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Impact of Investment Case Approach on Equitable Access to Maternal and Child Health Services in Nepal

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Abstract

Introduction: Investment Case (IC) aims to support the local level to prepare comprehensive equitable development plans that are responsive to the local barriers confined in the area of maternal and child health (MCH). The main aim of the study was to assess the effect of the intervention designed by applying the IC approach in improving MCH service outcomes in Nepal.

Methods: The study used a mixed method quasi-experimental research design involving 16 intervention and 24 comparison districts. The Nepal Demographic Health Survey (NDHS) datasets (2011 and 2016) were used for this study. Difference-in-difference (DiD) analysis adopting linear regression was used in order to assess the effectiveness of the IC approach. Similarly, a phonomyography qualitative study with stakeholders involved in planning and implementing the IC approach was used to explore their perception on IC approach in equitable planning and budgeting in MCH services.

Results: Improvements in the majority of the outcome variables (antenatal care check-up, skilled birth attendant assisted delivery, wasting and underweight) followed similar trends in both intervention and comparison districts, indicating that the districts implementing IC approach did not improve MCH outcomes when compared to control districts. DiD analysis showed a significant increase in wasting among children aged under five (β: 0.019; p = 0.002) in the intervention districts. Qualitative findings, however, showed that the stakeholders were positive towards the effectiveness of IC approach for district-level health planning. They believe that IC has helped to increase responsiveness and accountability of stakeholders.

Conclusions: IC helped immensely for the planning process, making it evidence based, but was unable to deliver expected results at impact level within the allocated timeframe mainly due to the inadequate implementation of the agreed plans. Hence, execution of the agreed plans should be the key focus of future interventions.

Keywords

Investment Case, Maternal and Child Health, Nepal, Quasi-experimental study

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Abbreviations

AHW	Auxiliary Health Worker
ANC	Antenatal Care
ANM	Auxiliary Nurse Midwife
BCG	Bacille Calmette Guerin
BEONC	Basic Emergency Obstetric and Neonatal Care
CEONC	Comprehensive Emergency Obstetric and Neonatal Care
CI	Confidence Interval
CIH	The Center for International Health
DHS	Demographic and Health Survey
DiD	Difference-in-Difference
DOTS	Directly Observed Treatment, Short course
DPT	Diphtheria, Pertussis and Tetanus
EPI	Expanded Program on Immunization
FCHV	Female Community Health Volunteers
FGD	Focus Group Discussion
GoN	Government of Nepal
HDI	Human Development Index
HIV/AIDS	Human immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
HMIS	Health Management Information System
HP	Health Post
I/NGOs	International Non-governmental Organizations
IC	Investment Case
BCC	Behaviour Change and Communication
KII	Key-informant Interview
LDO	Local Development Officer
LMIS	Logistic Management Information System
MBB	Marginal Budgeting for Bottlenecks
MDG	Millennium Development Goal
MCH	Maternal and child health

MR	Measles and Rubella
NDHS	Nepal Demographic and Health Survey
NHSP-IP	Nepal Health Sector Program-Implementation Plan
NHSS	Nepal Health Sector Strategy
ORT	Oral Rehydration Therapy
PHC/ORC	Primary Health Care/ Outreach Clinic
PHCC	Primary Health Care Center
PhD	Doctor of Philosophy
PMTCT	Prevention of Mother to Child Transmission
PNC	Post Natal Care
SBA	Skilled Birth Attendant
SHP	Sub-Health Post
STD	Sexually Transmitted Disease
TB	Tuberculosis
UNFPA	United Nation Family Planning Association
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
VDC	Village Development Committee

1. Introduction

1.1 Maternal and Child Health

Globally, many women die from pregnancy and childbirth-related causes (1). More than 300,000 women died due to maternal causes worldwide in 2015, with almost 99% of these incidents occurring in low- and middle-income countries (2). Countries across the globe had adopted the Millennium Development Goals (MDGs) back in 1990 to improve overall health and development of the population. MDGs 4 and 5 were related to improving health of children and mothers respectively. Since the adoption of the MDG, the maternal mortality, and child mortality have decreased significantly. These improvements are the results of intense efforts from government and civil societies from all over the world. Despite the improvements, the world was unable to meet the targets set by MDG 4 and 5. Under-five child mortality has decreased by 53%as compared to the child mortality rate of 1990, missing the target of two-third reduction of MDG 4. Similarly, maternal mortality has decreased by 44%in 2015 falling short of the MDG target 5 of 75% reduction from 258 to 213 per 100,000 live births (3). The Sustainable Development Goals (SGDs) has also included reduction in maternal and child mortality as key indicators for achieving health related goals. SDG purposes to decrease the maternal mortality by 70 per 100,000 live births, neonatal mortality by 12 per 1000 live births, and under-five mortality by 20 per 1000 live births (4).

The MCH is a priority program in Nepal. Nepal has implemented a number of focused programs, policies and strategies on MCH which aimed at improving the MCH service utilization by reducing barriers on the demand and supply side to ensure adequate service provision. The National Safe Motherhood Program 1997 (5), the National Safe Motherhood Plan 2002-2017 (6), the Skilled Birth Attendant (SBA) Policy 2006 (7), the National Neonatal Health Strategy 2004 (8), and the Community Based New-born Care Program 2007 are some of the major programmes, policies and strategies to be emphasised.

Nepal Health Sector Strategy was developed informed by the National Health Policy 2014 to guide the health sector in collaboration with different sectors to address the broader determinants of health (9, 10).

Although there are some improvements in MCH indicators in the past decade (10), there exists a significant equity gaps across different geographical areas, caste groups and socio-economic status as indicated in the findings of the Nepal Demographic Health Surveys (NDHS) (11-13). The existing efforts seem to be less sufficient considering the access to and utilization of MCH services particularly in rural area and among the poor and marginalized people.

1.2 Major MCH Programs in Nepal

In order to achieve its mandate of health as the fundamental rights, the Government of Nepal (GoN) is dedicated to provide equitable, accessible and high-quality health services to the people (14). MCH interventions implemented by the GoN together with private sectors and international organizations aim to ensure facility readiness to deliver quality services at supply side and community mobilization for improved service utilization at the demand side. After the restructuring of the administrative system of Nepal since the promulgation of the new Constitution of the country, GoN has started the involvement of local-level stakeholders, including the local government and civil society organizations in planning, budgeting, and implementing MCH programmes. The Nepal Health Sector Programme – Implementation Plan II also envisages an equitable health system and an improved quality health services for all the citizens of Nepal (15).

1.2.1 Safe motherhood and newborn health program

Safe Motherhood and Newborn Health program, a priority one program under the Ministry of Health and Population (MoHP), aims to improve MCH by reducing maternal and neonatal morbidity and mortality through disease preventive and health promotive activities. Evidence suggests that three delays (delays in seeking, reaching and receiving

care) as important factors for morbidity and mortality among mothers and children in low- and middle-income countries, including Nepal. Safe motherhood program was initiated in 1997 and gained momentum after the formulation of Safe motherhood policy in 1998 (16). The Safe Motherhood Program (*Aama* Program) strives to increase institutional delivery through mitigation of the cost related to delivery at health institutions. Under the Safe Motherhood program, the health facility provides free antenatal care (ANC) services, free institutional delivery care and management of obstetric complications (which is reimbursed by the MoHP to the respective health facilities) and provides transportation allowance to the mothers for institutional delivery (17). Safe Motherhood programme has improved access to ANC, institutional deliveries as well as emergency obstetric care (EOC) services by ensuring free services to the women of Nepal (17).

Provisions of the Safe Motherhood: Safe Motherhood Program included the transport allowance to the mother who comes to the health facility for institutional delivery, incentive for completing the 4 ANC visits, free institutional delivery services, free services for obstetric complication including caesarean section operation, and incentives to health service provider (16, 17).

Provisions of Newborn Health Program: The component for newborn care was included into the Safe Motherhood Program in 2016. It has different package and the cost for each package depend on the services that was provided. There was zero cost for package 0, and NPR 1000, NRP 2000 and NRP 5000 for package A, B and C respectively, and an incentive of NPR 300 per case to health service provider (16, 17).

1.2.2 Immunization program

After the eradication of smallpox with the introduction of smallpox vaccine globally, it was proved that the diseases can be prevented and controlled by effective immunization. The Expanded Program on Immunization (EPI) program was initiated in Nepal in 1978 (16, 18). Currently, the EPI program, now called as National Immunization Program (NIP) is

providing vaccination against 11 vaccine preventable diseases (VPDs) in Nepal. The comprehensive Multi-Year Plan (cMYP) 2017 – 21 for immunization has aim of reduction of VPD associated child morbidity and mortality, with the strategic objective to "reach every child for full immunization". The NDHS survey 2016 reported that there is a significant improvement in vaccination of children, with subsequent reduction in infant and child mortality (11). Immunization coverage has improved across the decades and significant decrease in inequity amongst the wealth quantile groups (19). According to the NDHS 2016, full immunization has decreased from 87% in 2011 to 78% in 2016. Although there was no differences in immunization coverage by the wealth quintile, inequity existed by education level with mothers having a higher level of education having higher rate of their children vaccinated compared to mothers with lower level of education (11).

1.2.3 Nutrition Program in Nepal

The National Health Policy of Nepal focuses on the improved nutritional status of the citizens so does the constitution of Nepal 2015 (20, 21). The nutrition program of Nepal focuses to improve the nutritional status across life course, particularly under five children, adolescents, and pregnant women. The program aims to improve nutritional status of people by implementing different types of better nutrition interventions in collaboration with relevant sectors, thereby contributing to the socio-economic development of the country (17). Although globally child undernutrition is decreasing in recent years, but it is still higher in Nepal with the prevalence of stunting at 35%, wasting at 10% and underweight at 27%. Almost two-third (66%) of children are exclusively breastfed (11). Malnutrition among mothers is also a problem with 17%of mothers in Nepal are suffering from undernutrition whereas overweight is in an increasing trend (22% in Nepal Demographic Health Survey, 2016). Anaemia prevalence among women of reproductive age and pregnant women were 41% and 46% respectively (11). The NDHS 2016 reported that the prevalence of anemia among children aged 6-23 months was 68%while 44%among the adolescent girls aged 15-19 which has increased from 38.5%in 2011 (11).

1.3 Inequity in maternal and child health

Inequity refers to the unfairness and injustice or disparities across population regarding various issues. According to the World Health Organization (WHO), Universal Health Coverage (UHC) should provide "*access to key promotive, preventive, curative and rehabilitative health interventions for all at an affordable cost, thereby achieving equity in access*" (22). It is recommended that there should be categorisation of services as high, medium and low priority and then expand services for high-priority area (23). While doing so, it should be considered that the disadvantaged groups which often includes poor-income groups and populations in rural areas are not left behind (24), although lack of agreement on the issue of equity in health may create a challenge among decision-makers. Disadvantaged groups have a lower utilization of health services (23). In order to meet the targets of universal health coverage including the poor and disadvantaged group, health systems should systematically target those who are the poorest and hardest to reach (23). Community health services plays a vital role to attain UHC by empowering communities to increase their health literacy, change health practices and improve access and utilization of services (23).

The inequity in health is highly prevalent in South-east Asia. Studies have shown that the inequities in health are due to poor status of social determinants like education, employment, nutrition, with other factors. It has been recognized that the people from low wealth quintile and poor education are facing inequities in health service utilization (25). In Nepal, even though maternal, neonatal, infant and child mortality have greatly declined in the last ten years, the disparities in utilizing the health services have been a great problem. Different studies have shown that the mothers belonging to the highest wealth quintile and having higher education, utilized MCH services more often than the poor and illiterate mothers (23, 25).

There is huge disparity among the rich and the poor in utilizing MCH services in Nepal; for example, 81% of mothers of highest tertile use the skilled birth services while only 11%

in the poorest quintile use the service despite the services being offered free of cost (24). The disparity in utilization of MCH services differed by the place of residence, with women from urban areas are more likely to use the ANC, SBA and postnatal care (PNC) services than women from rural areas. The reason for the better utilization of the services in the urban areas may be due to the higher number of skilled health workers available in urban areas and the lack of transport might have affected the utilization of services in the rural areas (26). Continuum of care in MCH has now received greater attention globally for the better health of mothers and children. Utilization of the continuum of care for MCH services has been greatly affected by different socio-economic factors such as economic status, education, and the place of residence (urban/rural) (26, 27).

GoN has started the involvement of local level stakeholders in planning and implementation of programmes in order to provide equitable, responsive and accessible health services by improving health system, as envisioned in the second sectoral implementation plan of health sector in Nepal (15). However, the health system in Nepal is limited by a number of factors including resource constraints, geographical difficulties, and inadequate number of trained human resources for health, affecting the GoN's aim to improve the MCH services. Nepal has 0.67 doctors, nurses and midwives for every 1,000 population, which is much less than the recommended 2.3 doctors, nurses and midwives for every 1,000 population (28). Furthermore, district and local health system which are the main service providers lack the knowledge and competency on planning and budgeting preventing them from designing effective health plans and budgeting (29). Underdeveloped health system have the adverse impact on poor and marginalized groups, resulting their limited access and utilization to quality health services (30). Addressing the challenges specific to underprivileged populations and equity gaps is a pre-requisite of for achieving universal health coverage.

1.4 District health system in Nepal

The District (Public) Health Offices (DPHOs) are the health focal points at the district level in Nepal. They ensure the proper delivery of preventive, promotive and curative health services through various levels of health institutions like health posts, primary healthcare centers, hospitals. DPHOs are mandated to regulate all activities and events of the health sector at the district level. Health services are planned and provided as per the target-based total population adhering to the principles of primary health care including community participation, equitable access, quality of services and intersectoral collaboration. It strives to enhance the health system and its efficiency by targeting health workers and health institutions in order to realize improved health status among people.

A district health system based on the principle of essential health care is a self-contained component of the national health system (16). A district health system entails many interrelated components that contribute to health in houses, education sectors, institutions, and society through the health and other relevant sectors. The district health care system includes holistic health services in one place. Also, include functional two-way referral mechanism, adequate diagnosis, treatment, counselling, and logistic service available. Basically, a district in Nepalese Health System is the management level of local health system, where health programs and policies are planned and implemented.

Role of district public health office in Nepal

- Safe-motherhood, family planning and immunization
    - Ensure that safe motherhood services are provided by local health facilities including the primary health care centers (PHCC), Health posts (HPs), and outreach clinics
    - Make arrange and ensure ANC services in each health institution
    - Make arrange and establish a birthing center for institutional delivery and SBA delivery.

    - Ensure that vaccination services are regularly provided by EPI clinics and health facilities at community level.
    - Ensure the arrangement for the regular supply of vaccines and management of the cold chain.
    - Ensure family planning services are offered in the district through the local health facilities, health workers and volunteers.
    - Provide necessary technical and logistic support to offer family planning services through health facilities, PHC outreach, health workers and volunteers.
    - Make sure availability and follow-up of family planning services and defaulters.
- Nutrition
    - Make arrangements for the nutrition screening and growth monitoring through health facilities and PHC outreach clinics
    - Make necessary provisions for vitamin A capsules to children and iron and folic acid tablets to pregnant women and postpartum mothers.
- Monitoring and quality control
    - Monitor the health programs in the district including for a routine analysis of ANC visit, health facility delivery, immunization coverage, and nutrition status, including others.
    - Prepare or have others prepare periodic district health profile.
    - Have the in-charge of the PHCCs and HPs prepare field supervision plans and approve them.

Female Community Health Volunteers (FCHVs) are the first contact point in the health system in Nepal, are the bridge between the health facilities and communities. They are the promoters/service providers of family-oriented community-based services such as handwashing with soap, exclusive breastfeeding, ORS/ORT, etc. The EPI clinics and

Primary Health Care/ Outreach Clinic (PHC/ORCs) are the extended service delivery points of the health facilities (16, 17). Population-oriented outreach services such as immunization and some of the family planning methods are delivered from this level. Health institutions such as hospitals, PHCCs and HP provide individual-oriented inpatient or outpatient health services such as deliveries, delivery complication management, and surgical care (5, 31). Table 1 describes the three-service delivery mode against Nepal's District Health System.

Table 1. District health system setup according to the service delivery model

Service Delivery Mode	**Defined in Nepal's Context**	**Key Providers**
Family Oriented community-based services	FCHVs at community level	FCHVs
Population Oriented Schedulable Services	Sub-Health Post/Outreach clinic/EPI clinic	Vaccinator, Auxiliary Nurse Midwife (ANM), Auxiliary Health Worker (AHW)
Clinical Care – Primary Level	Health Post	ANM, AHW Medical officer/specialist, paramedics, midwives, registered nurse.

1.5 Investment Case Approach

The Investment Case (IC) approach has been acknowledged as an evidence-based strategic approach to improve planning and financing aspect of MCH services. It focuses the immediate problems and challenges affecting service access and utilization of MCH services. The IC approach is grounded on the 'Tanahashi model', which considers different factors to assess the strength of the intervention to deliver a desired quality of services (32). The model consists of five determinants which included (i) availability, (ii) accessibility, (iii) acceptability, (iv) contact, and (v) effectiveness. Figure 1 illustrates the Tanahashi

model and the linkages between accomplishment of service targets and the level of coverage.

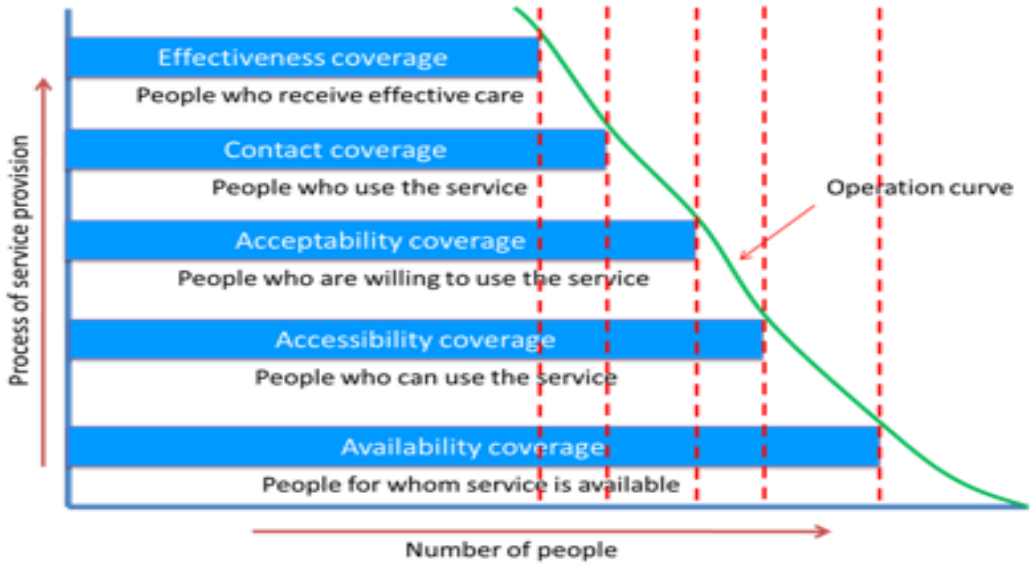

Figure 1. The Tanahashi model, illustrating the links between service delivery goals and types of coverage (32, 33)

The first two determinants, availability and accessibility includes the supply side aspects, while the acceptability, contact, and effective coverage are the demand side determinants (32, 33). The availability refers to the readiness of health services based on the availability of logistics and human resources to provide the services related to MCH, while the accessibility focuses to the physical accessibility of health facilities. From the users perspective, the acceptability implies to the number of people who want to utilize the services; the contact implies to the immediate level of contact and utilization of health services; and the appropriate coverage implies to the service performances that are judged as acceptable (32, 33). The term bottleneck refers to the particular components that constrain a health system's ability to enhance the health status (34).

