

Impact of Investment Case on Equitable Access on Maternal and Child Health Services in Nepal: Quasi-experimental study

Janak Kumar Thapa (✉ janakthapa7@gmail.com)

Center for International Health, Ludwig Maximilians University, Munich and Nepal Public Health Foundation (NPHF) <https://orcid.org/0000-0002-1420-0965>

Doris Stöckl

Helmholtz Zentrum München

Raj Kumar Sangroula

Nepal Public Health Research and Development Center (PHRD Nepal)

Dip Narayan Thakur

Nepal Public Health Research and Development Center (PHRD Nepal)

Suresh Mehata

Ministry of Health and Population

Asha Pun

UNICEF

Maria Delius

Department of Obstetrics and Gynecology, University Hospital, LMU Munich

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Abstract

Background

Different areas of disparities remain a concern in developing countries like Nepal regarding the utilization of maternal, neonatal and child health services like disparities in education, income, administrative regions, ethnic groups, province-level etc. In order to support equitable outcomes for Maternal, Neonatal and Child Health (MNCH) and to scale-up quality services, an Investment case was launched by developmental partners in the Asia-Pacific region. Investment Case (IC) at the local level aims to develop a coherent plan with local level development plans, which is equitable and responsive to the bottlenecks and the local needs. The study aims to identify the factors affecting equitable access to maternal health services in Nepal.

Methods

The study focuses on the impact of the intervention package developed by applying the investment case (IC) approach in maternal and child health services in Nepal introduced in 2011. Complex sample analysis was carried out to adjust the weight of the sample. Cross tabulation with Confidence Interval (CI) was used to generate weighted disaggregated data. Difference in Difference (DiD) analysis was carried out using a linear regression model. Finally, multivariate linear regression was carried out to figure out the effect of the intervention.

Results

Based on the data, the improvements before and after the intervention were calculated in both the intervention and comparison districts; no variables showed a significant association. Changes were similar for intervention and comparison areas: four antenatal care seeking (DiD=-4.8, $p = 0.547$ CI= -0.041-0.022), Skill Birth Attendance (SBA) delivery (DiD = 6.6, $p = 0.325$, CI= -0.010-0.039). Multivariable regression analysis also did not reveal any significant improvement in aggregate outcomes. The intervention did not play a significant role in any variables, i.e., four antenatal care seeking (p-value 0.062), SBA delivery (p-value 0.939).

Conclusion

The IC approach is itself a successful approach in most of the developing countries. After the implementation of IC, some of the MNCH indicators like ANC, SBA delivery have shown improvements in the intervention as well as comparison districts but have not shown significant with the intervention.

1. Background

Maternal mortality reduction has also been a globally, SERO regional and national commitment, with a vital role to be played in the Agenda for Sustainable Development. A major target under Sustainable Development Goal no. 3 is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births. Almost all maternal deaths (99%) occur in developing countries (1).

Nepal is ranked 149 out of 187 countries in terms of human development, and 25% of the people live below the poverty line (2). The majority of the poor are women, Dalit, and disadvantaged Janjati (indigenous groups). According to the Central Bureau of Statistics (3), the most disadvantaged are households from the remote hill and mountain areas, as well as the Terai community. Due to the constraints and bottlenecks in the health system, the interventions do not reach the needy people (4). According to the Nepal Demographic and Health Survey, 2016, the proportion of four ANC visits and institutional delivery are not equally distributed across different provinces and geographical areas (5). The government of Nepal (GoN) is committed to bring about tangible changes in the health-sector development process and provide equitable access to quality health care for all people. The aim is to provide an equitable, high-quality health care system for the Nepalese people (6).

To decrease the inequities in health through responsive and accessible services and improved quality health system, the Government of Nepal has initiated engaging local-level stakeholders in planning and implementing programmes, as envisioned in Nepal Health Sector programme-Implementation Plan II (NHSP-IP II)(7). In order to support equitable outcomes for Maternal, Neonatal and Child Health and to scale-up quality services, the Investment case approach was launched by developmental partners in the Asia-Pacific region (8). Investment Case (IC) at the local level aims to develop a coherent plan with local level development plans, which is equitable and responsive to the bottlenecks and local needs (9).

