Effective Coverage of Sick Child Care Services and Relationship with Under-5 Mortality Across Seven Provinces, 2022 Nepal DHS and 2021 Nepal HFS

DHS Further Analysis Reports No. 148

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This is one of 11 reports from a further analysis activity undertaken as part of the follow-up to the 2022 Nepal Demographic and Health Survey (NDHS). ICF provided technical assistance for the activity while USAID Learning for Development coordinated the activity. USAID Learning for Development also provided quality assurance and led the analysis of eight of the 11 reports, coordination with government stakeholders, and dissemination. ICF led the analysis of three of the reports.

This report is a publication of The Demographic and Health Surveys (DHS) Program, which is designed to collect, analyze, and disseminate data on fertility, family planning, maternal and child health, nutrition, and HIV/AIDS. Funding was provided by USAID through The DHS Program (#720-OAA-18C-00083). The opinions expressed here are those of the authors and do not necessarily reflect the views of USAID or other cooperating agencies.

The 2022 NDHS was implemented by New ERA under the aegis of the Ministry of Health and Population of Nepal from January 5, 2022, to June 22, 2022. The funding for the NDHS was provided by USAID. ICF provided technical assistance through The DHS Program, a USAID-funded project providing support and technical assistance in the implementation of population and health surveys in countries worldwide.

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PREFACE

The 2022 Nepal Demographic and Health Survey (2022 NDHS) is the sixth survey of its kind implemented in the country as part of the worldwide Demographic and Health Surveys (DHS) Program. It was implemented under the aegis of the Ministry of Health and Population (MoHP) of the Government of Nepal with the objective of providing reliable, accurate, and up-to-date data for the country. The survey received funding from the United States Agency for International Development (USAID). 2022 NDHS information has assisted policymakers and program managers in policy formulation, monitoring, and designing programs and strategies for improving health services in Nepal. The 2022 NDHS is a key data source for tracking the progress of the Nepal Health Sector Strategic Plan 2023–2030 and the Sustainable Development Goal indicators.

The 2022 NDHS further analysis reports provide additional in-depth knowledge and insights into key issues that emerged from the 2022 NDHS. This information provides guidance for planning, implementing, refocusing, monitoring, and evaluating health programs in Nepal. This further analysis is also an important initiative to strengthen the technical capacity of Nepali professionals for analyzing and using large-scale data to better understand specific issues related to the country's needs. We are glad that in the sixth round of the NDHS, we were able to produce 11 further analysis reports. We urge that all policymakers, program administrators, program managers, health workers, and other key stakeholders optimally use the information from these reports in program planning and management. High-quality evidence should be the basis of our health programs planning, implementation, monitoring, and evaluation.

Finally, we would like to appreciate the leadership of the Policy Planning and Monitoring Division, and the efforts of the different individuals of the MOHP, and the Department of Health Services in generating these reports. We are thankful to USAID Nepal for their continued support in implementing the NDHS and further analysis studies in Nepal.

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FOREWORD

The 2022 Nepal Demographic and Health Survey (2022 NDHS) is the sixth nationally representative comprehensive survey conducted as part of the worldwide Demographic and Health Surveys (DHS) Program in the country. The survey was implemented by New ERA under the aegis of the Ministry of Health and Population (MoHP). Technical support for this survey was provided by ICF, with financial support from the United States Agency for International Development (USAID) through its mission in Nepal.

The standard format of the survey's final report included descriptive presentations of findings and trends but not of analytical methods that could ascertain the significance of differences and associations among variables. Thus, although largely sufficient, the final report is limited, particularly in providing answers to "why" questions-answers those are essential for reshaping important policies and programs. After the dissemination of the 2022 NDHS, the MoHP, USAID, and other health development partners convened and agreed on key areas that are necessary for assessing progress, gaps, and determinants in high-priority public health programs being implemented by the MoHP. In this context, 11 further analysis studies have been conducted by Nepali consultants under the direct leadership of the MoHP. The consultants were supported by USAID through the Leaming for Development Activity in Nepal and through The DHS Program.

