation exercises with a doll. Hand washing skills, being a relatively simple practice that is also addressed by other trainings, were found fairly high (81 for HWs, 68 for CHWs, and 60 for FCHVs) in all groups of providers; it did, however, show enormous variation (32 – 97 percent) between districts. The skill to address birth asphyxia as a unique skill that health providers can only learn through the CB NCP training was found to be relatively poor (53 for HWs, 37 for CHWs and 27 for FCHVs), but with much variation (1 – 88 percent) between districts.

Table 4.4.1c Health providers skills

Percentage of health providers who were able to demonstrate hand washing and birth asphyxia steps as outlined in CB NCP training package

District	Hand washing			Manage birth asphyxia (using doll)		
	HW	CHW	FCHV	HWs	CHWs	FCHVs
Bardiya	81	65	67	47	43	39
Chitwan	71	51	58	76	61	39
Dang	86	81	69	48	30	52
Dhankuta	67	42	58	61	39	47
Doti	76	57	38	43	24	9
Kavre	86	66	52	48	30	20
Morang	97	85	63	88	66	--
Palpa	73	70	55	42	23	19
Parsa	90	96	92	22	17	1
Sunsari	--	--	50	--	--	18
Mean (unweighted)	**81**	**68**	**60**	**53**	**37**	**27**

Data source: Assessment of the community-based newborn care package (August 2012)

d) Availability of key commodities: Availability of key commodities is an equally important component of program success, and the data from the FUT shows that availability of cotrimoxazole pediatric tablets to treat newborn infections was high for all types of providers (99 at health facility, 87 with CHWs and 89 with FCHVs). Similarly, availability of gentamicin was also high (95 at HFs and 78 at CHWs, note: FCHVs are not provided with gentamicin as they are not trained and authorized to administer use of this antibiotic). Availability of a thermometer among FCHVs was fairly high (87 percent, range 66-98).

Table 4.4.1d: Availability of CB NCP-related commodities

Percentage of health facilities, community health workers and female community health volunteers with specific drugs and commodities

District	Cotrimoxazole pediatric tablet			Gentamicin injection		Thermometer
	HF	CHW	FCHV	HF	CHW	FCHV
Bardiya	100	100	92	97	97	98
Chitwan	100	100	100	100	100	90
Dang	100	83	96	100	80	99
Dhankuta	100	99	90	95	83	66
Doti	100	71	85	98	93	90
Kavre	100	94	86	96	77	84
Morang	100	89	98	84	80	78
Palpa	99	62	85	89	59	85
Parsa	95	87	64	94	54	78
Sunsari	100	85	92	98	55	81
Mean (unweighted)	**99**	**87**	**89**	**95**	**78**	**87**

Data source: Assessment of the community-based newborn care package (August 2012)

4.4.2 Newborn care seeking and utilization of services

Information on newborn care seeking and utilization is available from regular MIS data, therefore situation before and after intervention period is compared between intervention and comparison area. **Table 4.4.2** shows that the percentage of women who attended the first antenatal care visit increased more in the intervention area than in the comparison area. However, the women who completed at least four antenatal care visits increased more in the comparison area than in the intervention area. The coverage of iron supplementation decreased in both intervention and comparison areas with a higher percentage reduction in the comparison area.

Table 4.4.2: Health care utilization

Percentage distribution of key indicators related to health care utilization by intervention and comparison areas

	Intervention area			Comparison area			Diff. of differences
	Before	After	Diff.	Before	After	Diff.	
Antenatal care							
Antenatal care first visits as percentage of expected pregnancy	68.9	80.6	**11.7**	73.4	77.6	**4.1**	**7.5**
Antenatal care, four or more visits as percentage of first antenatal visit	35.9	42.7	**6.8**	34.9	46.2	**11.3**	**-4.5**
Women receiving Iron tablets as percentage of expected pregnancy	73.8	62.4	**-11.5**	73.3	58.4	**-14.9**	**3.4**
Delivery care							
Delivery at health institution, as percentage of expected live births	25.9	40.1	**14.1**	23.2	37.0	**13.9**	**0.3**
Delivery by skilled attendant or health worker, as percentage of expected live births	33.5	42.1	**8.6**	36.5	46.5	**10.0**	**-1.4**
Delivery by skilled birth attendant, as percentage of expected live births	27.1	38.3	**11.2**	24.9	35.8	**11.0**	**0.3**
Postnatal care							
Postnatal visit, as percentage of expected pregnancy	43.5	54.1	**10.7**	41.0	44.7	**3.7**	**7.0**
Postpartum mother who received vitamin A, as percentage of expected live births	54.4	63.8	**9.4**	49.3	54.0	**4.7**	**4.7**
Care of sick young infants (< 2months)							
PSBI among under 2 months child	1.0	1.3	**0.3**	0.4	0.5	**0.1**	**0.2**
LBI among under 2 months child	1.4	1.7	**0.3**	1.0	2.0	**1.0**	**-0.7**
LBW among under 2 month child	0.3	0.4	**0.2**	0.3	0.3	**0.0**	**0.1**
Any illness among under 2 month child	3.2	6.2	**2.9**	1.7	2.7	**1.0**	**2.0**

CHW: Community Health Worker; FCHV: Female Community Health Volunteer; PSBI: Possible Severe Bacterial Infection; LBI: Local Bacterial Infection; LBW: Low Birth Weight

Data source: Assessment of the community-based newborn care package (August 2012)

The percentage of women who delivered their last baby at a health institution increased in both intervention and comparison areas with almost equal percentage points. A similar pattern can be observed for deliveries assisted by skilled birth attendants and/or health workers, as this indicator is highly correlated with institutional delivery rates.

Postnatal care improved more in the intervention area than in the comparison area. The percentage of postpartum mothers who received vitamin A also increased more in the intervention area than in the comparison area.

The HMIS data does not track indicators by neonatal and post-neonatal period, but by less than two months of age and 2-59 months of age as per the community-based Integrated Management of Childhood Illness (CB-IMCI) program guideline. The reporting is very patchy and does not reflect a clear trend. Generally, the data suggests that care seeking for any kind of bacterial infection, either possible severe infection or local infection is relatively better in the intervention area than in the comparison area.

As indicated in Chapter 3 (Study design, data sources and methods) and elaborated on in Chapter 5 (Discussion), the MIS data is subject to many limitations and may not precisely reflect the outcomes of the program in intervention and comparison areas, but the data generally supports the lack of clear impact of CB NCP observed in the DHS data. As the data is reported as part of routine monitoring, it cannot be analyzed for statistical significance and should be interpreted with caution.

4.5 Qualitative data analysis from FGD and KII

The qualitative component of this study was carried out in one intervention and one comparison site. This section summarizes information from focus group discussions with recently delivered women (two at each site), mother-in-law (one at each site), father-in-law (one at each site) and key informant interviews with community health workers (two at each site) and female school teacher (one at each site). The objectives of the qualitative components of the study were to identify enabling and restraining factors for improved newborn care practices, to supplement information from quantitative methods and to compare situation between intervention and comparison sites. Individual diagrams of each FGD responses by thematic areas are presented in Annex 5.

Findings from the discussions are organized as enabling factors and restraining factors to improve newborn health across different pre-specified categories of expected programme outcomes (i.e. care for pregnant and postnatal women, birth preparedness, immediate newborn care, care of sick newborn, family care, services from FCHVs, practices to be promoted or discouraged, and changes from the past).

4.5.1 FGDs with recently delivered women

Four focus group discussions with recently delivered women were conducted at two study sites. **Table 4.5.1** shows the profile of the women in these focus group discussions. At each site, one FGD was conducted near the health facility and the other far from the health facility to gather information from two diverse groups of participants. The number of participants in each FGD ranged between 8 and 9; the majority of the participants were from marginalized families as the sites selected were relatively remote areas of the intervention and comparison districts.

Table 4.5.1: Profile of FGD participants (Recently Delivered Women)

Socio-demographic profile of FGD participants (Recently delivered women) in intervention and comparison area

	Intervention area (Korak, Chitwan)		Comparison area (Palase, Makawanpur)	
Number of FGDs	1 (near)	1 (far)	1 (near)	1 (far)
Number of FGD participants	8	8	9	8
RDWs from : marginalized caste / ethnicity[1]	8	8	1	8
other caste/ethnicity	0	0	8	0
RDWs with: no education	1	4	2	2
primary education	1	4	1	4
secondary or higher education	6	0	6	2
Age range (in years)	19-30	23-43	21-31	19-35
Sex of the child (most recent only)				
male	6	6	4	3
female	2	2	5	5
Length of FGD (in minutes)	75	51	59	68

[1] *dalit and janajati*

Care for pregnant and postnatal women: It is normal within Nepali culture that pregnant and postnatal women are given extra care within the family, focusing on provision of nutritious foods, rest and emotional support from family members. Although people have knowledge of diverse foods and are aware of their importance during pregnancy and post-childbirth, these foods may not be available locally or are very expensive and thus the woman is bound to have whatever is available locally.

> *We had saag (green leaves) and dindho (flour porridge). We actually need to have apples, oranges, and beans during that time, but nothing is found here. [RDW 6, far HF, Intervention area]*

> *It is not a town; we have to eat what we get in the village. [RDW 2, far HF, Intervention area]*

> *We need money, even if we have money, we don't get to eat them, because they are not available. [RDW 5, far HF, Intervention area]*

Birth preparedness: Generally, at both intervention and comparison sites, recently delivered mothers claimed to have some birth preparedness, primarily collecting money for expenses during delivery and the postnatal period and preparing some food items and

newborn clothes. Even though promoted through the birth preparedness package, identifying and providing a potential blood donor, making specific travel arrangements, and identifying and making contact with health workers were not commonly cited by the participants. They reported to have learnt from the local radio about a need for these preparations.

> *We collected money for transportation, to take the pregnant woman downwards (to city, hospital) after labor pain. [RDW 1, Near HF, Intervention area]*
>
> *We also prepared for food items- fish, meat, green leaves, likewise milk, ghee/butter. [RDW 3, Near HF, Intervention area]*
>
> *There is a saying that we have to prepare 10 items in 10 months (of pregnancy). We arrange things like oil and spices, we also keep delivery kit ready. [RDW 7, Far HF, Comparison area]*
>
> *Some couples live alone (in nuclear family) and don't know anything. Their mother-in-law and father-in-law are also old. They don't have money in hand. If they make preparation, they can use that in need. That's why savings and collections are done. In my turn, three or four roosters were reared, I don't know about oil and spices. [RDW 6, Near HF, Comparison area]*

Immediate newborn care: Some of the recommended immediate newborn care practices (e.g. immediate wiping and wrapping, delayed bathing after birth) are being introduced and institutionalized among recently delivered women, but some are still transitioning to adopt these practices or are still concerned whether these new practices are better than their current practices (such as applying oil to the cord, giving bath to the newborn baby).

> *When a baby is born, there is blood in the body, so it is wiped with a soft cotton cloth after applying oil. In the past, there was practice of bathing and then oil massaging immediately after birth, but now we first apply oil on baby's body to avoid rashes and then wipe smoothly with a piece of cloth. [RDW 7, Far HF, Comparison area]*
>
> *Baby will catch cold and pneumonia if they are bathed immediately, so we ask to keep the baby on mother's chest, that's how mother's warmth will reach to the baby. [RDW 5&6, Near HF, Intervention area]*

Once the cord is cut, it is tied with a small thread, and then oil is applied. I did that to my child. We applied warm oil, why should not we apply oil in the cord? [RDW 6, Far HF, Intervention area]

My baby never caught pneumonia. I bathed all three babies immediately after birth. We have to give them bath immediately, but after that we need to massage them. If we do that, nothing will happen. [RDW 5, Far HF, Intervention area]

In our case, we gave bath immediately after birth and cleaned it. Babies born at home need to be bathed. [RDW 5, far HF, Intervention area]

Postnatal care: Special care for a postnatal mother is almost universal both in intervention and comparison areas, and no stark differences were noted. RDWs reported that special care is provided for a postnatal mother both by their in-laws and their parents, and the support from the husband varies by their availability and interest. During the postnatal period, the family focuses on their need to rest and their need for additional nutritional requirements by providing them with more frequent and nutritious food. However, certain postnatal restrictions and cultural pressures, such as considering the mother ritually polluted and not allowing her to move outside the home, exist that affect care seeking during the postnatal period, including postnatal care visits and the workload during the postnatal period. RDWs reported that a postnatal visit is considered necessary only in case of any complications rather than as a routine check-up.

The new mother is taken to their maternal home after 22 days of delivery to feed them well. They are fed with soup of jwano (ajwain) and fenugreek soup [RDW 6, Near HF, Intervention area]

We can't have cauliflower and cabbage as they are cold, taro roots and hot and sour items. [RDW 6, Near HF, Intervention area]

We are not allowed to eat potatoes or vegetables (at home) because they are (considered) cold and baby may fall sick due to them, but we get to eat them at hospital. [RDW 1, Near HF, Intervention area]

If Mother-in-law (MIL) is working, Daughter-in-law (DIL) cannot sit and watch. This is village. If DIL sits ideally shaking her belly while her MIL is working then people will say that she is uncultured and will start gossiping about her from the next day. [RDW 6, near HF, Comparison area]

They give tasty food to eat (to a postnatal mother). May be because I have not yet forgotten the tasty food, I feel like giving births again and again. [RDW 6, near HF, Comparison area]

New mother and the baby are kept in a corner of a passage in a bit secret way so that they will be safe from cold air. [RDW 7, far HF, Comparison area]

Why to go (for postnatal check up)? I was already feeling better so I only took my child for vaccine. [RDW 8, Far HF, Comparison area]

Care of sick newborn: Most of the mothers, even in the intervention area, were found unaware of the specific danger signs of newborn illness and have little faith in the medication and care provided by government health institutions. As a result, they were either not seeking timely care for their sick newborns or visited the informal health sector, such as private pharmacies or individual care providers.

We know by looking at the baby, if they are lethargic and they cry while being breastfed [RDW 5, far HF, Intervention area]

I had heard of them (danger signs of newborn illness) but I don't remember what they are [RDW 3, Far HF, Intervention area]

Those who do the job of weighing babies (FCHVs) must know of it. How do we know? [RDW 5, Far HF, Intervention area]

We think, they give us expired medicine. Why would the medicine not work otherwise? When the medicine doesn't work, we think it is an expired one. [RDW 6, Far HF, Intervention area]

My baby is never cured by that medicine (of HP) so I always have to take my child to the medical (private drug retail shop). [RDW 4, Far HF, Intervention area]

Services from FCHVs: Recently delivered women were found to be aware of the services that FCHVs are providing or supposed to provide and some of them claimed that they are not able to reach out to all communities and every family within the community. In other cases, they reflected that not everyone in the community follows their advice; and thus some of the messages may not reach those they are intended to reach or may not be perceived as trusted information.

> *There are people who call them (FCHVs), but I never call them, because I am shy [RDW 6, Near HF, Intervention area]*
>
> *Our community is far so it is difficult for them (FCHV) to come here, they come only when we inform them. [RDW 5, Far HF, Intervention area]*
>
> *Some follow her instructions, others don't. Maybe she feels bad when people don't follow her advice. [RDW 7, far HF, Comparison area]*

Family support: Affordability of care is an issue in deciding to seek care or not, as stated by some RDWs. Also, the family's economic status and power relations within the family played a role in care seeking. Emotional support from the family, primarily MIL and/or the husband was described by most of the mothers as a major support that they receive from their family. They also reflected on the existence of gender preferences and its effect on newborn care, where male children are more likely to receive nutritious foods, to be taken care of by other family members and to be taken to the government health service than female children.

> *He (husband) said that he will take me to health post if I am not feeing well, but I preferred to deliver at home because I don't feel like spending money as long as I am safe. So I asked him to call one or two friends of mine and delivered at home [RDW 1, far HF, Intervention area]*
>
> *They (MIL) teach us. They console us by saying that this (delivery) is every woman's story, we have to suffer anyhow. They also tell us not to be nervous and to push. [RDW 1, far HF, Intervention area]*
>
> *He (husband) massaged this child of mine. [RDW 4]*

Maybe because he was very happy to have a son, otherwise they (husband) don't even touch. [RDW 6, far HF, Intervention area]

Barriers for improved maternal and newborn health: The family's economic situation (e.g. competition for limited resources), difficult geographic terrain (e.g. poor transportation system) and socio-cultural norms (e.g. not eating any cold foods during the postnatal period) were frequently reported by the mothers as important barriers to improving maternal and newborn care.

Some people from the other side of the river do not come because they are shy. Some of them think that if two or three children could be delivered at home, others could also be. But, it is not like that in this area. [FCHV 6, near HF, Comparison area]

There is no transportation facility in this area. Transportation facility is available only during winter, otherwise, we need to carry (on back or stretcher) during rainy season. [RDW 7, near HF, Comparison area]

If everything happens in a good way, then it is an advantage to everyone. If daughter-in-law become strong, they can work, otherwise they (in-laws) won't have spent money on them. [RDW8, near HF, Comparison area]

After delivery, I stopped eating fruits to save the child from cold and diarrhoea. I am not very much into cold fruits like apple, orange, and also hot and sour foods. [RDW 7]

Latte ko saag (local green leaf vegetable) and pharsi ko munta (leaves and soft stem of pumpkin) should not be eaten too. [RDW8, far HF, Comparison area]

We eat whatever we get. People in the village don't even have money to buy cooking oil, how will they have fruits? Even if we buy fruits, we cannot have it alone, other members are also there. [RDW 6, near HF, Comparison area]

Changes from the past: Mothers gave multiple examples of changes in their community during the last five years, some of which were related to general health conditions or behavior or related to overall developmental changes. Most of the RDWs in the discussions indicated improved knowledge about better care for pregnant and postnatal mothers and

newborns, however some changes are yet to be observed in practice. Most of the FGD participants also expressed overall infrastructural improvement, such as access to road and communication resulting in better access to health services.