The Investment Case (IC) is a strategic and evidence-based problem-solving approach to support better maternal, neonatal, and child healthcare planning and budgeting. It highlights the immediate need to accelerate progress towards health-related MDGs 4 and 5 by describing health issues being faced by a country in the area of MNCH. IC analysis is based on the 'Tanahashi model', bottlenecks framework, the idea of five different determinants to measure the capacity and intervention to produce the desired quality of service i.e., effective coverage (9). Tanahashi's model is the model designed in 1978 in order to identify the gaps in quality and effectiveness in service delivery. The gap refers to the proportion of the target population that does not receive effective coverage (4). The five determinants of the Tanahashi model are (i) availability (ii) accessibility (iii) acceptability (iv) contact and (v) effectiveness (10). It is designed to identify current barriers to better coverage and performance and to work out the costs and impacts of potential interventions to improve performance and overall equity (9). Implementation of the IC approach involves five steps, which start from advocacy with the government, selection of interventions (tracers), data mapping and collection, data validation, bottlenecks analysis, and strategies development (11).

In order to achieve health-related MDG goals 4 and 5, in partnership with UNICEF Nepal, Nepal Government intervened Investment case approach in 19 districts of Nepal in 2011 in order to address the local constraints to MNCH intervention coverage. IC aims to explore the prevalent constraints in the existing health system of districts that hinder the desired outcomes, especially related to maternal, neonatal, and child health. The districts that had low coverage were chosen in the approach and representative from each ecological region (8). Hence, the study aims to identify the factors affecting equitable access to maternal health services in Nepal.

2. Methods

Study setting and population

Geographically Nepal is divided into three ecological regions- Mountains, hills, and plains. According to the census of 2011, 50 percent of the population resides in the Plain area, 43 percent in the hills and the rest 7 percent in mountain areas (12). In this study, 16 districts were taken as intervention districts in which the investment case approach was used and 24 districts with similar HDI were taken as comparison districts. Both intervention and comparison districts had Plain, hilly and mountainous areas.

Study design

The study used quasi-experimental study design in order to assess the impact of the intervention package developed by applying an investment case (IC) approach in maternal and child health services in Nepal. The study used the Nepal Demographic and Health Survey data for 16 intervention and 24 comparison districts of Nepal to assess the IC approach's impact. The study comprises data from two surveys i.e., NDHS 2011 and 2016. All the methods of both the survey were same.

Data Sources and variables

The study uses the Nepal Demographic and Health Survey to assess the impact of the intervention package developed by applying the investment case (IC) approach in maternal and child health services in Nepal. The Demographic and Health Survey (DHS) is a standardized survey that collects household data for population, health and nutrition. The DHS survey is nationally representative and uses a multi-stage sampling process for collecting data (13). The study comprises data from two surveys i.e., NDHS 2011 and 2016. All the methods of both the survey were same. Considering the intervention duration, data were restricted to the recent three years of the surveys (2009 to 2014) i.e. back to 2009 for 2011 surveys and back to 2014 for 2016 survey for many ANC, at least 4 ANC, Skilled Attended Delivery.

Table 1: Number of households and women of reproductive age by survey years

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

The variables examined under study were:

Dependent variables: At least four ANC; Skilled Birth Attendant Delivery

Independent variables: Program intervention (Program areas, control areas)

Control variables: Wealth tertile; women's education; women's occupation; place of residence; women's Age; ethnicity; distance to nearest health facility; head of household; ecological region; husband's education.

Figure: Conceptual Framework

Data analysis

The Difference in Difference (DiD) analysis was done to identify any differences between the intervention and comparison groups as a result of changes over time rather than as a consequence of the intervention itself. The linear regression method was used to calculate DiD. In the first step, screening of the variable was performed where variables or interaction term with p-value ≤ 0.2 . Eligible variables based on the cut-off value were further analysed using a multivariate linear regression model using the stepwise method. Before proceeding to the multivariate model, multi-collinearity was assessed for each model. Multi-collinearity was assessed on the basis of the variance inflation factor (VIF) cut-off value of 3. Control variables with p-value ≥ 0.05 were excluded (variables with the highest p-value were removed first) from the model one by one. The final resulting model was considered to give the true effects of interventions. The process was repeated for each independent variable.