The Tanahashi model (1978) seeks to identify service delivery gaps with the gap denoting to the proportion of the target groups not receiving the services (32, 33). The implementation of the IC approach begins from lobbying with the government sector, choice of interventions (tracers), data collection, data validation, bottleneck evaluation, and strategy formulation (35). The IC approach analyses the health system against a different type of supply, demand, and quality related aspects that affect the degree to which the population benefits from the health service delivery. The analysis logic is based on the Tanahashi model (1978), which consequently adapted by Soucat and others in the early 2000s (32, 33).

The IC framework merges the fundamental structure of strategic problem solving with an evidence-based decision-support model. In order to support for the equitable access to MCH services and to scale-up quality services, the IC was introduced by developmental collaborators in Asia-Pacific region, including Nepal (36). The approach aims to support local level to prepare comprehensive equitable development plans that is receptive to the bottlenecks and local contexts (36). The IC has been implemented in Indonesia, Nepal, Philippines, and India to provide for problem-based local level planning and budgeting for equitable services in MCH.

The IC approach is complicated in its nature involving various interventions related to different MCH indicators. The appraisal of the IC interventions in the Asian-Pacific countries showed a high complication of the approach. The district administrators understood the successful application of the IC approach beyond the capacity of the staff (30). Research also indicated that the IC approach may support in improving MCH, however, these studies primarily concentrated on the process of applying the IC approach using qualitative methods, rather than the outcomes of the approach. The IC approach was helpful for straightforward explanations to address the bottlenecks related to the MCH (29, 30, 37). The approach supported the government in order to improve the communication channels with districts and establish different mechanisms to support the implementation

(29, 30). In Philippines, the IC process influenced the annual plans and budget development in all tiers of government. The problem-solving strategies and costing information had been instrumental in providing different contributions for the yearly plans and negotiating budgets allocation with other authorities (29, 30, 36). In Indonesia, the IC recommendations were incorporated in the local plans of some of the sites (29). The local plans have incorporated many of the IC suggestions that are within the domain of district health offices. The key strategies were to improve access to quality services focused on strengthening health system components. The IC approach had prompted the policymakers to address the issues related to health system.

1.6 Investment Case approach in Nepal

MCH services are incorporated into the essential health service package in Nepal. Although Nepal has gained a significant improvement in MCH indicators, the progress is uneven across different districts and socio-economic groups. Gaps exist in terms of the logistics and trained human resources in remote districts, which hinder the delivery of essential services. To ensure equitable MCH service outcomes and to strengthen the service quality, the IC approach was initiated by the UNICEF and GoN. The approach in Nepal, implemented from 2011, aimed to support the problem-based planning, implementation, budgeting of the collaborative framework for health governance at local level, and to organize and manage the available resources in different districts (35). The IC approach were implemented in districts with a low Human Development Index (HDI) to support evidence-based planning (29, 30). The IC approach was initially executed in five districts in 2011, which included Dadeldhura, Dhading, Jajarkot, Kapilvastu and Udayapur, which was further extended to 15 additional districts in 2012. The added districts in second phase were Achham, Bajhang, Bajura, Dolpa, Doti, Humla, Jumla, Kalikot, Mugu, Baitadi, Dhanusha, Mahottari, Parsa, Rautahat and Saptari. The program was implemented in all districts by 2016. A set of indicators had been identified to monitor improvements of the

IC approach. The IC approach has supported to developed implementation plan which was in line with the local development plans which focused on local needs and barriers (38).

The IC approach in Nepal investigated the bottlenecks towards the accomplishment of health outcomes. It validated the evidence from different sources through consultative workshops with district and local level stakeholders. The IC also considered the local context and the viability of implementing the strategies at the district and local level. The main areas for feasibility included socio-cultural, financial, and policy issues. The main characteristic of this approach was that the entire course of planning and implementation is data driven.

1.6.1 Process of IC implementation in Nepal

Implementation of the IC program in Nepal encompassed a five-step process (Figure 2), beginning with the advocacy with the government and ending with presenting results related to the cost and effect to the stakeholders and generating an ownership for implementation. The key feature of the IC intervention was that the whole process is driven by evidence.

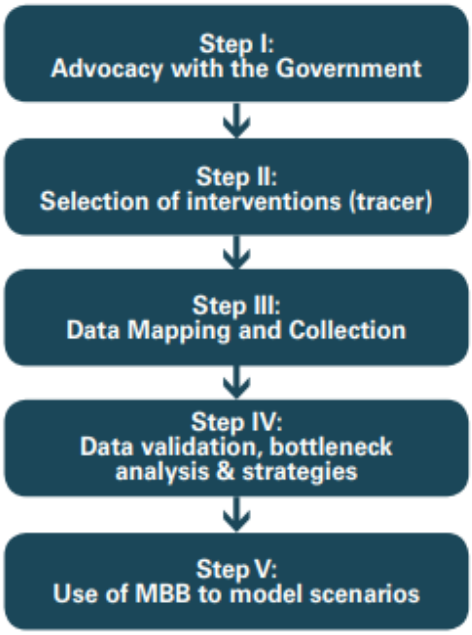

Figure 2. Five steps process of Investment Case Approach

In the first step, advocacy with government through official meetings with a range of stakeholders at all levels, from central to district level was carried out. The advocacy was mainly to inform the stakeholders about the process and obtain an official commitment of the government to adopt the IC process and the Marginal Budgeting for Bottlenecks (MBB) tool for evidence planning in Nepal.

Advocacy and coordination at the district level often occurred between the UNICEF, the IC consultant and DPHO team. The consulting team communicated with DPHO and informed them about the data collection process and the support they required from the DPHO team. Then team from the UNICEF, and consultant debriefed the DPHO team (including Senior Public Health Administrator, Family Planning Supervisor, Tuberculosis focal person, Malaria focal person, Public Health Nurse and administrative staff) regarding the IC implementation process and other aspects. The IC consultant and the UNICEF team then advocated for the need to conduct the bottleneck analysis workshop to ensure bottom-up and evidence-based planning.

The second step involved the selection of tracer elements related to interventions and indicators. Tracer interventions are demonstrative of programs and analysing them providing an overall picture of health system. The major aspects considered while selecting the tracer interventions were national priority, international recommendations, availability of data across the different coverage determinants, and proven high impact on health outcomes (39). The selection of tracers was based on a detailed consultations with relevant stakeholders at the national and district levels. In the IC program, components related to MCH were selected. It was also ensured that when selecting these tracers, they represented different levels and types of health services such as family-oriented community-based, population-oriented, and individual-oriented services.

Step three involved data collection, which encompassed recognising and assessing all the possible data sources and retrieving necessary data from different sources. The main sources of information were published reports, surveys, standards and protocols published by the Department of Health Services (DoHS) and other government sources which included the Nepal Multiple Indicator Cluster Survey, Nepal Demographic Health Survey, Nepal Living Standards Survey, National Population and Housing Census, DoHS Annual Reports, DPHOs, District Health Information system, VDC level data, calculations based on district specific monitoring sheet and raw data, data from central divisions (Logistic

Management Division, Family Health Division, National Health Education Information Communication Center, Epidemiology and Disease Control Division, National Tuberculosis Center, and Finance Division), and Reproductive Health Clinical Protocols. This data was then carefully analyzed and cleaned for any inconsistencies found. The data set went through a rigorous quality assurance process with support from national and international experts. Additionally, primary data were also collected from the district level health officers and focal persons, health staff from local health facilities, Female Community Health Volunteers (FCHVs), and women's groups through key qualitative interviews and focus groups.

Step four comprised data validation, problem analysis, and designing implementation plan, which was carried out through district level intensive workshops. The key objectives of conducting the bottleneck analysis and strategies workshop were to facilitate structured discussions with key stakeholders to: a) Review indicators of health service coverage and verify the data collected, or provide alternative data in case of disagreement; b) Identify, analyse and prioritise problems (bottlenecks) in achieving effective coverage; c) Identify feasible actions to overcome the bottlenecks; and d) Estimate likely impact in terms of increased coverage (bottleneck reduction or setting the target) of these strategies. The collected information was validated in a workshop through participatory discussion among stakeholders. The stakeholders identified the bottlenecks with the guidance of technical team. Problem analysis was guided by Tanahashi framework, that helped to identify limitations and challenges in both supply and demand sides (39). Similarly, under the technical support of the UNICEF and National Research Institutes, the district stakeholders developed the strategies to overcome the identified bottlenecks. Appreciative Inquiry approach was commonly used throughout the workshop, with sessions to create a positive attitude among the participants and to make them responsible and accountable throughout the planning process.

The final step was to develop model scenarios using the MBB tools. The MBB is a systematic tool for problem-based planning and budgeting. The MBB organises health, nutrition, water and sanitation related interventions into 3 service delivery modes and 12 sub-packages to analyse and address health system bottlenecks in a standard way. Problems and possible solutions identified during the consultative meetings with the district stakeholders were entered in the MBB tool, which was further utilized to develop three scenarios through a participatory process, with the best and the agreed scenario was implemented. The UNICEF team and the IC consultant were responsible for the continuous monitoring of the progress as per the plan. Also, UNICEF supported various commodities and equipment along with technical support, in order to ensure while implementing the plan. The process was continued every year during the yearly planning cycle.

1.6.2 Service delivery modes of the IC approach in Nepal

The delivery modes represented different approaches for health care services delivery. Interventions were grouped into three delivery modes and 12 sub-packages based on their similarity, and/or beneficiaries within each service delivery model (Table 2). The important assumption for the sub-packages was that the intervention provided through the same delivery model and to a similar target population having a similar type of bottlenecks and required similar collaborative actions (40). For example, if the unavailability of skilled health providers is an issue for family planning activities, the same issue may exist for other services like antenatal care as both services are usually provided by the same health worker (40).

Table 2. Delivery Modes and Sub-Packages of the IC approach (40)

Delivery mode- Services	Sub-packages
Family-oriented, community-based services	Family preventive services
	Family neonatal care
	Infant and child feeding

	Community management of common illnesses
Population-oriented schedulable services	Preventive care for adolescent girls and women
	Preventive pregnancy care
	HIV/AIDS prevention and care
	Preventive infant and childcare
Individual-oriented clinical services	Clinical primary level skilled maternal and neonatal care
	Clinical management of illnesses at primary level
	Clinical first referral illness management
	Clinical second referral illness management

Family-oriented community-based services are those health interventions which are provided to families and communities on their own or with little inputs. Family-oriented community services may not require a skilled health service provider. However, community-based worker or family members often needs some special training and support from the professionals. These services are mainly delivered via various information, education and communication (IEC) strategies. Examples include activities like keeping new-borns warm; early, exclusive, and continued breast-feeding; and handwashing. Other services at community level such as provision of safe drinking water, and oral rehydration therapy (ORT) may also require commodity support for successful implementation (40).

Population-oriented, schedulable services are health services targeted for prevention and delivered in health facilities or via out-reach clinics to a target group, based on schedule. Examples include vaccinations, antenatal care, family planning, Directly Observed Treatment System (DOTS) for TB, vitamin A supplementation, deworming, and intermittent presumptive treatment for malaria (40).

Individual-oriented services primarily include clinical services provided by skilled health workers at a health institution. Such services include safe motherhood and delivery services, individual illness management through OPD or IPD services (40).

1.6.3 Selection of the tracer Indicators/ programs

Twelve tracer programs and 6 indicators were selected after thorough and comprehensive discussions which were most relevant to Nepal's context health policies and data availability.

A tracer program represents a set of health services and is selected to be representative of the health system level to identify bottlenecks of that level or service delivery mode. Under one sub-package there could be options of selecting different tracers as per the district context. For example, under clinical first referral care management there was a choice between TB management and Basic Emergency Obstetrics and Neonatal care (BEONC). Only one tracer intervention was selected as proxy under a sub-package for bottleneck analysis to simplify the analysis. The criteria used to select the tracer interventions included:

1. The tracer was nationally relevant.
2. The tracer was selected only when data are available and accessible for each six determinants.
3. The tracer had a good scale implementation.
4. The tracer represented the other indicators of the same intervention group in terms of having similar health system constraints at specific service delivery level in order to ensure correct assessment of costs to overcome system bottlenecks.

Selected tracer based upon the available tracers in each sub-package were as below:

1. Family neonatal care – Exclusive breast-feeding up to 6th months
2. Infant and child feeding – Minimum adequate diet
3. Preventive pregnancy care – Antenatal care
4. Preventive infant and childcare – Full immunization
5. Clinical primary level maternal and neonatal care – Skilled birth attendance
6. Clinical first referral illness management – Basic emergency obstetrics neonatal care (BEONC)

1.7 Rationale of the study

In order to support the district health system for planning and budgeting MCH intervention, the IC programme was launched in poor performing districts with low HDI in Nepal. The IC approach used principles of the 'Tanahashi model' and the 'bottlenecks analysis framework' to explore the current barriers to access and utilization of health services, and determines the budget and outcome of interventions to enhance service quality and equity (29). The IC program is grounded in data and evidence, by identifying equity in service coverage which can help to develop and implement focused interventions (29).

A proper planning focusing the left behind groups through expansion of service networks as well as enabling geographical access is required to reduce inequity. The IC program is based on evidence, which can identify inequity in service coverage through targeted interventions Studies suggest that IC approach helped in improving MCH status in different countries including Philippines, Indonesia, Bangladesh, India and Ruwanda (29, 30, 36). However, first-hand local evidence does not exist to evident effectiveness of the Investment Case program in Nepal. Until now, there are not any study which have evaluated the effectiveness of the IC approach in MCH services. This study aimed to assess the effect of the intervention designed utilizing the IC approach in improving MCH service outcomes in Nepal. This will help the policy makers and health managers in successful planning and implementing MCH related program thereby reduce inequity in service utilization. This study measured the utilization of MCH services in Nepal, thereby assessed the effectiveness of the IC approach.

1.8 Objectives of the study

The objectives of the study were:

- To assess the effect of the IC approach on access of MCH services in Nepal.

- To explore perceptions of key stakeholders from both service and demand sides regarding the planning and budgeting aspect of the IC approach and effectiveness of the approach in reducing inequities related to MCH services in Nepal.

1.9 Research questions

- What is the effect of the IC approach on improving the access to MCH services in Nepal?
- What are the perceptions of key stakeholders about the effectiveness of the IC approach in contributing the planning and budgeting process at district level to address equitable access to MCH services in Nepal?

1.10 Structure of the thesis report

This thesis has been organized in five major chapters. Chapter 1 has provided a summary of the health care system in Nepal, including the situation of MCH and major MCH related programs in Nepal, and an introduction to the IC approach and its implementation modality in Nepal to address MCH indicators. This chapter has also stated the study objectives and research questions, and the rationale of the study. Chapter 2 details the methodological considerations, research process, data sources, and the qualitative fieldwork. The results of the study are presented in two chapters (Chapters 3 to 4). Chapter 3 includes the results of quantitative study which address the effectiveness of the IC approach in MCH indicators. Chapter 4 presents the results of qualitative study which explore the perception of the IC implementors and stakeholders on its effectiveness in planning and budgeting at district level and below. The findings presented in these chapters have been published in peer reviewed journals (38, 39). Chapter 5 synthesizes key findings, and presents a discussion on the findings, presents study's strengths and limitations. Chapter 5 also discussed further research and policy implications and concludes the study.

2. Study approach and methods

2.1 Overview

The study included a mixed method approach utilizing both quantitative and qualitative methods. The first research question of the study was addressed through quantitative data obtained from the Nepal Demographic and Health Surveys (NDHSs) using a difference-in-difference (DiD) analysis method to assess the effect of IC approach on MCH outcomes. The second research question was answered through the qualitative approach using a phenomenological analysis for the identification of the enabling and restraining factors while implementing the IC approach in Nepal.

2.1.1 Study design

The study adopted quasi-experimental design with mixed method approach. The mixed method study was used to draw the strengths and minimize the weakness of individual qualitative and quantitative studies in a single research study.

The quantitative approach in this study used the data from the NDHSs 2011 and 2016. The qualitative approach was used to provide in-depth insights of the stakeholders on their experiences and perceptions regarding IC approach, thereby reducing the over-dependence on statistical data to explain the experiences which are purely subjective in nature. Stakeholders' perception and experience while involving in planning and implementing IC approach has been explored using the phenomenological research (41). Phenomenography as a qualitative research method considers that researchers embrace the subjective beliefs regarding the understanding of knowledge. Phenomenology considers the conception of phenomena is relational, with the world constructed differently based on the individual perspective and the circumstances (42). Phenomenographic approach for qualitative study was adopted using Focus Group Discussion (FGD) and Key Informant Interview (KII) in this research to explore a set of themes drawn from the participants' awareness regarding the IC approach to address equitable access to MCH services. The triangulation of methods provides alternative interpretation of data and can improve the appraisal by addressing that

the shortcomings of one type of data can be balanced by the assets of other (43). Table 3 shows the study components, data sources, level of analysis, and analytical approach used in this study.

Table 3. Study components, data sources, level of analysis, and analytical approach

Study components	Data source	Level of analysis	Analytical approach
Analysis of the effect of IC approach	NDHS 2011 and NDHS 2016	16 intervention and 24 comparison districts	Difference in difference (DiD) analysis using a linear regression model
Analysis of enabling and restraining factors related to IC approach	6 focus group discussions 30 key informant interviews	6 districts (3 intervention and 3 comparison districts) representing three ecological regions - mountain, hill and plain of Nepal	Phenomenological analysis

2.1.2 Study Setting

This study was conducted in Nepal, which is a low-income country in South Asia with the total population of 29.3 million, and annual population growth rate of 0.9% (44). Nepal is located in the Himalayas and is rich in its diverse ethnic group and culture. According to the constitution of Nepal 2015, Nepal is a secular federal republic which is divided into seven provinces and three ecological regions: mountains, hills and plains (20). Almost 50% of the population reside in the Plain region, 43% in the hills and the remaining 7% in the mountain region (45). Table 4 shows the socio-economic characteristics and key health indicators of Nepal.

Table 4. Basic socio-demographic and health indicators of Nepal

Indicators	Value
Area	147,181 sq. km.
Population [1]	29.3 million
Total fertility rate (number of children per woman) [2]	2.3
Current use of any method of family planning[2]	53%
Neonatal mortality [2]	21/ 1,000 live births
Infant mortality [2]	32/ 1,000 live births
Maternal mortality ratio[2]	239/100,000 live births
Under-five mortality [2]	39/1,000 live births
Children who have received all basic vaccinations[2]	78%
Population having access to an improved source of drinking water[2]	95%
Literacy rate[1]	65%

Source: [1] Central Bureau of Statistics, 2021 and 2011

[2] Nepal Demographic and Health Survey, 2016

In this study, 16 districts where the IC approach was implemented were selected as the intervention group and 24 districts with similar HDI where the IC intervention was not implemented were included as the control group. Both intervention and control districts were from plain, hilly and mountain areas, ensuring the geographical representation of the country. On top of the regular government programs on MCH (in all districts), the IC approach was executed only in the intervention districts. Furthermore, for obtaining qualitative data, six districts were selected, three from the intervention (Bajhang, Baitadi and Parsa) and three from the control (Darchula, Sindhuli and Bara) districts. Intervention

districts included the districts where the IC approach (intervention) was implemented while control districts had similar characteristics except the intervention. The districts selected for qualitative fieldwork included Bajhang (mountain), Baitadi (hill), and Parsa (plain) from intervention group and Darchula (mountain), Sindhuli (hill) and Bara (plain) from control group. Figure 3 shows a map of Nepal with the study area.