The primary objective of the analysis studies was to provide more in-depth knowledge and insights into key issues that emerged from the 2022 NDHS. This information provides guidance for planning, implementing, refocusing, monitoring, and evaluating health programs in Nepal. One of the learning objectives is to strengthen the technical capacity of Nepali professionals for analyzing and using data from complex national population and health surveys to better understand specific issues related to country needs.

The further analysis of the 2022 NDHS was the concerted effort of many individuals and institutions, and it is with the great pleasure that we acknowledge the work involved in producing this useful document. The participation and cooperation of the officials of the MoHP and the Department of Health Services are highly valued. We would like to extend our appreciation to USAID Nepal for providing financial support for the further analysis. We would also like to acknowledge The DHS Program for its technical assistance at all stages. Our sincere thanks also goes to the USAID Learning for Development Activity team for the overall management and coordination of the entire process. Our special appreciation goes to the Policy Planning and Monitoring Division, MoHP, for their efforts and dedication to the completion of the further analysis of the 2022 NDHS.

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The further analysis of the 2022 Nepal Demographic and Health Survey (2022 NDHS) was conducted under the aegis of the Policy Planning and Monitoring Division of the Ministry of Health and Population (MoHP). The United States Agency for International Development (USAID) provided financial support, with technical assistance provided by the Demographic and Health Surveys (DHS) Program. Overall coordination, recruitment of local consultants, facilitation, administration, and logistic support were provided by the USAID Learning for Development Activity.

I am indebted to Dr. Bikash Devkota, Additional Secretary of the MoHP, for his unwavering guidance throughout the analysis process. I would like to acknowledge the efforts of Dr. Push pa Raj Poudel, Mr. Ravi Kanta Mishra, Mr. Manoj Tamrakar from the Policy Planning and Monitoring Division/MoHP. My special gratitude goes to all the co-authors for their input, coordination, data analysis, and writing of reports. My special thanks go to the co-authors from the MoHP and the Department of Health Services (DoHS) who provided significant contribution to ensure that the analysis aligned with our data needs and to improve the quality of the reports. My sincere appreciation goes to the peer reviewers: Dr. Gunanidhi Sharma from MoHP, Kabita Aryal, Sagar Dahal, Dr. Abhiyan Gautam, Dr. Uttam Pachya, Dr. Poma Thapa, and Dr. Bibek Lal from the DoHS; Pradeep Poudel from USAID Learning for Development; Tirtha Tamang from the United Nations Population Fund; Milima Dangol; Bidur Bastola from the USAID Adolescent Reproductive Health project; Dr. Rahul Pradhan from the World Health Organization; Abhilasha Gurung, and Naveen Poudyal from the United Nations Children's Fund; and Dr. Saroj Dhakal, Dr. Jaganath Sharma, and Sabita Tuladhar from USAID for reviewing the reports.

Special thanks to Sabita Tuladhar from USAID for her continuous support of this process. My sincere appreciation to Dr. Kerry L. D. MacQuarrie from The DHS Program, Jade Lamb, Tarun Adhikari, Sagar Neupane, Lokesh Bhatta, and Alexandra Cervini from USAID Learning for Development for their hard work in supporting the completion of these 11 further analysis reports.

12.07.2024

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ABSTRACT

Target 3.2.1 of the United Nations Sustainable Development Goals sets the objective for all countries to achieve an under-5 mortality rate (U5MR) of 25 or fewer deaths per 1,000 live births by 2030. According to data from the Nepal Demographic and Health Survey (NDHS) over the past two decades, Nepal has achieved a 72% reduction in U5MR (from 118 to 33 deaths per 1,000 live births), surpassing the average reduction of 50% globally. Between the 2006 and 2011 surveys, however, infant and neonatal deaths decreased at a much slower pace, with the neonatal mortality rate stagnating from 2006 to 2011 and again from 2016 to 2022.

Child mortality may be linked to inadequate quality of care in health facilities. A comparative analysis of the 2015 Nepal Health Facility Survey (NHFS) and the 2021 NHFS underscored notable progress in sick child care services nationwide. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend effective coverage measurement for assessing health system performance. Despite the importance of evaluating effective coverage, a limited number of studies have addressed sick child care or U5MR across provinces in this context. No identified studies have examined effective coverage of sick child care by province in Nepal or the association between effective coverage and U5MR.