Ethical approval was taken from the Ethical Review Board of the Nepal Health Research Council and the LMU Ethical Commission

3. Results

Table 2 presents the difference in difference (DiD) findings for the distribution of at least 4 ANC practices in relation to the female participants' independent variables by intervention and comparison areas and before and after the intervention period. After the intervention period, at least 4 ANC increased from 40.1 to 52.4 in the intervention area and from 43.9 to 61.1 in the comparison area. The difference in the rate of increase in the comparison area was 4.8 percentage and was statistically insignificant. Almost all variables have shown improvement in intervention as well as the comparison districts. For the majority of variables, the improvements in comparison districts are more pronounced than the intervention districts. Except for service or business (difference in difference of 47.1), highest wealth quintile (difference in difference of 5.4) and hilly region (difference in difference of 2.0), other variables show greater improvement in comparison districts. The greater improvements in comparison districts include age category of 15–24 (difference in difference of 15.5) and 25–35 years (difference in difference of 14.4), education (no education:15.5, primary education: 14.4 and secondary or higher 4.3), lowest and middle wealth tertile, husbands' education (no education 8.4 and primary education 17.0). There were moderate to little improvements in other variables in comparison districts. Only the difference in service or business category was statistically significant with at least 4 ANC with p-value 0.005.

Table 2
Difference in difference analysis of at least four ANC

At Least 4 ANC	Intervention area			Comparison area			Difference of difference	B	95% CI	p-value
	Before N = 600 weighted	After N = 603 weighted	Difference	Before N = 792 Weighted	After N = 740 Weighted	Difference				
At least 4 ANC	40.1	52.5	12.4	43.9	61.1	17.2	-4.8	-0.009	-0.041–0.022	0.547
Age (3 cat)										
15–24 years	46.23	55.49	9.3	53.41	64.95	11.5	-2.3	-0.004	-0.039–0.029	0.795
25–34 years	38.02	51.29	13.3	39.16	57.95	18.8	-5.5	-0.011	-0.048–0.026	0.559
35–49 years	19.08	34.99	15.9	25.25	51.46	26.2	-10.3	-0.021	-0.078–0.037	0.479
Ethnicity										
Advantaged	50.44	62.09	11.6	53.56	74.49	20.9	-9.3	-0.018	-0.057–0.020	0.346
Disadvantaged	36.30	48.95	12.6	37.50	54.12	16.6	-4.0	-0.008	-0.045–0.029	0.673
Education										
No Education	30.29	41.87	11.6	19.53	46.65	27.1	-15.5	-0.031	-0.067–0.005	0.089
Primary	54.29	45.90	-8.4	47.60	53.60	6.0	-14.4	-0.029	-0.075–0.018	0.226
Secondary or higher	71.86	74.13	2.3	69.45	76.06	6.6	-4.3	-0.009	-0.043–0.026	0.624
Occupation										
Unemployed	41.57	46.88	5.3	46.55	52.87	6.3	-1.0	-0.002	-0.056–0.051	0.941
Agriculture or labor work	39.32	57.16	17.8	39.57	64.10	24.5	-6.7	-0.013	-0.046–0.019	0.425
Service or business	37.00	81.96	45.0	74.29	72.16	-2.1	47.1	0.094	0.029–0.159	0.005
Wealth Tertile										
Lowest	34.40	51.30	16.9	26.70	58.40	31.7	-14.8	-0.029	-0.066–0.007	0.109
Middle	36.50	50.90	14.4	41.00	59.70	18.7	-4.3	-0.008	-0.051–0.034	0.694
Highest	53.70	56.50	2.8	73.30	70.70	-2.6	5.4	0.011	-0.039–0.061	0.671
Ecological Region										
Hilly	56.60	77.63	21.0	42.07	61.10	19.0	2.0	0.004	-0.032–0.040	0.827
Mountain	37.95	51.29	13.3	55.06	72.44	17.4	-4.0	-0.008	-0.056–0.039	0.737
Plain	35.60	47.89	12.3	39.89	55.82	15.9	-3.6	-0.007	-0.065–0.050	0.802

At Least 4 ANC	Intervention area			Comparison area			Difference of difference	B	95% CI	p-value
Residence(U/R)										
Urban	53.52	57.85	4.3	55.52	64.60	9.1	-4.7	-0.009	-0.047–0.028	0.624
Rural	34.70	48.57	13.9	32.44	57.38	24.9	-11.1	-0.022	-0.063–0.019	0.289
Husband Education										
No Education	21.54	36.07	14.5	15.71	38.64	22.9	-8.4	-0.017	-0.059–0.025	0.434
Primary	41.27	41.89	0.6	38.75	56.39	17.6	-17.0	-0.034	-0.075–0.007	0.105
Secondary or higher	55.08	62.92	7.8	57.79	68.74	11.0	-3.1	-0.006	-0.038–0.025	0.700
Head of Household										
Male	37.71	50.36	12.6	43.55	59.96	16.4	-3.8	-0.007	-0.041–0.026	0.657
Female	48.83	59.00	10.2	44.87	63.80	18.9	-8.8	-0.017	-0.057–0.022	0.386
Distance to nearest HF										
Big Problem	35.85	52.97	17.1	34.31	58.13	23.8	-6.7	-0.013	-0.044–0.017	0.394
Not much problem	49.26	51.40	2.1	58.18	67.33	9.2	-7.0	-0.014	-0.058–0.030	0.536