> *Babies will be gone (will die) if we seek help from them (traditional healers), however, the medicine (from health post) doesn't work and we are bound to seek their help. [RDW 1, Far HF, Intervention area]*
>
> *In the past, colostrums was thrown. Before five years, it was thrown but since we got the knowledge about feeding colostrums, we do not throw. [RDW 7, far HF, Comparison area]*
>
> *At present, babies have been protected from pneumonia due to the practice of wiping them immediately after birth and bathing them only after 24 hours. [RDW 7, far HF, Comparison area]*
>
> *There are lot of changes for pregnant women compared to past. They used to deliver at home, stay home even after 4-5 days of labor pain, used to call Jhankris (spiritual healers), but now ambulance comes as soon as they cry from (labor) pain, [RDW 6, Near HF, Intervention area]*
>
> *Nowadays, blade is used to cut the cord, in our time sickle was used. [RDW 5, far HF, Intervention area]*

Summary: Generally, mothers reported that things are changing both in their own practices and on health services availability and utilization, but still there are issues to adopt recommended practices. No major differences were felt between intervention and comparison area as a result of CB NCP, but those who were from far from the health facilities reported to face more issues to seek and utilize services than those from near health facilities.

4.5.2 FGDs with other family members (Mothers-in-Law, Fathers-in-Law)

One focus group discussion each in intervention and comparison areas was conducted with a group of Fathers-in-Law (FIL) and Mothers-in-Law (MIL) and analyzed jointly as a view of guardians. **Table 4.5.2** shows the profile of the participants in these discussions. The number

of participants in each FGD was seven to eleven; participants were aged 33 to 75 years with a majority from marginalized families.

Table 4.5.2: Profile of FGD participants (Family members)

Socio-demographic profile of participants in FGDs with Mothers-in-Law (MIL) and Fathers-in-Law (FIl)

	Intervention area (Korak, Chitwan)		Comparison area (Palase, Makawanpur)	
Number of FGDs	1 (MIL)	1 (FIL)	1 (MIL)	1 (FIL)
Number of FGD participants	7	10	9	11
Participant from :				
marginalized caste / ethnicity[1]	7	10	3	4
other caste/ethnicity	0	0	6	7
Sex of the child (most recent only)				
male	4	5	4	5
female	3	3	2	5
Age range (in years)	47-75	40-75	33-75	43-60

[1] *dalit or janajati*

Care for pregnant and postnatal women: Family members expressed mixed opinions about the importance of care for pregnant and postnatal mothers. As shown in the quotations below, the MILs in the intervention area reflected why antenatal check-ups are important and how they manage their household duties during their absence. In contrast, one FIL from the comparison area reflected concerns about the usefulness of these types of visits and services for pregnant women and postnatal mothers.

> *They have to go for checkup in time. We have to send them by handling their household chores ourselves. [MIL 5, Intervention area]*

> *Nowadays, women are given vitamins and are advised to do many things which is totally unnecessary. They are advised not to work and to rest all the time. As a result they end up with operation (caesarean section delivery). Pregnant women should do some exercise. [FIL 11, comparison area]*

Birth preparedness: Family members reflected common birth preparedness practices in the community and mentioned that conscious preparation for birth, as suggested by the program, is generally lacking. Most of the preparations are around foods and, to a lesser extent money.

How can we keep the clothes ready before the child is born? We don't even know whether boy will be born or a girl. We buy clothes only after baby is born. [FIL 4, Comparison area]

People buy small chicks and start rearing them for future as soon as they learn of pregnancy in their house. They may not have money when they need. So, they collect things like fenugreek, butter, cumin etc. We should collect nine things in nine months of pregnancy: chicken, oil, butter, spices, fenugreek, ajwain, honey, peas, soybean. [FIL 9 & 5, Intervention area]

Immediate newborn care: None of the immediate newborn care practices are universally practiced at our study sites. Family members who participated in our discussions indicated that some of the practices are still uncommon despite the program's intention to promote such practices, such as delaying bathing or promoting hygienic cord care.

Babies born at home are given bath immediately after birth; I don't know what they do at hospitals. [FIL 9, Intervention area]

Postnatal care: Postnatal care is not a very common practice, unless there is an obvious medical reason to seek care from the provider. At both intervention and comparison sites, family members indicated that they do not feel that regular postnatal care visits are necessary unless the mother is sick.

Women do not go for postnatal check-up. They go only if they become unwell after delivery. Otherwise, neither a health worker pays them a visit, nor they go by themselves. [FIL 4, Comparison area]

If she is well, she is well. If she is not, she is taken to the hospital. [FIL 10, Comparison area]

Services from FCHVs: Generally, focus group discussions revealed FCHVs as key players in promoting health awareness and basic services, reflected their limited ability to reach out to everyone in the community. MILs and FILs mentioned that FCHVs are generally the first point of contact and that women and children are referred to higher levels of care based on the type and seriousness of the illness.

They (FCHVs) bring and give medicines. If the medicine does not work, they are taken to health post. If they are not well even from there, they are taken to the hospital. [MIL 2, Intervention area]

Since the time Public Health Office has appointed trained FCHVs in villages, they are informing pregnant women and their families to go to health institution for delivery. They also keep the record of pregnant women, small babies and deaths (of mothers and babies) in the village. [FIL 3, Intervention area]

Barriers to seek timely care: MILs and FILs indicated some of the barriers to seeking timely care related to cultural beliefs (e.g. concept of bad-air), geographic difficulties and ability to pay.

People say that baby is affected by some spiritual power (bad air) and thus they are fanned with nanglo and sari of the baby's mother. [FIL 4, Comparison area]

We have to go to the health post, which is 4 hours away from here. Sometime, the pregnant woman has to be transported on a stretcher or on doko (tranditional bamboo basket) on the back.[FIL 2, Intervention area]

Changes from the past: The discussion revealed that the practice of seclusion of women during the postnatal period is being applied less strongly and as a result women are getting more support from their family members. MILs and FILs also reflected that increased awareness about the issues of handling heavy weights and nutritional needs during pregnancy and postnatal period.

They (pregnant women) have check-up every month with Auxiliary Nurse Midwife (ANM). FIL, MIL and husband do not allow them to carry heavy load. In the past, there was the belief that if pregnant women do not do heavy work, they cannot deliver a baby. [FIL 2, Intervention area]

Restrictions are not followed completely nowadays. If the new mother is too weak, her husband should do cleaning and should also wash clothes. [MIL 5, Intervention area]

Summary: These discussions confirmed important role of senior family members regarding care and health service utilization for maternal and newborn care, but without major difference between the intervention and comparison area. Similar to the findings from the recently delivered women, senior members also confirmed that things are changing with time but economic and geographic barriers are still a major one to utilize health services for mothers and newborns.

4.5.3 FGDs with female community health volunteers

One focus group discussion each in intervention and comparison areas was conducted with Female Community Health Volunteers. **Table 4.5.3** shows the profile of the FCHVs in these focus group discussions. While all FCHVs in a given VDC (where 1 FCHV is assigned to each of the nine wards) were invited, only seven of them could attend the discussion. FCHVs had between 6 months and 21 years of work experience as an FCHV, and FCHVs in the comparison area reported to cover more households (average 208 households) than those in the intervention area (average 127 households).

Table 4.5.3: Profile of FGD participants (FCHVs)

Socio-demographic profile of FGD participants (FCHVs) in intervention and comparison area

		Intervention area (Korak, Chitwan)	Comparison area (Palase, Makawanpur)
Number of FGDs		1	1
Number of FGD participants		7	7
FCHV from :	marginalized caste / ethnicity	7	5
	other caste/ethnicity	0	2
FCHV with: experience	less than 5 yrs	5	0
	5-10 years	1	4
	10 or more years	1	3
Household covered			
	average	127	208
	min-max	33-200	80-300
Length of FGD (in minutes)		54 min	67min

Care for pregnant and postnatal women: Change in workload is a commonly reported phenomenon once a woman is pregnant; however the FCHVs indicated that the pregnant woman is still expected to do light household chores. Generally, husband and MIL were reported to be supportive for taking good care of pregnant women, and the FCHVs also reported that this is changing with better knowledge and awareness as well as with social pressure. Increased utilization of health services is reported to occur due to recently introduced incentives system. The Government of Nepal initiated a program to provide incentives for women to make four antenatal check-ups and to compensate them for the transportation cost travelling to health institutions for delivery. The FCHVs reported that increased antenatal check-up attendance and delivery rates in health institutions.

> *It (working during pregnancy) is a compulsion, as they have cows, buffalos, and goats at home. How can they just rest and stay idle? They have to bring bundles of grass and wood from forest but only the small ones [FCHV 3&7, Comparison area]*
>
> *Husbands tell their wives not to carry heavy loads, not to go far away, stay at home and do their cooking [FCHV 6, Intervention area]*
>
> *MILs let them rest, don't let them carry heavy loads and give them nutritious food like lentil soup. [FCHV 3, Intervention area]*
>
> *It is because they have now understood (the importance), or out of social pressure. [FCHV 7, Intervention area]*
>
> *Government is giving NRs 1,400 (~$18) to mothers for making antenatal care visits and delivering at health facility, and thus they (pregnant women) are coming. They did not come in the past. [FCHV 1, 6, Comparison area]*
>
> *Women receiving ANC have increased because of that and it is now easier for us to tell them to deliver at health facility [FCHV 7, Comparison area]*

Birth preparedness: Most of the FCHVs reported that general preparations are made to prepare for the arrival of the new baby, but that those are dependent on the economic status

of the family. Arranging for money was common, some people think and plan for transportation and very few plan for a blood donor.

> *They keep the (telephone) number so that they can call for vehicle when needed and they also save some money. [FCHV 4, Intervention area].*
>
> *Those who are rich take help of their own relatives (for blood) but people of low profile cannot do so. Only some rich families look for (blood) donor and make other preparation. [FCHV 4, Intervention area]*
>
> *Some do make preparations, some do not. Chicken, butter, oil, ajwain, spices are common preparations. [FCHV 2, Intervention area]*
>
> *There was a tradition of keeping a child wrapped in pieces of clothes until the rice feeding day, now a days as soon as the child is born, they are dressed. [FCHV 4,5 Intervention area]*
>
> *They make some preparation of money. [FCHV 3, Comparison area]*
>
> *They are aware of emergency situation that may arise, so they save money. [FCHV 4 Comparison area]*
>
> *We also tell them that old cloths are ok if they don't have new. We advise them to wash the old cloths and keep them ready. [FCHV 8, Comparison area]*

Immediate newborn care: In the intervention area, FCHVs generally reported that people are shifting to healthy behaviors for mothers and newborns. They also reported that they have been disseminating messages related to better care for mothers and newborns such as kangaroo mother care, danger signs of newborn illness, cord care and thermal care.

> *We have been telling them about the kangaroo mother care for low birth weight babies. We tell them that the warmth of mother is also nutritious element for the baby. Such babies are frequently breastfed and mother is also provided with more food. [FCHV 5,7 Intervention area]*
>
> *They do keep the baby in mother's bare chest. [FCHV 5, Intervention area]*

They don't throw colostrum as in past [all FCHVs, Intervention area] and feed within one hour, if possible [FCHV 3, Intervention area] or as soon as placenta comes off [FCHV 7, Intervention area]

When discussing cord care, FCHVs provided mixed opinion, some saying that people do not apply anything and others saying that they apply oil, however, they reflected that this practice has recently been improving.

They don't apply anything (on the cord). [FCHV 2,4,6 Comparison area]

Oil is applied in some places [FCHV 7,8 Comparison area]

In the past, they used to give bath (immediately), now they don't. [FCHV 5, Comparison area]

We threw colostrum during our time, now the women feed it. [FCHV 5, Comparison area]

Postnatal care: A postnatal care visit was not common, both because it was not perceived necessary to seek care without a concrete problem or because of postnatal weakness, restrictions in postnatal mobility and difficult geographic terrain.

We tell them that it is necessary to (to have postnatal check up) but they don't visit. [FCHV 6, Comparison area]

If the health facility is not nearby and they are not strong enough to walk, they don't go. [FCHV 8, Comparison area]

Some of them are ignorant also; others don't come because they are weak and are also stopped by family members. [FCHV 4, Comparison area]

Care of sick newborn: Pneumonia and jaundice were most commonly cited newborn illnesses in intervention and comparison areas. FCHVs also reported common danger signs of newborn illness such as inability to suck or drink, breathing difficulty, chest in-drawing, lethargy, and fever and reported that FCHVs are the first point of contact. In the comparison area, FCHVs reported that they handle only young infants (those of 2 months or more) and refer newborns to higher-level health facilities.

Babies suffer from pneumonia and jaundice. They suffer from jaundice even before they are born. [FCHV 2,6 Comparison area]

Sick babies cannot suck the milk properly and their mouth feels hot (while breastfeeding). They come to us first because the health post is far. [FCHV 4, Comparison area]

They call us or bring their baby to us. [FCHV 6 Comparison area] For sick newborns, we check and refer them. [FCHV 7 Comparison area]

In relation to low birth weight babies and special care for them, FCHVs from the comparison area were either aware of low-birth weight or did not know the cut-off level for low birth weight. They also reported that low-birth weight babies receive the same care as other babies do. A few FCHVs reported that low-weight babies were fed more frequently and that the mother is given a lot of fluid. They also reported that the baby is kept on the mother's chest, after having been wrapped. They reported that cases of low-birth weight and breathing problems are not common nowadays, and narrated common approaches to care for such babies.

We tell them to keep the (asphyxiated) baby on mother's shoulder and massage the baby with oil. [FCHV 1, Comparison area]

In the past, a plate was ringed with a spoon near baby's ear. [FCHV 2, Comparison area]

Services from FCHVs: Despite efforts to clarify the role of FCHVs in the community and their volunteerism, FCHVs expressed some frustration with others view towards their role and benefits. FCHVs reported that people are suspecting that they are paid with salary and thus expect them to provide home-to-home services.

They think that nobody will walk for free, like us. We actually do not get a penny for our work, but they think that we have a job and earn money. They say that we have to go to their homes and provide the service. During polio campaigns, we have to go to their homes. They don't come to the immunization clinics and we have to mark on their walls the next day. [FCHV 4, 6, 7, Comparison area]

Some FCHVs especially from the comparison area, also reported lack of confidence and limited ability to help people.

> *We are ourselves less informed and lack skills. So, we fail to make people understand. If we could learn something from the training,... (it will be helpful). We have to keep on telling them as they do not understand at once. [FCHV 6, 7, Comparison area].*
>
> *We also have to leave our own household chores to provide services. [FCHV 4, Comparison area]*

Some FCHVs reported that there are some ethnic groups, such as *Chepang*, *Praja* and *Tamang, who are particularly resistant to behavior change*.

> *We have been able to make others understand but Praja just does not come (for antenatal services). It is difficult to make them understand. [FCHV 4, Comparison area]*
>
> *It is also difficult to make Chepangs understand and Tamangs are also like that. [FCHV 5,7 Comparison area].*
>
> *However, they (Praja, Chepang, Tamangs) are now progressing. [FCHV 4, Comparison area]*

Family support: The MIL plays a prominent role in the care of pregnant and postnatal women, even greater than that of the husband. Engaging and training the MILs will help to change behavior and practice, as reported by some FCHVs.

> *The nearest family member of pregnant woman is not necessarily her husband. Husbands of some of the pregnant women are abroad for work, and MILs are the nearest one to the pregnant. Thus, they need some sort of training so that it will be easy for us to teach them. [FCHV 7, Comparison area]*

Different socio-cultural factors were reported by FCHVs to play a detrimental role in newborn health. Seclusion during the post-partum period, shyness, economic status and workload are commonly reported factors.

> Male members of the family refused to carry her (postnatal mother) as she is un-touchable. They say that they will have fits if God becomes angry with them. If they touch the new mother (till nine days), God will make them sick from inside. *Even the mother-in-law didn't touch the grand-daughter as she believed that God will be angry [FCHV 4, Comparison area]*
> *People gossip about us when they see us doing so (touching new mother) [FCHV 7, Comparison area]*

Changes from the past: In both intervention and comparison areas, all FCHVs mentioned that there had been changes in maternal and child health in their area, primarily related to the mortality of newborns and mothers, sickness among children and availability of services. FCHVs from the intervention site cited change in their role as an FCHV and indicated that they are more active in educating community members. As a result, compliance with their message by community members had improved, which indicates improved access to services and promotion of healthy behaviors in the intervention area. Generally the program and training helped to bring FCHVs closer into contact with mothers and to build trust within the community.

> *Compared to past, they (community people) have been complying with our advice, informing us about the births happening in the community and we have been walking through the community on regular basis. We were not informed about every births before attending the (CB NCP) training. [FCHV 7, Intervention area]*

General knowledge about health care (e.g. immunization for children), behavior (e.g. taking iron tablets) and utilization (e.g. antenatal care visits and delivery at health institutions) is found to have improved in both intervention and comparison areas. General care for pregnant and postnatal women has improved, but not across all families.

> *They (pregnant women) are given better care than before, more food is provided to them than usual, and their cleanliness is also taken care of. They are also allowed to take rest; it was not like this in the past. [FCHV 4 & 5, Comparison area]*

But, only those who understand give them such privilege (of taking rest) [FCHV 7, Comparison area].

When we give them iron tablets, especially among the Chepangs, some of their MIL and FIL say that the tablet is for abortion, [FCHV 2&4, Comparison area]

They (pregnant women) ask for iron tablets and deworming tablets once they become pregnant. We arrange iron and deworming tablets for them through sisters (Maternal and Child Health Workers) who first examine them and then provide them with the tablets. [FCHV 7, Intervention area]

Better education of mothers and their husbands has changed the level of awareness and thus some of the harmful practices are being phased out.

No one delivers their baby at cowshed, like before. They have understood that if they give birth at cowshed, the baby may suffer from tetanus. Nowadays, both husband and wife are at least educated to 8th or 10th grade so they want fewer children, healthy children. [FCHV 7, Intervention area]

Summary: FCHVs, mostly from intervention area reported that the CB NCP helped them to understand more better care of newborns, and also confirmed that community practices differs by their socio-economic background and cultural beliefs.

4.5.4 Key Informant Interviews with Community Health Workers

This section summarizes information from key informant interviews using a semi-structured guideline with community health workers (two in each site), one of them in-charge of the health facility (generally male service provider) the other one involved in delivering maternal and child health services (usually female service provider). Information obtained from the key informants is organized by type of trainings received and knowledge on care of sick newborns, their viewpoint in community practices related to care of pregnant women, care during delivery, care of postnatal women, decision making for care seeking and practices to be promoted and discouraged in the community to promote newborn health.