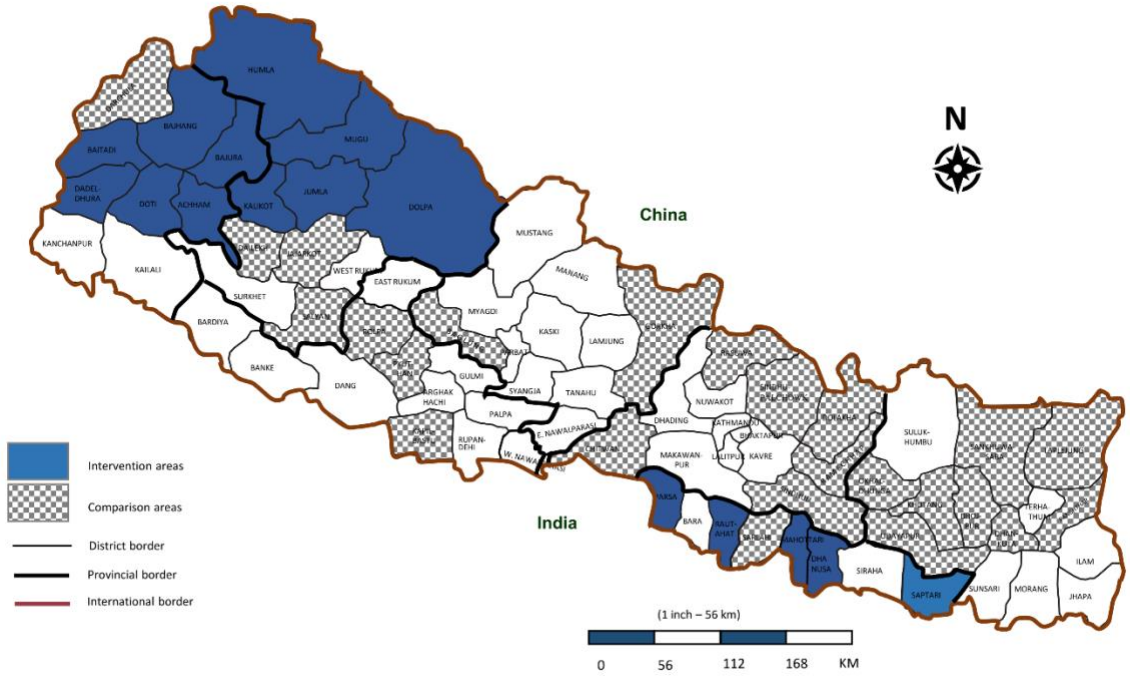

Figure 3. Map of Nepal showing the IC intervention and control districts.

The map is modified from the Wikipedia.
(http://en.wikipedia.org/wiki/File:Nepal_districts.png)

2.1.3 Intervention

Prior to the intervention, a district level workshop was organised to design the IC approach in all the 16 intervention districts. The intervention was implemented by the DPHOs

(Government of Nepal) at the district level with technical and financial support from the UNICEF.

The intervention package primarily included following seven components.

1. Supply of medicines and commodities
2. Recruitment and deployment of human resources.
3. Different types of MCH related trainings for health workers: e.g., SBA training for nurses, cesarean section training (advanced SBA) for doctors, essential newborn care training for nurses, Community Based Integrated Maternal, Neonatal, and Childhood Illness (CB-IMNCI) and nutrition related trainings.
4. Scale up of Birthing centres/Basic emergency obstetric and newborn care (BEoNC)/ Comprehensive emergency obstetric and newborn care (CEoNC) services.
5. Supervision and monitoring by DPHOs and UNICEF.
6. Technical and financial provision for the evidence-based planning, implementation, and budgeting.

In the district level workshop, different activities for all the aspects of the IC approach based on the Tanahashi model (1978) were enlisted and the action plans for each of the components were developed, which was subsequently implemented under the leadership of DPHOs.

2.1.4 Study participants

For quantitative study, data from the NDHS was used. NDHS is a standardized survey which gathers household level information on population, health, and nutrition from a nationally representative sample collected by a multi-stage sampling (46). This study utilized data from the recent past two NDHS surveys –2011 and 2016. A detailed explanation of the survey design can be uncovered in the NDHS reports (11, 13).

Table 5 presents the number of sample households, women of reproductive age, women having a child below 5 years of age in the two surveys, and the sample of women involved

in this analysis. This study included 1,527 women having a child below 5 years of age in baseline – 2011 (679 in intervention and 848 in control) and 1343 in the end line – 2016 (603 in intervention and 740 in control).

Table 5. Number of households and women of reproductive age by survey years (39)

Parameters	**NDHS 2011**			**NDHS 2016**		
Total sample households	10,826			11,473		
Response rate (%)	*99.4*			*98.5*		
Total sample women aged 15-49 years	12,674			13,089		
Response rate (%)	*98.1*			*98.3*		
	Intervention	Control	Total	Intervention	Control	Total
Sample women for this study (women having a child below 5 years of age)	679	848	1527	603	740	1343

For the qualitative study, the study assessed the perception and experiences of stakeholders involved in designing and implementing the IC approach using a phenomenographic research approach. An equal number of KIIs and FGDs were conducted in both the intervention and comparison districts, with 15 KIIs and 3 FGDs in each group. The study participants included the key stakeholders from district and community levels as shown in Table 6.

Table 6. Details of the participants (38)

Participants	Participants' details
District (public) health officers	District level health managers who manage health activities in the district, who also had primary role in the implementation of the IC intervention
Public health nurses	They were responsible for providing the services as well as monitor the tracer elements of the IC intervention
Frontline health workers	Their roles in the IC were to directly engage in implementing the IC at the community level and monitor the indicators
Local development officers	Representatives from the Local Development Office who coordinated and supported the health-related activities in the district
VDC secretaries	Chief administrative officer of the VDC whose role was to allocate the budget for health-related activities in community level and monitor progress of the IC
Female community health volunteers (FCHVs)	The role of FCHVs is to advocate health behavior among mothers and community people
Mothers having children below 2 years	They are the main beneficiary group of the IC approach

Qualitative study participants were purposively selected ensuring variation among the stakeholders' experiences and perception on the IC approach. Included participants having experience in a district level IC program for at least six months during the execution phase to ensure that the participants had in-depth understanding of the topic in the intervention districts. However, the level of experience among the participants varied. In the comparison

districts, participants were recruited from different levels of health system a geographical and administrative region to maintain sufficient diversity.

2.1.5 Variables description

The outcome variables included a range of MCH outcomes, and comprised any ANC visit, at least four ANC visits, SBA delivery, breast feeding initiation within one-hour of birth, full immunization of the children, and nutritional status of children that consisted underweight, stunting, and wasting. Any ANC represented at least one ANC check-up at any time during pregnancy, and at least four ANC represented mothers visiting to health facility for at least four times during the most recent pregnancy with no consideration about their timing of the visits. SBA delivery included delivery conducted by a trained SBA, with the trained SBA included ANM, staff nurses, and doctors. Full immunization represented children immunized with BCG, Polio, DPT3 and MR1. Nutrition status of children were defined as children whose weight-for-age Z-score, height-for-age Z-score and weight-for-height Z-score below two standard deviations (-2 SD) from the median score of the reference population as underweight, stunting and wasting respectively, as per the WHO standards (39).

The covariates included were wealth index; women's education; women's occupation; place of residence; women's age; ethnicity; distance to the nearest health facility; gender of the household head; ecological region; and husband's education. Figure 4 shows the conceptual framework of the study.

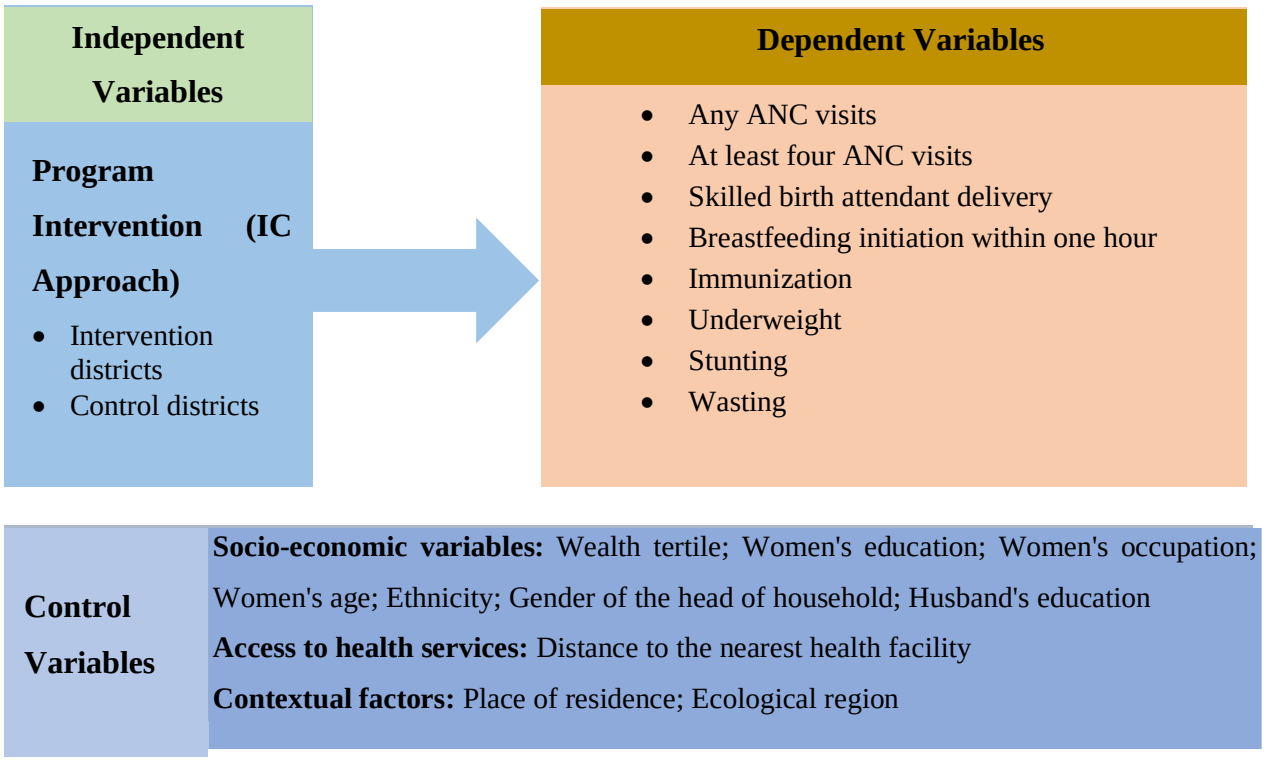

Figure 4. Conceptual framework of the study

For qualitative study, the experience of stakeholders in implementing the IC approach at district level, and their perception on the effectiveness of the approach in planning and budgeting MCH services were assessed.

2.2 Data Sources

The analysis used primarily two data sources; the NDHS dataset to assess the effect of the IC interventions in improving MCH services, and qualitative fieldwork to assess the perceptions, experience and enabling and restraining factors related to IC approach in intervention.

2.2.1 Quantitative study

For quantitative study, the data from the NDHSs were used. The standardized survey collects data on health seeking behaviour, healthcare practices, maternal health services, nutrition, child health including immunization, fertility, knowledge of HIV/AIDS, and some non-communicable disease such as hypertension (11), and is designed to provide representative data on country as a whole; urban/rural populations; and administrative regions (size/level depends on country). It uses two stage sampling procedure. In the first stage, clusters/enumeration areas from sampling frame (ideally, a recent census) are selected and the selected clusters/enumeration areas are visited to conduct a complete household listing and mapping operation. The second Stage involves selection of households from the listing for each cluster/enumeration area (11). The data for the survey were collected by the skilled enumerators having education background in health after having verbal consent.

This study utilized data from the recent past two NDHS surveys i.e., NDHS 2011 and 2016. (39). All the methods of both surveys were identical. Data required were downloaded from the DHS Program website (www.dhsprogram.com). Table 7 shows the number of sample households and individual participants which included women of reproductive age.

Table 7. Number of households and women of reproductive age by survey years

Parameters	NDHS 2011	NDHS 2016
Total households	10,826	11,473
Response rate (%)	99.4	98.5
Women aged 15-49 years (total)	12,674	13,089
Response rate (%)	98.1	98.3

2.2.2 Qualitative study

Qualitative data were gathered by key informant interviews (KIIs) and focus group discussions (FGDs). For data collection, three FGD facilitators and three note takers with Bachelor's in Public Health degree having previous two years' experience were employed. The same field researchers were engaged in taking the key-informant interviews. A 3-days training on qualitative research- was provided to the field research team. The training included sessions related to the focus group and interview techniques, rapport building, data quality, and research ethics. A total of 15 KIIs and 3 FGDs were carried out each in intervention and comparison districts. The duration of each FGD ranged from 50 and 60 minutes, while the KIIs lasted for 45 to 50 minutes. KIIs were conducted in the District Health Offices, Local Development Offices, Health Posts, and District Hospitals. The FGDs were conducted at the health institutions or community buildings. FGD and KII guidelines included issues related to facilitators and barriers in planning, budgeting, and implementation of the IC approach, as well as the planning and budgeting aspect of MCH programs at district and community level. The instruments underwent through a pre-testing which was conducted in one IC implemented district and one non-implemented district. All the approached participants agreed to participate. Data were collected in the Nepali language. The focus groups as well as interviews were recorded by a note taker, as well as audio taped. Collected information were transcribed from the audio recordings and field notes. The collected data were examined by for accuracy and consistency for ensuring descriptive and interpretation validity. The transcripts were translated into the English language.

For qualitative analysis 3 intervention and 3 comparison districts were selected purposefully, ensuring one district from Mountain, hilly and plain areas for both intervention and comparison areas. Table 8 shows the selection of districts for qualitative study.

Table 8. Selection of districts for qualitative study (38)

Mountain districts		Hill districts		Plain districts	
Intervention	Comparison	Intervention	Comparison	Intervention	Comparison
Bajahang	Darchula	Baitadi	Sindhuli	Parsa	Sarlahi
Total study districts		6 districts			

2.3 Data analysis

2.3.1 Quantitative analysis

All the study variables were presented using descriptive statistics (frequency and confidence intervals) for baseline and end line assessments, by intervention and control districts. The Difference in Difference (DiD) analysis using a linear regression was carried out to estimate the effect of the intervention on MCH service utilization outcomes and assess changes in outcomes from baseline to end line. The DiD analysis considers the difference between the baseline and end line measurements in the intervention districts versus the difference between the baseline and end line measurements in the control districts. The DiD analysis adjusts for the time-varying factors that may influence the outcome measurements (47). The DiD analysis also addresses the bias due to sample selection as it is calculated in a regression framework to permit adjust for potential confounders (47). Regression model(s) consisted of the year of data collection (0 for 2011 and 1 for 2016), the intervention variable (0 for control group and 1 for intervention group), the interaction term between the intervention and the year, and potential confounding variables. The regression coefficient of the interaction between the intervention and the year yielded the DiD estimating the effect of the intervention. The final models were developed by a stepwise backward selection method adjusting for the confounding

variables which were significant at $p < 0.05$. To address for the complex sampling design, a survey data command 'svy' was used in the analysis. Statistical analyses were carried out using the Stata version 15.

2.3.2 Phenomenological analysis of qualitative data

Phenomenography as a qualitative method considers that researchers possess a subjective belief regarding the understanding of knowledge. Phenomenological approach was used to identify a set of themes derived from the participants' perception and understanding regarding the IC approach to address inequities in MCH services (38).

The analysis started with transcription and translation (from Nepali to English) of the raw data collected from the field, which was followed by the main analysis guided by the study of González (48). Data were analyzed manually using the phenomenological approach by thematic analysis (49). Firstly, all the qualitative data were assembled and categorized based on the types of the participants and intervention areas. The data were transcribed into the Nepali language, which were further translated into the English language. The transcriptions were reviewed for understanding the meaning of the content by the PhD Candidate and supervisors. A deductive method was used to discover the perception and experience of stakeholders who were involved in planning and budgeting of MCH services at the district and local level. Coding of the data were done from intervention and control district separately. The codes identified from the raw data were discussed with supervisors, and the ultimate codes were finalized. The remaining transcripts were coded using the final codes. The codes showing a related meanings were kept together to develop a common theme. Important verbatims, as stated by the participants, were included in each of the identified themes. Data organized corresponding to the identified themes were summarized based on to the pattern of findings. The list of codes and themes are provided in Table 9.

Table 9. Themes and categories for data analysis (38)

Themes	Codes
1. Perception of health service planning in the district 2. Perception of the resource allocation in health services 3. Perception of the plan implementation 4. Perception of equity in the access to MCH services	Steps and process of planning involved Evidence based planning Role of IC approach in planning and budgeting Participatory planning Community participation Influencers and hindrances in planning Ownership Improvement in coordination Budget allocation process Partnership with external partners MCH Program implementation Monitoring and supervision Improvements in MCH indicators Human resource availability Equity Quality of health services

2.4 Data triangulation between different data sources (qualitative and quantitative)

The findings of quantitative (NHDS analysis) and qualitative (FGD and KII) studies are presented separately. The important findings from qualitative and quantitative approach are tabulated in order to assess the analysis from these two approaches are in the same direction or they diverge. If the analysis from qualitative as well as quantitative approach give similar conclusion then the study leads to the reliable results. The strengths and weaknesses of each data source (quantitative and qualitative) must be taken into consideration. Qualitative data are likely to approach main source of description for the impact of the IC approach in the districts of Nepal or the lack thereof. Triangulation of data between qualitative and quantitative data sources leads to the quality in the research and enhance reliability of the study.

2.5 Rigor, reliability, and validity

The research approach is iterative and collaborative to level up rigor, reliability and validity (50). Study tools were finalized in consultation with the quantitative and qualitative as well as subject experts, and the data were collected by well-trained field researchers. This included a careful questionnaire construction to minimize the bias in the process of data collection. Field researchers were closely supervised throughout the fieldwork. Moreover, the researchers' interpretations were controlled and cross-checked by university and local supervisors to ensure that the results show in a presentable manner, avoiding researchers' subjective judgement. The collected data were checked for their accuracy and ensured the descriptive and interpretative validity. Furthermore, in the context of phenomenological research, the research aimed at reaching completeness of the analysis and minimizing personal perspective (42).

2.6 Ethical consideration

Prior to the study, ethical clearance was obtained from the Nepal Health Research Council (Ref. no. 1296/2016). The quantitative data for the study was taken from the NDHSs 2011 and 2016 which was approved by the Nepal Health Research Council and the ICF International, USA. The proposal was also approved from the Institutional Review Board of the CIH LMU (Project no. 708-16d). While collecting information, confidentiality was maintained during the study. After describing the purpose of the study verbal and written consent was taken from the qualitative participants. The PhD candidate has safely stored the informed consent forms and qualitative filed notes.

2.7 Conclusion

The first research question of the study was addressed through quantitative data obtained from the NDHS and the second research question was addressed through the qualitative approach. In order to assess the post-intervention improvement of the IC approach, DiD using linear regression were used. For qualitative data, phenomenological analysis was adopted for the explanation of the enabling and restraining factors in significant

relationship with the intervention. The next chapter presents the results of quantitative study.

3. Results of quantitative study

Chapters 3 and 4 present quantitative and qualitative results of the study respectively. Chapter 3 includes the findings related to quantitative study which describes the effect of IC approach on MCH service utilization outcomes. First the sociodemographic characteristics of the study participants are presented, which is followed by the MCH service utilization pattern (outcome indicators), and the effect of the intervention on MCH outcomes.

3.1 Socio-demographic characteristics of study population

Socio-demographic characteristics of study participants in baseline (2011) and end-line (2016) across the intervention and comparison groups are presented in Table 10. The highest proportion of women in both intervention and comparison groups were from 15 – 24 years age group, and disadvantaged ethnic populations. In comparison group women without education was comparatively lower compared to the intervention group. Unemployment had reduced over the years, with increasing proportion of respondents reporting their occupation as agriculture or labor work. Similarly, urban population had increased over the years among both intervention and comparison groups (39). Table 10 shows the socio-demographic characteristics of the participants.