Table 3 shows the difference in differences and the level of significance within the independent variables with delivery conducted by SBA. After the intervention period, SBA delivery increased from 30.1 to 51.0 in the intervention area and from 28.8 to 43.1 in the comparison area. The difference in the rate of increase in the intervention area was 6.6 per cent greater and was statistically insignificant (p-value 0.325). Almost all variables have shown improvement in intervention as well as the comparison districts. For the majority of variables, high improvements are seen in intervention districts than the comparison districts. The variables which show greater improvements in intervention districts in relation to delivery conducted by SBA are age within the category of 25–34 (difference in difference of 8.0) and 35–49 (difference in difference of 15.8), an advantaged category in ethnicity (difference in difference of 12.4), secondary or higher in education (difference in difference of 9.1), service or business (difference in difference of 37.0), the highest category of wealth tertile (difference in difference of 14.3), mountain region (difference in difference of 8.4) and hilly region (difference in difference of 33.8) in ecological regions. Other variables like residence, husband education, head of households and distance to nearest health facility also showed greater improvements in relation to SBA delivery in intervention areas. Only the difference of hilly region category under the ecological region was statistically significant with p-value 0.002. Other variables like husbands' education (primary education) was near to significant (p-value: 0.061). Only plain regions (difference in difference of 5.0), no education in husbands' education showed moderate increment in comparison group. The difference in difference of none of the variables has shown significant with the deliveries conducted by SBA.

Table 3
Difference in difference analysis of Skilled Birth Attendant Delivery

Skilled attended delivery	Intervention area			Comparison area			Difference of difference	Beta Coeff.	95% CI	p-value
	Before N = 679 weighted	After N = 603 weighted	Difference	Before N = 848 Weighted	After N = 740 Weighted	Difference				
Skilled attended delivery	30.1	51.00	20.9	28.8	43.1	14.3	6.6	0.013	-0.010–0.039	0.325
Age (3 cat)										
15–24 yrs	35.64	57.99	22.3	33.13	50.78	17.7	4.7	0.009	-0.024–0.043	0.586
25–34 yrs	27.25	45.31	18.1	27.43	37.49	10.1	8.0	0.016	-0.015–0.047	0.306
35–49 yrs	12.93	31.06	18.1	17.56	19.85	2.3	15.8	0.031	-0.020–0.084	0.233
Ethnicity										
Advantaged	23.75	52.30	28.6	35.80	51.95	16.2	12.4	0.025	-0.018–0.067	0.256
Disadvantaged	32.33	50.49	18.2	24.20	38.45	14.2	3.9	0.007	-0.025–0.040	0.636
Education										
No Education	22.63	38.25	15.6	11.98	30.10	18.1	-2.5	-0.005	-0.035–0.026	0.750
Primary	38.35	53.25	14.9	25.70	37.40	11.7	3.2	0.006	-0.039–0.052	0.781
Secondary or higher	55.94	70.52	14.6	50.45	55.89	5.4	9.1	0.018	-0.017–0.054	0.315
Occupation										
Unemployed	44.16	55.11	11.0	38.26	43.25	5.0	6.0	0.012	-0.039–0.064	0.650
Agriculture or labor work	19.44	44.69	25.2	21.89	39.85	18.0	7.3	0.014	-0.013–0.043	0.308
Service or business	45.36	81.96	36.6	65.43	65.05	-0.4	37.0	0.074	-0.006–0.015	0.071
Wealth Tertile										
Lowest	14.10	47.40	33.3	12.10	31.10	19.0	14.3	0.029	-0.004–0.062	0.087
Middle	30.70	48.30	17.6	27.10	47.90	20.8	-3.2	-0.006	-0.042–0.029	0.725
Highest	50.70	59.80	9.1	56.50	69.30	12.8	-3.7	-0.007	-0.055–0.040	0.757
Ecological Region										
Hilly	25.66	70.08	44.4	28.05	38.65	10.6	33.8	0.067	0.026–0.108	0.002
Mountain	17.04	39.92	22.9	28.95	43.43	14.5	8.4	0.016	-0.045–0.079	0.591
Plain	34.81	49.62	14.8	29.84	49.68	19.8	-5.0	-0.010	-0.055–0.034	0.654