Table 4.5.4: Profile of key informant interview participants (CHWs)

Socio-demographic profile of participants in KIIs with community health workers (CHW)

	Intervention area (Korak, Chitwan)	Comparison area (Palase, Makawanpur)
Number of CHWs interviewed	2	2
Type of CHW: Auxiliary Health Worker Auxiliary Nurse Midwife	1 1	1 1
Length of service (years)	10-13	1.5-3

Training received and knowledge on care of sick newborns: In both intervention and comparison areas, the CHWs reported to have received some training on neonatal health. In the intervention area, they had received CB NCP training whereas in the comparison area, they had received general newborn care training (e.g. basic training on essential newborn care practices).

In intervention area, CHWs were able to report major danger signs of illness such as inability to suck, hypothermia, lethargic, and fast breathing, and were able to report treatment and referral protocols. In contrast, the CHWs from the comparison area reported some danger signs, and were not able to report specific details of the treatment protocol or just mentioned that they would refer the case to higher level of care. For example, both CHWs in the intervention area mentioned that asphyxiated newborn should be assisted for respiration using bag-and-mask step-by-step, whereas the CHWs from the comparison area only mentioned that they would need general stimulation and artificial respiration.

In both intervention and comparison area, CHWs admitted that there are areas for further improvement in knowledge and skills of health workers and volunteers. They also emphasized the need to ensure regular supply of drugs and commodities to provide quality services for mothers and newborns. CHWs also expressed need for frequent and quality supervision visits, periodic monitoring and refresher trainings to help them maintain their knowledge and skills. They claimed that community trust towards the services delivered by the CHWs and FCHVs is encouraging.

Community practices on care of pregnant women: When asked about the care of pregnant women in the community, the CHWs from both the intervention and comparison areas reported that frequency of meals is as usual during pregnancy. CHWs in both areas reported that locally available food rich in vitamin A (green leaves) and protein (lentil soup, meat) is commonly fed to pregnant and postnatal women. CHWs reported that there are no specific restrictions in food during pregnancy, except one CHW reported that taro-root, pumpkins and garlic are restricted.

One CHW in the intervention area reported that most people do not complete all four visits, one CHW said that the fourth visit is very uncommon as it is difficult for pregnant women to walk up to the health facility, another CHW said that pregnant women are negligent about the need to complete four visits. The CHW from the comparison area reported that, pregnant women generally complete all four ANC visits unless they are shy, occupied with other household chores or restricted by their mother-in-law.

Community practices on care during delivery: CHWs from the intervention area reported that delivery at the health institution is not a common practice, with only 1-2 out of 5 deliveries happening at the health institution. Similarly, in the comparison area, CHWs reported that approximately 2 out of 5 deliveries are happening at the health institution. They implied that people are negligent about their own health and the health of their newborns or that delivery occurs at home due to poor transportation system.

Community practices on immediate newborn care: In both areas, CHWs reported that the majority of babies are given bath after 24 hours these days, as people are aware that early

bathing may result pneumonia or hypothermia. CHWs reported that the applying something on the cord such as turmeric powder or mothers' food was common before but the people do not apply anything these days. CHWs reported that a sterile blade is being used by most of the people, but they also reported the use of sickle or bamboo blade in some cases, both in intervention and comparison areas. Most of the CHWs reported that nothing is applied on the cord, except for one CHW from the comparison area reporting the use of *Betadine* (providone iodine). CHWs reported that the initiation of breastfeeding is immediate after the separation of cord from the placenta, usually within 1 hour of birth and that colostrum are fed. CHWs reported that exclusive breastfeeding is practiced for 2-3 months in the intervention area. In the comparison area, CHWs reported that feeding foods other than mother's milk is a common practice. CHWs reported that breastfeeding is continued for 1-3 years in both intervention and comparison areas.

Community practices on care of postnatal mothers: The CHW from both the intervention and comparison area reported that postnatal and lactating mothers are provided with frequent meals in contrast to the pregnancy. CHWs also reported that there are no specific restrictions in food during post natal period, except one CHW reported that taro-root, pumpkins and garlic are restricted like during pregnancy.

Community practices on decision making for care seeking: CHWs reported that most of the decisions are taken by senior members of the family, usually by the mother-in-law or father-in-law. However, CHWs reported that they involve the women in the decision making process on the matters related to seeking antenatal or delivery care from the health facility.

Community practices to be promoted: CHWs reported that there are some families who follow recommended practices for good health of mother and newborns, such as providing nutritious food for pregnant and lactating mother, providing rest, delaying bathing for first 24 hours, and immediate breastfeeding; and these practices are similar in both intervention and comparison areas and should be promoted to other families.

Community practices to be discouraged: CHWs reported that some women, both in the intervention and comparison area follow some practices which are not recommended during

pregnancy and/or postnatal period such as to take-up heavy work such as fetching water, go to jungle for wood and grass within 4-5 days of delivery, do not allow mothers to go out from their home even when they have to seek health services, seek care from spiritual healer and drink alcohol. These practices are common especially among *Tamangs* and should be discouraged.

Summary: CHWs from the intervention area were found to be more knowledgeable than those from comparison area as a result of the training they received on newborn care. Though some of the recommended practices for better maternal and newborn care are not being followed universally, CHWs reported that they are being improved except among some ethnic groups (e.g. *Tamangs*). Regular monitoring and support is expected to maintain their ability to recognize and manage newborn illnesses and to promote good practices in the community.

4.5.5 Key informant interviews with school teachers

This section summarizes information from key informant interviews using a semi-structured guideline with female school teacher at primary level (one in each site). Information gathered from the school teacher is organized by community practices for care of pregnant and recently delivered women and newborns, services by the health facility and services by the FCHVs.

Table 4.5.5: Profile of key informant interview participants (school teacher)

Socio-demographic profile of participants in KIIs with school teacher

	Intervention area (Korak, Chitwan)	Comparison area (Palase, Makawanpur)
Number of teacher interviewed	1	1
Length of service	5 yrs	11 yrs

Community practices for care of pregnant and recently delivered women and newborns: School teachers, both from the intervention and comparison area reported that delivering at home and preparing for the clean home delivery kit is common. School teacher from the intervention area reported that people seek services from the maternal and child health worker only when there is any complication during delivery. In the comparison area, the school teacher reported recent shift in delivering at health institution especially after establishment of a birthing center and referring complicated cases to higher level of care.

Services by the health facility: In both intervention and comparison areas, school teachers mentioned major services being delivered by the health facility for women during pregnant (e.g. antenatal check-up, distribution of iron tablets), delivery (e.g. information on importance of delivering at health institution) and post-natal and newborn period (e.g. postnatal check-up, immunization for newborns, care of low-birth weight babies). School teachers were found to be knowledgeable on availability of services and satisfied with the regularity of those services in both areas. However, the school teacher from the comparison area is a bit skeptical on the level of awareness among families from the remote part of the village on availability and importance of services for mothers and newborns, indicating need to make an effort to disseminate information in remote areas.

Services by the FCHVs: In the intervention area, school teacher reported that FCHVs are educating women and their families about better care of newborns e.g. danger signs of newborn illness and importance of immunization, however she reflected that some community people don't care and value much about the information that the FCHVs are disseminating. In comparison area, the school teacher reported that FCHVs are generally the first point of contact for basic health services and they do visit the postnatal mothers to assess their health condition. In comparison area, the school teacher reported that FCHVs play an important role in dissemination of information regarding care of pregnant, postnatal mothers and newborns and are the first point of contact of community people when care or services are needed. School teacher from the intervention area reported that FCHVs are in need of backstop support to delivery better services in their communities and to build community trust on their services.

Summary: School teachers echoed that community practices for better newborn care is being improved, but still poor in some sections of the community. Generally, the services delivered by the health facility and volunteers are satisfactory, but continued backstop support is necessary to maintain their knowledge, skills and motivation. Not any significant differences were observed in the opinion of school teachers between intervention and comparison areas.

4.6 Triangulation of information

This study utilizes data from different sources and methods to analyze the situation of and progress in newborn health in Nepal. Section 4.1 analyzed trends and equity of progress, section 4.2 described the outcomes of propensity-score matching, section 4.3 assessed the impact of community- and home-based interventions on practices during pregnancy, delivery and the postnatal period using DHS data, section 4.4 examined the impact of community- and home-based interventions on practices using MIS data, and section 4.5 analyzed enabling and restraining factors to improve neonatal health in Nepal from a socio-economic, cultural, geographic and health system perspective using qualitative approaches. **Table 4.6** summarizes the major findings obtained through different components of this study.

Table 4.6: Overall findings from different data sources and types of analysis

SN	Analysis	Major findings
1.	Trend and equity analysis	While neonatal mortality in Nepal decreased substantially between 1996 and 2011, no clear and consistent pattern emerges in the reduction of neonatal mortality across different sub-populations. Rate ratios (rr) and rate differences (rd) are relatively stable during this 15-year period. Both relative (rr) and absolute (rd) inequalities are more pronounced for wealth, and less pronounced for mother's education, caste and ethnicity and geographic features (urban-rural, ecological regions, developmental regions).
2.	Impact analysis using Demographic and Health Survey data	Improvement was observed in some indicators (antenatal care seeking, delivery at health institution, delivery assisted by skilled birth attendants, immediate newborn care practices, and postnatal care visits), but these improvements are similar in both intervention and comparison areas. Neither difference-in-differences analysis nor multivariable regression analysis suggests a significant improvement in aggregate outcomes (i.e. birth preparedness, antenatal care, delivery by skilled birth attendant, immediate newborn care and postnatal care) as a result of the CB NCP.
3.	Impact analysis using Management Information System data	Training coverage is satisfactory as a majority of service providers were trained. Overall, health providers' knowledge and skills are fair, with some variation by type of health provider. Great variation between districts points to concerns in quality of training and supervision. Availability of key medicines and supplies was relatively good. Improvements in antenatal care seeking, delivery at health institution, delivery by skilled birth attendants and postnatal visit were observed after the intervention period in both intervention and comparison areas. Only antenatal care seeking and postnatal care visits were found to have increased

SN	Analysis	Major findings
		in more pronounced ways in the intervention area than in the comparison area; the statistical significance of these differences could not be assessed.
4.	Enabling and restraining factors from a of socio-economic, cultural, geographic and health system perspective	Overall access to health services, as well as knowledge about care for pregnant women, recently delivered women and newborns improved. Some people are, however, skeptical about some of the recommended practices (e.g. delayed bathing) due to their deep-rooted beliefs and thus continue traditional practices. Distance from the health facility and from FCHVs, lack of faith in the medicines available in government facilities, and the financial burden associated with seeking care (e.g. travel cost) and following recommended practices (e.g. buying fruits and meat for the mother) remained a concern for many families. A routine postnatal care visit is not considered necessary or valued.

The analysis based on DHS data, using difference-in-differences as well as multivariable regression techniques, and the analysis based on MIS data, using difference-in-differences, both suggest that the CB NCP has not achieved any marked improvements in key behaviors to promote neonatal health during delivery or the antenatal and postnatal periods. While each of these data sources has its specific strengths and limitations (see Discussion), the fact that both analysis suggest the same lack of impact lends credibility to the findings. The qualitative data reflects the perspectives of those delivering the program (e.g. health care providers) and those benefiting from the program (e.g. pregnant women) ,and offers some explanation for this lack of impact as well as potential entry-points for program improvement. What can be learnt from bringing together the findings across the different components of the study is illustrated through the following examples:

Birth preparedness: DHS data did not show any improvement in birth preparedness practices, and the qualitative study showed that people do not realize the value or importance of such practices. Although they were informed about the necessity of different aspects of preparation by the program, putting such preparations into practice is usually restricted by socio-economic conditions and cultural beliefs. The focus groups with recently delivered women reflected that some women and their families believe that making preparations before the birth may bring bad luck and should be avoided. Current behavior change communication efforts in the CB NCP are primarily focused on improving knowledge

by disseminating information through mass-media or printed materials rather than on addressing underlying beliefs and attitudes or helping families to actually follow recommendations through face-to-face communication.

Care-seeking during the antenatal period, delivery and the postnatal period: Overall, many of the intermediate factors that might improve newborn survival (e.g. institutional delivery, antenatal care-seeking) are improving in relatively even ways in both intervention and comparison areas as reflected by the DHS and MIS data. The CB NCP was anticipated to provide more frequent interaction between pregnant women and FCHVs to discuss the importance of institutional delivery as well as care seeking during the antenatal and postnatal periods and to extend support when needed (e.g. accompanying the women to the health institution for delivery). Qualitative data suggest that some areas within the intervention districts are still out of the reach of health facilities and FCHVs, indicating that the program is not reaching hard-to-reach sections of society. The program puts an emphasis on the follow-up visits for the mother and newborn and on an integrated financial incentive system for FCHVs to make those visits. As a result, postnatal visits were found to be gradually improving in the intervention area than in the comparison area as indicated by the DHS and MIS data.

Care seeking for sick newborns is limited as shown by the MIS data (the DHS data do not provide information to assess this), and the qualitative study revealed cultural restrictions during the immediate postnatal period, such as not allowing new mothers to go outside the premises until the name giving ceremony. This is likely to affect recognition of the need for medical care and thus lead to delays in care seeking. The qualitative data also suggested that private medical clinics or drug-retailers provide cheaper, more flexible and friendly services than government health facilities, by not charging any consultation fee and opening during morning and evening hours. Moreover, communities believe that the quality of medicines available in private medical clinics and drug-retail shops is superior to those in government health facilities. It is therefore apparent that a significant proportion of sick

newborns are either taken care of at home, or taken to be seen by the informal sector. This is at least one significant contributor to poor utilization rates of the government health system, as measured in the MIS data.

Pregnancy, delivery and the postnatal period are considered to be normal human life events rather than a period that needs regular medical consultation, as reflected by participants in the focus group discussions. Seeking medical care is considered only, if newborns or their mothers present with an obvious health problem. Therefore, postnatal care visits are still very infrequent, as shown by both DHS and MIS data.

In conclusion, the use of multiple data sources and mixed methods in this study enabled a more in-depth understanding of CB NCP-generated changes or a lack thereof. Thus, this study not only quantitatively documents the changes in key practices influencing neonatal health but also provides some explanations as to why such changes did not occur to the extent expected. In summary, despite having knowledge about the importance of preparing for the arrival of a baby, it is not a regular practice due to a limited understanding of the value of preparation and the consequences of not being prepared, as well as socio-cultural beliefs. Utilization of antenatal care and delivery at a health institution is improving evenly in both intervention and comparison areas, suggesting that the CB NCP program did not make an additional effort to reach the un-reached and to enable them to utilize the services. Postnatal care is found to be gradually improving, because of the incentives for the providers and as the rate was relatively very low.

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5. Discussion

5.1 Strengths and limitations

This study utilizes multiple methods to answer two main research questions: 1) trend and equity analyses of neonatal mortality in Nepal to describe and analyze the current situation and progress in neonatal mortality, and 2) a mixed-method quasi-experimental approach, which comprises quantitative and qualitative data from different sources to analyze the impact of the community-based newborn care package pilot and to assess socio-cultural, geographic and health system factors that enable or restrain improvements in newborn health. Data from different sources are collected, compiled, analyzed and contrasted to triangulate overall findings and conclusions. Although the different data sources used in the study have their own limitations, the study draws its major strength from the data triangulation process. In the following section, key strengths and limitations in design, data collection and analysis are discussed for each major study component.

5.1.1 Trend and equity analysis

Data used for the trend and equity analysis were from the Nepal Demographic and Health Survey for four survey periods (1996, 2001, 2006 and 2011). The DHS represents a gold-standard approach for large-scale nationally representative surveys, as the data collection tools are standardized, pre-tested and administered in local languages by highly trained and supervised enumerators. (Corsi et al., 2012) Indeed, this survey has been conducted repeatedly in more than 70 low and middle-income countries since the early-1980s, resulting in a process of continuous improvement over time. Rigorous cross-checking for inter-respondent validity of each survey provides a clean dataset for analysis.

Strengths:

- → *Design*: Use of standardized means of trend analysis (i.e. annual rate of reduction) and standardized ways of calculating neonatal mortality
- → *Data*: Nationally representative data for multiple time-periods; standardized data collection and reporting carried out at multiple time points

→ *Analysis*: Use of multiple dimensions of equity measurement (i.e. rate difference for absolute inequality, rate ratio for relative inequality) across different socio-economic, geographical and ethnic indicators

Limitations:

→ *Data*: Data collection strategy and sample size not customized for representativeness at all desired levels (e.g. neonatal mortality by caste and ethnicity); therefore, the comparison of rate differences and rate ratios and their changes across time must be made with caution;

→ *Analysis*: Equity analysis used two extreme groups rather than assessing the gradient across all groups; due to limited sample sizes, neonatal mortality was calculated for the last ten years preceding the survey, resulting in sample overlaps between estimates for different points in time

5.1.2 Impact analysis using Demographic and Health Survey data

As indicated in section 5.1.1, data used for the difference-in-differences analysis are from the Nepal Demographic and Health Survey 2011, which offers multiple advantages and some limitations as described above. In relation to the impact analysis, the following strengths and limitations are of particular significance:

Strengths

→ *Design*: An a priori conceptual framework (**Figure 3.3.4**) was employed to define the outcomes of the intervention. Propensity score matching, a technique recommended when randomization is not feasible or appropriate, was used to select comparison districts for better comparability, and resulted in balance for most key variables between intervention and comparison areas. Selection of births for analysis (i.e. before, during and after intervention period) was customized according to district-specific intervention time-points, and the analysis excluded births taking place during the intervention period (i.e. while training of health providers was ongoing).