Table 10. Socio-demographic characteristics of the study participants (39)

Characteristics	2011 (%)		2016 (%)	
	Intervention (n=679)	Comparison (n=848)	Intervention (n=603)	Comparison (n=740)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Women's age				
15-24 years	51.5 (46.5 -56.4)	44.7 (40.0 - 49.4)	51.3 (45.3 - 57.2)	51.4 (46.0 - 56.7)
25-34 years	38.1 (32.1 - 44.5)	43.2 (38.5 - 48.0)	42.8 (37.8 - 47.9)	41.5 (36.3 - 46.8)
35-49 years.	10.4 (8.02 - 13.4)	12.1 (9.0 - 16.2)	5.9 (4.0 - 8.5)	7.1 (4.9 - 10.3)

Characteristics	2011 (%)		2016 (%)	
	Intervention (n=679)	Comparison (n=848)	Intervention (n=603)	Comparison (n=740)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Ethnicity				
Advantaged	26.1 (17.8 - 36.6)	39.4 (32.5 -46.8)	26.9 (21.6 - 32.9)	34.2 (26.9 - 42.2)
Disadvantaged	73.8 (63.4 - 82.1)	60.6 (53.2 -67.5)	73.1 (67.1 - 78.4)	65.8 (57.8 - 73.0)
Women education				
No education	70.8 (61.9 - 78.3)	42.7 (35.7 - 49.9)	50.3 (42.0 - 58.5)	31.5 (26.6 - 36.7)
Primary education	12.9 (8.6 - 18.8)	21.2 (18.0 - 24.7)	19.2 (15.6 - 23.5)	25.5 (20.6 - 31.0)
Secondary or higher	16.3 (11.8 - 22.0)	36.1 (29.9 - 42.8)	30.5 (23.7 - 38.3)	43.0 (36.7 - 49.6)
Women occupation				
Unemployed	38.5 (27.4 - 51.0)	20.3 (15.1 - 26.7)	51.5 (43.8 - 59.1)	32.8 (25.3 - 41.4)
Agriculture or labour work	57.2 (45.2 - 68.4)	71.5 (65.4 - 76.9)	46.0 (38.5 - 53.7)	58.8 (50.6 - 66.6)
Service or business	4.3 (2.3 - 7.9)	8.1 (5.8 - 11.4)	2.5 (1.3 - 4.5)	8.3 (6.2 - 11.1)
Wealth tertile				
Lowest	36.3 (28.4 - 45.0)	35.8 (28.8 - 43.3)	30.8 (25.6 - 36.6)	52.9 (44.5 - 61.0)
Middle	36.7 (31.1 - 42.6)	40.3 (32.8 - 48.4)	43.3 (38.4 - 48.4)	28.1 (23.7 - 33.1)
Highest	27.0 (20.1 - 35.3)	23.9 (17.8 - 31.2)	25.9 (21.0 - 31.4)	19.0 (13.0 - 26.7)
Ecological region				
Hill	19.1 (13.9 - 25.8)	49.9 (42.8 - 56.9)	13.7 (8.8 - 20.8)	51.3 (40.0 - 62.4)
Mountain	16.7 (12.4 - 22.3)	19.1 (14.1 - 25.4)	15.0 (10.1 - 21.7)	15.4 (8.9 - 25.3)
Plain	64.1 (54.1 - 73.0)	31.0 (24.9 - 37.8)	71.3 (65.7 - 76.3)	33.3 (23.9 - 44.2)
Place of residence				
Urban	28.1 (17.0 - 42.7)	49.0 (35.0 - 63.0)	42.2 (29.4 - 56.0)	51.4 (39.6 - 63.0)
Rural	71.9 (57.3 - 82.9)	51.0 (36.9 - 64.9)	57.8 (44.0 - 70.5)	48.6 (37.0 - 60.4)
Husband education				
No education	35.7 (28.1 - 44.1)	23.8 (17.6 - 31.2)	19.8 (14.8 - 25.8)	14.8 (11.6 - 18.7)

Characteristics	2011 (%)		2016 (%)	
	Intervention (n=679)	Comparison (n=848)	Intervention (n=603)	Comparison (n=740)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Primary education	21.9 (17.7 - 27.0)	23.9 (19.7 - 28.8)	24.4 (19.5 - 30.0)	26.5 (21.7 - 32.0)
Secondary or higher	42.3 (35.9 - 48.9)	52.3 (46.8 - 57.7)	55.8 (48.5 - 62.9)	58.7 (52.9 - 64.3)
Head of the household				
Male	78.8 (68.8 - 86.3)	74.8 (69.9 - 79.1)	75.4 (69.3 - 80.6)	70.7 (66.4 - 74.7)
Female	21.1 (13.7 - 31.2)	25.2 (20.9 - 30.1)	24.6 (19.4 - 30.7)	29.3 (25.3 - 33.6)

3.2 Situation of maternal and child health in intervention and comparison groups

3.2.1 Women with any (at least one) ANC visit

Women with any ANC visit with socio-demographic characteristics is given in Table 11. The proportion of making any ANC visit increased from 82.4% in 2011 to 95.3% in 2016 in the intervention area and from 81.6 to 93.6% in the comparison area. The inequities across age of mothers have reduced in 2016 compared to 2011. Any ANC was lowest in both groups among 35 – 49 years age group. Any ANC has increased from 2011 to 2016 across all age groups in both intervention and comparison area and was highest among 15 – 24 years age group in both intervention (86.48% vs. 96.2%)) and comparison areas (89.19% vs 97.15%). The higher change in the proportion of any ANC across the years was in the age group of 35 – 49 years in both intervention and comparison groups. Regarding ethnicity of the participants, the advantaged had higher proportion of any ANC in both the intervention and comparison groups in both the years. There was increase in any ANC in both the groups in intervention and comparison area. For education of women, any ANC visit was seen higher in the women with education secondary or higher level and was lower in the women with no education in both intervention and comparison area. Any ANC increased from 2011 to 2016 across all educational level in both intervention and

comparison area. The rate difference of any ANC decreased in 2016 in both intervention and comparison area as compared to 2011. Regarding occupation of the participants, there was an increase in any ANC across all occupational groups in intervention and comparison area from 2011 to 2016. Any ANC was lowest among the women with occupation of agriculture or labour work and was highest among the women with occupation service or business. The rate difference increased in the intervention area (-0.53 vs 4.58) but decreased in comparison area (12.06 vs 1.26) across the years. Any ANC was highest in the participants with highest wealth tertile and was lowest among the participants with lowest wealth tertile in both intervention and comparison areas in both the years. Any ANC increased from 2011 to 2016 across all groups in both intervention and comparison areas and the rate difference also decreased across the years in both intervention and comparison areas. The participants of mountain region had lower proportion of any ANC in 2011 in both intervention and comparison areas. In 2016, the participants of hilly region had lowest proportion of any ANC in comparison area. The rate difference decreased in both the intervention and comparison areas across the years. Any ANC was higher among the participants residing in urban areas than rural areas in both intervention and comparison areas. There was increase in the proportion of any ANC from 2011 to 2016 in both intervention and comparison area across all categories of place of residence. The rate difference of any ANC decreased across the years in both intervention and comparison areas. Any ANC was lowest among the participants whose husband had no education in both intervention and comparison areas. There was increase in any ANC from 2011 to 2016 across all educational level in both the intervention and comparison areas and the rate difference also decreased in both areas across the years. The household with male as head had lower proportion of any ANC in both years across the intervention and comparison areas. There was increase in any ANC in both 2011 and 2016 in both intervention and comparison area across the categories of head of household and the rate difference also decreased across the years in both the areas. In terms of the distance to health facility, the participants with distance as a big problem had lower proportion of any ANC in both the

years and areas. There was increase in any ANC across distance from 2011 and 2016 in both intervention and comparison areas. The rate difference also seemed to decrease across the years.

Table 11. Any ANC across Intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 Weighted	After n=545 weighted	Before n=792 Weighted	After n=680 weighted
Any ANC (Total sample)	**82.4**	**95.3**	**81.6**	**93.6**
Women's age				
15-24 years	86.48	96.20	89.19	97.15
25-34 years	81.40	94.81	79.76	90.44
35-49 years	66.93	91.24	60.21	87.16
Rate difference (15*-35*)	19.56	4.96	28.99	9.99
Ethnicity				
Advantaged	84.35	93.40	82.31	95.60
Disadvantaged	81.64	96.01	81.16	92.55
Rate difference (A-D)	2.70	-2.61	1.15	3.05
Women education				
No education	77.45	93.77	69.90	89.57
Primary	93.85	95.94	84.09	92.02
Secondary or higher	94.86	97.37	93.52	97.30
Rate difference (S-N)	17.41	3.60	23.62	7.74
Women occupation				
Unemployed	83.80	95.42	87.34	95.30
Agriculture or labor work	81.38	94.88	77.96	92.34
Service or business	83.27	100.00	99.40	96.56
Rate difference (S-U)	-0.53	4.58	12.06	1.26
Wealth tertile				

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 Weighted	After n=545 weighted	Before n=792 Weighted	After n=680 weighted
Lowest	76.30	91.30	65.90	89.90
Middle	83.60	96.70	85.40	97.50
Highest	89.50	97.70	98.10	98.30
Rate difference (H-L)	13.20	6.40	32.20	8.40
Ecological region				
Hilly	90.18	98.93	75.10	90.14
Mountain	77.44	88.09	83.75	96.88
Plain (Tarai)	81.28	96.09	90.92	97.56
Rate difference (H-T)	8.90	2.84	-15.83	-7.42
Place of residence				
Urban	91.41	95.89	89.31	95.47
Rural	78.75	94.85	74.05	91.63
Rate difference (U-R)	12.66	1.04	15.27	3.83
Husband education				
No education	70.11	96.59	61.37	86.08
Primary	88.97	93.97	80.91	92.03
Secondary or higher	89.07	95.31	90.42	96.12
Rate difference (S-N)	18.95	-1.28	29.05	10.04
Head of the household				
Male	81.21	94.57	81.50	93.89
Female	86.66	97.48	81.94	92.92
Rate difference (N-B)	15.59	-0.67	19.66	3.75
Distance to nearest HF				
Big problem	77.46	95.51	73.73	92.41
Not much problem	93.06	94.84	93.39	96.15
Rate difference (N-B)	15.59	-0.67	19.66	3.75

3.2.2 At least Four ANC

Table 12 gives at least 4 ANC for NDHS 2011 and 2016 survey, by geographical location and socio-demographic and socio-economic characteristics. The proportion of making at least four ANC visit increased from 40.1% in 2011 to 52.5% in 2016 in the intervention area, while it increased from 43.9% to 61.1% in the comparison area At least four ANC has increased from 2011 to 2016 across all age groups in both intervention and comparison areas and was highest among 15-24 years age group in both intervention (46.23% vs. 55.49%) and comparison areas (53.41% vs 64.95%). The rate difference decreased in both intervention and comparison areas across the years and was lowest in comparison area. Regarding ethnicity of the participants, the advantaged had higher proportion of at least four ANC visit in both the intervention and comparison groups in both the years. There was increase in at least four ANC in both the advantaged and disadvantaged groups in intervention and comparison area. The rate difference decreased slightly in intervention area across the years but increased in comparison area. At least four ANC visit was seen higher in the women with education of secondary or higher level and was lower in the women with no education in both intervention and comparison area. At least four ANC visit increased from 2011 to 2016 across all educational level in both intervention and comparison area. The rate difference of any ANC decreased in 2016 in both intervention and comparison areas as compared to 2011 and the decrease was higher in comparison area. Regarding occupation of the participants, at least four ANC was lowest among the women with occupation of agriculture or labour work and was highest among the women with occupation service or business. There was an increase in at least four ANC across all occupational groups in intervention and comparison area from 2011 to 2016. The rate difference decreased in both intervention and comparison area across the years. At least four ANC was highest in the participants with highest wealth tertile and was lowest among the participants with lowest wealth tertile in both intervention and comparison areas in both the years. At least four ANC increased from 2011 to 2016 across all categories of wealth

tertile in both intervention and comparison areas and the rate difference also decreased across the years in both intervention and comparison areas and higher decrease was seen in comparison area. The participants of mountain region had lower proportion of at least four ANC in 2011 and 2016 in both intervention and comparison areas. The proportion of at least four ANC increased from 2011 to 2016 across the ecological regions in both intervention and comparison areas. The rate difference of at least four ANC decreased in both the intervention and comparison areas across the years. At least four ANC was higher among the participants residing in urban areas than rural areas in both intervention and comparison areas. There was increase in the proportion of at least four ANC from 2011 to 2016 in both intervention and comparison areas across all categories of place of residence. The rate difference of at least four ANC decreased across the years in both intervention (18.82 vs 9.28) and comparison (23.08 vs 7.22) areas. At least four ANC was lowest among the participants whose husband had no education in both intervention and comparison areas. There was increase in at least four ANC from 2011 to 2016 across all educational level in both the intervention and comparison areas and the rate difference also decreased in both intervention (33.54 vs 26.85) and comparison areas (42.08 vs 30.10) across the years. The households with male as head had slightly lower proportion of at least four ANC in both years across the intervention and comparison area. There was increase in at least four ANC in both 2011 and 2016 in both intervention and comparison areas across the categories of head of household and the rate difference also decreased across the years in both the areas. In terms of the distance to health facility, the participants with distance as a big problem had lower proportion of at least four ANC in both the years and areas. There was increase in at least four ANC across distance from 2011 and 2016 in both intervention and comparison areas. The rate difference also seemed to decrease across the years

Table 12. At least 4 ANC for NDHS 2011 and 2016 survey, by geographical location and socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 weighted	After n=603 weighted	Before n=792 weighted	After n=740 weighted
At least 4 ANC (Total sample)	**40.1**	**52.5**	**43.9**	**61.1**
Women's age				
15-24 years	46.23	55.49	53.41	64.95
25-34 years	38.02	51.29	39.16	57.95
35-49 years	19.08	34.99	25.25	51.46
Rate difference (15*-35*)	27.15	20.50	28.16	13.49
Ethnicity				
Advantaged	50.44	62.09	53.56	74.49
Disadvantaged	36.30	48.95	37.50	54.12
Rate difference (A-D)	14.14	13.13	16.06	20.36
Women education				
No education	30.29	41.87	19.53	46.65
Primary	54.29	45.90	47.60	53.60
Secondary or higher	71.86	74.13	69.45	76.06
Rate difference (S-N)	41.57	32.26	49.91	29.40
Women occupation				
Unemployed	41.57	46.88	46.55	52.87
Agriculture or labour work	39.32	57.16	39.57	64.10
Service or business	37.00	81.96	74.29	72.16
Rate difference (S-N)	41.57	32.26	49.91	29.40
Wealth tertile				
Lowest	34.40	51.30	26.70	58.40
Middle	36.50	50.90	41.00	59.70
Highest	53.70	56.50	73.30	70.70
Rate difference (H-L)	19.30	5.20	46.60	12.30

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 weighted	After n=603 weighted	Before n=792 weighted	After n=740 weighted
Ecological region				
Hilly	56.60	77.63	42.07	61.10
Mountain	37.95	51.29	55.06	72.44
Plain	35.60	47.89	39.89	55.82
Rate difference (H-T)	20.99	29.73	2.18	5.28
Place of residence				
Urban	53.52	57.85	55.52	64.60
Rural	34.70	48.57	32.44	57.38
Rate difference (U-R)	18.82	9.28	23.08	7.22
Husband education				
No education	21.54	36.07	15.71	38.64
Primary	41.27	41.89	38.75	56.39
Secondary or higher	55.08	62.92	57.79	68.74
Rate difference (S-N)	33.54	26.85	42.08	30.10
Head of the household				
Male	37.71	50.36	43.55	59.96
Female	48.83	59.00	44.87	63.80
Rate difference (F-M)	11.12	8.64	1.32	3.84
Distance to nearest HF				
Big problem	35.85	52.97	34.31	58.13
Not much problem	49.26	51.40	58.18	67.33
Rate difference (N-B)	13.41	-1.57	23.87	9.20

3.2.3 Skilled birth attendant delivery

The SBA delivery for NDHS 2011 and 2016 survey, by geographical location and socio-demographic and economic characteristics is given in Table 13. The proportion of delivery of SBA increased from 30.1% in 2011 to 51.0% in 2016 in the intervention area and from 28.8% to 43.1% in the comparison. SBA delivery had increased from 2011 to 2016 across all age groups in both intervention and comparison area and was highest among 15 – 24 years age group in both intervention (35.64% vs. 57.99%) and comparison areas (33.13% vs 50.78%). But the rate difference increased in both intervention and comparison areas across the years. The advantaged participants had higher proportion of SBA delivery in both the intervention and comparison groups in 2011 and 2016. There was increase in SBA delivery in both the advantaged and disadvantaged groups in intervention and comparison area. The rate difference decreased in intervention area across the years but increased in comparison area. SBA delivery was seen higher in the women with education of secondary or higher level and was lower in the women with no education in both intervention and comparison areas. The proportion of SBA delivery increased from 2011 to 2016 across all educational level in both intervention and comparison areas. The rate difference of SBA delivery decreased in 2016 in both intervention and comparison areas as compared to 2011 and the decrease was higher in comparison area (38.47 vs 25.79). Regarding occupation of the participants, the proportion of SBA delivery was lowest among the women with occupation of agriculture or labour work and was highest among the women with occupation service or business. There was an increase in SBA delivery across all occupational groups in intervention and comparison area from 2011 to 2016. The rate difference increased in intervention area but decreased in comparison area across the years. Regarding wealth quintile of the participants, SBA delivery was highest in the participants with highest wealth tertile and was lowest among the participants with lowest wealth tertile in both intervention and comparison area in 2011 and 2016. SBA delivery increased from 2011 to 2016 across all categories of wealth tertile in both intervention and comparison

area and the rate difference also decreased across the years in both intervention and comparison areas and higher decrease was seen in intervention area. The participants of mountain region had lower proportion of SBA delivery in 2011 in intervention area but in 2016 the participants of mountain region had lower proportion of SBA delivery in both intervention and comparison area. The participants of hilly region had lower proportion of SBA delivery in comparison area in 2011. The proportion of SBA delivery increased from 2011 to 2016 across the ecological regions in both intervention and comparison areas. The rate difference increased in the intervention and comparison area across the years. SBA delivery was higher among the participants residing in urban areas than rural areas in both intervention and comparison areas. There was increase in the proportion of SBA delivery from 2011 to 2016 in both intervention and comparison area across all categories of place of residence. The rate difference of SBA delivery increase across the years in intervention area but decreased in comparison area. The proportion of SBA delivery was lowest among the participants whose husband had no education in both intervention and comparison area. There was increase in SBA delivery from 2011 to 2016 across all educational level in both the intervention and comparison areas and the rate difference was almost equal in intervention area and decreased in comparison area (29.58 vs 19.05) across the years. The households with female as head had slightly lower proportion of SBA delivery in 2011 in intervention area but in comparison area, SBA delivery was high among the household with female as head in 2016. There was increase in SBA delivery in both 2011 and 2016 in both intervention and comparison areas across the categories of head of household and the rate difference also decreased across the years in both intervention and comparison areas. Regarding distance to health facility, the participants with distance as a big problem had lower proportion of SBA delivery in both the years and areas. There was increase in SBA delivery across distance from 2011 and 2016 in both intervention and comparison areas. The rate difference also seemed to decrease in intervention area but was almost equal in comparison area across the years.