Skilled attended delivery	Intervention area			Comparison area			Difference of difference	Beta Coeff.	95% CI	p-value
Residence(U/R)										
Urban	39.23	59.45	20.2	42.68	53.10	10.4	9.8	0.019	-0.020–0.059	0.336
Rural	26.51	44.80	18.3	15.43	32.47	17.0	1.3	0.002	-0.029–0.034	0.876
Husband Education										
No Education	21.22	37.16	15.9	10.76	33.23	22.5	-6.5	-0.013	-0.056–0.030	0.553
Primary	22.67	45.18	22.5	21.82	27.74	5.9	16.6	0.033	-0.001–0.067	0.061
Secondary or higher	41.69	57.81	16.1	40.34	52.29	11.9	4.2	0.008	-0.023–0.039	0.601
Head of Household										
Male	31.06	50.65	19.6	27.45	42.31	14.9	4.7	0.009	-0.019–0.038	0.511
Female	26.41	51.97	25.6	32.70	44.89	12.2	13.4	0.027	-0.010–0.064	0.155
Distance to nearest HF										
Big Problem	24.58	48.87	24.3	19.69	35.96	16.3	8.0	0.016	-0.014–0.046	0.290
Not much problem	42.74	55.72	13.0	42.65	58.10	15.5	-2.5	-0.005	-0.044–0.034	0.801

Table 4 shows the bivariate and multivariate regression for at least 4 ANC. The independent variables contributing towards change in at least 4 ANC visit were wealth index (p-value < 0.001), women education (p-value < 0.001), women occupation (p-value 0.036) place of residence (p-value 0.006), ethnicity (p-value 0.009), gender (head of households) with (p-value 0.001), ecological region (p-value 0.05) and husbands' education (p-value < 0.001). Intervention did not play significant role for at least 4 ANC visit between the time period 2011 and 2016 (p-value 0.062).

Table 4
Binary and Multivariate Regression coefficient for at least ANC

variables	Period 2011 to 2016							
	Bivariate Regression Coefficient				Multivariate Regression Coefficient			
	b estimate	95% CI		p value	b estimate	95% CI		p value
Lower		Upper	Lower			Upper		
Wealth index	0.1014	0.0644	0.1384	0.000	0.074	0.037	0.111	0.000
Women education	0.1914	0.1640	0.2187	0.000	0.123	0.090	0.157	0.000
Women Occupation	0.0341	0.0076	0.0607	0.012	0.025	0.002	0.049	0.036
Place of residence	-0.1436	-0.2143	-0.0728	0.000	-0.085	-0.145	-0.024	0.006
Ethnicity	-0.16288	-0.224891	-0.100862	0.000	-0.076	-0.132	-0.019	0.009
Gender (Head of household)	0.057522	0.0093861	0.1056586	0.019	0.057	0.014	0.100	0.010
Ecological region	-0.0508	-0.094436	-0.007154	0.023	-0.038	-0.076	0.000	0.050
Husband education	0.168071	0.1414714	0.1946704	0.000	0.064	0.031	0.098	0.000
Year	-	-	-	-	0.034	0.019	0.049	0.000
Intervention	-	-	-	-	45.264	-2.197	92.725	0.062
Intervention* Year	-	-	-	-	-0.022	-0.046	0.001	0.062
Constant	-	-	-	-	-68.186	-98.952	-37.421	0.000

Table 5 shows the bivariate and multivariate regression for SBA delivery. The independent variables contributing towards change in SBA delivery were wealth index (p-value < 0.001), women education (p-value < 0.001), place of residence (p-value < 0.001), women's age (p-value 0.011), distance from health facility (p-value 0.007), and ecological region (p-value 0.024). Intervention did not play significant role for SBA delivery between the time period 2011 and 2016 (p-value 0.939).

Table 5
Binary and Multivariate Regression coefficient for SBA delivery

Variables	Period 2011 to 2016							
	Bivariate Regression Coefficient				Multivariate Regression Coefficient			
	b estimate	95% CI		p value	b estimate	95% CI		p value
Lower		Upper	Lower			Upper		
Wealth index	0.1678243	0.1316307	0.204018	0.000	0.1246	0.0846	0.1646	0.000
Women education	0.1626658	0.1344115	0.19092	0.000	0.0962	0.0650	0.1275	0.000
Place of residence	-0.1945108	-0.257598	-0.13142	0.000	-0.1268	-0.1810	-0.0726	0.000
Women age	-0.1092028	-0.141533	-0.07687	0.000	-0.0420	-0.0742	-0.0097	0.0110
Distance from HF	0.1818694	0.123608	0.240131	0.000	0.0757	0.0207	0.1308	0.0070
Ecological region	0.0223003	-0.01663	0.061231	0.260	-0.0384	-0.0717	-0.0051	0.024
Year	-	-	-	-	0.0302	0.0169	0.0435	0.000
Intervention	-	-	-	-	-1.5251	-43.9476	40.8974	0.944
Intervention* Year	-	-	-	-	0.0008	-0.0203	0.0219	0.939
Constant	-	-	-	-	-60.4854	-87.2854	-33.6854	0.000