→ *Data*: The DHS provides a range of health indicators (i.e. context, knowledge, practice) with standardized definitions for major variables of interest (e.g. skilled birth attendant) *Analysis*: Analysis was carried out among the most recent births only to avoid non-independence of observations (due to multiple births per woman) and to reduce recall bias; use of multiple analysis approaches (e.g. difference-in-

differences and univariate/multivariable regression analysis) helped to examine the effect with and without adjustment for possible confounders

Limitations

- *Design*: As this is a non-randomized study, some differences between intervention and comparison areas were observed even before the intervention despite use of the propensity score. This study did not match individual intervention and comparison districts but rather matched aggregate intervention and comparison areas.
- *Data*: As DHS are cross-sectional surveys with retrospective recording of births, deaths and behaviors, the data may be subject to recall bias; DHS data are designed to be representative at the national level but may not necessarily be representative at the district level; measurement of health impact (i.e. neonatal mortality) was not feasible due to limited sample size for sub-national data, and thus limited to intermediate behavior level indicators (e.g. utilization of services); information on all outcomes of interest for this study (e.g. treatment of newborn infection) is not available in the survey as it is not designed specifically to evaluate this program; the number of births included in this analysis is also limited, especially for the post-intervention period, as exposure time to the intervention was short (ranging from 5 to 12 months) (533 for intervention and 347 for comparison area before intervention; and 168 for intervention area and 103 for comparison area after intervention) and thus there is limited power to reflect true changes between these groups.
- *Analysis*: Adjustment through design or analysis for newborn health programs in the comparison area was not feasible, which might be an important underlying reason for the observed changes or lack thereof in intervention versus cmoparison areas. As we tested multiple outcome variables, there is a risk of some results being statistically significant by chance alone.

5.1.3 Impact analysis using MIS data

MIS offers routine data across the country with minimal human and financial resources and can be used to monitor the CB NCP program over prolonged periods of time. Key strengths and limitations of MIS data and their analysis are described below:

Strengths

→ *Design*: Use of the set of comparison districts identified through propensity score matching; selection of births for analysis (i.e. before, during and after intervention) was customized by district-specific intervention time-point and the analysis excluded births during the intervention period

→ *Data*: With easily and routinely available data from community to hospital level, HMIS data for each district are available on an annual basis; the specifically set up NHIS is a unique source of data which provides data on newborn programs from pilot districts and is more detailed than HMIS data (e.g. number of providers trained, number of newborns with infections treated with antibiotics); detailed health service utilization indicators are available; data quality problems in HMIS data (e.g. under- and over-reporting of specific indicators) are generally expected to be balanced between intervention and comparison areas

Limitations

→ *Design*: Simple difference-in-differences calculations are subject to multiple sources of bias

→ *Data*: Issues in overall data quality due to incomplete and inconsistent reporting by health workers and FCHVs either due to lack of skills or lack of recognition of the value of data; likely over-reporting due to incentive schemes for certain indicators (e.g. higher number of newborns weighed than births recorded); facility-based data among only those who utilize government health services is subject to substantial selection bias; some data are only available for intervention districts undermining the ability to make comparisons; limited sample sizes, especially for the post-intervention period, as the exposure time to the intervention was short (ranging from 5 to 12 months)

Analysis: Limited to descriptive analysis primarily for NHIS

5.1.4 Enabling and restraining factors to improve newborn health

Qualitative information offers much added value to the information obtained through quantitative methods, however, its unique strengths and limitations must be assessed carefully.

Strengths

→ *Design*: Purposive selection of study sites, a process considered good practice in qualitative research, identified comparable sites; a sufficient number of focus group

discussions and key informant interviews were held to approach saturation (i.e. no additional insights generated from additional FGDs or KIIs); both provide in-depth insights into local phenomena from a range of perspectives.

- → *Data*: The richness of the quotes generated helps to explain why something is happening or not happening; FGDs with multiple respondents from different backgrounds (beneficiaries and their family members) and across generations (new mothers and their in-laws); information from KIIs provides an opportunity to compare and contrast information from the different perspectives of providers (i.e. CHWs) and independent community informants (i.e. school teacher) about what is expected and what is actually practiced; socio-culturally appropriate interviewers/discussion facilitators and choice of setting where FGDs and KIIs could be conducted in an environment of open and friendly discussions; FGDs and KIIs were audio-recorded as well as detailed notes taken, transcriptions and translations were verified by a second person which enhanced overall data quality
- → *Analysis*: Through the use of thematic analysis, the analysis was conducted without any prior assumptions, letting the information as presented by FGD participants and KII respondents speak for itself

Limitations

- → *Design*: Study covers limited sites for qualitative component, and insights generated may not apply throughout intervention and comparison areas.
- → *Data*: In some FGDs several questions were asked by the FGD facilitator as leading questions, which might have resulted in bias in the information provided by respondents, although this was carefully considered during analysis
- → *Analysis*: Thematic analysis was carried out by a single person, not by two persons independently as recommended in qualitative research, although regular advice was provided by a second person

5.1.5 Combining multiple data sources and approaches

In a real-life scenario, impact evaluation of a complex population-level intervention is rarely feasible through randomized controlled trials, and quasi-experimental studies represent the best possible design (Ho et al., 2008, O'Cathain et al., 2010). We employed such a quasi-experimental approach by using propensity score matching to select comparison districts; this resulted in intervention and comparison areas that were largely balanced, which

increases the reliability of our findings. (Rosenbaum and Rubin, 1983, D'Agostino, 1998, Austin, 2011) In addition, any remaining differences were taken into account through adjustment for confounders in the regression analysis. Mixed-method studies combine elements from both qualitative and quantitative paradigms to produce converging findings in the context of complex research questions, and employing these methods can generate important new and more in-depth insights. (Lingard et al., 2008) Indeed, the lack of CB NCP impact for many of the important practices can at least partly be explained by the findings offered through the qualitative analysis.

This study has attempted to gather the most appropriate available data from multiple routine sources – some available in the public domain, some only available upon request from the Ministry of Health and Population– to generate in-depth insights into process indicators (e.g. number of people trained, impact of training on knowledge and skills of health providers) and outcome indicators (e.g. immediate newborn care practices). Drawing on such multiple data sources not only allows to validate results (e.g. data from DHS and MIS showing similar findings) but also paints a much more detailed picture than any individual data source could provide. (O'Cathain et al., 2010) In view of the real-life limitations imposed on the evaluation of large-scale, complex programs such as the CB NCP, whose implementation in ten pilot districts had commenced before the design of an evaluation study was possible, we believe that the quasi-experimental, mixed-method design employed here represents the best possible approach. (Victora et al., 2004) Given its use of multiple data sources and types of enquiry, this study generates fairly reliable insights to understand the (lack of) effect of the program as well as the program's strengths and limitations. (Lingard et al., 2008, O'Cathain et al., 2010)

5.2 Locating findings in literature

5.2.1 Equity and trend

The equity and trend analysis did not show a clear and consistent pattern in relation to reduction of neonatal mortality in Nepal. Equity indicators measured as rate ratio and rate difference are relatively stable between 1996 and 2011. Inequality is more pronounced for wealth and less pronounced for mother's education, caste and ethnicity and geographic features (urban-rural, ecological regions, developmental regions).

On a positive note, Nepal's rate of reduction in neonatal mortality is higher than in South-Asia and globally. (Lawn et al., 2012, Pradhan et al., 2012) However, the share of neonatal mortality in under-five mortality is increasing and inequality in neonatal mortality remains a concern. (Paudel et al., 2013, Rajaratnam et al., 2010) The result from this and other studies clearly indicates wide disparity in progress in neonatal mortality rate reductions. (MOHP, 2008, Nguyen et al., 2013) For most of the variables, both relative inequality (measured as rate ratios) and absolute inequality (measured as rate differences) were relatively stable, with some fluctuations. Other studies looking at inequality in reduction in neonatal mortality in Nepal also suggested that although there is a downward trend in absolute inequality, the relative inequalities appeared to have remained stable over time. (Nguyen et al., 2013)

5.2.2 Impact of community- and home-based interventions

Some improvement has been observed in the aggregate outcomes (birth preparedness, antenatal care seeking, delivery at health institution, delivery assisted by skilled birth attendants, immediate newborn care practices, and postnatal care visits), but these improvements are generally similar in both intervention and comparison areas. Both difference-in-differences and multivariable regression analyses did not show any significant improvement.

A meta-analysis in a systematic review of home visits by community health workers to prevent neonatal deaths in developing countries showed a 38 percent reduction in neonatal mortality (Gogia and Sachdev, 2010) and the studies included in the review included more rigorous prescribed home visits by dedicated health workers than existing health care providers in the CB-NCP. A Cochrane review of community-based intervention packages for reducing maternal and neonatal mortality and morbidity and for improving neonatal health outcomes showed a 24 percent reduction in neonatal mortality.(Lassi et al., 2010) Based on several studies conducted in South-Asia and focusing on community- and home-based interventions to improve newborn health (Arifeen, 2013, Tinker et al., 2010, Bang et al., 1999, Baqui et al., 2008, Bhutta et al., 2008, Kumar et al., 2008, Manandhar et al., 2004), community based newborn care through home visits, home-based treatment of illness and community mobilization can reduce newborn mortality by 20 to 62 percent (see **Table 5.2.2**).

Table 5.2.2: Evidence on community-based newborn care from South-Asia

Study, Country (timeframe)	Design	Population Coverage	Delivery approach	Interventions			Neonatal mortality reduction
				Home visit	Home treatment of illness	Community mobilization	
SEARCH India (1993-1998)	1 intervention and 1 control	81,147	project's village health worker	x	x	x	62%
Projahnmo Bangladesh (2001-2006)	Cluster randomized trial	500,000	female community health worker	x	x	x	34%
Shivgarh India (2003-2006)	Cluster randomized trial	104,123	community health worker	x		x	50%
Hala Pakistan (2003-2005)	Pilot (4 vs 4 cluster)	138,600	lady health workers and traditional birth attendants	x		x	20%
Makawanpur Nepal (2001-2003)	Cluster randomized	400,000 (28,931 women)	female facilitator conducting monthly meetings			x	30%

Source: (Arifeen, 2013, Tinker et al., 2010, Bang et al., 1999, Baqui et al., 2008, Bhutta et al., 2008, Kumar et al., 2008, Manandhar et al., 2004)

A study conducted in Gadchiroli, India (Bang et al., 1999) showed that neonatal mortality can be reduced by 62 percent in intervention areas through home-based neonatal care and

management of neonatal sepsis. Baqui and colleagues in Bangladesh showed that a home-based integrated package of preventive and curative newborn care is effective in reducing neonatal mortality.(Baqui et al., 2008) A study among tribal and rural population of eastern India showed that community mobilization through participatory women's groups resulted nearly one-third reduction in neonatal mortality. (Tripathy et al., 2010) Similarly, a behavior change approach to prevent high-risk newborn care practices showed substantial behavioral modification and reduced neonatal mortality. (Kumar et al., 2008) Another study from rural Pakistan confirmed that community health workers can effectively help improved home care practices by families, increased care-seeking behavior and greater utilization of skilled care providers. (Bhutta et al., 2008) A study conducted in a Central Hill district of Nepal used a focused action-learning cycle about perinatal health outcomes, facilitated by a dedicated female facilitator. It showed that this intervention with women's groups can reduce neonatal mortality by 30 percent (Manandhar et al., 2004).

Multiple studies from South Asia showed that topical application of chlorhexidine was effective in reducing neonatal mortality by 23 percent (Hodgins et al., 2013, Mullany et al., 2006, Mullany et al., 2009, Soofi et al., 2012). Other studies in Nepal showed that an improvement in the neonatal services using the resources available under the government's primary healthcare system, was feasible (Hodgins et al., 2010, Khanal et al., 2011) These evidences provided hope that improvement in neonatal care is effective and feasible through existing primary care health care system of Nepal and CB NCP was developed.

5.2.3 Enabling and restraining factors to improve newborn health

We gathered information from multiple FGDs and KIIs to better understand those factors that enable or restrain progress with neonatal health in the community setting in Nepal. Our qualitative study provided some valuable insights on this matter, sometimes by confirming the results obtained from the quantitative data or explaining these, and sometimes

challenging quantitative insights. In the following, our findings are compared with those of other relevant qualitative studies conducted in Nepal.

Pregnancy and child birth is considered a special life-time period both physiologically and culturally and thus mothers and newborns are provided with better care at home or at the home of the pregnant woman's in-laws (Kesterton and Cleland, 2009). Yet, pregnancy and child birth are not perceived as conditions that require frequent medical check-up. (Kaphle et al., 2013) but utilization for antenatal and delivery services is increasing recently.(Powell-Jackson et al., 2009)

Transportation and communication are still poor in many remote parts of Nepal, but they are improving and enabling better access to health services than in the past. Perceived quality of care and convenience are key factors for service utilization. In many remote areas, medical shops are more convenient and preferred over government health facilities in Nepal. (Mesko et al., 2003) Though there is a provision of compensation for the transport services through national *Aama* program, going to hospital for delivery is associated with significant informal payments or unexpected expenses.(Simkhada et al., 2012) As a result, unless there is any remarkable danger sign, some women prefer to deliver at home as either the health facility is too far, or expensive or felt unnecessary by the women. (Shrestha et al., 2012, Simkhada et al., 2012, Dahal, 2013) FCHVs and mass media play in disseminating maternal and newborn care messages. However, knowledge by itself is not sufficient to achieve behavior change, especially in view of prevailing cultural norms and values in Nepal. (Beun and Wood, 2003, Kesterton and Cleland, 2009)

In Nepali culture, the mother-in-law plays a crucial role with respect to care seeking (Thapa and Niehof, 2013) as well as household-level care for pregnant women, recently delivered women as well as newborns, and many of them are guided by their own experience and tradition. (Kaphle et al., 2013) Our FGDs also revealed that some traditional opinions and

practices regarding postnatal seclusion prevail. Some respondent shared that the postnatal seclusion is a good practice as they can get more rest and recover their health, whereas others were keen to receive proper care during this period. As a postnatal mother is considered ritually polluted (Manandhar, 2000, Kaphle et al., 2013) until the name-giving ceremony or until the umbilical cord falls off, this imposes barriers to seeking care, even when mother or newborn are sick. Earlier studies also indicate that there is an increased tendency to watch and wait in the postnatal period limiting timely care seeking from health providers. (Mesko et al., 2003, Dhakal et al., 2011)

Being shy to go to health facilities for antenatal services, delivery and postnatal services is also a barrier to seek care for antenatal, delivery and postnatal care in Nepal. Other studies done in Nepal also showed that shyness among the pregnant women and/or their husband limits their contacts with health care providers and the ability to discuss pregnancy and preparations for birth. (Thapa and Niehof, 2013, Shrestha et al., 2012) Some food taboos such as restrictions to eating fruit during the postnatal period as most fruits are cold items and believed to cause neonatal cold or pneumonia in some Nepali families, which may result deficiency of some micronutrients.

5.3 An attempt to explain the limited impact of the intervention

Unexpectedly, the CB NCP did not show any significant improvements in intervention districts relative to comparison districts. Offering explanations for the lack of impact of the CB NCP to date is very important in view of the continued implementation of the program in the pilot districts and its scaling up to remaining districts across the country. There are some possible reasons that can explain why the CB NCP did not show an impact in this study, and these are grouped into four major headings.

a) Complex intervention package and delivery mechanism:

The CB NCP is a package of multiple interventions delivered through a complex network of different cadres of health workers with a complicated data tracking system. Program

delivery is primarily targeted through FCHVs who have only basic health care knowledge and skills, but need to acquire a range of skills and whose presence is demanded at specific and unpredictable times (at the time of delivery with follow-up on days three, seven and 28). Provision of incentives for their functions and record-keeping of all pregnancies and outcomes is not an easy task for illiterate or semi-literate FCHVs. Both technical design and implementation modality of the community- and home-based newborn care package are complex due to the integration of multiple interventions in a package (relatively simple components, e.g. hand-washing, and complex components, e.g. resuscitation using bag-and-mask for asphyxiated baby), and due to the diverse roles for different health service providers (e.g. SBA to take care of mother and FCHV to care take of the newborn). CB NCP was developed based on evidence from different trials and studies within Nepal and neighboring countries. (KC et al., 2011) Evidence of effectiveness exists for most of the individual components, e.g. community health workers' ability to diagnose and treat newborn infections (Khanal et al., 2011); however evidence on the effectiveness of a "comprehensive package" of these interventions is lacking (Pradhan et al., 2011). It is possible that when several interventions are combined in a package, the overall effectiveness gets diluted due to the dispersed attention of service providers and their limited ability to retain required knowledge and skills and limited oversight by supervisors and managers.

Multiple studies from South Asia showed that topical application of chlorhexidine was effective in reducing neonatal mortality by 23 percent (Hodgins et al., 2013, Mullany et al., 2006, Mullany et al., 2009, Soofi et al., 2012), but chlorhexidine was not integrated with the CB NCP. This can be considered a missed opportunity, as many Nepalese newborns are exposed to substances that may result in cord infections (Mullany et al., 2007, Karas et al., 2012) and as this relatively simple and cost-effective intervention could have been delivered using the same implementation approach without further complicating the overall program.

b) Implementation intensity and quality:

Most of the evidence related to community- and home-based interventions from Nepal and other South-Asian countries is either derived from studies conducted in a limited geographic area (e.g. MIRA (Manandhar et al., 2004)), implemented through a dedicated cadre of high-level service providers (e.g. SEARCH (Bang et al., 2005)), or undertaken as a rigorous research project with high-level health care providers (e.g. resuscitation (Msemo et al., 2013)) , or examining a single and relatively simple component (e.g. chlorhexidine for cord care (Hodgins et al., 2013)).

Most of the previous trials (Bang et al., 1999, Baqui et al., 2008, Bhutta et al., 2008, Kumar et al., 2008, Tinker et al., 2010) were implemented in relatively controlled setting, utilizing project-specific health workers focused on neonatal care and/or with specific incentives to ensure high-quality performance. The CB NCP was implemented only through the existing cadre of community health workers in the government system and FCHVs at the community level. The CB NCP program expects unpaid volunteers to make antenatal contacts and counseling as well as to hold monthly mothers' group meetings and discuss a wide range of health issues.(Poudel et al., 2012, Pradhan et al., 2011) As a result, intervention fidelity with respect to the regularity of these meetings and dedicated time and effort to discuss neonatal health issues cannot be assured.

A study using community-based participatory learning cycle activities showed remarkable reductions in neonatal mortality in India (Houweling et al., 2013, Tripathy et al., 2010) and Nepal (Manandhar et al., 2004) but not in Bangladesh (Azad et al., 2010). This raises some concerns as to why and how such reductions are possible in one setting but not in other similar settings. It certainly suggests that context and intensity of implementation matter.(Victora, 2013) At a minimum, it can be concluded that the findings of community-

based interventions are sensitive to context, including socio-cultural, economic and geographic variation and thus require appropriate customization to guarantee impact.