Table 13. SBA delivery for NDHS 2011 and 2016 survey, by geographical location and socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=679 weighted	After n=603 weighted	Before n=848 weighted	After n=740 weighted
SAB delivery (Total sample)	30.1	51.0	28.8	43.1
Age groups				
15-24 years	35.64	57.99	33.13	50.78
25-34 years	27.25	45.31	27.43	37.49
35-49 years	12.93	31.06	17.56	19.85
Rate difference (15*-35*)	22.71	26.93	15.56	30.93
Ethnicity				
Advantaged	23.75	52.30	35.80	51.95
Disadvantaged	32.33	50.49	24.20	38.45
Rate difference (A-D)	-8.57	1.81	11.60	13.50
Education				
No education	22.63	38.25	11.98	30.10
Primary	38.35	53.25	25.70	37.40
Secondary or higher	55.94	70.52	50.45	55.89
Rate difference (S-N)	33.31	32.27	38.47	25.79
Occupation				
Unemployed	44.16	55.11	38.26	43.25
Agriculture or labour work	19.44	44.69	21.89	39.85
Service or business	45.36	81.96	65.43	65.05
Rate difference (S-U)	1.20	26.85	27.16	21.80
Wealth tertile				
Lowest	14.10	47.40	12.10	31.10
Middle	30.70	48.30	27.10	47.90
Highest	50.70	59.80	56.50	69.30
Rate difference (H-L)	36.60	12.40	44.40	38.20

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=679 weighted	After n=603 weighted	Before n=848 weighted	After n=740 weighted
Ecological region				
Hilly	25.66	70.08	28.05	38.65
Mountain	17.04	39.92	28.95	43.43
Plain	34.81	49.62	29.84	49.68
Rate difference (H-T)	-9.15	20.46	-1.79	-11.03
Residence				
Urban	39.23	59.45	42.68	53.10
Rural	26.51	44.80	15.43	32.47
Rate difference (U-R)	12.73	14.65	27.24	20.63
Husband education				
No education	21.22	37.16	10.76	33.23
Primary	22.67	45.18	21.82	27.74
Secondary or higher	41.69	57.81	40.34	52.29
Rate difference (S-N)	20.47	20.65	29.58	19.05
Head of household				
Male	31.06	50.65	27.45	42.31
Female	26.41	51.97	32.70	44.89
Rate difference (F-M)	-4.65	1.32	5.25	2.58
Distance to nearest HF				
Big problem	24.58	48.87	19.69	35.96
Not much problem	42.74	55.72	42.65	58.10
Rate difference (N-B)	18.17	6.84	22.96	22.15

3.2.4 Breast feeding within one hour

Breast feeding within one hour across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics is shown in Table 14. The proportion of breast feeding within one hour increased from 38.8% in 2011 to 54.2% in 2016 in the intervention area and from 43.5% to 59.1% in the comparison area. Breast feeding within one hour has increased from 2011 to 2016 across all age groups in both intervention and comparison area and was highest among 15-24 years age group in both intervention (42.30% vs. 54.68%) and comparison areas (48.77% vs 60.49%). The rate difference decreased in both intervention and comparison areas across the years. Regarding ethnicity of the participants, the advantaged participants had higher proportion of breast feeding within one hour in both the intervention and comparison groups in 2011 and 2016. There was increase in breast feeding within one hour in both the advantaged and disadvantaged groups in intervention and comparison area. Across the years, the rate difference increased in intervention area across the years but decreased in comparison area. The proportion of breast feeding within one hour was seen higher in the women with education of secondary or higher level and was lower in the women with no education in both intervention and comparison areas. The proportion of breast feeding within one hour increased from 2011 to 2016 across all educational level in both intervention and comparison areas. The rate difference of breast feeding within one hour decreased in 2016 in both intervention and comparison areas as compared to 2011. Regarding occupation of the participants, the proportion of breast feeding within one hour was lowest among the women with occupation of agriculture or labour work and was highest among the women with occupation service or business. There was an increase in breast feeding within one hour across all occupational groups in intervention and comparison area from 2011 to 2016. The rate difference increased in intervention area but decreased in comparison area across the years. Regarding wealth quintile of the participants, the proportion of breast feeding within one hour was highest in the participants with highest wealth tertile in 2011 in

intervention and comparison area, but it was higher among the participants with lowest wealth tertile in 2016 in intervention area. The proportion of breast feeding within one hour increased from 2011 to 2016 across all categories of wealth tertile in both intervention and comparison area. The participants of plain region had lower proportion of breast feeding within one hour in 2011 and 2016 in intervention area but in 2016 the participants of mountain region had lower proportion of breast feeding within one hour in comparison area. The proportion of breast feeding within one hour increased from 2011 to 2016 across the ecological regions in both intervention and comparison areas. The rate difference increased in the intervention and comparison area across the years and the increase was higher in intervention area. The proportion of breast feeding within one hour was higher among the participants residing in urban areas than rural areas in both intervention and comparison areas. There was increase in the proportion of breast feeding within one hour from 2011 to 2016 in both intervention and comparison area across all categories of place of residence. The rate difference of breast feeding within one hour increased across the years in intervention area as well as comparison area. Regarding husbands' education of the participants, the proportion of breast feeding within one hour was lowest among the participants whose husband had no education in both intervention and comparison areas. There was increase in breast feeding within one hour from 2011 to 2016 across all educational level in both the intervention and comparison areas and the rate difference was almost equal in intervention area and decreased in comparison area across the years. The households with female as head had lower proportion of breast feeding within one hour in intervention area in both years but in comparison area, breast feeding within one hour was high among the household with female as head. There was increase in the proportion of breast feeding within one hour in both 2011 and 2016 in both intervention and comparison areas across the categories of head of household and the rate difference also decreased across the years in intervention area but increased in comparison area. Regarding distance to health facility, the participants with distance as a big problem had lower proportion of breast feeding within one hour in both the years and areas. There was increase in proportion

of breast feeding within one hour across distance from 2011 and 2016 in both intervention and comparison areas. The rate difference seemed to increase in intervention and was almost equal in comparison area across the years.

Table 14. Breast feeding within one hour across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=679 weighted	After n=603 weighted	Before n=848 weighted	After n=740 weighted
Breast feeding within one hour (Total sample)	38.8	54.2	43.5	59.1
Age groups				
15-24 years	42.30	54.68	48.77	60.49
25-34 years	36.10	53.91	41.70	59.02
35-49 years	31.36	51.93	30.52	50.06
Rate difference (15*-35*)	10.94	2.74	18.25	10.43
Ethnicity				
Advantaged	54.11	73.14	45.53	59.63
Disadvantaged	33.37	47.22	42.18	58.88
Rate difference (A-D)	20.74	25.92	3.36	0.75
Education				
No education	32.13	47.51	31.59	53.51
Primary	48.44	59.74	40.10	57.62
Secondary or higher	60.16	61.69	59.58	64.14
Rate difference (S-N)	28.03	14.18	27.99	10.63
Occupation				
Unemployed	34.24	46.11	41.69	59.59
Agriculture or labour work	40.52	62.29	42.29	57.32
Service or business	56.87	71.48	58.55	70.16
Rate difference (S-U)	22.63	25.37	16.86	10.57

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=679 weighted	After n=603 weighted	Before n=848 weighted	After n=740 weighted
Wealth tertile				
Lowest	37.30	70.70	39.10	58.40
Middle	37.20	47.70	38.00	58.30
Highest	42.90	45.40	59.50	62.60
Rate difference (H-L)	5.60	-25.30	20.40	4.20
Ecological region				
Hilly	51.56	75.89	43.22	61.64
Mountain	47.53	71.36	49.56	55.50
Plain	32.72	46.40	40.21	56.95
Rate difference (H-T)	18.84	29.49	3.01	4.69
Residence				
Urban	51.46	56.24	54.95	66.20
Rural	33.86	52.69	32.51	51.67
Rate difference (U-R)	17.60	3.55	22.44	14.53
Husband education				
No education	30.04	44.83	26.57	56.79
Primary	37.53	49.92	40.96	52.73
Secondary or higher	47.43	60.05	52.65	62.49
Rate difference (S-N)	17.39	15.22	26.08	5.69
Head of household				
Male	40.79	55.97	43.98	60.72
Female	31.38	48.74	42.06	55.31
Rate difference (F-M)	-9.42	-7.23	-1.92	-5.41
Distance to nearest HF				
Big problem	37.95	52.33	40.13	56.25
Not much problem	40.77	58.38	48.65	65.24
Rate difference (N-B)	2.82	6.05	8.52	8.99

3.2.5 Full Immunization

Table 15 shows full immunizations across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics. The proportion of full immunization decreased from 55.8% in 2011 to 51.3% in 2016 in the intervention area and from 63.6% to 57.4% in the comparison area. Full immunization has decreased from 2011 to 2016 across all age groups except the age group of 25 – 34 years in both intervention and comparison areas. The proportion of full immunization was highest among the 35 – 49 years age group in comparison area in both years. The rate difference decreased in the intervention area but increased in the comparison area across the years. Regarding ethnicity of the participants, the advantaged participants had higher proportion of full immunization in both the intervention and comparison areas in 2011 and 2016. There was decrease in full immunization in both the advantaged and disadvantaged groups in the intervention and comparison area. The rate difference decreased in intervention and comparison area across the years. The proportion of full immunization was seen higher in the women with education of secondary or higher level in both years of intervention area and in 2016 of comparison area. The proportion of full immunization decreased from 2011 to 2016 across all educational level in both intervention and comparison areas. The rate difference of full immunization decreased in intervention area but increased in comparison area. Regarding occupation of the participants, the proportion of full immunization was lowest among the women who were unemployed. There was decrease in full immunization across all occupational groups in comparison area from 2011 to 2016 but among unemployed there was increase in the proportion of full immunization in intervention area. The rate difference decreased in intervention area but increased in comparison area across the years. Regarding wealth quintile of the participants, the proportion of full immunization was lowest in the participants with highest wealth tertile in 2011 and 2016 in intervention area and was highest in comparison area in both the years. The proportion of full immunization decreased from 2011 to 2016 across all categories of

wealth tertile in both intervention and comparison areas. Regarding ecological regions, the proportion of full immunization decreased from 2011 to 2016 across the ecological regions in both intervention and comparison. The rate difference decreased in the intervention and increased in comparison area across the years. The proportion of full immunization was higher among the participants residing in urban areas than rural areas in both the years in intervention area but in comparison areas the proportion of full immunization was higher in comparison area in 2016. There was decrease in the proportion of full immunization from 2011 to 2016 in both intervention and comparison areas across all categories of place of residence. The rate difference of full immunization increased across the years in intervention area but decreased in comparison area. Regarding husbands' education of the participants, the proportion of full immunization was lowest among the participants whose husband had no education in intervention area in both the years. In 2016, participants' husband with primary level of education had lower proportion of full immunization in comparison area. There was decrease in full immunization from 2011 to 2016 across all educational level in both the intervention and comparison area and the rate difference was almost equal in intervention area and decreased in comparison areas across the years. The households with female as head had lower proportion of full immunization in intervention area in both years but in comparison area, full immunization was high among the household with female as head in 2011 and 2016. There was decrease in the proportion of full immunization in both 2011 and 2016 in both intervention and comparison areas across the categories of head of household and the rate difference increased across the years in intervention area but decreased in comparison area. Regarding distance to health facility, the participants with distance as a big problem had lower proportion of full immunization in both the years and areas. The proportion of full immunization among the participants with HF distance as a big problem decreased across the years in both intervention and comparison areas. The proportion increased among the participants who did not have distance to HF as not much problem in intervention area. The rate difference seemed to increase in both intervention comparison areas across the years.

Table 15. Full immunizations across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 weighted	After n=545 weighted	Before n=792 weighted	After n=680 weighted
Full immunization (Total sample)	55.8	51.3	63.6	57.4
Age groups				
15-24 years	55.02	48.45	59.96	55.62
25-34 years	53.66	54.22	66.39	58.47
35-49 years	66.54	53.52	67.26	64.26
Rate difference (15*-35*)	-11.52	-5.07	-7.30	-8.64
Ethnicity				
Advantaged	62.74	54.06	62.23	57.97
Disadvantaged	53.24	50.20	64.49	57.16
Rate difference (A-D)	9.50	3.86	-2.26	0.81
Education				
No education	54.83	52.94	60.38	57.72
Primary	55.51	47.71	71.74	52.25
Secondary or higher	60.10	50.68	62.59	60.25
Rate difference (S-N)	5.26	-2.26	2.22	2.53
Occupation				
Unemployed	45.15	47.77	58.08	47.34
Agriculture or labor work	62.27	55.09	64.52	60.26
Service or business	59.26	49.93	68.39	76.27
Rate difference (S-U)	14.11	2.16	10.32	28.93
Wealth tertile				
Lowest	57.10	50.90	57.10	57.00
Middle	56.00	52.30	65.60	51.10
Highest	53.60	49.90	69.80	68.00
Rate difference (H-L)	-3.50	-1.00	12.70	11.00
Ecological region				

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=600 weighted	After n=545 weighted	Before n=792 weighted	After n=680 weighted
Hilly	63.84	57.84	63.09	60.69
Mountain	56.92	49.60	65.45	55.35
Plain	53.02	50.30	63.25	53.24
Rate difference (H-T)	10.82	7.54	-0.15	7.45
Residence				
Urban	61.80	57.69	67.50	56.55
Rural	53.36	46.50	59.74	58.38
Rate difference (U-R)	8.44	11.19	7.76	-1.83
Husband education				
No education	53.96	48.68	53.07	55.54
Primary	55.89	49.52	61.77	51.99
Secondary or higher	57.64	52.44	68.63	60.23
Rate difference (S-N)	3.68	3.76	15.56	4.68
Head of Household				
Male	56.00	51.85	61.39	55.90
Female	54.90	49.50	69.99	61.07
Rate difference (F-M)	-1.10	-2.35	8.61	5.16
Distance to nearest HF				
Big problem	54.80	45.77	62.83	54.11
Not much problem	57.88	63.02	64.73	64.53
Rate difference (N-B)	3.07	17.25	1.90	10.42

3.2.6 Stunting

Stunting among children across intervention and comparison groups, by geographical location, socio-demographic and economic characteristics are shown in Table 16. The proportion of stunting decreased from 46.9% in 2011 to 38.2% in 2016 in the intervention

area and from 45.4% to 43.0% in the comparison area. Stunting has decreased from 2011 to 2016 across all age groups in both intervention and comparison areas except among the 25 – 34 years age group in the comparison area. The rate difference is almost equal in intervention area but has decreased in comparison area across the years. Regarding ethnicity of the participants, the disadvantaged had higher proportion of stunting in both the intervention and comparison groups in both years. There was a decrease in stunting in both the advantaged and disadvantaged groups in intervention and comparison area. The rate difference increased in intervention and comparison area. Stunting was seen higher in the women with no education in both intervention and comparison areas. Stunting decreased from 2011 to 2016 across all educational level in both intervention and comparison areas except among the women with primary education. The rate difference of stunting was almost equal in both intervention and comparison areas. Regarding occupation of the participants, stunting was lowest among the unemployed women in the intervention area in 2011 and 2016. Stunting was lowest among the women with occupation of service or business in 2011 and 2016 in comparison area. There was decrease in stunting among unemployed and women with occupation of agricultural or labour work in intervention and comparison area from 2011 to 2016. The rate difference increased in intervention area but decreased in comparison area across the years. Stunting was highest in the participants with lowest wealth tertile in both intervention and comparison area in both the years. Stunting decreased from 2011 to 2016 among lowest and middle wealth tertile in both intervention and comparison areas and the rate difference also decreased across the years in both intervention and comparison. The participants of mountain region had higher proportion of stunting in 2011 and 2016 in both intervention area and in comparison, stunting was higher among the participants of hilly region in 2011 and plain region in 2016. Stunting decreased from 2011 to 2016 across the ecological regions in both intervention and comparison. The rate difference of stunting decreased in both the intervention and comparison area across the years but in plain region the stunting increased in comparison area across the years. There was decrease in the proportion of stunting from

2011 to 2016 in both intervention and comparison area across the categories of place of residence. The rate difference of stunting decreased across the years in both intervention and comparison area. Stunting was lowest among the participants whose husband had education of secondary or higher in both intervention and comparison area. There was decrease in stunting from 2011 to 2016 across all educational level in both the intervention and comparison area and the rate difference increased in intervention area but decreased in comparison area across the years. There was decrease in the proportion of stunting in both 2011 and 2016 in both intervention and comparison area across the categories of head of household and the rate difference slightly changed in both the areas. Regarding distance to health facility, the participants with distance as a big problem had higher proportion of stunting in both the years and areas. There was decrease in stunting across distance from 2011 and 2016 in intervention area. There was change in the rate difference across the years in intervention and comparison areas. The child of age less than 2 years had lower proportion of stunting in both the intervention and comparison areas in 2011 and 2016. Except children of 48-59 months age group, there was decrease in the proportion of stunting from 2011 to 2016 in both intervention and comparison areas.

Table 16. Stunting across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Stunting (Total sample)	46.9	38.2	45.4	43.0
Age groups				
15-24 years	43.80	32.90	38.80	34.20
25-34 years	47.10	40.10	46.50	50.50
35-49 years	60.00	49.30	58.90	46.90
Rate difference (15*-35*)	-16.20	-16.40	-20.10	-12.70

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Ethnicity				
Advantaged	49.60	48.80	42.10	36.90
Disadvantaged	45.80	33.80	47.50	46.30
Rate difference (A-D)	3.80	15.00	-5.40	-9.40
Education				
No education	49.10	40.60	54.80	55.30
Primary	40.20	40.50	44.80	41.40
Secondary or higher	39.70	31.30	31.60	31.00
Rate difference (S-N)	-9.40	-9.30	-23.20	-24.30
Occupation				
Unemployed	32.60	31.80	47.20	42.60
Agriculture or labour work	55.10	42.80	45.80	43.50
Service or business	48.10	48.90	36.10	41.30
Rate difference (S-U)	15.50	17.10	-11.10	-1.30
Wealth tertile				
Lowest	59.10	55.30	56.90	47.10
Middle	46.10	31.50	44.40	40.00
Highest	29.90	30.20	28.90	37.20
Rate difference (H-L)	-29.20	-25.10	-28.00	-9.90
Ecological region				
Hilly	58.50	44.50	47.10	38.70
Mountain	60.80	57.90	44.40	38.20
Plain	39.50	32.60	43.40	50.70
Rate difference (H-T)	19.00	11.90	3.70	-12.00
Residence				
Urban	49.60	35.30	40.50	38.20
Rural	45.80	40.20	50.50	47.60
Rate difference (U-R)	3.80	-4.90	-10.00	-9.40
Husband education				

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
No education	47.50	40.00	53.90	56.90
Primary	54.50	38.80	48.70	47.20
Secondary or higher	40.40	37.40	39.50	36.30
Rate difference (S-N)	-7.10	-2.60	-14.40	-20.60
Head of Household				
Male	48.50	40.70	44.20	43.20
Female	41.00	31.90	48.10	42.60
Rate difference (F-M)	-7.50	-8.80	3.90	-0.60
Distance to nearest HF				
Big problem	48.10	40.60	51.70	46.00
Not much problem	44.70	33.10	33.60	38.10
Rate difference (N-B)	-3.40	-7.50	-18.10	-7.90
Children age (Months)				
0-23 m	31.40	28.00	34.70	32.90
24-35 m	63.00	51.60	54.40	51.70
36-47 m	60.20	40.80	55.40	47.10
48-59 m	48.70	41.90	47.70	52.80
Rate difference (0-24)	31.60	23.60	19.70	18.80

3.2.7 Underweight

Table 17 shows underweight among children across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics. The proportion of underweight increased from 35.9% in 2011 to 38.2% in 2016 in the intervention area and decreased from 33.8% to 29.8% in the comparison area. Underweight has decreased from 2011 to 2016 among the mothers of children across 15-24 age groups in both intervention and comparison but increased among other age groups in intervention and comparison area. The rate difference has increased in intervention area but has

decreased in comparison area across the years. Regarding ethnicity of the participants, the disadvantaged had higher proportion of underweight in both the intervention and comparison groups in both the years. There was increase in underweight in both the advantaged and disadvantaged groups in intervention area but has decreased in comparison area across the years. The rate difference decreased in intervention and comparison area across the years. Underweight was seen higher in the children whose mothers had no education in both intervention and comparison areas. Underweight increased from 2011 to 2016 across the children of mothers of all educational level in intervention area but in comparison area, it has decreased among the participants with no education and primary level of education across the years. The rate difference of underweight decreased in both intervention and comparison area. Regarding occupation of the participants, underweight was highest among the children of unemployed women in both the intervention and comparison area in 2011 and 2016. Underweight among children increased from 2011 to 2016 across women of all occupation in intervention area but in comparison area, it has decreased among the unemployed and children of participants with occupation of agriculture or labour work. The rate difference decreased in intervention as well as comparison area across the years. Underweight was highest in the participants with lowest wealth tertile in both intervention and comparison areas in both the years. The rate difference also decreased across the years in both intervention and comparison. In intervention area, the participants of mountain region had higher proportion of underweight in 2011. In comparison area, underweight was highest among the children residing in plain area. Underweight decreased from 2011 to 2016 across hilly and mountain regions in both intervention and comparison but has increased in plain region. The rate difference of underweight increased in both the intervention and comparison areas across the years. There was increase in the proportion of underweight from 2011 to 2016 in intervention area across the categories of place of residence, but it has decreased in the comparison area. The rate difference of underweight decreased across the years in comparison area. Underweight was lowest among the children of the participants whose husband had

education of secondary or higher level in intervention and comparison area except in the intervention area in 2016. There was decrease in underweight of children from 2011 to 2016 among participants whose husband had primary level of education in both the intervention and comparison areas and the rate difference increased in intervention area but decreased in comparison area across the years. There was decrease in the proportion of underweight among children in both 2011 and 2016 in comparison area across the categories of head of household and the rate difference slightly changed in both the areas. Regarding the distance to health facility, the children of participants with distance as a big problem had higher proportion of underweight in both the years. There was decrease in underweight across distance from 2011 and 2016 in comparison area. There was decrease in the rate difference across the years in intervention and comparison areas. The child of age less than 2 years had lower proportion of underweight in intervention area in 2011. The rate difference decreased in intervention area but increased in comparison area.