This analysis of data from the 2022 NDHS and 2021 NHFS found that 70% of sick children in Nepal had contact with a facility of some kind for their illness. After adjusting for service readiness, 46% of sick children received input-adjusted coverage. After then adjusting for whether the children received the complete intervention for their illness, intervention-adjusted coverage dropped to 22%. Finally, after adjusting for whether providers followed the recommended process of care, the quality-adjusted coverage dropped to a final figure of 8%. No significant relationship was observed between U5MR and quality-adjusted coverage.

These findings indicate a need for improved availability of supplies to treat childhood illnesses and increased provider training. A breakdown of results by province and other background characteristics identified facility types and locations that need the most improvement for each step along the effective coverage cascade. The findings also support the notion that mortality is a complex outcome influenced by many factors, and that improving effective coverage of sick child care is one of many interventions that will be needed to continue bringing U5MR down.

Key words: effective coverage, NDHS, sick child care, under-5 mortality

ACRONYMS AND ABBREVIATIONS

ARI	acute respiratory infection
BHCC	basic health care center
DHS	Demographic and Health Survey
DoHS	Department of Health Services
IMNCI	integrated management of neonatal and childhood illness
MoHP	Ministry of Health and Population
NDHS	Nepal Demographic and Health Survey
NHFS	Nepal Health Facility Survey
PHCC	primary health care center
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
U5MR	under-5 mortality rate
WHO	World Health Organization

1 INTRODUCTION

Global efforts have significantly reduced the under-5 mortality rate (U5MR), with the rate dropping by 59% from 93 deaths per 1,000 live births in 1990 to 39 deaths per 1,000 live births in 2018,[1] and further decreasing to 37 deaths per 1,000 live births in 2020.[2] However, children born in low-income countries continue to face significantly higher mortality rates, with a rate of 66 deaths per 1,000 live births in 2020, compared with just 5 deaths per 1,000 live births in high-income countries, highlighting ongoing disparities in socioeconomic factors and access to health care. Notably, South Asia contributed 26% of the global U5MR in 2019.[3]

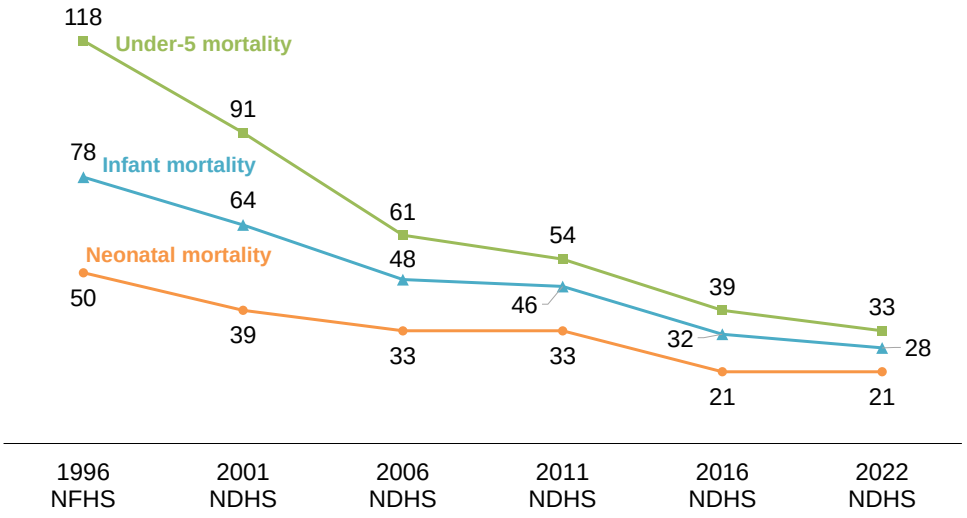
Target 3.2.1 of the United Nations Sustainable Development Goals sets the objective for all countries to achieve an U5MR of 25 or fewer deaths per 1,000 live births by 2030.[4] Furthermore, the Nepal Health Sector Strategy 2023–2030 has set a target to reduce the U5MR to 20 deaths per 1,000 live births.[5] These targets play a pivotal role in setting priorities for the global initiative to enhance child survival and decrease mortality rates.