While there is literature from Nepal which suggests that community health workers and FCHVs can identify and manage maternal and newborn health problems (Khanal et al., 2011), it requires frequent training, mentoring and follow-up. The data suggests a wide range of variation in performance of the program across districts, generally indicating better performance in areas with frequent and additional follow-up components than the districts implementing the intervention with less intensity. This finding raises concerns about the quality of implementation of the CB NCP. Our qualitative data suggest that there was great variation in CB NCP program performance as a result of differences in quality of implementation and geographic as well as socio-cultural variation. It can therefore be concluded that it is as important to implement the interventions in the right way, as it is to implement the right interventions.

c) Limitations in study design, sample size and study period:

Another important factor to be considered is the study design that we employed and the time frame required for program implementation to mature and to show an impact at population level. The data used in this study are based on a quasi-experimental design and analyzed using difference-in-differences as well as multivariable regression techniques. This study is not a randomized controlled trial, and thus may pose some selection bias. Even though propensity score matching largely achieved balance between intervention and comparison areas, some uncertainties remain.

Additionally, measuring impact of a relatively complex intervention with multiple outcomes is a challenge. Implementation of the training activities during the pilot phase took several months and varied by district. In many cases the program was not fully functional even after training of all health care providers due to delays in supplying key medicines and

technologies. The data used for this study (i.e. DHS and MIS) were collected within a few months to one year of implementation of the program, giving the study little time to observe any impact on behavior change. It is quite possible that such changes will become manifest over longer periods of time, once health providers have internalized new recommendations and implement them on a regular basis, and once a broader dissemination of new practices at the community level across a large number of pregnancies and deliveries has been achieved.

Data from the births after the intervention was gathered during a limited time period and consequently, numbers of births are relatively small. This limits this study's overall power and lack of significance in some results might be due to lack of adequate power in the study. Neonatal mortality is a relatively rare event, even in a high-neonatal mortality setting like Nepal; as a result, we were unable to examine the impact of the CB NCP on the ultimate outcome of interest in this study. Also, the care practices that affect newborn health are distributed in such a way that higher sample sizes to disaggregate findings and to precisely report impacts would be required.

Although the study tried to balance co-variates to select appropriate comparison sites, other programs are implemented in parallel in comparison as well as intervention areas, some of whom directly focus on newborn health (e.g. MIRA (MIRA, 2013)) and some of whom are related to maternal and child health or health system strengthening and thereby indirectly affect newborn health (e.g. Health Sector Support Program of German Technical Cooperation (GIZ, 2013). The impact of these programs might have contributed to better-than-expected indicators in the comparison area. Controlling for the impact of these programs is both highly challenging and beyond the scope of this study and, indeed, the objective was to examine the impact of the CB NCP up and above existing, ongoing activities to improve newborn health.

d) Equity and responsiveness to marginalized population:

This study raises some concerns on the equitable coverage of interventions as reflected in the trend and equity analysis as well as in qualitative analysis. Data from the study suggests that the program is not reaching those who are in greatest need (e.g. mothers with no education, indigenous groups) and inadequate to address socio-economic, geographic and cultural barriers (e.g. access and transportation in remote areas, affordability of care related to indirect expenses, decision making power among women, deep-rooted cultural beliefs that affect health of the mothers and newborns). Such inequalities are also reported by other studies (Nguyen et al., 2013, Pandey et al., 2013) in different magnitude and types and the study suggests that either the effort is lacking (e.g. reaching un-reached section of the village by facility-based health workers or community-based health volunteers) or inadequate to address these barriers (e.g. limited behavior change communication for delayed bathing despite community perceptions on the need of immediate bathing in case of home delivery).

The CB-NCP program was tight in packaging multiple and relatively complex interventions and relatively loose in terms of implementation modality, follow-up and thus the results should not be expected to be as marked as those reported in controlled trials. The program adopted a relatively passive approach to case finding for newborn illness. The profile of FCHVs, the training provided to them and the frequency of their contact with mothers is lower than in most other studies. We believe that the effectiveness of a program not only depends on the efficacy of its individual components, but equally on the focus on a particular topic, sustained effort on the matter of interest and components of motivations or incentives to the providers.

5.4 Programmatic and research implication

Overall, the study suggests major programmatic and research implications in the following areas:

a) **Equity considerations:** This study indicates that there is a wide gap in the rate of neonatal mortality between different socio-economic groups and that the rate of progress is uneven, both in terms of absolute and relative inequalities. To reduce neonatal mortality, programs should address areas and populations with higher neonatal mortality rates (e.g. rural areas, households with the least wealth, and disadvantaged caste and ethnic groups) and the groups with lower rates of progress over time (e.g. western region, *janajatis*, mother's with no education). Equity-focused program implementation, monitoring and evaluation should be the focus of future efforts.

b) **CB NCP program revision and continued monitoring:** This study focused on the impact of community- and home-based interventions to improve neonatal care practices, a proxy of neonatal mortality as improved practices are expected to lead to reduced mortality. Given the very recent implementation of the program , a longer-term evaluation is needed to better understand the impact of the CB NCP as the program matures and is scaled up. This can be achieved through the use of routine quantitative data supplemented with focused qualitative data to understand why the CB NCP is working or not working and how can it be improved. The fact that this study did not find the expected improvements in key practices raises concerns about the quality and effectiveness of the ongoing programs and may need further revision possibly with modular training that can be customized by district need and by ensuring quality control in implementation and regular follow-up .

   As this study provides a broad insight of community-based program, it would be beneficial to engage policy and program planners in those studies and mobilize

champions to develop a national strategy for community-based programs in Nepal. The recently completed assessment of the CB NCP is comprehensive and provides some strategic directions for future rollout, and assessment of the program should be continued once revised program is designed and implemented. In addition to the comprehensive review, specific focused studies are deemed necessary to better understand the feasibility and effectiveness of implementation (e.g. Are FCHVs capable of and interested in using bag-and-mask resuscitation to manage asphyxiated babies? Is it cost-effective to have these technical components together or should they be packaged differently?).

c) **Contextualize interventions and strategies:** Context matters a lot for implementation feasibility, community acceptability and utilization of community-based programs. Some of the evidence used to develop the CB NCP were drawn from other countries, where the socio-cultural setting (e.g. cultural beliefs on food taboos), the profile of the healthcare provider (e.g. lady health workers in Pakistan vs. FCHVs in Nepal) or the implementation modality (e.g. additional project-hired paid staff vs. existing unpaid volunteers) were very different from those in Nepal. Therefore, existing as well as newly generated evidence should be critically reviewed to understand what works and what does not in Nepal's context, and even in different geographic areas within Nepal. This study, primarily the qualitative component, suggests that there is strong involvement of other family members in the decisions related to maternal and newborn care, and it should be examined if the program adequately targets the relevant groups, in particular mothers-in-law.

d) **Importance of mixed-method research and better utilization of existing survey data:** This study employed an innovative method to measure program impact from multiple perspectives using quantitative data from different sources as well as qualitative data and triangulating information to draw overall conclusion. Use of a mixed-method approach for evaluation of a large-scale program using data from cross-sectional surveys, routine MIS, and primary qualitative data collection from

intervention and comparison sites attempting to explore and explain why improvement has been happening or not happening is the overall strength of this study. This type of study can be useful and cost-effective in the evaluation of complex public health and/or development interventions. In many developing countries like Nepal, data from nationally representative cross-sectional surveys and from the routine health information system are under-utilized except for standard reports, and this study provides an example of how such data can be used for program evaluation.

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6. Conclusions

6.1 Conclusions of the study

The Nepal Ministry of Health and Population in cooperation with multiple donors designed and piloted the community-based newborn care package to improve newborn care practices and survival in Nepal. This study utilized data from multiple sources to assess if progress in neonatal health over time has been equitable for different geographical, socio-economic and ethnic groups in Nepal; and to examine the impact of the community-based newborn care package on essential practices to improve newborn health.

The findings of the trend and equity analysis utilizing data from nationally representative DHS conducted between 2011 and 1996 indicate that the overall rate of progress is encouraging, with a 3.3 percent annual reduction in neonatal mortality. There is, however, a wide gap in the neonatal mortality rate between different socio-economic and geographic groups, both in terms of absolute and relative inequalities, measured as rate difference and rate ratio respectively.

The quantitative analysis of Nepal DHS and MIS data showed some improvements over time in essential practices to improve newborn health; however, generally speaking there are no obvious differences between the intervention and comparison areas. Some of these improvements (e.g. increased care seeking during the antenatal period, increased institutional delivery rates) are pronounced but, given equal findings for intervention and comparison areas, cannot plausibly be attributed to the CB NCP. Other improvements are only marginal (e.g. birth preparedness) and may well be due to general improvements in education and communication. The improvement in post-natal visits is notable in intervention area and could be due to the financial incentives for volunteers.

Lack of clear improvements as a result of the CB NCP can be explained by four groups of factors: i) intervention packaging and delivery mechanism were complex ii) implementation quality was questionable, iii) study approach, sample size and study period showed

limitations, and iv) program coverage was non-equitable and/or non-responsive to the needs of marginalized groups.

This indicates that the program may require re-packaging of content (e.g. emphasizing components with high burden and effectiveness and dropping components with lower burden and effectiveness) and revision of implementation modality. Careful attention to delivering the program as designed, as well as frequent and need-based support for service providers, especially during and shortly after training, is crucial. Regular monitoring of program coverage, quality and equity is needed. The program would benefit from in-depth formative research on why some of the recommended practices are not yet materialized and applying the findings of such studies for behavior change communication.

Further efforts are essential to explore program functionality in different geographic settings, to examine the effectiveness of different intervention components, and to monitor process using routinely available data. If packaged and implemented carefully, the CB NCP may contribute to meaningful reductions in neonatal mortality in Nepal.

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Annex 1: Ethical clearance

Nepal Health Research Council

Estd. 1991

NHRC

Ref. No. 1005

Executive Committee

Executive Chairman
Dr. Chop Lal Bhusal

Vice - Chairman
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National Planning Commission
Ministry of Health & Population
Chief, Research Committee, IOM
Chairman, Nepal Medical Council

April 7, 2011

Mr. Deepak Paudel
Principal Investigator
Center for International Health
Ludwig- Maximilian's University
Munich, Germany

Ref: Approval of Research Proposal entitled **Impact of Community-and Home-Based Interventions for Improved Newborn Care Practices in Nepal**

Dear Mr. Paudel,

It is my pleasure to inform you that the above-mentioned proposal submitted on 13 Feb 2011 has been approved by NHRC Ethical Review Board on 1 April, 2011 (2067-12-18).

As per the NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in the objective(s), problem statement, research questions or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of your research proposal and submit progress report and full or summary report upon completion.

As per your research proposal, your research is self-funded and NHRC processing fee is US$ 100.

If you have any questions, please contact our research section.

Thanking you.

Sincerely Yours,

Dr. Shanker Pratap Singh
Member Secretary

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Annex 2: Informed consent form

Dear _____,
Namaste!

I am _____, working for a research project of a PhD student from the Center for International Health at Ludwig Maximilians University of Munich, Germany.

I am here to collect some information for the study "*Impact of community- and home-based interventions for improved newborn care services in Nepal*." The study aims to assess the impact of community based newborn care program promoted and being piloted by the Ministry of Health and Population of Nepal in 10 districts of Nepal. The study will also explore the enabling and restraining factors to improve newborn care practices in Nepal. In this regard, you have been selected as a respondent(s) for this study. Thus, I would like to invite your participation in this study. We would very much appreciate your participation in this survey.

All information provided by you will remain strictly confidential. The information will not be disclosed to anybody specifying your identity. You are free to participate or decline to participate in the study at any point of time. This won't have any consequence of any form. The information that you will provide will be audio-recorded and noted down in the paper for further analysis by the researcher, but your personal identity will not be noted/recorded. The audio records and papers will be destroyed once the information analysis is completed.

Though there is no any direct benefit for you for participation in this study, the consolidated study findings will be shared at national and local level and will be utilized to design and modify appropriate newborn program for Nepal. The interview/discussion will take approximately 60 - 90 minutes.

I will be happy to clarify your queries/questions about the study and its purpose, if you have any.

If you agree to participate in the study, please provide your signature/finger print here:

Participant(s):_____ Date: _____

Interviewer: _____ Date: _____

Witness (if participant is illiterate): _____

Annex 3: Study tools

Key Informant Interview: Community Health Worker
Name of HF:_____ HF Type: _____HW Type: _____District:_____

1. How long are you working as a CHW in this area? ___

2. What are the major maternal and newborn care services do you provide? ___ Usually for how many mothers and newborns per month? ____ mothers, ____ newborns

3. What are the major Maternal, Newborn and Child Health related trainings that you received in last five years? __ BPP __ IMCI __ CB NCP__ CHX__ Other MNH

4. What are the items that people generally prepare for their birth in advance?
__ Money __Transport arrangement __ Blood donor__ SBA___ Place to delivery
___CHDK __Cloths for newborn __ Food for mother___ Other

5. What is the usual time to give bath to the newborn? Why?
__ Within one hr __Within the day __After 24 hrs___Other

6. What is applied in the cord of the newborn immediately after birth or in the newborn period? Why?
__Nothing__CHX__Other medicines__local herbs__Oil__Turmeric powder___Other

7. When do mothers initiate breastfeeding? Do they feed or throw the colostrums?
__Immediatly within 1 hr___Within 1 day___Other
__Throw only few drops__Throw for the first day__ Other

8. Usually, for how long women feed ONLY their breast milk for their baby? How long do they continue to feed their breastmilk?
___ months Exclusive ___ months continued breastfeeding

9. What are the food items women are encouraged to eat during their pregnancy and postnatal period? What is the usual frequency of food in this period?
Pregnancy: _____ Frequency: More than ususal/as usual/less than usual
Postnatal: _____ Frequency: More than ususal/as usual/less than usual

10. What are the food items women are discoursed to eat during their pregnancy and postnatal period? What is the usual frequency of food in this period?
Pregnancy: _____ Frequency: More than ususal/as usual/less than usual
Postnatal: _____ Frequency: More than ususal/as usual/less than usual

11. How many visits to HF or HW do women usually make during their pregnancy? Why or why not?
_____ visits, because _____

12. How many visits to HF or HW do women usually make during their postnatal period? Why or why not?
_____ visits, because _____

13. How many total deliveries do you remember in your locality in last six months? How many of them delivered at HF? How many by SBAs? Why people go to HF or get SBA assistance for delivery?
    ___ total deliveries ____at HF ___ at home ___ don't know
    Reasons for going HF/SBA:
    _____
    Reasons for not going HF/SBA:
    _____

14. Who usually cut the cord? What is used to cut the cord? What is applied in the cord?
    ___health worker__ traditional birth attendants___relatives___ other
    ___ safe instrument___ unsafe instrument
    __Nothing__CHX__Other medicines__local herbs__Oil__Turmeric powder___Other

15. Who usually makes the decision on the matter of where to give birth? Whom to call for assistance? What to eat and what not to eat?

16. In your opinion, what are the good practices regarding care of mothers and newborns in this community?
    Related to mothers:
    _____
    Related to newborns:
    _____

17. In your opinion, what are the bad practices regarding care of mothers and newborns in this community?
    Related to mothers:
    _____
    Related to newborns:
    _____

18. What are the activities being done by HF, CHWs and FCHVs to promote good practices and to discourage bad practices in this community?

	To promote good practices	To discourage bad practices
Health Facility		
CHWs		
FCHVs		

19. How do you identify sick newborns? What services do you provide for sick newborns?
    Danger signs:
    _____Others:_____
    Treatment with: _____Dose:
    _____
    Referral to:_____Counsel on:
    _____
    Others:
    _____

20. How do you identify newborns with birth asphyxia? What services do you provide for asphyxiated newborns?
    Signs of asphyxia:
    _____Others:_____
    Initial stimulation: _____ Use of DeLee suction:_____Use of bag and mask:_____Others:
    _____

21. How do you assess birth weight of newborns? How do you classify them to normal, low birth and very low birth weight? What are the services that you provide in specific situations?
    Birth weight: _____
    Classification:_____Normal_____Low birth_____Very low birth weight_____
    Services:____Refer to HF____Counsel for KMC__Counsel to keep baby warm and continue breastfeeding
    Others:_____

22. What are the key immediate newborn care that should be provided to newborn?
    ___Clearing the airway_____skin to skin contact or KMC_____ breastfeeding within one hour_____Others

23. What is your opinion on the services of health facility, CHW and FCHVs regarding the maternal and newborn services in this community?
    A. Competency of health workers and volunteers___
    B. Availability of drugs and supplies____
    C. Training and supervision support for health workers and volunteers____
    D. Community trust and acceptance of services____

24. What are the major changes in community practices, services from health facility and services from health volunteer in this area in past 5 years?
    Positive:
    _____
    Negative:
    _____

25. [ONLY FOR INTERVENTION AREA] What are the strengths and limitations of the CB NCP program?
    (probe: training content, training methodology, refresher and monitoring support, equipment and supplies, work-load, complication, community acceptance, FCHV satisfaction, cash incentives)

    Strength: _____
    Limitation:_____

Key Informant Interview: School Teachers

Name of School: _____ VDC/Municipality/District: _____

1. How long are you teaching here in this school?____ years

2. What are the common birthing practices in this community? Where do people prefer to give birth? Why? Who generally support or assist the mother while giving birth? Do people call TBA? Do people call FCHV? Do people use CHDK?

3. What are the services provided by HF, CHWs and FCHVs with regard to maternal and newborn care?
   HF: __ANC__PNC__Delivery__IFA__TT__BPP Counseling___Treatment of sick newborns__Management of LBW babies__KMC counseling__Asphyxia management

   CHW: __ANC__PNC__Delivery__IFA__TT__BPP Counseling___Treatment of sick newborns__Management of LBW babies__KMC counseling__Asphyxia management

   FCHV: __ANC__PNC__Delivery__IFA__TT__BPP Counseling___Treatment of sick newborns__Management of LBW babies__KMC counseling__Asphyxia management

4. Do people know about the services being delivered from the FCHVs for maternal and newborn care? Do they prefer to visit/consult FCHVs? Why or why not?