Table 17. Underweight across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Underweight (Total sample)	35.9	38.2	33.8	29.8
Age groups				
15-24 yrs	34.11	32.87	24.91	20.40
25-34 yrs	36.29	39.50	36.05	39.70
35-49 yrs	42.43	51.70	49.03	25.18
Rate difference (15*-35*)	-8.33	-18.82	-24.12	-4.78
Ethnicity				
Advantaged	30.71	36.94	32.62	29.30
Disadvantaged	38.05	38.63	34.54	30.02

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Rate difference (A-D)	-7.34	-1.68	-1.92	-0.72
Education				
No education	39.63	41.55	46.29	38.80
Primary	23.44	36.09	29.68	26.64
Secondary or higher	24.84	31.92	17.83	22.32
Rate difference (S-N)	-14.79	-9.63	-28.46	-16.48
Occupation				
Unemployed	28.31	36.79	37.35	28.24
Agriculture or labour work	42.21	39.43	34.69	30.91
Service or business	13.08	35.95	13.80	27.95
Rate difference (S-U)	-15.23	-0.84	-23.55	-0.29
Wealth tertile				
Lowest	41.20	44.00	42.70	31.20
Middle	37.40	35.60	35.20	30.40
Highest	25.80	35.90	16.60	25.40
Rate difference (H-L)	-15.40	-8.10	-26.10	-5.80
Ecological region				
Hilly	40.74	30.12	33.41	26.96
Mountain	41.48	39.44	30.26	22.14
Plain	32.90	39.33	36.53	36.57
Rate difference (H-T)	7.83	-9.20	-3.11	-9.61
Residence				
Urban	36.76	37.34	31.72	29.37
Rural	35.58	38.66	35.92	30.15
Rate difference (U-R)	1.18	-1.32	-4.20	-0.78
Husband education				
No education	38.88	38.22	43.90	46.15
Primary	40.88	36.39	38.73	30.20
Secondary or higher	28.58	38.96	26.17	24.66

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Rate difference (S-N)	-10.30	0.75	-17.73	-21.49
Head of household				
Male	37.67	39.39	33.09	30.10
Female	29.58	34.92	35.26	29.08
Rate difference (F-M)	-8.09	-4.47	2.16	-1.02
Distance to nearest HF				
Big problem	37.78	37.73	37.89	29.28
Not much problem	32.46	38.99	26.08	30.57
Rate difference (N-B)	-5.33	1.26	-11.81	1.29
Children age (Months)				
0-23 m	30.84	37.99	33.11	25.04
24-35 m	42.43	40.95	29.85	31.14
36-47 m	35.76	33.72	33.58	32.81
48-59 m	40.43	41.13	39.20	35.59
Rate difference (0*-24*)	11.59	2.96	-3.26	6.09

3.2.8 Wasting

Wasting among the children across intervention and comparison groups, by geographical location, socio-demographic and economic characteristics is shown in Table 18. The proportion of wasting increased from 10.9% in 2011 to 14.8% in 2016 in the intervention area and decreased from 12.4% to 10.9% in the comparison area. Wasting has increased from 2011 to 2016 among mothers of children across all age groups in intervention area but in comparison area wasting has decreased across all age groups. The rate difference has increased in intervention area but has decreased in comparison area across the years. Regarding ethnicity of the participants, the disadvantaged had higher proportion of wasting in intervention as well as comparison groups in both the years. There was decrease in

wasting among the children of the disadvantaged groups in both intervention and comparison areas. The rate difference increased in intervention but decreased in comparison area across the years. Wasting was seen higher in the children whose mothers had no education in intervention area in both the years and was seen higher in 2016 in comparison area. Wasting increased from 2011 to 2016 across the children of mothers of all educational level in intervention area but in comparison area, it has decreased among the children of the participants of all the education level across the years. The rate difference of wasting decreased in both intervention and comparison areas. Regarding occupation of the participants, wasting was highest among the children of unemployed women in both the years of intervention and comparison areas. Wasting increased from 2011 to 2016 across children with mothers of all occupation in intervention area but in comparison area, it has decreased among the children of mothers with occupation of agriculture or labour work. The rate difference increased in intervention and decreased in comparison area across the years. Wasting was highest in the participants with lowest wealth tertile in both 2011 and 2016 of intervention area but in comparison area it was highest among children of middle wealth tertile. The rate difference was almost equal across the years in both intervention and comparison. In intervention area, the children of plain region had a higher proportion of underweight in 2016 and both the years in comparison area. Wasting decreased from 2011 to 2016 across the ecological regions in intervention and comparison but has increased in plain region. The rate difference of wasting increased in intervention area and decreased in comparison area in 2011 and 2016. The children residing in urban area had higher proportion of wasting in intervention and comparison areas. There was increase in the proportion of wasting from 2011 to 2016 in intervention area across the categories of place of residence, but it has decreased in the comparison area. The rate difference of underweight decreased across the years in comparison area. The participants whose female as household head, the wasting among children was high in intervention area in both the years. In comparison area, wasting among children was higher with female as household head in 2016. The proportion of wasting was

highest among the children of the participants whose husband had no education in intervention area in 2016 and across both years in comparison area. There was decrease in wasting among children from 2011 to 2016 across the husband education in comparison area. The rate difference decreased in both intervention and comparison areas across the years. Regarding distance to health facility, the children of participants with distance as not a big problem had higher proportion of wasting in both the years in intervention area. There was decrease in wasting across distance from 2011 and 2016 in comparison area. Rate difference of distance across the years was almost equal in intervention and comparison areas. The child of age less than 2 years had higher proportion of wasting in both intervention and comparison areas across the years. The rate difference increased in intervention area but decreased in comparison area.

Table 18. Wasting across intervention and comparison groups, by geographical location, socio-demographic and socio-economic characteristics

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Wasting **(Total sample)**	10.90	14.80	12.40	10.90
Age group				
15-24 years	9.07	14.54	10.16	9.21
25-34 years	12.24	13.28	12.48	7.07
35-49 years	12.88	22.91	18.13	2.52
Rate difference (15*-35*)	-3.81	-8.36	-7.98	6.69
Ethnicity				
Advantaged	9.71	8.12	8.79	7.66
Disadvantaged	11.37	17.61	14.76	7.49
Rate difference (A-D)	-1.66	-9.50	-5.97	0.18
Education				

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
No education	12.12	16.23	14.63	8.88
Primary	9.47	10.90	15.15	6.93
Secondary or higher	5.10	14.32	7.12	6.56
Rate difference (S-N)	-7.02	-1.92	-7.51	-2.32
Occupation				
Unemployed	10.99	16.17	15.95	11.33
Agriculture or labor work	10.65	14.62	12.17	6.38
Service or business	13.08	2.94	5.23	2.80
Rate difference (S-U)	2.09	-13.23	-10.72	-8.53
Wealth tertile				
Lowest	11.20	16.40	8.80	7.60
Middle	11.90	12.50	17.40	7.90
Highest	8.90	16.80	8.40	6.80
Rate difference (H-L)	-2.30	0.40	-0.40	-0.80
Ecological Region				
Hilly	14.08	10.57	9.18	8.34
Mountain	12.50	9.67	8.99	4.67
Plain	9.42	16.76	19.60	7.61
Rate difference (H-T)	4.66	-6.19	-10.42	0.72
Residence				
Urban	13.14	17.09	13.47	8.28
Rural	9.94	13.29	11.36	6.85
Rate difference (U-R)	3.20	3.81	2.11	1.43
Husband education				
No education	10.31	14.82	16.60	10.68
Primary	10.41	16.31	10.62	8.49
Secondary or higher	12.11	14.35	11.20	6.15
Rate difference (S-N)	1.80	-0.47	-5.41	-4.54
Head of household				

Characteristics	Intervention (%)		Comparison (%)	
	2011	2016	2011	2016
	Before n=553 weighted	After n=509 weighted	Before n=698 weighted	After n=594 weighted
Male	10.43	14.59	12.99	7.26
Female	12.55	15.42	11.26	8.15
Rate difference (F-M)	2.12	0.83	-1.73	0.88
Distance to nearest HF				
Big problem	9.88	14.39	12.98	6.45
Not much problem	12.78	15.75	11.39	9.35
Rate difference (N-B)	2.89	1.37	-1.59	2.90
Children age (Months)				
0-23 m	15.81	22.75	17.86	12.49
24-35 m	7.32	9.48	10.48	4.75
36-47 m	4.00	7.64	8.91	4.04
48-59 m	11.86	13.27	7.02	2.93
Rate difference (0*-24*)	-8.49	-13.28	-7.38	-7.74

3.3 Effect of the intervention

In this section, the effect of the intervention on the MCH service outcomes from the results of the difference-in-difference (DiD) analysis are presented. The MCH outcomes included any ANC, at least 4 ANC, delivery conducted by SBAs, breast feeding within one-hour of birth, full immunization, and nutritional status of children which included stunting, underweight and wasting. MCH outcome variables measured at baseline and end line by intervention and control districts, and the effect of the intervention as resulted the DiD analysis (adjusted regression coefficients) are shown in Table 19. The results presented in this section has been published in the BMC Health Services Research (39).

3.3.1 Changes in the outcome variables over time

Improvement in the maternal health related service across all the outcomes measured were found in both intervention and control groups at the end line. In terms of child health outcomes, the changes from baseline to end line varied. Breastfeeding initiation within one hour of birth improved in both groups, while the proportion of fully immunized children decreased in both intervention and comparison groups. There were differences in the changes in the children's nutrition status between intervention and control groups, with the proportion of children with stunting decreased in both the intervention and control groups, and the proportion of children with underweight and wasting increased in the intervention group, but decreased in the control group.

3.3.2 Effect of the IC approach on the outcomes

The DiD analyses revealed that the changes from baseline to end line among women who visited for 4 ANC higher in the control group, which indicated that the improvement was more in the control group (DiD % = -4.8). Women who had made at least one ANC visit, and whose deliveries were conducted by SBA improved from baseline to end line over time in both groups, while the change was higher in the intervention group (DiD % = 6.6) compared to the control group. Breastfeeding within one hour of birth increased in both

intervention and comparison groups, with the increment almost similar (15.5%) in both groups. The adjusted analyses showed that these observed differences were not statistically significant, indicating that the intervention did not have any effect. Results varied in case of child health outcomes. The prevalence of fully immunized children was higher in the control districts at both baseline and end line. At the end line fewer proportion of children were fully immunized at the end line with intervention districts having a slightly higher proportion of fully immunized children (DiD % = 1.7), although the difference was not statistically significant. The prevalence of stunting decreased from baseline to end line in both groups, with the effect higher in the intervention group (DiD % = -6.3), this difference remained statistically insignificant. The prevalence of underweight (DiD % = 6.3) and wasting (DiD % = 5.4) increased in the intervention group while they decreased in the control group from baseline to end line. The adjusted analyses depicted that the change was statistically significant only for wasting (β = 0.019, p = 0.002), indicating that wasting among children increased significantly in the intervention districts compared to the control districts (39). The results shows that the IC approach did not have effect on improving the MCH outcomes, with changes in most of the MCH outcome indicators from 2011 to 2016 similar in both groups. The only significant difference observed was in wasting of children which decreased in the control group compared to the intervention group, indicating the intervention had negative effect on wasting among children (39).

Table 19. Difference in difference analysis of intervention on MCH outcomes (39)

Outcome variables	Intervention area (%)			Control area (%)			Effect of the intervention (DiD)		
	Pre	Post	Difference	Pre	Post	Difference	Change over time (%) between intervention and control	DiD (β)	p-value
Any ANC	82.4	95.3	12.9	81.6	93.6	12.0	0.9	-0.004[a]	0.641
At least 4 ANC	40.1	52.5	12.4	43.9	61.1	17.2	-4.8	-0.022[b]	0.062
Skilled birth delivery	30.1	51.0	20.9	28.8	43.1	14.3	6.6	0.001[c]	0.939
Breast feeding within one hour of birth	38.8	54.2	15.4	43.5	59.1	15.6	-0.2	-0.005[d]	0.726
Full immunization	55.8	51.3	-4.5	63.6	57.4	-6.2	1.7	-0.020[e]	0.129
Stunting	46.9	38.2	-8.7	45.4	43.0	-2.4	-6.3	-0.006[f]	0.565
Underweight	35.9	38.2	2.3	33.8	29.8	-4.0	6.3	0.015[g]	0.134
Wasting	10.9	14.8	3.9	12.4	10.9	-1.5	5.4	0.019[h]	0.002

DiD: Difference-in-difference

β: Adjusted regression coefficient denoting the difference in difference between intervention and control groups.

[a] Adjusted for wealth index, place of residence, women age, distance from health facility, and husband education.

[b] Adjusted for wealth index, women education, women occupation, place of residence, ethnicity, gender (head of household), ecological region, and husband education

[c] Adjusted for wealth index, women education, place of residence, women age, distance from health facility and ecological region

[d] Adjusted for women education, place of residence, ecological region and husband education

[e] Adjusted for distance from health facility and husband education

[f] Adjusted for wealth index, women education, child age

[g] Adjusted for wealth index, women education, women age and ecological region

[h] Adjusted for wealth index, women education, women age and ecological region

3.4 Conclusion

This chapter presented the results of the study pertaining to the first research question. Data from the NDHSs 2011 and 2016 were analyzed to assess the impact of IC approach on MCH services. First the situation of major MCH indicators in the intervention and control groups at baseline (2011) and end line (2016) are presented, which was followed by the multivariate analyses of the impact of the IC intervention in MCH indicators. The results showed that the IC approach, when compared to control districts, did not have significant contributions in improving MCH outcomes. The next chapter presents the findings of qualitative study exploring the perception of the IC approach implementing stakeholders.

4. Results of qualitative study

This chapter presents the results of the qualitative study which includes stakeholders' perspective on the implementation and effectiveness of the approach. First the socio-demographic characteristics of qualitative sample are presented, which is followed by the perception of stakeholders on different aspects of the IC approach. A part of the results presented in this chapter has been published in the *PLoS One(38)*.

4.1 Sample characteristics

Table 20 shows the characteristics of qualitative research participants. The total number of participants in the key-informant interviews were 30. Total 6 FGDs were conducted (3 in intervention and 3 control districts) which consisted of 61 female participants, with a total of 82 participants in qualitative study. Regarding age of the participants, 41.5 per cent were under the age of 30 years, while less than a one-third (31.7 per cent) were in the 30–40 year age group, followed by the 40-50 year age group (18.3 per cent) and those over 50 years (8.5 per cent) age groups. Majority (74.4 per cent) of the participants were female while one-fourth (25.6 per cent) were male. Hinduisms were practiced by more than two-thirds of the participants (68.3 per cent). Buddhists were followed by one-fourth (25.6 per cent) and Christian were followed by only 6.1 per cent. Around 39 per cent) were Brahmin/Chettri, while nearly one-third of the participants (30.5 per cent) were the Indigenous (*Janajati)*, followed by Dalits (25.1 per cent) and Madhesi (4.9 per cent). Majority of the participants (96.3 per cent) were married. Around one-fourth of the participants (26.8 per cent) had a lower secondary level of education while 21.9 per cent had a bachelor level education followed by higher secondary and primary level were (17.1 per cent). Table 20 show the characteristics of qualitative participants.

Table 20. Characteristics of qualitative participants (38)

Characteristics	KII (n = 30)		FGD (n = 52)		Total (n = 82)	
	n	%	n	%	n	%
Age						
Less than 30	3	10.0	31	59.7	34	41.5
30-40	10	33.3	16	30.7	26	31.7
40-50	11	36.7	4	7.7	15	18.3
More than 50	6	20.0	1	1.9	7	8.5
Sex						
Male	21	70.0	0	0.0	21	25.6
Female	9	30.0	52	100	61	74.4
Religion						
Hindu	22	73.3	34	65.4	56	68.3
Buddhist	7	23.3	14	26.9	21	25.6
Christian	1	3.3	4	7.7	5	6.1
Ethnicity						
Brahmin/Chhetri	13	43.3	19	36.6	32	39.0
Indigenous (*Janajati)*	9	30.0	16	30.8	25	30.5
Dalits	6	20.0	15	28.8	21	25.6
Madhesi	2	6.7	2	3.8	4	4.9
Marital status						
Married	29	96.7	50	96.2	79	96.3
Unmarried	1	3.3	0	0	1	1.1
Widow/widower	0	0	2	3.8	2	2.4
Education						
Read and write only	0	0	4	7.7	4	4.9
Primary	0	0	14	26.9	14	17.1
Lower secondary	0	0	22	42.3	22	26.8
Secondary	0	0	10	19.2	10	12.3
Higher secondary	12	40.0	2	3.8	14	17.1
Bachelor level	18	60.0	0	0	18	21.9

4.2 Stakeholders' perspective of the IC approach

The information collected from participants of qualitative study revealed four main themes. The results have been presented based on the discovered themes, reflecting the stakeholders' perception on the IC approach and their experience regarding the *health planning process*; *resource allocation*; *plan implementation*; and *equity in access to MCH services*, as shown in Table 21.

Table 21. Themes of descriptions (38)

	Theme A: Health planning	Theme B: Resource allocation for health	Theme C: Implementation of plan	Theme D: Equity in access to MCH services
Key aspects	- planning process - evidence generation - participatory planning - contingency or ad-hoc planning	- Use of the MBB tools - Conventional budgeting tools - flexibility	- influencers and hindrances in implementation of the plan - monitoring and evaluation - external support	- equality in access to care for equal need - equal use of services for equal need - equal quality of care for all people in need
Major focus	- evidence based planning	- allocation of budget for health	- overcoming implementation challenges	- equitable distribution of scarce health resources
Impact of the IC*	- the IC approach as a strategic analysis	- use of the MBB tool in simplifying budgeting and adopting the IC approach	- support from external agencies in overcoming implementation challenges	- extent to which the IC program ensure equity in access and utilization
* Observed in the intervention districts in comparison in the control districts.				

4.2.1 Perception on health planning at the district

All districts used a bottom-up approach to health care planning, commencing at the settlement level, moving up to the ward level, then to the Village Development Committee (VDC) level, and finally to the district level for approval. The planning procedure considered the previous year's strategy and targets as well as the existing local resources. Although the planning in both intervention and control areas was based on the locally recognized problems and available resources, strategies in the intervention area were designed and finalized in the district level planning workshop organized as a part of the IC approach. No differences were detected in the planning process at the settlement level. Problems that arose at various administrative levels were forwarded to the immediate higher level for discussion. Community involvement throughout the planning process have been sought with the support from the ward citizen forum and village councils. Women, the disabled, and individuals from the lowest caste (*Dalit*) were particularly encouraged to participate. However, women in both the intervention and control areas during the FGDs expressed a common voice that they were rarely consulted in the settlement and village level planning process (38).