4. Discussion

Key findings and their explanation

This study intends to assess the intervention's effectiveness in the 16 implemented districts taking other districts as a comparison. The study's main purpose was to assess the impact of the intervention package developed by applying the investment case (IC) approach in maternal health services in Nepal.

The maternal and child health indicators are greater than the Sub-Saharan African countries, and the reduction rate is also high (14). Some improvement has been observed in at least 4 ANC and skilled birth attendant delivery, but these improvements are generally similar in both intervention and comparison areas. Difference-in-differences did not show any significant improvement in the intervention and comparison districts. The intervention did not play significant role in any of the major indicators related to the Investment Case between the time period 2011 and 2016. Studies from a review of the survey of data from 54 countries indicated that skilled birth interventions were the least equitable intervention followed by four or more antenatal care visits (15).

A meta-analysis is a systematic review from eleven randomised and clustered randomized study from the countries like Nepal, Bangladesh, India, and Pakistan showed that community intervention and education of women showed no difference in the at least one ANC visit and three or more ANC visits and health care facility birth between the community interventions combined and control (16). A cluster randomized controlled trial of a package of community-based maternal- neonatal interventions was conducted in Mirzapur, Bangladesh in which indicators of practices and knowledge related to maternal and neonates improved in the intervention areas than comparison areas (17). A systematic review conducted for maternal health interventions in resource-limited countries revealed that the programs with multiple interventions would positively impact maternal health outcomes than the single intervention programs (18). A community-based intervention study conducted in India has shown significant health improvements in care-seeking and health behaviour (19).

A systematic review which analysed 208 innovative approaches reported in 259 studies and reports, including systematic and narrative reviews, randomized controlled trials (RCTs), cluster randomized controlled trials, controlled and uncontrolled pre-post and time-series studies, cross-sectional studies, and expert perspectives papers concluded that innovative approaches in MNH with innovative implementation and service delivery would help to improve equity in MNH services (20). The "*Aama Suraksha Karyakram*" (safe motherhood security program) implemented by the government of Nepal in order to address barriers in accessing maternal health services in Nepal is an effective and efficient program in order to reduce the barriers occurring inside health service and financial condition (21).

Intervention Package

The investment complex is itself a complex program involving different interventions related to various maternal, neonatal, and child health-related indicators. All the Tanahashi model determinants are involved in the study, making it difficult and complex to monitor by health workers. Investment case was developed based on evidence from different trials and studies from other countries (22), and the settings may not be the same and neighbouring countries. The actors involved in the Investment case are all the stakeholders related to health in the districts. If several interventions are combined in a package. In that case, the overall effectiveness of the whole intervention gets diluted due to the dispersed attention of service providers and the policy and decision-makers. The evaluation of the Investment case of Asian and Pacific countries has also shown the complexity of the approach in which the district managers have mentioned the tool used was beyond the staff's capacity (8).

Implement intensity and Quality

During the investment case implementation, more focus was on both budgeting and technical assistance in the districts. The workshop conducted in the districts concluded with action plans with the responsibilities of different stakeholders related to different tracers (23). But the action plans were not monitored on a regular basis by the stakeholders as well as the implementing partners. There were no technical officers in the districts who regularly monitored the intervention. The resources limitation also played a major role in the quality of intervention as the hard to reach areas had very limited resources (especially human resources) to carry out the activities (11).

Strengths And Limitations

Study design and study population

Study design, study population, and time frame are important factors to be considered in the study design in order to show a potential impact on the population. The data used are taken from Nepal Demographic and Health Survey. The study has used data for a quasi-experimental design and analysed using difference-in-differences and multivariable regression techniques. As the study is quasi-experimental, it may pose different potential biases (24). The sample taken for the districts from NDHS may not represent the whole population of the districts as some districts sample are bigger and some have smaller sample sizes and the population of each selected districts may also differ from one another. The sample taken for MNCH related indicators is smaller, which reduces the power of the study, which may have affected the significant association between the variables (25).