5. Do HFs have better skills and supplies to deliver maternal and newborn services? Do they open regularly to provide services? Do people know what is available where? Do they know the signs of illness that require immediate medical care for mothers and newborns?

6. Do FCHVs make regular home visits to educate and counsel mothers and families? What do they educate? Are they trusted by community for the information that they know and services that they offer to the community with regard to maternal and newborn care?

7. Do you think that FCHVs are properly supported by CHWs and HF? What do they receive from the HF?

Focus Group Discussion: Recently Delivered Women/Mother in Law/Father in Law/FCHV

District:_____ VDC: _____ Group: _____

1. What are the common practices for care of pregnant woman in this community?
   Probe: ANC, TT, Food taboos, Work load, Decision making role of women, men and Mother in laws

2. What are the common preparation before the delivery?
   Probe: Preparation for money, person to assist in delivery and cord cutting, blood donor, place to delivery, food for delivered mother, cloths for newborns.

3. What are the common practices during delivery?
   Probe: Who actually assists in delivery? role of TBAs, role of husband, role of mother in law, If delivered at home: where?

4. What are the common practices for newborn immediately after birth?
   Probe: Where to put the newborn? How to cut the cord? What to apply on the cord? How to clean the newborn? When to give bath? When to initiate breastfeeding? Do they feed colostrums or throw some colostrums? Immunization practice during newborn period?

5. What are the common practices for postnatal mother immediately after birth?
   Probe: Contact with newborn? Food and other care? Hygiene ? Postnatal check up?

6. What are the rituals during neonatal period? What are the exposures and restrictions?
   Probe: Concept of impure, name giving ceremony, restriction in movement, keeping together or away from mother

7. What are the major health problems among newborns? How do you identify danger signs that require medical treatment? Whom to seek care first?

8. What are the common practices for care of small (low birth weight) babies?

9. What do they do if the baby does not cry or does not breathe immediately after birth?

10. What are the services delivered by HF for mothers during pregnancy, delivery and postnatal period? How frequently do people use those services? Why or why not?

11. What are the services delivery by FCHVs for mothers during pregnancy, delivery and postnatal period? How frequently do people use those services? Why or why not?

12. What community behaviors and practices should be discontinued or discouraged to improve health of mothers and newborn in this community?

13. What community behaviors and practices should be promoted or continued to improve health of mothers and newborns in this community?

14. What are the major remarkable changes in this community in the last five years with regard to maternal and newborn health and survival?

Annex 4: Detailed HMIS data

Note: Time periods are the same within the 10 “district pairs”, one set in Nepali dates, the other set in Western dates. The key rows are the summary shaded rows at the bottom, which are weighted by district population. I=Intervention, C=Comparison, B=Before, A-After.

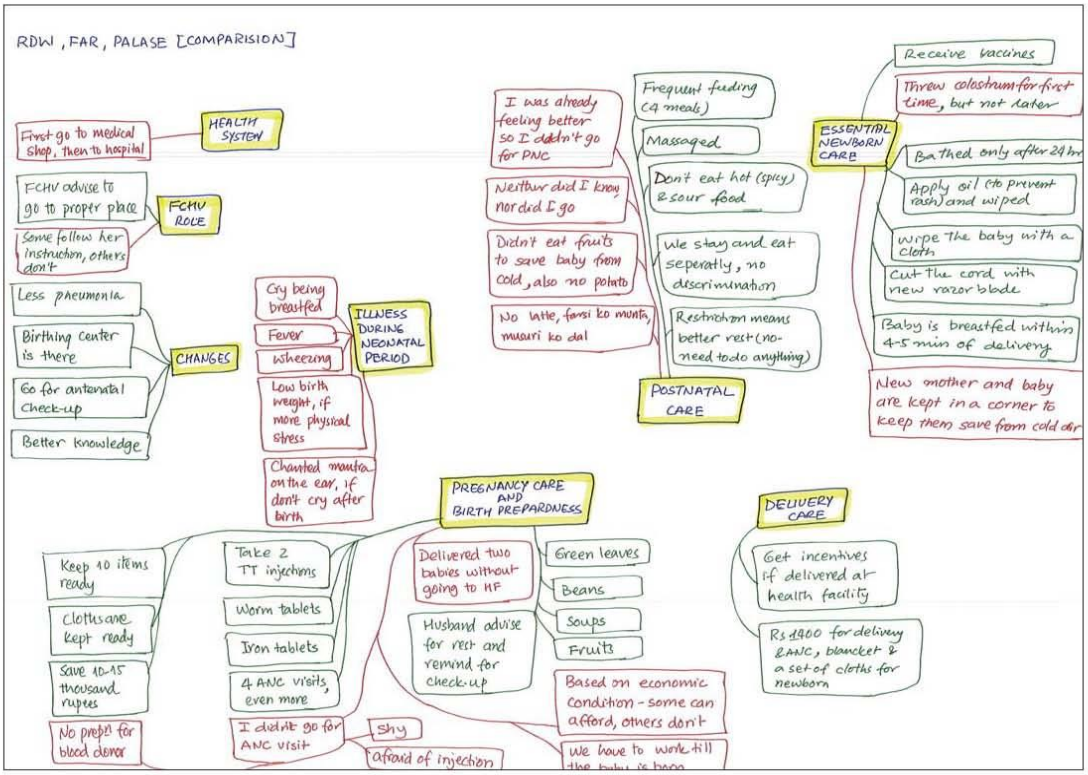
#	District	I-C	B-A	Indicator (%)											
				1 ANC	4 ANC	Iron supplementation	Facility delivery	Delivery by SBA/HW	Delivery by SBA	PNC visit	PP mother get VA	PSBI among <2m	LBI among <2m	LBW among <2m	Any case among <2m
1	Morang	I	B	63.7	33.2	79.7	24.3	28.0	25.2	43.7	52.8	2.4	2.9	0.4	6.8
		I	A	79.9	39.5	73.0	47.1	48.0	47.3	74.9	81.5	1.5	1.9	0.3	5.2
	Jhapa	C	B	86.6	41.1	69.5	27.3	36.0	28.6	43.8	43.8	0.3	1.5	0.3	2.1
		C	A	87.0	53.8	77.1	54.2	57.9	48.3	45.2	52.0	0.2	1.4	0.4	2.1
2	Sunsari	I	B	63.7	36.0	60.0	40.3	49.6	44.0	52.7	70.9	0.6	1.4	0.3	2.8
		I	A	79.8	42.6	70.1	59.8	61.2	60.0	65.5	85.3	1.2	1.9	0.8	4.7
	Udayapur	C	B	60.4	29.1	58.7	7.5	14.8	7.9	29.9	34.8	0.3	1.4	0.3	2.0
		C	A	70.1	41.7	59.7	16.1	24.1	16.5	39.8	43.5	0.4	2.1	0.3	4.2
3	Dhankuta	I	B	54.5	29.0	49.6	7.4	16.6	9.0	37.4	41.6	0.7	1.3	0.3	2.9
		I	A	58.7	34.3	52.2	11.4	19.0	11.8	41.6	45.0	0.9	2.8	0.8	6.6
	Sindhuli	C	B	52.1	23.5	80.0	9.8	33.0	16.5	33.8	39.8	0.3	0.3	0.1	0.7
		C	A	51.7	22.8	60.0	13.9	27.0	15.3	35.4	45.2	0.3	0.7	0.1	1.2
4	Kavre	I	B	68.7	35.9	62.1	22.5	26.6	23.4	30.7	47.2	0.3	0.7	0.1	1.3
		I	A	67.5	36.9	49.3	27.4	29.5	27.8	35.4	42.4	0.3	0.8	0.1	2.3
	Lalitpur	C	B	98.5	26.1	45.9	52.7	55.0	50.5	55.3	58.9	0.0	0.1	0.1	0.4
		C	A	89.6	65.4	0.0	63.2	64.2	59.8	65.9	68.2	0.0	0.0	0.0	0.0
5	Parsa	I	B	57.4	36.3	97.8	24.6	47.6	26.4	42.6	60.8	0.1	0.1	0.0	0.1
		I	A	77.2	47.8	0.0	22.0	23.4	5.7	37.5	61.4	0.0	0.0	0.0	7.0
	Dhanusa	C	B	79.3	44.2	93.6	30.6	69.4	35.9	49.7	57.2	0.2	0.5	0.2	0.4
		C	A	95.9	46.6	35.2	40.6	75.1	42.7	52.0	59.1	0.4	5.0	0.1	1.9
6	Chitwan	I	B	72.1	32.6	66.0	39.9	43.4	38.0	48.6	41.9	1.6	0.8	0.3	3.1
		I	A	91.8	46.7	60.8	45.6	47.4	46.1	56.3	29.8	0.8	1.4	0.2	7.1
	Makawanpur	C	B	51.6	24.3	60.8	12.7	14.8	13.0	29.4	42.1	0.3	0.7	0.1	1.1
		C	A	55.4	28.7	58.0	21.3	21.6	20.0	26.1	38.5	0.1	1.0	0.2	1.8
7	Palpa	I	B	88.8	34.3	66.2	22.6	29.9	24.3	42.8	61.9	0.1	0.6	0.3	1.3
		I	A	110.2	43.0	62.5	41.8	45.9	41.5	46.7	60.6	0.3	1.0	0.9	5.7
	Baglung	C	B	67.5	37.2	83.4	13.0	33.5	15.1	43.2	50.7	0.4	0.9	0.1	2.6
		C	A	72.7	44.1	73.8	22.9	39.7	23.9	48.2	50.0	0.6	2.3	1.0	4.4
8	Dang	I	B	74.5	37.1	76.8	22.1	26.5	22.9	44.9	52.2	0.4	1.5	0.3	2.5
		I	A	74.4	41.7	79.0	35.9	38.0	34.4	45.0	64.6	1.4	2.1	0.4	5.8
	Syangja	C	B	49.3	32.2	55.3	8.0	16.2	9.0	28.1	35.8	0.3	0.9	0.2	1.4
		C	A	63.2	42.2	58.2	14.4	19.3	14.3	28.9	43.3	0.1	1.0	0.1	1.7
9	Bardiya	I	B	79.6	48.8	80.3	12.7	19.8	14.1	40.8	49.5	1.2	1.8	0.4	3.4

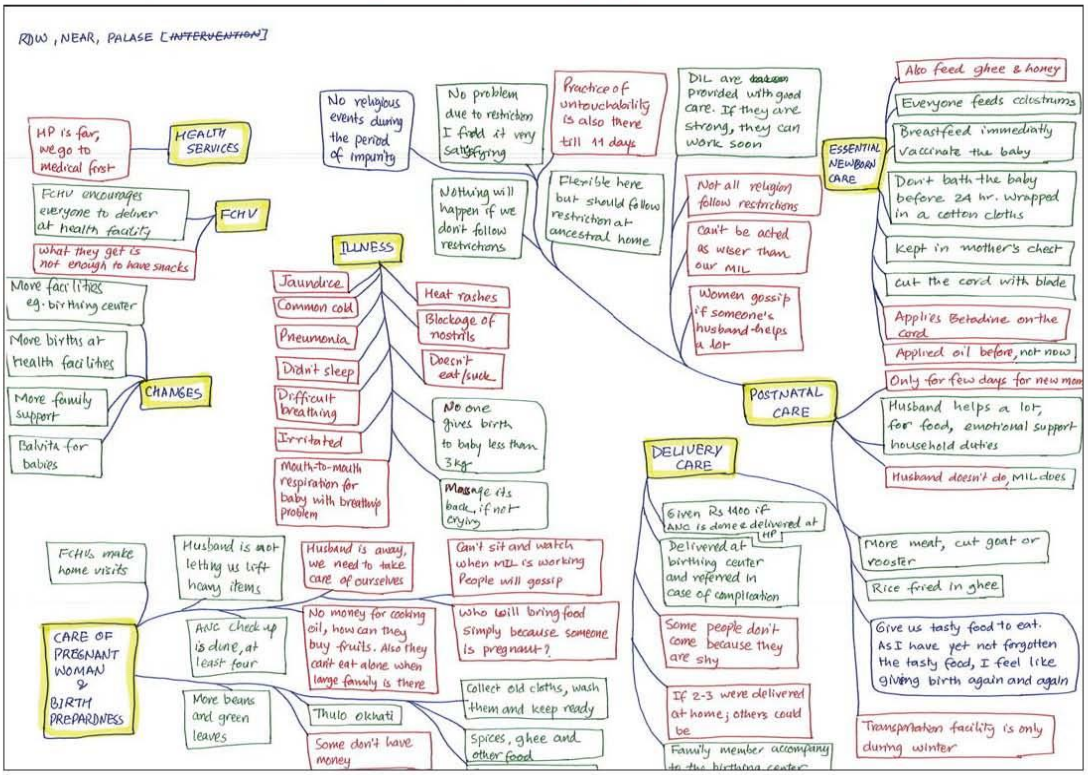
#	District	I-C	B-A	Indicator (%)											
				1 ANC	4 ANC	Iron supplementation	Facility delivery	Delivery by SBA/HW	Delivery by SBA	PNC visit	PP mother get VA	PSBI among <2m	LBI among <2m	LBW among <2m	Any case among <2m
		I	A	70.8	46.0	75.2	35.0	36.1	35.2	44.7	58.9	4.9	3.4	0.6	11.7
	Surkhet	C	B	100.8	50.1	100.9	26.2	38.0	26.2	51.7	75.9	1.2	2.3	0.5	4.8
		C	A	94.1	62.5	96.1	45.4	50.9	45.2	57.8	76.7	2.7	2.5	0.6	7.4
10	Doti	I	B	79.4	33.5	89.4	15.0	22.6	14.3	31.8	53.9	1.1	0.9	0.6	4.2
		I	A	105.1	48.2	105.1	37.3	42.4	35.3	53.6	75.5	1.5	1.8	0.6	8.4
	Kanchanpur	C	B	59.0	28.8	81.4	20.0	24.8	21.4	31.5	50.8	0.7	1.6	0.5	2.7
		C	A	64.9	39.1	74.3	37.1	38.7	36.7	38.2	57.4	0.8	2.9	0.4	4.2
	All intervention	B	B-I	68.9	35.9	73.8	25.9	33.5	27.1	43.5	54.4	1.0	1.4	0.3	3.2
	All intervention	A	A-I	80.6	42.7	62.4	40.1	42.1	38.3	54.1	63.8	1.3	1.7	0.4	6.2
	All control	B	B-C	73.4	34.9	73.3	23.2	36.5	24.9	41.0	49.3	0.4	1.0	0.3	1.7
	All control	A	A-C	77.6	46.2	58.4	37.0	46.5	35.8	44.7	54.0	0.5	2.0	0.3	2.7
	Difference in intervention (A – B)			11.7	6.8	-11.5	14.1	8.6	11.2	10.7	9.4	0.3	0.3	0.2	2.9
	Difference in control (A – B)			4.1	11.3	-14.9	13.9	10.0	11.0	3.7	4.7	0.1	1.0	0.0	1.0
	Difference of differences			7.5	-4.5	3.4	0.3	-1.4	0.3	7.0	4.7	0.2	-0.7	0.1	2.0

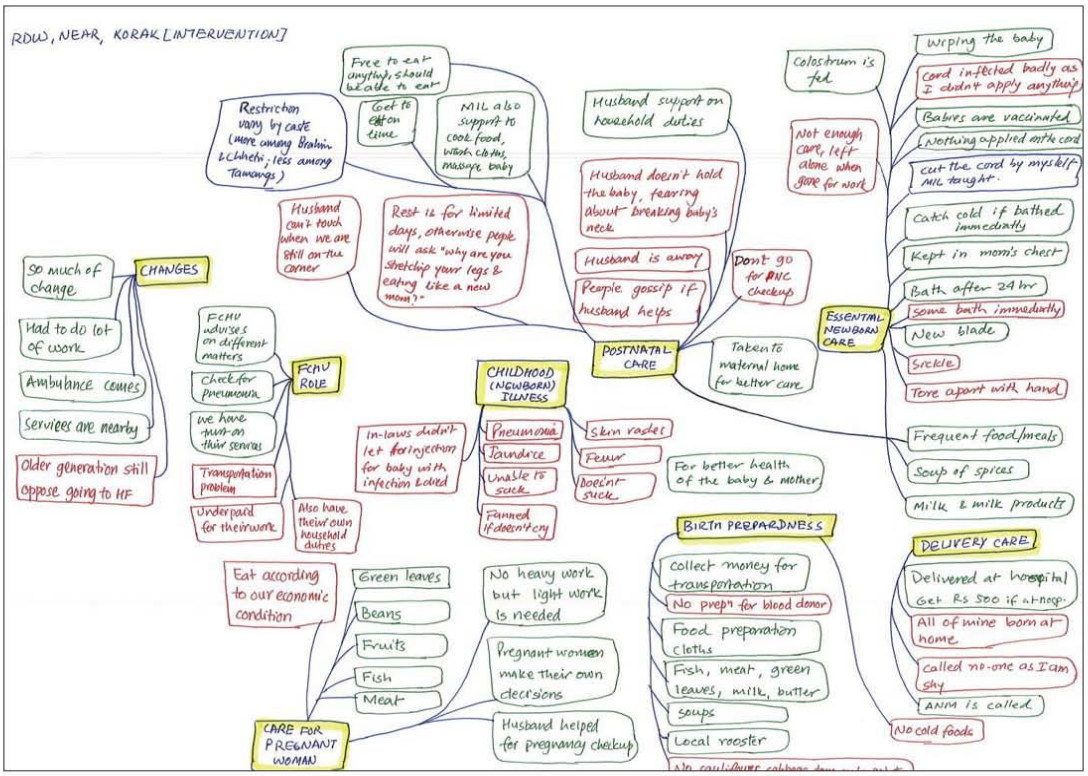
Data source: CHD/MOHP, CB NCP Assessment Report, August 2012