"*No, I'm not familiar with this annual planning. During the process, we are not consulted. Leaders are the ones who do it*." – An FCHV from the intervention district

In few districts, Female Community Health Volunteer (FCHVs) were engaged during the planning process, but were not involved in the budgeting.

Many stakeholders acknowledged the changes that have been observed at the district level in the intervention area. Their expressed a positive attitude towards the annual health planning at district and community level. Majority of the participants believed that the participation of political leaders in the IC process positively affected the planning process. In the comparison areas, this was not observed. Stakeholders frequently referred to the previous year's plan, which had been adopted with some changes. Participants in the control

districts perceived limited ownership of the plans, with many of the participants perceiving that the plan was directed and imposed from the central level (38).

"*We aren't really concerned about yearly planning. Budgets from the federal government are subject to change, thus we must adapt our previous year's plans accordingly…….Of course, we look at health indicators and targets provided by the federal level and adjust our plan accordingly. Most of the time, activities are directed from a higher level. Even if we send our budget and plan, the majority of the activities and budget headings are eliminated*." - A 35 years' old Health Post In-charge from control district

There was a lack of coordination between municipal planning and the IC program. Within the IC approach, health indicators were collected at the community level through various records, and were expected to be used for district-level planning. Unfortunately, the yearly plan developed at the Village Development Committee (VDC) level and submitted to the District Development Committee (DDC) did not receive the attention it deserved. In certain districts, both intervention and comparison area, had difficulty collaborating with the District Development Committee, especially when it came to incorporating their ideas into the district red book (38).

Technical human resources and community health workers in the intervention districts acknowledged that the IC planning process was systematic and evidence-based, and the plans designed were focused on meeting the targets set in the IC districts. In contrast, stakeholders in the comparison area felt that they need similar approach to the IC during annual planning. Health workers in the comparison districts showed limited awareness and understanding with the process of health planning (38).

The lack of clarity among stakeholders regarding their duties and responsibilities was one of the impediments to the planning process noted in the comparison districts. On the other side, more clarity regarding responsibilities was observed in the intervention districts. From the district level stakeholders, issues related to the technical challenges in planning and

implementation of the IC were upraised. "*It's a good method for examining and utilizing data for effective planning. It does, however, demand a large amount of resources in order to function. At various levels of stakeholders, it is somewhat intricate and difficult to comprehend.*" - A 44 years' old District Health Officer from an intervention district.

4.2.2 Perception of the resource allocation in health services

Besides governmental resources, UNICEF and USAID were major resource providers in the intervention areas while organizations such as SUHAARA and Plan International were providing support in the comparison districts. Health workers, FCHVs and district focal persons in both the intervention and comparison districts coordinated with those partners. They were also involved in the planning and the implementation of the programs and projects. A bottom-up approach was used to allocate and segregate the budget, with a spirited discussion among all stakeholders at all levels. The plans requiring large amount of budget and human resource related support was shifted to the national level and the low to medium level budget activities were approved at the district level. This was common in both groups (38).

Prioritization in the allocation of budget for health services under different headings was discovered after the implementation of the IC in the intervention districts, which was then taken to the council for approval. In addition, the Marginalized Budgeting for Bottlenecks (MBB) tools were used at the district level in the intervention districts while no such standard or similar tools were used in the comparison districts (38).

According to a 46 years' old District Health Office (DHO) from an intervention district, "*…. Prior to the implementation of the IC approach, the budget allocated for health by all 68 VDC was just NRs. 5 million (~US $ 4500). Currently, the amount allocated for health programs by these VDCs has increased to NRs. 1 crore 35 million (~US $ 120,000).*"

On the other hand, the budget allocation for health in the comparison districts did not differ much in comparison to previous years.

4.2.3 Perception of the plan implementation

Health programs in the districts were implemented according to the annual plan, according to district and community stakeholders. A similar level of experiences and perceptions was observed in both groups regarding the implementation of annual health plan. The IC approach served as a support structure in the intervention districts, guiding and supervising their execution and providing technical assistance. The district health officers as well as health workers stated that the IC approach has played an important role in not only for the organized planning but also for the implementation of health activities (38).

"*Improved collaboration and coordination among various stakeholders, such as political parties, health workers, VDCs and other relevant stakeholders to address the health issues have made the implementation more effective and easier. Otherwise, persuading politicians to invest in health is quite difficult.*" - A 34 years' old public health nurse from intervention district

Similarly, the Local Development Officers (LDOs) and the VDC secretaries stated that the IC approach had successfully made all stakeholders accountable and reinforced to meet the health indicators substantially. They acknowledged the support from the UNICEF in establishing MCH sector health plans at the district level to reach optimal health status by addressing deep-rooted issues and by supporting the community level planning (38).

In contrast, in the comparison districts lacked an external support system, where the implementation issues were managed within the capabilities of the existing health system. Conventional support was provided from the central and regional health offices. Proper monitoring of the implementation of the activities were not practiced even in the intervention districts despite the ongoing support from the IC implementation team. Also, the main reason for the program's proper implementation being a challenge was noted to be frequent employee transfers. Most of the stakeholders interacted unanimously mentioned that the need for the strategic location of the I/NGOs in remote part of the district

and their commitment were needed, in addition to a strong support from the national and local governments. Stakeholders overwhelmingly underlined the need for community people and stakeholders to take ownership of the project in order for it to be successful (38).

Most of the health workers mentioned that there was a need to incorporate the government's responsibility to implement local level plans in the national MCH plans and provide budgetary support for VDC specific programs. Public health efforts, such as awareness programs and the adaptation of behaviour change and communication (BCC) materials in local languages, should be intensified at the government level. DPHOs and Public Health Nurses (PHNs) recommended focusing more on the implementation, monitoring, and regular follow up of the action plans developed during the IC workshops. The lack of monitoring, and an effective feedback system was cited by stakeholders as an impediment in both intervention and comparison districts (38).

"*There is a support system and feedback, however it does not work in practice. It is not common to give constructive feedback.*" - A 46 years' old VDC secretary from comparison district

4.2.4 Perception of equity in the access to MCH services

Stakeholders from both intervention and comparison districts noted that the MCH situation had improved, with better access than in prior years. Rather than being driven by local interests, such improvements were primarily motivated by national interests. In case of intervention area, stakeholders reported having locally developed innovative strategies such as tracking pregnant and lactating mothers and using flag systems (unique coloured flags for households with golden 1000 days' mother – pregnancy, delivery, and postpartum period) to ensure no one is left behind. Renovation and revitalization of primary healthcare outreach clinics, reactivation of health mothers' groups, and investment in health infrastructure were all more common in the intervention areas than in the non-intervention

districts. "*When a child is born in the community, we ensure that the new-borns' rights are met, such as vaccination with all available vaccines without leaving any child. We have developed greeting/welcome cards for pregnant women. In each ward, we go through the list of pregnant women and make it mandatory for them to complete four times antenatal check-up, to get vaccinated with TT, to take albendazole, iron tablets, and counsel them to take green leafy vegetables in one of the meals"*. - A 38 years' old health post in-charge from an intervention district.

Similarly, investment in human resources like recruiting staffs on contract basis where needed was also observed in both intervention and comparison areas. This has been more often observed in the intervention districts. "*.... previously there was only three staff in the health post but now it has increased, because of which we are able to go in the field for immunization, ANC check-up and growth monitoring*". - A 30 years' old health post in-charge from an intervention district

Contrary to this, some stakeholders in both the intervention and comparison areas expressed concern about a lack of suitable human resources. Furthermore, the supply-side improvements in human resource availability, service regularity, SBA training, availability of supplies and commodities which were reported in the intervention area, were observed less often in the comparison area (38).

Importantly, the unreached and left-behind population in the intervention district was identified through stakeholder consultation, which led to the design and implementation of targeted interventions. In the comparison districts, similar practices were not observed, as reaching the poor was done on an ad hoc basis and was mostly impacted by non-governmental organizations rather than effective planning. Increasing community awareness, according to key informants from both the intervention and comparison areas, was the main reason for the improvement in the health status of mothers and children. The conditional cash transfer to women and mothers for utilizing maternal health services as

part of the safe motherhood program was acknowledged as a motivator for better service coverage. In both the intervention and comparison districts, increase in the awareness of service utilization (antenatal care, institutional delivery, postnatal care, immunization and growth monitoring) among stakeholders and beneficiaries was observed in similar ways. A VDC secretary credited increased access to communication media for such increased awareness. However, a 50 years' old FCHV from the comparison area said, "*We worked hard in the community to aware golden 1000 days' mothers for service uptake. They are more conscious than they were previously. They're also more proactive when it comes to gathering information*."

There were few catchy buy-ins that the local level implemented without a second thought. Many local governments, for example, have adopted some initiatives like providing cash incentives for FCHVs who recommend and refer pregnant women to health facilities. In this scheme, FCHVs were provided with NRs 200 – 500 per case. This encouragement has helped in ensuring access to otherwise unreached women. In comparable districts, such additional incentives for FCHVs or health workers were not common. However, non-governmental organizations were providing similar types of incentives for community mobilization and ensure utilization of services (38).

"The whim of 'zero home delivery' and 'fully immunization VDC' had also caught the eye of local leaders as "they easily agreed for such targets", such catchy targets are easily conceived by leaders compared to targets in numbers and percentages(38)*."* - A 34 years' old health worker from the intervention districts

Stakeholders identified a number of issues that have an impact on health services. The problems of *chhaupadi* (superstitious beliefs about menstruation) were among the key issues identified. The concern of being discriminated against by health personnel was also brought up in the focus groups. Furthermore, district level stakeholders praised the IC approach as helpful on making Comprehensive Emergency Obstetrics and Neonatal Care

(CEONC) service available and the timely utilization of the services in coordination and collaboration with FCHVs and health facility staffs. Such services were deemed to be more accessible than before in control districts too (38).

Focus Group Discussions with mothers of under 2 years' children yielded mixed results, with some mothers reporting no significant changes after the IC program was implemented, while others reported visible changes such as increased institutional deliveries, regular mothers' group meetings with the involvement of health workers, availability of 24 x 7 delivery services, and increased public awareness regarding delivery incentives. In backlight, there were certain areas where access to health services was not ensured due to the lack of the implementation of the plan. On further probing, it was reported that the geographic difficulties, lack of transportation facilities, and resources constraints had kept them on the back foot (38).

The participants from the Mountain region emphasized the importance of service interruptions due to tough geography and natural disasters. Stakeholders further stated that flooding and landslides made access difficult and emphasized the need of overcoming such barriers including access to roadways; water supply; flood and landslide mitigation measures; and construction of physical infrastructure including appropriate health facility buildings. One of the under 2 years' child mother from a comparison district sadly mentioned, "*A child from an affluent family despite spending around five hundred thousand Nepali Rupees and they could not save the child, died of a minor disease like diarrhea, it's extremely unfortunate!*" (38).

4.3 Conclusion

The qualitative data reflects the opinions of the key stakeholders, FCHVs and mothers of under five children regarding the planning and budgeting aspect on MCH at district level. Participants in general perceived the IC approach positively. Health workers expressed that inclusion of the political parties' representatives, as one of the stakeholders during

workshops, was an important factor to influence the positive change in IC districts. Coordination for proper planning and budgeting among stakeholders was improved in the intervention districts, which was missing in the comparison districts. The participants stated that IC approach have successfully made stakeholders accountable. Institutional delivery in some of implemented districts especially hill district, which delivery advocated using the slogan of the "home delivery free VDC" had contributed to increase the proportion of deliveries conducted at health facility. The fulfilment of the vacant posts and expansion of birthing centres in the district may have contributed to the improvement in maternal health which was possible after IC approach. FGD from the intervention districts also revealed that some mothers experienced no change after IC approach while other mentioned the changes are visible in terms of increased ANC, PNC, institutional deliveries, regular mothers' group meetings with involvement of health workers, 24 x 7 service including holiday, awareness of institutional delivery incentives motivated to use health services.

5. Discussion and conclusion

This study aimed to assess the effect of IC approach on improvement in MCH outcomes and explore the perception of IC approach implementors at district level. This study uses mixed-method approach to analyse the situation of IC approach in intervention and comparison districts on Nepal. Difference-in-difference analysis was conducted for quantitative analysis and thematic analysis was done for qualitative data in order to find out the enabling and restraining factors related to IC. This chapter presents the summary of the key findings of this study with reference to the study objectives, research methods and the literature. It provides a discussion on the key findings as well as the differences observed in quantitative and qualitative study. Major strengths and limitation of the study are examined, and implication of the research are outlined. Finally, conclusions based on the findings of the study are presented.

5.1 Key findings of the study

Objective 1 – quantitative

Using the data from the recent two demographic health surveys in Nepal, this study assessed the effect of a MCH intervention adopting the IC approach on the utilization of MCH outcomes. Findings of the study displayed improvements in utilization of maternal health services, particularly the number of ANC visits and births attended by skilled health workers, from baseline to end line in both the intervention and control groups. In case of child health related service indicators, there was increase in children with underweight and wasting in the intervention districts, and decrease in the proportion of children fully immunized increased in both groups. The DiD analyses, overall, showed there was no significant change in most of the MCH indicators over time between the intervention and control districts indicating the intervention not having effect on MCH outcomes. Although the comparison area was not exposed to IC intervention, they showed comparable or even better status in different health indicators assessed. The results observed in this study could

be because the GoN has been implementing different intensive programs focusing the health of women and children in all the districts, irrespective the IC intervention (31). The control districts, although did not receive the IC intervention, were exposed to the MCH related priority programs. The findings suggested that the IC approach seems not working as intended to improve MCH in Nepal. IC approach not yielding the desired effect on MCH outcomes observed in this study could also be due to the absence of an organised monitoring and feedback system in place, as well as the limited participation of relevant stakeholders and service users particularly at the community level. Due to the lack of similar quantitative studies on the effectiveness of the IC approach on MCH health outcomes, we could not compare our findings from the previous studies.

Objective 2 – qualitative

The qualitative part of the study explored the perception of participants on health planning and budgeting at district and municipality level, and the role of the IC approach in contributing the planning and budgeting process to address equitable coverage of MCH services. The results showed that the IC approach was beneficial in identifying problems and challenges utilizing evidence-based data and finding solutions by government stakeholders. The IC strategy has aided in improving positive acceptance, and community stakeholders have embraced it. The participants perceived that the IC approach played an important role in the systematic planning and budgeting of health activities. The UNICEF report on the IC impact evaluation of Nepal and Indonesia also showed IC approach contributing to initiate a better planning and budgeting (36). The qualitative results obtained in this study are similar to a study conducted for the Evaluation of Accelerating the Implementation of the Investment Case for Maternal, Newborn, and Child Health in Asia and the Pacific Program, which reported that the IC approach resulted in positive changes (36). However, community stakeholders' viewpoints in this study revealed a limited and unequal participation of members from all sectors. Only a few of the FCHVs were given the opportunity to participate in the planning process, while others were only

communicated about meetings and their conclusions. Evidence suggests that community participation results in equitable and high-quality MCH services (51). Empowering women in terms of health and economics has been found to have a good influence on increasing knowledge and utilization of MCH services, as well as enhancing livelihood of community people (52).

Budgetary considerations have led to an increase in the budget for MCH-related activities, according to stakeholders. The health-related budget has increased in contrast to the previous health plan, and the VDC has begun to acknowledge its value. This might be accomplished primarily by involving relevant stakeholders in health-planning process and holding them responsible for the development of health services. An analysis of IC approach in India indicated the need of investing in basic resources such as infrastructure and personnel (30). Budget estimation is a useful feature of the IC approach that aids in making the best decisions among numerous strategies (29). The district health administrators in the intervention districts were found to advocate a comprehensive planning approach, which would cover different types of health issues prevalent in the district (36). In comparison districts, appropriate planning and budgeting was lacking.

Inter-sectoral coordination is important to attain any health-related indicators (53). Inter-sectoral collaboration involving the health, nutrition, sanitation, agriculture, and women's and children's welfare sectors was also mentioned by the stakeholders. Health professionals also collaborated with development partners such as UNICEF, USAID, and other non-governmental organizations. When it comes to the supply side, enough funding demonstrates an improvement in the quality of health facilities, such as the availability of qualified health workers, the consistency of services, and the expansion of the service range. The Tanahashi model, which asserts that the availability of labour, infrastructure, and pharmaceuticals maximizes the capacity of services, is based on the same concept (32). The availability of trained human resources in the health facilities, in the intervention districts, resulted in considerable health improvements in the MCH sector, such as prenatal

care, facility delivery, and immunization. In African countries, a project called "The East Africa Maternity Newborn Child Health Project (EAMNeCH)" was implemented, focusing on the quality, demand, and supply of maternal, neonatal, and child health services, as well as a favourable policy environment (54). The evaluation of the project also identified improvement in MCH outcomes (54). Filling vacant posts, regularity of health services, and access to services in the intervention districts were all identified by health workers as important factors in improving MCH indicators. A systematic review conducted in low-income African nations reported the lack of qualified health workers and limited access to health-care facilities were the main impediments to MCH service utilization (55). Increased access to communication and a good attitude of pregnant women and their in-laws toward the health service were also identified as contributing factors to the improvement of MCH related indicators. According to studies, ANC coverage of over 60% can be achieved if skilled health workers are available in sufficient numbers in the health facilities (56). The similar result has been seen in the Philippines, where it was found that availability is one of the most important factors in increasing service utilization. In Indonesia, research indicated that cities with better access to healthcare received better care (30). Access has also been found in other studies as a way to boost service utilization. Those who resided close to health facilities used them more frequently than those who lived further away (57, 58). A case study conducted in Nepal supported the finding. By establishing birthing centers near to the population, there was an increase in institutional deliveries (51). The only way to achieve health equity among marginalized people is to improve access to them particularly, focusing on the most vulnerable (59). Alternative care has an impact on service coverage including contraceptive use, ANC visit, health facility deliveries, PNC visit, and immunization services as service-seeking behaviour has a direct impact on a population's acceptance of health programs. Increased community awareness has a direct influence on favourable outcomes in behaviours such as early and exclusive breastfeeding, and neonatal care practices (56, 60). According to stakeholders, geographical location is important for the uptake of health service consumption and fluctuates with the seasons,

particularly in the Mountain and Terai districts in Nepal. Furthermore, MCH service utilization has been hampered by limited physical access and lack of transportation facilities to health facilities due to difficult geographical territories in hill and mountainous area (61, 62).

5.2 Difference in qualitative and quantitative findings

In the study, there are differences in the findings from qualitative and quantitative design. Qualitative design in this study was limited to intervention and comparison districts, and the opinions and views expressed or generated may not be representative at desired levels in intervention and control areas. The data generated from qualitative findings are mainly from the government officials and the officials form intervention districts had major role in the implementation of the IC intervention. The stakeholders perceived that the IC approach contributed them to design an evidence-based plan in a participatory approach involving a wide range of concerned stakeholders. This may have affected their perspective regarding the IC approach. In case of quantitative data, as the data are secondary and the retrospective data collected in the NDHS, in relation to maternal, neonatal and child health might have recall bias.

5.2.1 Implement intensity, quality, and monitoring the implementation of the IC approach

The main part of the success of any project is proper planning and as per the plan cycle there must be proper evaluation and assessment of the quality of any project. The IC approach in Nepal mainly emphasized on planning, financing and capacity building at district and community level. More focus was placed for budgeting rather than technical assistance in the districts. The district level workshops developed yearly plans and work schedules specifying the roles and responsibilities of relevant sectors, however, there was no systematic process to monitor and implementation of the plans. There were no technical officers appointed for regular monitoring of the interventions. The limited availability of resources also played a crucial role for the intervention's quality as the remote districts

were constrained by limited skilled human and financial resources to implement the activities (36).

5.2.2 Comparability of the intervention and control districts

The IC approach intervention areas were the districts with the lowest HDI in Nepal (30). These districts were the most disadvantaged and remote parts of the country constrained by limited resources as well as other structural and geographical barriers, resulting limited coverage of MCH indicators. Although the control districts were selected based on the low HDI scores, these districts were relatively at better position in health and socio-economic indicators. This might have contributed to the null results of the IC intervention.