1.1 Child Health in Nepal

Nepal is a diverse country in terms of geography, culture, and language, and its administrative divisions reflect this diversity. The federal structure of Nepal comprises seven provinces, each with its own distinct identity and characteristics.[6] According to the 2021 National Population and Housing Census,[7] Bagmati province accounts for the largest proportion of the population (20.97%) and Karnali the lowest (5.79%). Madhesh province has the second largest population, followed in decreasing order by Lumbini, Koshi, Sudurpaschim, and Gandaki.[7] Urbanization is growing in Nepal. The 2021 census found that about two-thirds of the total population resides in peri-urban or urban areas.[6] Mountain and Hill ecoregions are still dominated by rural populations, whereas Terai is an overwhelmingly urban population-dominated region. The degree of urbanization is relatively low in Karnali and Sudurpaschim provinces but high in Madhesh, Bagmati, Lumbini, and Koshi.[7] The capital of Kathmandu is the most populated city in Nepal. It is characterized by high population density and acute shortages of potable water during the hot and dry summer months due to increasing population demands in the valley.[8]

Child mortality rates in Nepal have significantly decreased in recent years (Figure 1). According to data from the Nepal Demographic and Health Survey (NDHS) over the past two decades, Nepal has achieved a 72% reduction in U5MR (from 118 to 33 deaths per 1,000 live births), surpassing the average reduction of 50% globally.[9] During the same period, infant mortality in Nepal dropped by nearly two-thirds and neonatal mortality by nearly three-fifths. Between the 2006 and 2011 NDHS surveys, however, infant and neonatal deaths decreased at a much slower pace. In fact, the neonatal mortality rate stagnated from 2006 to 2011 and again from 2016 to 2022.[9] As indicated by the 2016 and 2022 NDHS surveys, U5MR varies across all seven provinces in Nepal.[9,10]

Figure 1 Trends in child mortality rates in Nepal (deaths per 1,000 live births), 1996–2022



In 2022, 10% of children under 5 in Nepal had diarrhea and 1% had pneumonia—an increase of 2% and a decrease of 1%, respectively, from 2016.[9,10] A study conducted in Kathmandu to assess the effect of climate variability on diarrheal disease burden among children under 5 found a significant association between childhood diarrhea and increased maximum temperature and rainfall.[11]

The Nepal Ministry of Health and Population's integrated management of neonatal and childhood illness (IMNCI) program aims to provide antibiotics to 90% of children with pneumonia and provide oral rehydration solution and zinc to 90% of children with diarrhea by 2030.[12] The readiness of facilities to provide these services and their adherence to the recommended processes of care differ across provinces, as evidenced by the 2015 Nepal Health Facility Survey (NHFS) and the 2021 NHFS.[13,14]

Moreover, the 2022 NDHS revealed that 2 weeks before the survey, 25% of children under 5 with symptoms of acute respiratory infection and 43% of children under 5 with diarrhea did not seek advice or treatment.[9] Addressing these gaps in sick child care is crucial for improving overall child health outcomes.

High quality care for sick newborns and children requires an investment in skilled health care providers, as well as in service availability, readiness, and adherence to evidence-based practices. Quality care services should be well organized, accessible, adequately resourced, safe, efficient, equitable, timely, and people-centered. They should also ensure optimal clinical, developmental, and social outcomes for children under

5.[15] Quality of care is crucial to achieving universal health coverage, and poor quality of services can undermine consumer confidence.[16]

Poor quality services and care also compromise the effectiveness of interventions, elevate the risk of nosocomial (hospital-acquired) infections, and increase death from preventable complications and causes.[17] Child mortality may be linked to inadequate quality of care in health facilities.[18,19] Additionally, low quality health care can lead to lasting adverse outcomes, such as lack of trust in the health care system.[19]

A comparative analysis of the 2015 and 2021 NHFS surveys underscored notable progress in sick child care services nationwide. Both surveys indicated widespread provision of child growth and vaccination services, with universal availability of sick child care services at least 5 days a week. Significant enhancements in overall sick child care service readiness were observed in all provinces, particularly in public hospitals, primary health care centers, and basic health care centers. Adherence to the process of care also improved notably, especially in public hospitals and primary health care centers, with medical officers and paramedics/nurses displaying significant enhancements.[20]

1.2 Study Rationale

The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) recommend effective coverage measurement for assessing health system performance.[21,22] Effective coverage gauges the extent of service utilization while considering the health system's performance and the client's complete receipt of the intervention.