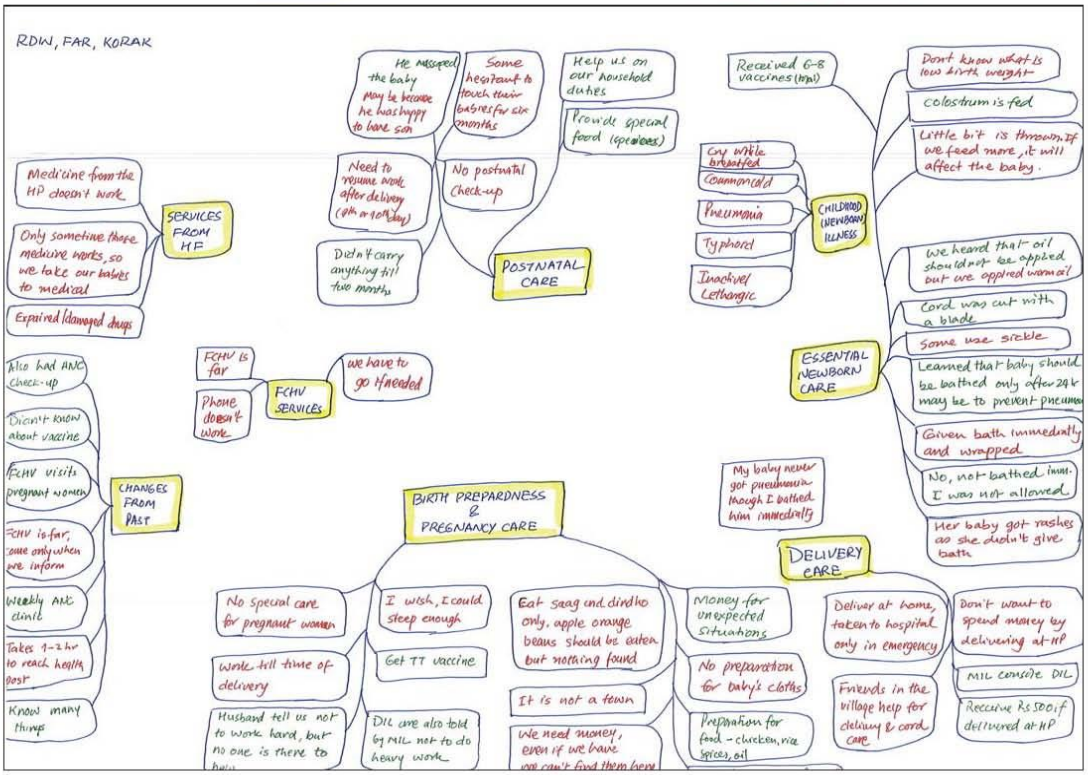
Annex 5: FGD Analysis Charts

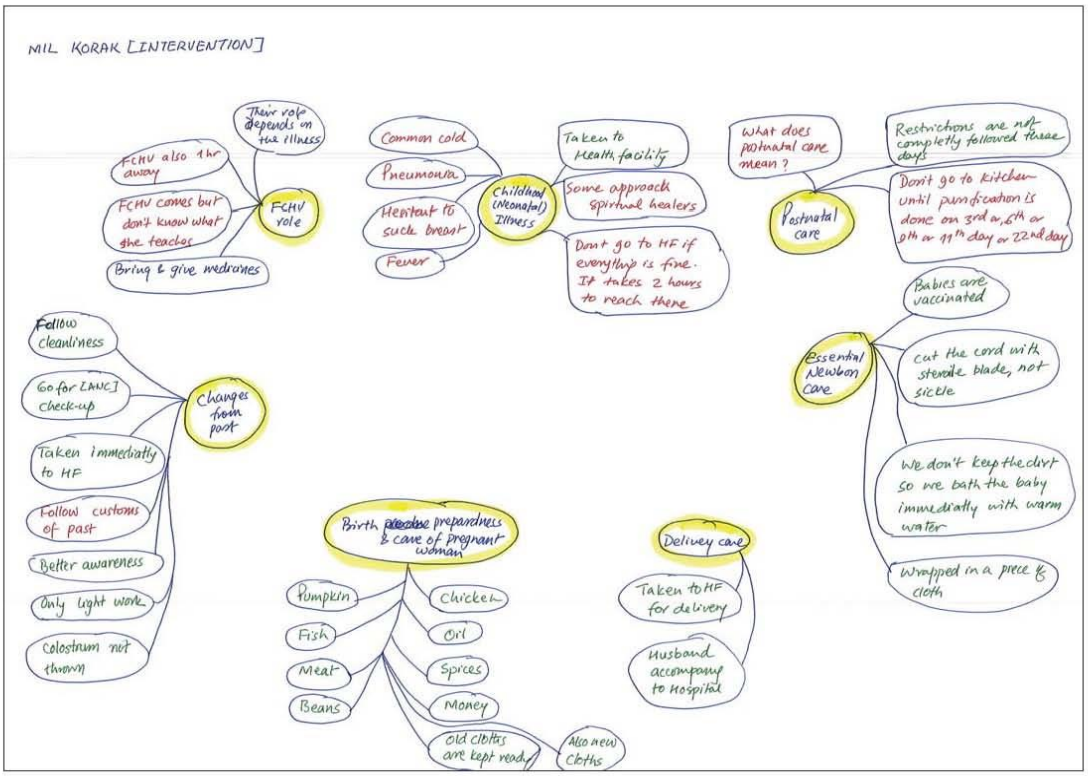
Note: Items on the green/blue indicate enabling factors and items on the red indicates restraining factors



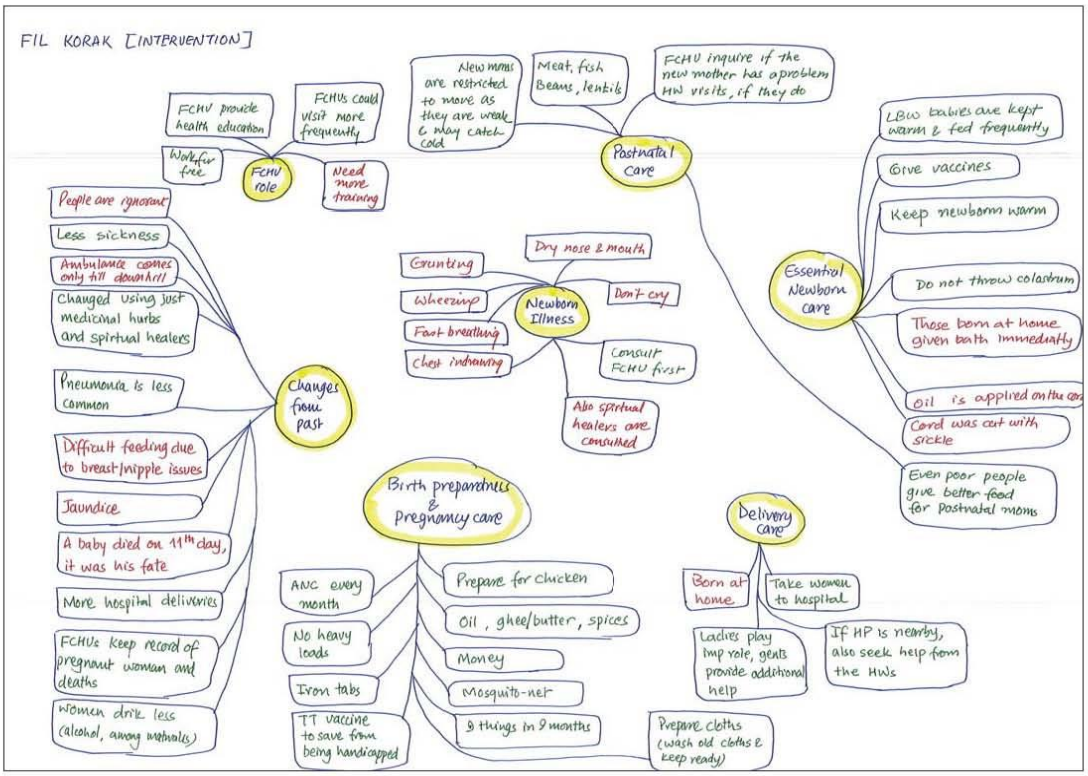


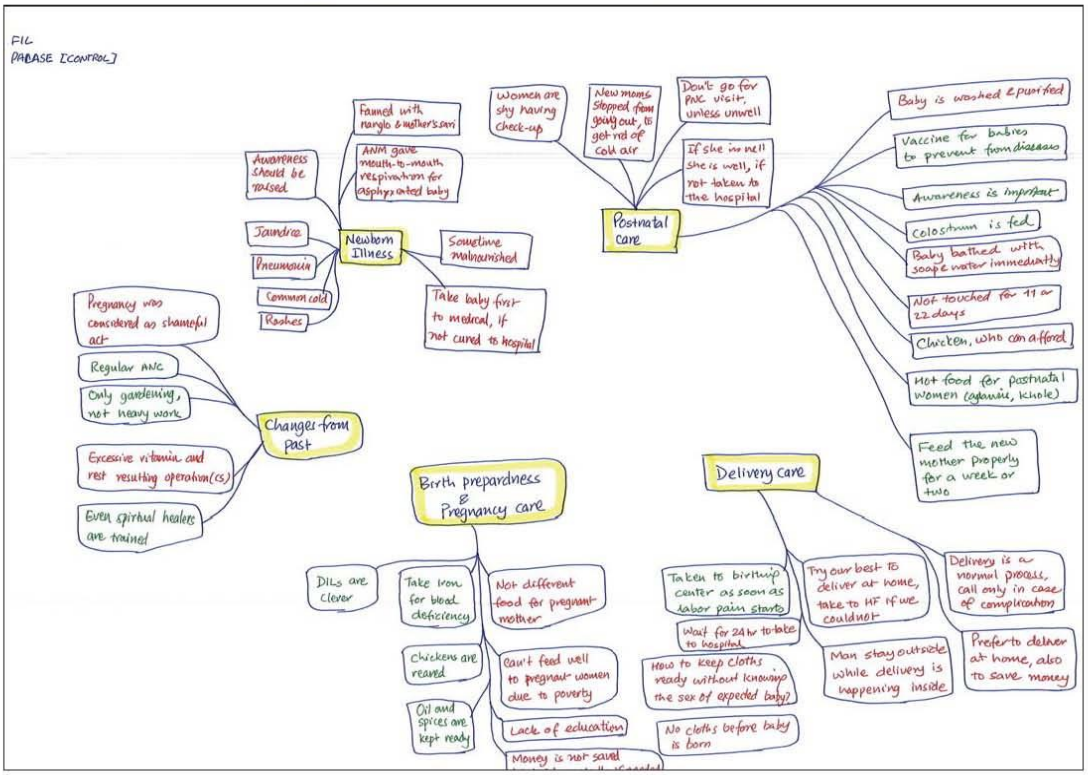

RDW, NEAR, KORAK [INTERVENTION]
CHANGES
So much of change
Had to do lot of work
Ambulance comes
Services are nearby
Older generation still oppose going to HF
FCHV ROLE
FCHV advises on different matters
Check for Pneumonia
We have mutt-an their services
Transportation problem
Underpaid for their work
Also have their own household duties
CARE FOR PREGNANT WOMAN
Eat according to our economic condition
Green leaves
Beans
Fruits
Fish
Meat
No heavy work but light work is needed
Pregnant women make their own decisions
Husband helped for pregnancy checkup
Restriction vary by caste (more among Brahmin & Chhetri; less among Tamangs)
Free to eat anything, should be able to eat
Got to eat on time
MIL also support to cook food, wash clothes, massage baby
Husband can't touch when we are still on the corner
Rest is for limited days, otherwise people will ask "why are you stretching your legs & eating like a new mom?"
POSTNATAL CARE
Husband support on household duties
Husband doesn't hold the baby, fearing about breaking baby's neck
Husband is away
People gossip if husband helps
Don't go for ANC checkups
Taken to maternal home for better care
CHILDHOOD (NEWBORN) ILLNESS
Pneumonia
Jaundice
Unable to suck
Fainted if doesn't cry
Skin rashes
Fever
Doesn't suck
In-laws didn't let for injection for baby with infection fever
For better health of the baby & mother
BIRTH PREPARDNESS
Collect money for transportation
No prepn for blood donor
Food preparation cloths
Fish, meat, green leaves, milk, butter
soups
Local rooster
No cold foods
ESSENTIAL NEWBORN CARE
Colostrum is fed
Not enough care, left alone when gone for work
Wiping the baby
Cord infected badly as I didn't apply anything
Babies are vaccinated
Nothing applied on the cord
Cut the cord by myself MIL taught.
Catch cold if bathed immediately
Kept in mom's chest
Bath after 24 hr
Some bath immediately
New blade
Sickle
Tore apart with hand
Frequent food/meals
Soup of spices
Milk & milk products
DELIVERY CARE
Delivered at hospital
Get Rs 500 if at hosp.
All of mine born at home
called no-one as I am shy
ANM is called

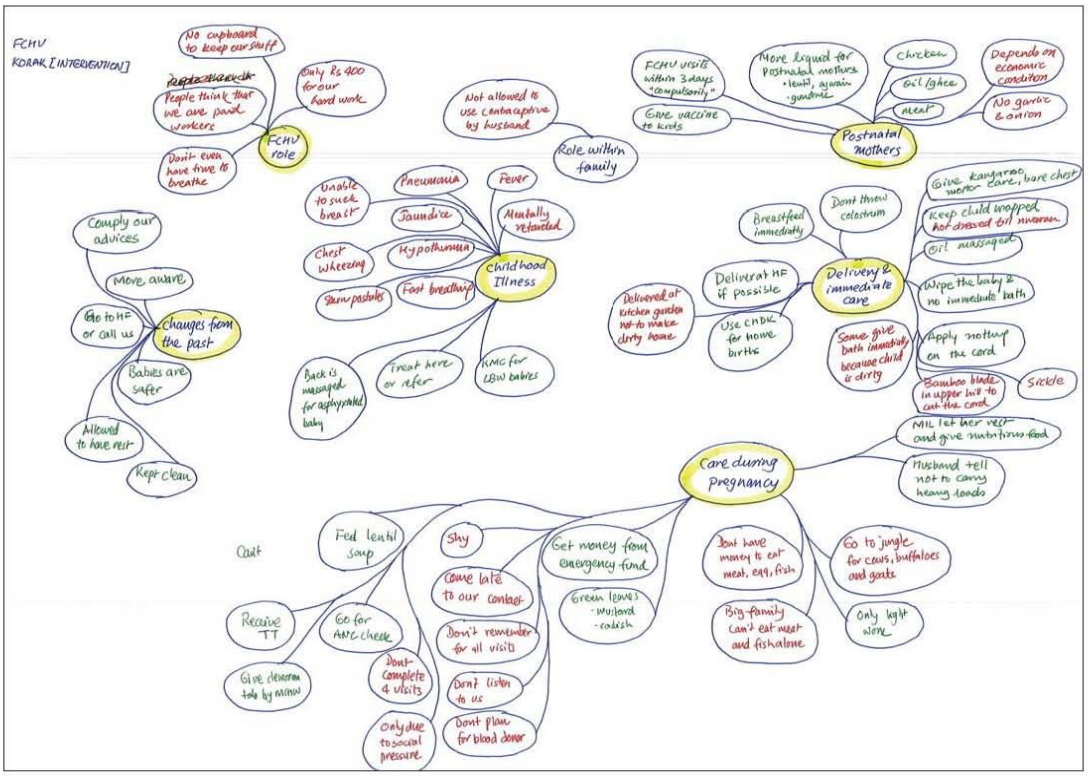

RDW, FAR, KORAK
SERVICES FROM HF
Medicine from the HP doesn't work
Only sometime those medicine works, so we take our babies to medical
Expired/damaged drugs
CHANGES FROM PAST
Also had ANC check-up
Didn't know about vaccine
FCHV visits pregnant women
FCHV is far, come only when we inform
Weekly ANC clinic
Takes 1-2 hr to reach health post
Know many things
FCHV SERVICES
FCHV is far
Phone doesn't work
We have to go if needed
POSTNATAL CARE
He stopped the baby may be because he was happy to have son
Some hesitant to touch their babies for six months
No postnatal check-up
Need to resume work after delivery (4th a month)
Didn't carry anything till two months
Help us on our household duties
Provide special food (specialties)
CHILDHOOD (NEWBORN) ILLNESS
Cry while breastfed
Common cold
Pneumonia
Typhoid
Inactive/Lethargic
Received 6-8 vaccines (npm)
ESSENTIAL NEWBORN CARE
Don't know what is low birth weight
colostrum is fed
Little bit is thrown. If we feed more, it will affect the baby.
We heard that oil should not be applied but we applied warm oil
Cord was cut with a blade
Some use sickle
Learned that baby should be bathed only after 24 hr may be to prevent pneumo
Given bath immediately and wrapped
No, not bathed imm. I was not allowed.
Her baby got rashes as she didn't give bath
BIRTH PREPARDNESS & PREGNANCY CARE
No special care for pregnant women
Work till time of delivery
Husband tell us not to work hard, but no one is there to help
I wish, I could sleep enough
Get TT vaccine
DIL are also told by MIL not to do heavy work
Eat saag and dirdho only, apple orange beans should be eaten but nothing found
It is not a town
We need money, even if we have we can't find them here
Money for unexpected situations
No preparation for baby's cloths
Preparation for food - chicken, rice spices, oil
My baby never got pneumonia though I bathed him immediately
DELIVERY CARE
Deliver at home, taken to hospital only in emergency
Friends in the village help for delivery & cord care
Don't want to spend money by delivering at HP
MIL consider DIL
Receive Rs 500 if delivered at HP