Furthermore, as MCH programs are a priority program in Nepal (16, 31), there are focused MCH interventions and services in both intervention and control areas implemented by federal, provincial and local government. This could be a reason for the similar results obtained in the control groups as these districts were also exposed to the MCH priority interventions implemented by the GoN. The intervention was not applied in controlled settings as this intervention has a broad-spectrum including involvement of a wide range of stakeholders.

5.2.3 Complexity of the IC approach

Though the IC approach has its own significance, the package itself is complex because of its understanding in planning, implementation and monitoring the interventions. The IC requires a number of initiations related to MCH services. Several determinants of the Tanahashi model are included in the IC approach which have made the approach complicated and intricate to implement and monitor. Investment case has evolved based on evidences generated from various previous researches conducted across globe (29) and the context of the previous researches may be different than in Nepal. The stakeholders engaged in the IC approach are all the participants relevant to health in the districts. If numerous interventions are mixed into a single package, the effectiveness of the whole

intervention is likely to get diluted as the stakeholders, policy makers and services providers may not be able to provide equal attention to the different interventions in the package. The assessment of the IC approach in the Asian and Pacific regions have also exposed the complexity of the IC with the district level stakeholders and health officers reporting that the tool used was beyond the ability of the staffs (36).

5.3 Strengths and limitations of the study

5.3.1 Strengths

The study has a number of strengths. Quasi-experimental study design was used in this research which has its own advantages. In the real settings, in order to evaluate the interventions may be difficult and unfeasible; in this scenario, the quasi-experimental research may be more feasible because it often does not have constraints of time and logistic as compared to randomized control trial (63). This study used multiple approaches to answer the main research questions: 1) the effectiveness of the interventions designed by adopting the IC approach in MCH services l and 2) the perceptions of key stakeholders both service and demand side regarding effectiveness of intervention package. The study utilized data from nationally representative demographic and health surveys, which had employed a rigorous and scientific research design. DHS is considered as gold standard for assessing health indicators around the world. The strength of DHS is that the sampling is done in a way that the sample represents the whole country, the tools are standardized, the data collectors are properly trained, monitoring and supervision is done intensively. The study covered a wide range of MCH service indicators as dependent variables using appropriate statistical analysis adjusting for potential confounders and including proper weighing. Another strength of the study is the PhD candidate and study team were independent of the IC approach designing and implementation, hence, there was not researchers' bias.

5.3.2 Limitations

The main limitation of the study is concerned with the nature of the research design and no availability of the data on monitoring and implementation aspects of the intervention. Since the researchers did not assign the districts into the intervention comparison groups, and did not control the intervention, this study assessed a “real life” situation and not the “optimal lab” scenario. From the theoretical perspective, not controlling the implementation of the programs such as the dose and intensity of the intervention could be seen as a limitation of the study. The DHS survey data can also have certain limitations like reporting and recall bias which relies on the memory of the participants. Data included in qualitative analysis may not be representative at desired levels. Due to lack of previous quantitative studies evaluating the effectiveness of the IC intervention in MCH, comparison of the results observed in this study with similar previous research was not possible.

5.4 Study implications

5.4.1 Policy implications

According to the findings from this study, there is a gap in the rate of MCH services uptake in both groups of districts. In order to reduce the gaps, the interventions should focus on the marginalized and disadvantaged communities. For the interventions that focused on the equity, effective implementation and regular monitoring should be ensured. Therefore, the IC intervention should ensure proper implementation of the selected interventions and regular monitoring should be embedded into the plans and should be conducted on regular basis.

Another important concern of this study was to find the equitable coverage of the intervention. From the results of qualitative and quantitative data of the study has shown that there are equity gaps regarding different health indicators in both groups, intervention and comparison. Nepal has diversity of culture and geography, with this diversity there are lots of impact on education, economy and living standards of the people of Nepal. So that

people of Nepal of the same area are also have different lifestyle and socioeconomic status. The program investment case approach (IC approach) must be equitable to them to maintain its standard and fulfil the objectives and aim of the investment case approach (IC approach). But the program could not run accordingly. All, reach and poor, educated and uneducated, developed and marginalized, have got equal opportunity but failed to maintain equity. Inequities were shown by different variables like wealth tertile, education, ecological region in the study. Other studies have also shown inequity in these factors (76). The marginalized community especially of low caste are not getting proper MCH related services in some parts of the nation (64, 65). So, it is important for the interventions to focus for marginalized community and make different strategies based on barriers related to proper MCH service uptake by the disadvantaged groups.

Investment case is itself a good approach for identifying the bottlenecks for effective coverage of health-related indicators especially maternal and child health. But, for an intervention to be effective, it is essential to regularly follow up the intervention by the local authorities and the funding agencies. After the intervention of Investment case approach in the districts, the DHO team and the stakeholders were given the responsibility for overseeing the intervention, however at the hindsight it was realized that lack quality monitoring was the major drawback. Without monitoring of a project, it is difficult to make success, and the monitoring part of the investment case was lacking ultimately this project investment case approach (IC approach) could not get achieve its objectively in proper manner. Regular monitoring could not be done in this project investment case approach (IC approach) because of different reasons like working area, limited manpower, and reporting and analysis. Regular monitoring and feedback system should be embedded into the IC intervention plans to produce the desired outcome. A regular monitoring would have helped the intervention to assess the effectiveness of the intervention. It would also have encouraged and motivated the local stakeholders to work effectively to achieve the targets made previously.

No significant change in most of the MCH service utilization rates in the intervention group compared to the control groups as observed in the quantitative results indicated that the IC approach may not be the appropriate strategy for improving MCH in Nepal. The IC approach was not found superior to the existing government interventions on MCH. In remote areas of low resource settings, other less complicated approaches than the IC may yield considerable outcomes. If the IC intervention is to be continued, certain modifications and changes in the implementation modalities may be required, which include incorporating strong engagement of local community people and service users for creating better ownership, proper follow up and monitoring of activities, and a regular feedback mechanism.

5.4.2 Research implications

This study has used both quantitative and qualitative data for measuring the outcome of the IC intervention and draw a conclusion. Nepal has been implementing IC approach since 2011 in different district of the country. This mixed method is good approach as it evaluated both qualitative as well as quantitative approach. The investment case approach (IC approach) has both qualitative and quantitative areas of assessment so that the whatever evaluation had done is good approach for the investigation case. So, the results from this research can be useful in identifying the effectiveness and challenges of the process thereby recommend feedback to make it further successful. This study has used the data from secondary source (NDHS) and has further utilized the data to evaluate the effectiveness of IC approach in context of Nepal in a cost-effective way.

More research is required in other settings and contexts to evaluate the effect of the IC approach on MCH outcomes. A re-analysis of the intervention approach might be advisable to optimize the impact of the intervention. Future research could also address the methodological limitations by applying stronger study designs such as a randomized controlled trial to evaluate the effect of the IC approach on MCH outcomes.

5.5 Conclusion

This study assessed the effect of the IC approach as suggested by Tanahashi model (1978) to improve MCH indicators in different districts of Nepal. A quasi-experimental study was conducted using data from the NDHS 2011 and 2016, with the analysis of the effect of the intervention using a DiD method. Although, some improvements were observed in the indictors like any ANC, at least four ANC, SBA delivery, breastfeeding within one hour and stunting, these improvements were similar in both intervention and comparison groups. The proportion of children with underweight and wasting increased in districts where the IC intervention was implemented, while full Immunization declined in both areas. Multivariate models using the DiD analysis did not show significant improvement in any of the MCH outcomes.

Qualitative findings showed somewhat a contradictory result on the effectiveness of the IC approach. IC approach helped the stakeholders for planning the health-related programs and budgeting. The utilization of MCH services were found to be increasing especially in intervention areas. The stakeholders also mentioned about the ownership of the approach to make it sustainable. However, the under five years children's mothers were not aware about IC and were not less involved in the planning and budgeting process. The stakeholders were positive towards continuity of IC approach for the district MCH planning to increase responsibility and accountability of stakeholders and reaching the level of mothers' group through FCHVs. The stakeholders in the intervention districts were positive towards that IC approach, as the approach helped them to develop evidence-based and problem-oriented plans in a participatory involving a range of relevant stakeholders; fulfil the sanctioned health workers positions; and fulfil the demand of commodities in the health institutions.

The quantitative findings of this study, however, showed that the IC approach was not successful in improving MCH service outcomes when compared to the comparison group. This suggested that in resource poor and remote settings, other less complicated approach

than the IC may be required. Furthermore, if the IC approach is to be continued, some alterations in the implementation modality may be required, which include ensuring better participation of community level stakeholders including the service users, incorporating a strong component of the monitoring of program implementation, and provision of a regular feedback mechanism. A clear guideline is required for the implementation of the IC approach especially at the local level. The IC interventions should be focused as per the need of certain geographical location, ethnic group, marginalized community to ensure the interventions addresses the need of that particular group thereby reduce the inequality gap. As the same approach may not fit everywhere, there is a need to adjust the IC intervention as per the need of the district or area to make it successful and effective.

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Annexes

Annex 1: List of Publications

1. Janak Kumar Thapa[1,3,4*], Doris Stckl[2], Raj Kumar Sangroula[4], Dip Narayan Thakur[3], Suresh Mehata5, Asha Pun[6] and Maria Delius[7] (2021). **Investment case approach for equitable access to maternal neonatal and child health services: Stakeholders' perspective** in Nepal. PLoS ONE 16(10): e0255231. https://doi.org/10.1371/journal.pone.0255231

Statement on Contribution by authors

Janak Kumar Thapa: **Conceptualization of manuscript, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Visualization and Writing – original draft**

Raj Kumar Sangroula: **Conceptualization, Data curation, Formal analysis, Methodology, Resources, Software, Visualization**

Maria Delius: **Conceptualization, Methodology and Supervision, Visualization**

Doris Stöckl and Mahesh Kumar Maskey: **Conceptualization, Supervision**

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2. Janak Kumar Thapa [1]*, Doris Stöckl [2], Raj Kumar Sangroula[3], Asha Pun[4], Meena Thapa[4], Mahesh Kumar Maskey[5], Maria Delius[6]. Impact of investment case on equitable access to maternal and child health services in Nepal: a quasi-experimental study. BMC Health Serv Res 21, 1301 (2021). https://doi.org/10.1186/s12913-021-07292-5. https://rdcu.be/cCDdF

Statement on Contribution by Authors

Janak Kumar Thapa: Prepared the original draft of this. Analyzed and interpreted the data.

Maria Delius and Doris Stöckl: provided feedback and proofreading.

Raj Kumar Sangoula and Asha Pun, Suresh Mehata and Dip Narayan Thakur:

Supported methodology, data curation and analysis.

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Statement on Pre-release

No

Annex 2: District list (Intervention and comparisons)

Code	District Name	Ecological Zone	DIC Started (Year)	HDI	Intervention/Comparison	Earthquake Afftected
67	Bajura	Mountain	2013	0.364	Intervention	No
68	Bajhang	Mountain	2013	0.365	Intervention	No
64	Kalikot	Mountain	2014	0.374	Intervention	No
66	Humla	Mountain	2013	0.376	Intervention	No
69	Achham	Hill	2013	0.378	Intervention	No
32	Rautahat	Terai	2014	0.386	Intervention	No
18	Mahottari	Terai	2014	0.388	Intervention	No
65	Mugu	Mountain	2013	0.397	Intervention	No
62	Dolpa	Mountain	2014	0.401	Intervention	No
70	Doti	Hill	2014	0.407	Intervention	No
63	Jumla	Mountain	2014	0.409	Intervention	No
74	Baitadi	Hill	2013	0.416	Intervention	No
17	Dhanusa	Terai	2013	0.431	Intervention	No
15	Saptari	Terai	2013	0.437	Intervention	No
73	Dadeldhura	Hill	2012	0.442	Intervention	No
34	Parsa	Terai	2014	0.464	Intervention	No
61	Jajarkot	Hill	-	0.393	Comparison	No
53	Rolpa	Hill	-	0.395	Comparison	No
19	Sarlahi	Terai	-	0.402	Comparison	No
52	Pyuthan	Hill	-	0.413	Comparison	No
60	Dailekh	Hill	-	0.422	Comparison	No
50	Kapilbastu	Terai	-	0.432	Comparison	No
75	Darchula	Mountain	-	0.436	Comparison	No
20	Sindhuli	Hill	-	0.44	Comparison	Yes
55	Salyan	Hill	-	0.441	Comparison	No
23	Sindhupalchok	Mountain	-	0.455	Comparison	Yes
22	Dolakha	Mountain	-	0.459	Comparison	Yes
29	Rasuwa	Mountain	-	0.461	Comparison	Yes
12	Okhaldhunga	Hill	-	0.468	Comparison	No
21	Ramechhap	Hill	-	0.468	Comparison	Yes
14	Udayapur	Hill	-	0.475	Comparison	No
45	Baglung	Hill	-	0.478	Comparison	No
10	Bhojpur	Mountain	-	0.479	Comparison	No
36	Gorkha	Hill	-	0.481	Comparison	Yes
9	Sankhuwasabha	Mountain	-	0.488	Comparison	No
1	Taplejung	Mountain	-	0.494	Comparison	No
13	Khotang	Hill	-	0.494	Comparison	No
2	Panchthar	Hill	-	0.498	Comparison	No
7	Dhankuta	Hill	-	0.517	Comparison	No
35	Chitawan	Terai	-	0.551	Comparison	No
16	Siraha	Terai	-	0.408		No
54	Rukum	Hill	-	0.431		No
33	Bara	Terai	-	0.457		No
71	Kailali	Terai	-	0.46		No
30	Dhading	Hill	-	0.461		Yes
46	Gulmi	Hill	-	0.464		No
28	Nuwakot	Hill	-	0.466		Yes
58	Bardiya	Terai	-	0.466		No
57	Banke	Terai	-	0.475		No
72	Kanchanpur	Terai	-	0.475		No

59	Surkhet	Hill	-	0.476		No
51	Arghakhanchi	Hill	-	0.482		No
56	Dang	Terai	-	0.485		No
43	Myagdi	Hill	-	0.49		No
48	Nawalparasi	Terai	-	0.493		No
6	Sunsari	Terai	-	0.496		No
31	Makwanpur	Hill	-	0.497		Yes
49	Rupandehi	Terai	-	0.498		No
47	Palpa	Hill	-	0.5		No
11	Solukhumbu	Mountain	-	0.502		Yes
38	Tanahu	Hill	-	0.506		No
37	Lamjung	Hill	-	0.507		No
42	Mustang	Mountain	-	0.508		No
44	Parbat	Hill	-	0.51		No
5	Morang	Terai	-	0.513		No
4	Jhapa	Terai	-	0.518		No
24	Kavrepalanchok	Hill	-	0.52		Yes
3	Ilam	Hill	-	0.526		No
8	Terhathum	Hill	-	0.527		No
39	Syangja	Hill	-	0.527		No
41	Manang	Mountain	-	0.568		No
26	Bhaktapur	Hill	-	0.573		Yes
40	Kaski	Hill	-	0.576		No
25	Lalitpur	Hill	-	0.601		Yes
27	Kathmandu	Hill	-	0.632		Yes

Annex 3: Analysis note

A Background

- Intervention districts for District Investment Case: 16 (from Terai, Hills and Mountains, most of them belongs to those with low HDI value.)
- Comparison districts: 24 (districts with similar performance at the time of starting of DIC)

B Dataset Preparation

* Nepal Demographic Health Survey raw dataset for the year 2011 and 2016 was downloaded from www.dhsprogram.com
Children dataset (KR file...spss version) of both survey year was used for the study
* Each variables in the datasets were cross checked one by one for uniformity over both surveys. Variables with different names were renamed, variables only available in one year was excluded, variables with different coding (value labels) were recoded to ensure uniformity across surveys
* Additional variables required like variables for intervention and comparison, variables for province in 2011, Year variable, Earthquake affected or not....were added to both datasets before merging
* Dataset were merged into one
* Variables of interest were recoded as per guideline/standard

Wealth tertile: Wealth index was recoded into wealth tertile using cut-off of 33.33 and 66.67 percentiles

Women Education: Pre-existing women education variable was recoded to form women education variable with three categories (No education, Primary and secondary or higher)

Women Occupation: Pre-existing related variable was recoded to form Unemployed, Agriculture or labor, and service or business (threse was no case for certain occupation group so just this three categories remained)

Place of residence: Based of cluster information of 2011 and latest classifcation of urban rural, new variables for uraban rural was created for 2011 to ensure comparability with that of 2016 DHS data as Nepal has been to rapid urban re-classification in recent years.

Women Age: Pre-exiting age of women (respondent) were categorized into 15-24, 25-34 and 35-49 years

Ethnicity: Advantaged (Hill Brahmin/Chhetri, Terai Brahmin Chhetri, Newar), disadvantaged (all others)

Distance to nearest Health facility: Big problem (Big problem); Not much problem(no problem, not a big problem)

Head of household: as it was in dataset

Ecological Region: as it was

Husband education: recoded same as womens education

Children's age: Categorized into 4 groups (0-23m, 24-35m, 36-47m, 48-59m)

Any ANC: recoded from number of ANC chec up

At least 4 ANC: recoded from number of ANC

Skilled attendant delivery: ANM, Doctors, SBA attended delivery

Breastfeeding with in one hour: recoded from when child put to breast

Full immunization: BCG+Polio+DPT3+MR1

Stunting: Height for age was recoded as per WHO standard guideline

Underweight: Weight for age was recoded as per WHO standard guideline

Wasting: Weight for Height was recoded as per WHO standard guideline

C Analysis Note

* Data were restricted to recent three years of the surveys (2009 to 2014) i.e.upto 2009 for 2011 surveys and upto 2014 for 2016 survey (for Any ANC, at least 4 ANC, Skilled Attended Delivery, and Breastfeeding with in one hour)

*Data were restricted to child age group 12-23 months for full immunization coverage whereas for nutrition status whole dataset was used (no any restriction)

Dependant variables: Any ANC; At least four ANC; Skilled Attendant Delivery; Breastfeeding initiation within one hour; Full Immunization; Stunting; Wasting; Underweight

Independent Variables: Wealth tertile; Women's education; Women's Occupation; Place of residence (Urban rural); Women's Age (three categories); Ethnicity (two categories- advantaged and disadvantaged); Distance to nearest Health Facility (whether problematic or not); Head of household (gender); Ecological region; Husband's education

1 **Cross-tabulation with Confidence Interval (95%) -SPSS v23**

Complex Sample Analysis was used (for which Weight=WGT, cluster=V021, strata=V022) by creating csplan file
Complex sample crosstab was run to generate weighted prevalence alongwith Confidence Interval (CI)
Prevalance, CI, and N were then put into table

2 **Difference in Difference Analysis (DID) -STATA 14** (merged file were exported to STATA from SPSS)

A. Variable Screening (Linear regression)

- Linear regression was run for each of the dependant variable with each of the independent variable putting Year and Intervention-comparison in the equation Example of syntax <svy: regress Any_ANC Wealth_tertile Int_Comp_new Year>

- Linear regression with interaction term (Year*intervention) with each independent variables putting Year and Intervention-comparison intact in each equation

- Variables or its interaction which were significant at p-value cut-off 0.2 were considered eligible for multi-variate linear regression

LOGISTIC REGRESSION (Enter method) (SPSS)
(notes in corresponding analysis sheet table)

B. Multi-variate Linear Regression

- Multi-colinearity was checked for significant independent variables and the process was repeated for all dependant variables
- No multi-colinearity was found at VIF cut-off value of 3
- For each dependant variables, multi-variate regression was carried out by putting those significant independent variables or interactions in the model

- Step by step method was used, in each step those variables which p-value was highest and greater than 0.05 was removed from the model until no any independent variables has p-value greater than 0.05. Year and Intervention-comparison varibales were kept intact despite its p-value.

For details check syntax files!

https://www.mailman.columbia.edu/research/population-health-methods/difference-difference-estimation