For comparison population, the districts selected had almost the same Human Development Index as the intervention districts but were relatively easy to reach districts as all the hard to reach districts were already selected by the IC approach as intervention districts. Thus, making the intervention and comparison districts incomparable.

Data and analysis

As DHS includes a cross-sectional survey, the retrospective data are collected related to maternal, neonatal, and child health, which may be subject to recall bias. DHS data are designed to represent at the national level but may not necessarily represent the district level. The sample of 1000–1500 women and children would be better for valid estimation of fertility and child morbidity and mortality (13). The analysis was carried out using multiple analysis approaches (e.g. difference-in-differences and univariate/multivariable regression analysis) helped to examine the effect with and without adjustment for possible confounders. Weighted values were calculated for all the variables.

Conclusion

This study utilized the data of NDHS 2011 and 2016 to assess the impact of the investment case approach in the implemented districts of Nepal. The data from Nepal Demography and Health Survey of 2011 and 2016 indicated that the overall progress. Some improvements have been observed in the major indicators like at least 4 ANC and skilled birth attendant delivery; however, these improvements are generally similar in both intervention and comparison areas. The results indicated that the re-design of the intervention strategies should be done in order to maximize the effectiveness of the IC approach.

Abbreviations

ANC Ante Natal checkup

CI Confidence Interval

DHS Demographic Health Survey

DiD Difference in Difference

GoN Government of Nepal

HDI Human Development Index

HF Health Facility

IC Investments Case

LMU Ludwig-Maximilians University

MDG Millennium Development Goals

MNCH Maternal Neonatal and Child Health

NDHS Nepal Demographic and Health Survey (NDHS)

NHSP-IP II Nepal Health Sector programme-Implementation Plan II

SBA Skill Birth Attendance

UNICEF United Nation Children's Emergency Fund

VIF Variance Inflation Factor

Declarations

The authors declare that they have no competing interests.

Ethics approval and consent to participate

Ethical approval obtained from the Nepal Health Research Council (Ref. 1296) and the Center for International Health, Ludwig-Maximilians University, Munich (CIH^{LMU} Ref no. 2016). Since this study did not collect primary data, no informed consent form from the participants was required.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed to the research for this article.

JKT: write up the first draft of this manuscript and all authors reviewed subsequent drafts and Coordinated the all study district. MD, DS: provide the feedback and proofreading. AP, SM, RKS and DNT: Support data collection and analysis part.

All authors read and approved the final manuscript.