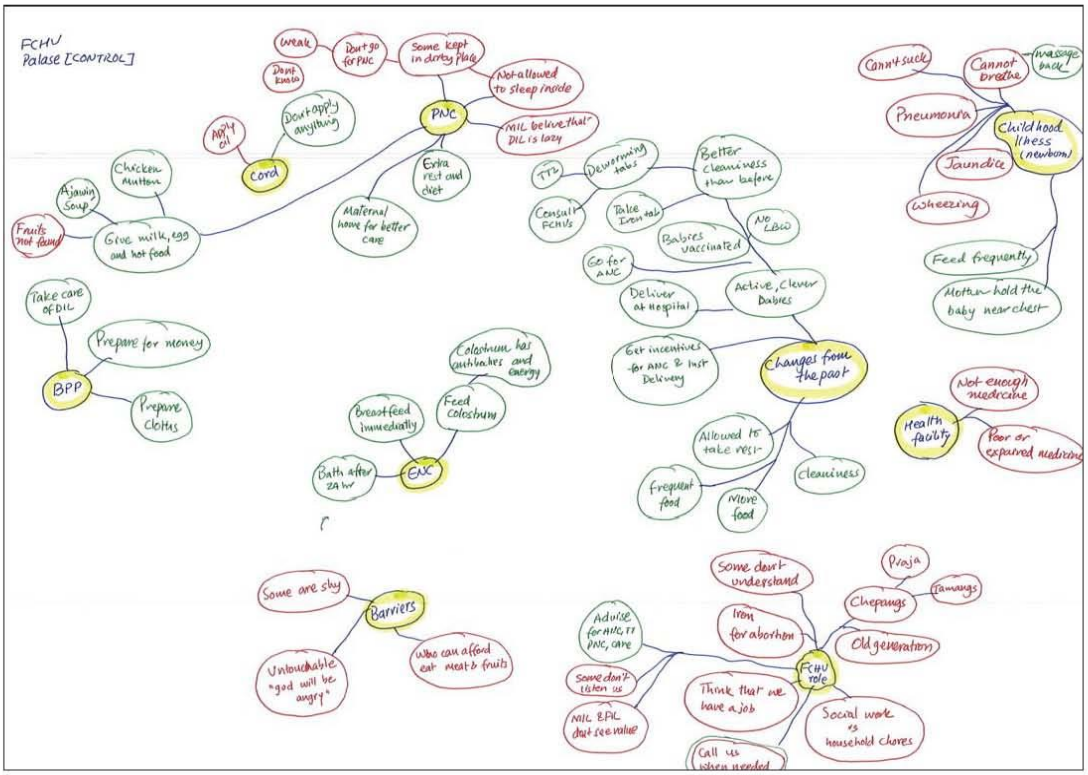

MIL KORAK [INTERVENTION]
FCHV role
Their role depends on the illness
FCHV also 1 hr away
FCHV comes but don't know what the teaches
Bring & give medicines
Childhood (Neonatal) Illness
Common cold
Pneumonia
Hesitant to suck breast
Fever
Taken to Health facility
Some approach spiritual healers
Don't go to HF if everything is fine. It takes 2 hours to reach there
Postnatal care
What does postnatal care mean?
Restrictions are not completly followed these days
Don't go to kitchen until purification is done on 3rd or, 5th or 9th or 11th day or 22nd day
Essential Newborn care
Babies are vaccinated
cut the cord with sterile blade, not sickle
We don't keep the dirt so we bath the baby immediatly with warm water
Wrapped in a piece of cloth
Changes from past
Follow cleanliness
Go for [ANC] check-up
Taken immediatly to HF
Follow customs of past
Better awareness
Only light work
Colostrum not thrown
Birth preparedness & care of pregnant woman
Pumpkin
Fish
Meat
Beans
Chicken
Oil
Spices
Money
Old clothes are kept ready
Also new clothes
Delivery care
Taken to HF for delivery
Husband accompany to hospital


MIL PALASE [COMPARISION]
FCHVs Role
FCHV visits new mom & advice them
People do trust her
Difficult for them to walk around
No FCHVs during our time. Now they are
Newborn Illness
Baby may soffocate with the blanket
Don't remember danger signs
Pneumonia
Jaundice, esp those born during summer
Cold
Breathing problem
The family is impure during the period
Untouchability is more common among Brahmin & Chhetri
Untouchability is not problematic
Take iron tab from ANM after delivery too
Postnatal care
Don't go for ANC unless there is difficulty or problem
Give ajwine and fenugreek soup
Fish, meat
Butter/Ghee, Lentil
Curd, milk
Changes from past
Greater family support
Shy of check-up
Not deliver at home
Go for ANC check-up
Take Iron tablets
More vaccines TT
More facilities (from HF) in the community
No heavy work
Nutritional food
Care for pregnant women and birth preparedness
Oil
Spices
Money
Ghee/Butter
Cotton cloths
Essential newborn care
We tell them to feed early
Fed baby after 1 hr after delivery & placenta
Given bath after 24 hr to prevent from cold
Kept on mom's chest
Don't know what applied on the cord
Oil was applied
Delivery care
Deliver at birthing center
Get a set of newborn cloths for free
No vehicle, need to carry
Get incentives for ANC checkup and delivery at HF
Everyone doesn't have money to cover delivery expenses
Travel cost to the hospital covers delivery cost here expense


FIL KORAK [INTERVENTION]
FCHV provide health education
FCHVs could visit more frequently
Work for free
FCHV role
Need more training
People are ignorant
Less sickness
Ambulance comes only till downhill
Changed using just medicinal herbs and spiritual healers
Pneumonia is less common
Difficult feeding due to breast/nipple issues
Jaundice
A baby died on 11th day, it was his fate
More hospital deliveries
FCHVs keep record of pregnant woman and deaths
Women drink less (alcohol, among mothers)
Changes from past
New moms are restricted to move as they are weak & may catch cold
Meat, fish Beans, lentils
FCHV inquire if the new mother has a problem HW visits, if they do
Postnatal Care
LBW babies are kept warm & fed frequently
Give vaccines
Keep newborn warm
Essential Newborn care
Do not throw colostrum
Those born at home given bath immediately
Oil is applied on the cord
Cord was cut with sickle
Even poor people give better food for postnatal moms
Grunting
Wheezing
Fast breathing
Chest indrawing
Dry nose & mouth
Don't cry
Newborn Illness
Consult FCHV first
Also spiritual healers are consulted
Birth preparedness & Pregnancy care
ANC every month
No heavy loads
Iron tabs
TT vaccine to save from being handicapped
Prepare for chicken
Oil, ghee/butter, spices
Money
Mosquito-net
9 things in 9 months
Prepare cloths (wash old cloths & keep ready)
Delivery care
Born at home
Take women to hospital
Ladies play imp role, gents provide additional help
If HP is nearby, also seek help from the HWs


FIL
PABASE [CONTROL]
Awareness should be raised
Framed with manglo & mother's sari
ANM gave mouth-to-mouth respiration for asphyxiated baby
Jaundice
Pneumonia
Common cold
Rashes
Newborn Illness
Sometime malnourished
Take baby first to medical, if not cured to hospital
Pregnancy was considered as shameful act
Regular ANC
Only gardening, not heavy work
Excessive vitamin and rest resulting operation(cs)
Even spiritual healers are trained
Changes from past
Women are shy having check-up
New moms Stopped from going out, to get rid of cold air
Don't go for ANC visit, unless unwell
If she is well she is well, if not taken to the hospital
Postnatal Care
Baby is washed & purified
Vaccine for babies to prevent from diseases
Awareness is important
Colostrum is fed
Baby bathed with soap & water immediately
Not touched for 11 or 22 days
Chicken, who can afford
Hot food for postnatal women (aguaniu, khole)
Feed the new mother properly for a week or two
Birth preparedness & Pregnancy care
DILs are clever
Take iron for blood deficiency
Not different food for pregnant mother
Chickens are reared
Can't feed well to pregnant women due to poverty
Oil and spices are kept ready
Lack of education
Money is not saved
Delivery care
Taken to birthing center as soon as labor pain starts
Wait for 24 hr to take to hospital
How to keep cloths ready without knowing the sex of expected baby?
No cloths before baby is born
Try our best to deliver at home, take to HF if we couldn't
Man stay outside while delivery is happening inside
Delivery is a normal process, call only in case of complication
Prefer to deliver at home, also to save money


FCHV
KORAK [INTERVENTION]
No cupboard to keep our stuff
People think that we are paid workers
Only Rs 400 for our hard work
FCHV role
Don't even have time to breathe
Not allowed to use contraceptive by husband
Role within family
FCHV visits within 3 days "compulsorily"
Give vaccine to kids
More liquid for Postnatal mothers
•lentil, ajawain •ghee
Chicken
Oil/ghee
Meat
Depends on economic condition
No garlic & onion
Postnatal Mothers
Unable to suck breast
Pneumonia
Fever
Jaundice
Mentally retarded
Chest wheezing
Hypothermia
Childhood Illness
Skin pustules
Fast breathing
Back is massaged for asphyxiated baby
Treat here or refer
KMC for LBW babies
Comply our advices
Move aware
Go to HF or call us
Changes from the past
Babies are safer
Allowed to have rest
Kept clean
Breastfeed immediately
Don't throw colestrum
Delivery & immediate care
Delivered at HF if possible
Use CHDK for home birth
Delivered at kitchen garden not to make dirty home
Same give bath immediately because child is dirty
Give kangaroo mother care, bare chest
Keep child wrapped, not dressed till warmth
Oil massaged
Wipe the baby & no immediate bath
Apply nothing on the cord
Bamboo blade in upper hill to cut the cord
Sickle
MIL let her rest and give nutritious food
Husband tell not to carry heavy loads
Care during Pregnancy
Cant
Fed lentil soup
Shy
Get money from emergency fund
Don't have money to eat meat, egg, fish
Go to jungle for cows, buffaloes and goats
Only light work
Big family can't eat meat and fish alone
Green leaves - mustard - radish
Come late to our contact
Don't remember for all visits
Don't listen to us
Don't plan for blood donor
Only due to social pressure
Receive TT
Go for ANC check
Don't complete 4 visits
Give decoction tab by mouth


FCHV
Palase [CONTROL]
Weak
Don't go for PNC
Some kept in dirty place
Don't know
Not allowed to sleep inside
PNC
Don't apply anything
MIL belive that DIL is lazy
Apply oil
Cord
Extra rest and diet
Chicken Mutton
Ajawin Soup
Fruits not found
Give milk, egg and hot food
Maternal home for better care
Take care of DIL
Prepare for money
BPP
Prepare Clothes
Colostrum has antibodies and energy
Feed Colostrum
Breastfeed immediately
Bath after 24 hr
ENC
Deworming tabs
TT
Consult FCHVs
Take Iron tab
Better cleaniness than before
No LBW
Babies vaccinated
Go for ANC
Deliver at Hospital
Active, Clever Babies
Get incentives for ANC & Inst Delivery
Changes from the past
Allowed to take rest
Frequent food
More food
Cleaniness
Cannot suck
Cannot breathe
Massage back
Pneumonia
Childhood Illness (newborn)
Jaundice
Wheezing
Feed frequently
Mother hold the baby near chest
Health facility
Not enough medicine
Poor or expaired medicine
Some are shy
Barriers
Untouchable "god will be angry"
Who can afford eat meat & fruits
Some don't understand
Praja
Tamangs
Chepangs
Iron for abortion
Old generation
Advise for HHC, TT PNC, care
Some don't Listen us
MIL & DIL don't see value
FCHV role
Think that we have a job
Social work + household chores
Call us when needed

Annex 6: Professional CV of the PhD candidate

DEEPAK PAUDEL

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Email: paudeld@gmail.com; Deepak.Paudel@campus.lmu.de

Professional experience

Senior Program Management Specialist (Maternal, Newborn and Child Health); United States Agency for International Development/Nepal, Kathmandu, Nepal; 10/11/2008 – to date

Community Health Specialist; CARE International in Nepal, Kathmandu, Nepal; 15/08/2003 to 25/08/2008

Training Officer; John Snow Inc (JSI) Research and Training Institute; 01/12/2001 to 15/06/2002

Research Officer; International Network for Rational Use of Drugs (INRUD), Kathmandu, Nepal; 01/10/2000 to 15/10/2001

Research Officer; Institute of Health Development and Research, Kathmandu, Nepal; 15/12/1999 to 15/10/2000

Academic qualification

PhD-International Health (Student), 10/2010 - 09/2013: Center for International Health, Ludwig Maxmilians University of Munich, Germany

Masters in Public Administration (**MPA**), 06/2004 – 06/2011 (part time): Tribhuvan University, Nepal

Masters in Public Health (**MPH**), 04/2002- 06/2003: Tribhuvan University, Institute of Medicine, Nepal

Bachelors in Public Health (**BPH**), 08/1996 – 12/1999: Tribhuvan University, Institute of Medicine, Nepal

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Training, Workshops, Seminars

June 2012	Global Public Health Workshop, Ludwig Maxmilians University of Munich, Germany
June 2012	Mobilization for Change: Social Movements in a Developing World, University of Bonn, Germany
March 2012	Symposium: Inequalities in Health- Realities, Efforts and Way forward, Munich (organized)
Sept 2011	Evidence-based programming in Public Health, NHRC/MCHIP/USAID, Kathmandu, Nepal
July 2011	Workshop on Scaling up Effective Practices in Reproductive and Maternal/Newborn Health, WHO, Hua Hin, Thailand
June 2008	USAID Child Survival Mini University Workshop and Global Health Conference in Washington DC, USA (presented a paper on Adolescents Take Action for RH)
Feb 2007	Health System Research Course, Royal Tropical Institute, the Netherlands.
July 2006	13th World Conference on Tobacco or Health, Washington DC, USA (presented a paper on youth tobacco use habits)
July 2005	Summer Course on Research Methods on Reproductive Health, The Gates Foundation, John Hopkins Bloomberg School of Public Health, Baltimore, USA
April 2004	International Conference on Promoting Use of Medicines, WHO/INRUD/MSH, ChiangMai, Thailand
May 2003	National Course on Health Research Methodology, Nepal Health Research Council, Kathmandu, Nepal
Oct 2000	VIII Asia Course on Promoting Rational Drug Use, WHO/INRUD/MSH, Padang, Indonesia

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Languages

Nepali (native), English (fluent), German (very basic)

Publications and research involvement

D Paudel, IB Shrestha, M Siebeck and EA Rehfuess. Neonatal health in Nepal: analysis of absolute and relative inequalities and impact of current efforts to reduce neonatal mortality. **[Submitted]**

D Paudel, M Ahmed, A Pradhan, RL Dangol. Use of tablet personal computers and wireless technologies for a large scale health survey in geographically extreme and resource challenged environments: experiences from the 2011 Nepal demographic and health survey; Glob Health Science and Practice, July 11, 2013 http://dx.doi.org/10.9745/GHSP-D-12-00056

D Paudel, A Thapa, PR Shedain, B Paudel. Trends and determinants of neonatal mortality in Nepal: Further analysis of Nepal Demographic and Health Survey 2001-2011. *March 2013, Calverton, Maryland, USA. Nepal Ministry of Health and Population, New ERA, and ICF International* (online at : www.measuredhs.com/pubs/pdf/FA75/FA75.pdf)

D Paudel. Quality of antenatal care and institutional delivery practice in Nepal: Further analysis of 2011 Nepal Demographic and Health Survey, and MT Solis Soto, **D Paudel**, M Abera. Does socio-demographic background of pregnant women affects the quality of antenatal care? Analysis of Demographic and Health Survey data from Bolivia, Nepal, and Ethiopia. Posters presented in Global Maternal Health Conference 2013, January 15-17, 2013. Arusha, Tanzania www.international-health.uni-muenchen.de/download/gmhc-poster-paudel.pdf; www.international-health.uni-muenchen.de/download/gmhc-solis-soto_paudel_abera.pdf

DP Tiwari, RS Pyakurel, N Sharma, **D Paudel**, K Roy. Community-based Distribution of Misoprostol towards the Prevention of Postpartum Hemorrhage: Drug Efficacy and Factors Associated with Misoprostol Ingestion in Doti District, Nepal. Research & Reviews: A Journal of Medicine. Volume 2, Issue 3, December 2012, Pages 8-19. (online at : www.stmjournals.com/index.php?journal=RRJoM)

DC Poudel DC, B Acharya, S Pant**, D Paudel**, YV Pradhan. Developing, piloting and scaling-up of Nepal's neonatal care program. J Nepal Health Res Counc. 2012 May;10(21):95-100. www.ncbi.nlm.nih.gov/pubmed/23034369

D Paudel, M Abera, R Kyeyune, MT Solis-Soto, A Lohani, S Wandiga, A Nji, G Fröschl. Inequalities in Health: Realities, Efforts and Way Forward. World Medical and Health Policy: Vol 4, Issu.2, Article 13, June 2012 (Link: http://onlinelibrary.wiley.com/doi/10.1515/1948-4682.1237/abstract)

D Paudel. Mixed Methods in Public Health Research, Health Prospect - Journal of Nepal Public Health Students' Society, Vol 10, 2011(Online at: http://dx.doi.org/10.3126/hprospect.v10i0.5649

Y V Pradhan, S R Upreti, N P KC, K Thapa, P R Shrestha, P R Shedain, J R Dhakwa, D R Aryal, S Aryal, D C Paudel, **D Paudel**, S Khanal, A Bhandari, A KC. Fitting Community based Newborn Care Package into the health systems of Nepal, Journal of Nepal Health Research Council, Vol. 9, No. 2, Issue 19, October 2011 www.ncbi.nlm.nih.gov/pubmed/22929840

A KC, K Thapa, Y V Pradhan, N P KC, S R Upreti, R K Adhikari, N Khadka, B Acharya, J R Dhakwa, D R Aryal, S Aryal, E Starbuck, **D Paudel**, S Khanal, M D Devkota. Developing Community-based Intervention Strategies and Package to Save Newborns in Nepal, Journal of Nepal Health Research Council, Vol. 9, No. 2, Issue 19, October 2011 www.ncbi.nlm.nih.gov/pubmed/22929839

D Paudel, S Karki. Socio-demographic determinants of children undernutrition in Nepal: Further Analysis of Nepal Demographic and Health Survey 2006, Paper presented in the 13th Annual Scientific Conference of ICDDR, Bangladesh to be held at Dhaka, Bangladesh from 14-17 March 2011.

D Paudel, N Sharma, RS Pyakurel, K Roy: Community Based Integrated Management of Childhood Illness (CB IMCI) in preventing under five mortality in Far West Nepal, Journal of Nepal Public Health Association, Vol 2, No 1., Nov 2009.

D Paudel. Role of family members and peers on initiating tobacco use among adolescent students in secondary schools of Pokhara metropolitian city (Published in Journal of Nepal Health Research Council, Vol 1, No 2, April 2003; Presented in 13th World Conference on Tobacco or Health USA) Online at: http://archive.idrc.ca/ritc/Paudel-Summary-Report.pdf

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