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Figures

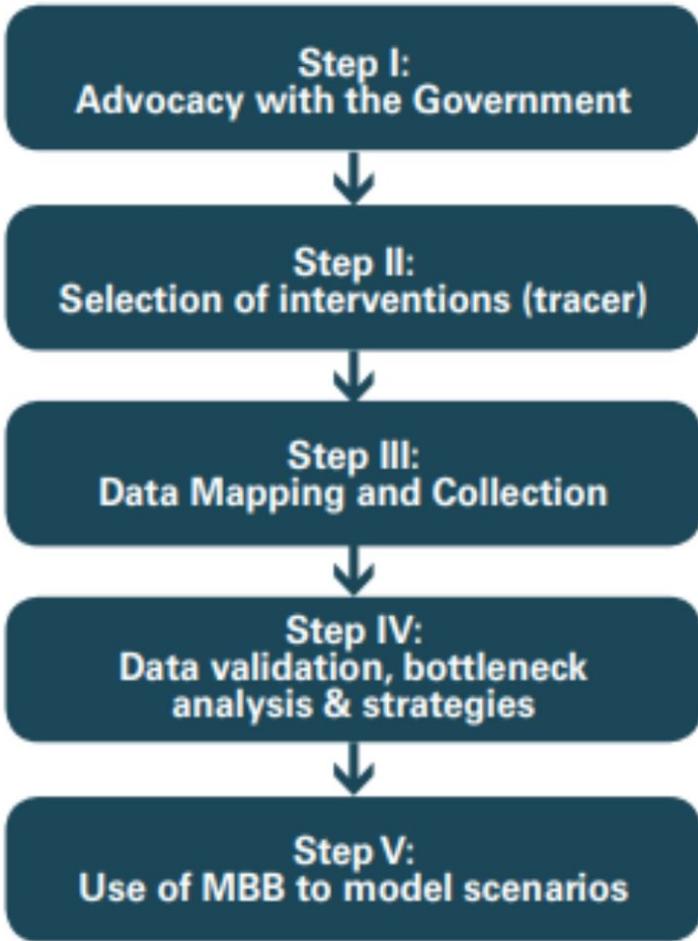


Figure 1: Key steps in IC Process

Figure 1

Key steps in IC Process

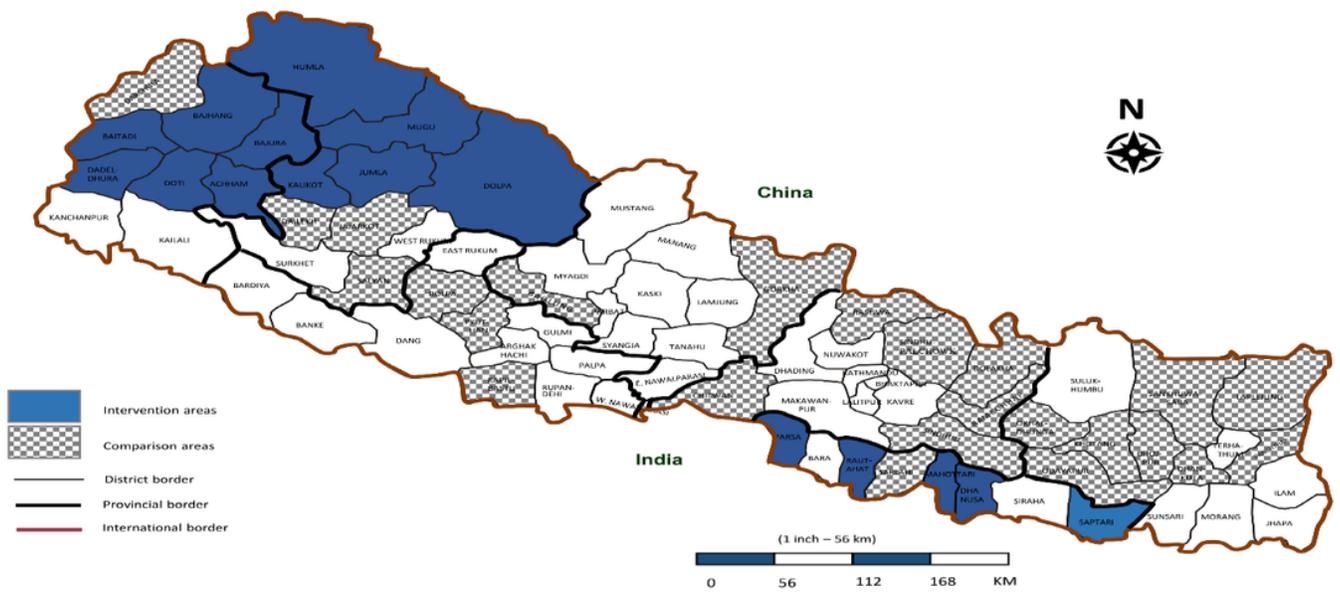


Figure 2

Map of Nepal showing IC intervention and comparison districts. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

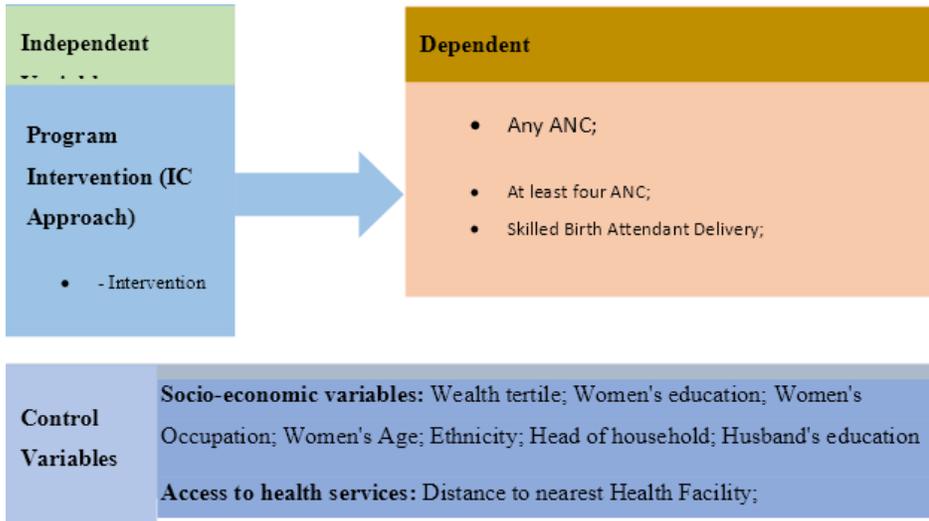


Figure 3

Conceptual Framework