To achieve the Sustainable Development Goal of ensuring the equitable distribution of health gains, it is imperative to gain a comprehensive understanding of the distribution of effective coverage and U5MR across provinces, particularly for key primary care services like sick child care. Effective coverage refers to the extent of service coverage, accounting for various dimensions of its quality. Despite the importance of evaluating effective coverage, only a limited number of studies have addressed sick child care or U5MR in this context. Many of them relied solely on Demographic and Health Survey (DHS) or other household survey data for effective coverage computation,[23–25] which could have resulted in overestimation of the quality of care.[26] DHS data, for example, tend to overestimate quality of sick child care visits in part because they rely on women's recall of the visits.[27,28] Conversely, data from health facility surveys yield more reliable estimates.[29] Studies combining both DHS and health facility survey data have explored regional disparities in effective coverage in Malawi, Nepal, Senegal, and Tanzania[30] and in antenatal care effective coverage in Senegal.[31] However, no identified studies have examined sick child effective coverage by province in Nepal, or examined the association between effective coverage and U5MR.

This study aimed to build on prior methodologies for measuring effective coverage and employ these measures to evaluate U5MR and sick child effective coverage across provinces, utilizing recent data from the NDHS and NHFS. The study's outcomes will enhance our comprehension of provincial disparities in effective coverage for sick child care and the contributions of effective coverage to U5MR. The findings can be utilized by the Government of Nepal and health development partners to target populations in need of improved access to high quality care, aligning with the overarching objective of enhancing child health outcomes.

1.3 Objectives

The objectives of this study were:

- To estimate the effective coverage cascade for sick child care services, including the four separate measures of effective coverage, within each of Nepal's seven provinces and at the national level
- To identify whether effective coverage is primarily influenced by factors related to care seeking, service readiness, receipt of complete intervention, or process quality
- To establish the nature of the relationship between each step of the effective coverage cascade and U5MR

2 METHODS

2.1 Conceptual Framework

Demographic and health surveys and health facility surveys are typically conducted independently of each other and at different time intervals. Variations in service availability, readiness, care processes, and staffing can be significant over time. Therefore, attempting to link these two types of surveys, if they are conducted at vastly different time points, may introduce considerable errors into an analysis. As a general guideline, surveys conducted within a year of each other are the most likely to yield reliable comparisons. Since the 2021 Nepal Health Facility Survey (NHFS)[14] and the 2022 Nepal Demographic and Health Survey (NDHS)[9] were conducted within this timeframe, they were used for this study.

Primarily, if the health facility survey is not a census of health facilities, the surveys should not be linked at geographic scales below the sample domain. Since the sample domain of the 2021 NHFS was the province, we merged the data files from each survey at the provincial level.

2.2 Data Sources

The analysis relied on data obtained from the 2021 NHFS[14] and the 2022 NDHS.[9] Detailed information regarding the NDHS and NHFS sampling procedures is available in the survey final reports,[9,14] accessible on The DHS Program website (www.dhsprogram.com).

The population of interest was children under 5 years. Throughout this report, any use of the term "children" refers to children under 5 only. Information on children came from the 2022 NDHS. The background characteristics (that is, independent variables) observed for children were place of residence, ecoregion, province, and wealth quintile. Nepal has three ecoregions: Mountain (the highest elevation), Hill (the middle level of elevation), and Terai (a lowland belt region in the southern part of Nepal).

Facility-level and client-level data came from the facility questionnaire, health worker interview questionnaire, and client questionnaire, of the 2021 NHFS. The background variables observed from the NHFS were facility type, managing authority, place of residence, ecoregion, province, and wealth quintile. Facility type referred to whether the facility was a public hospital, primary health care center, basic health care center, or private hospital. In our study, public hospitals, primary health care centers, and basic health care centers were considered publicly managed facilities. Private hospitals were considered privately managed facilities.

2.3 Effective Coverage Measures

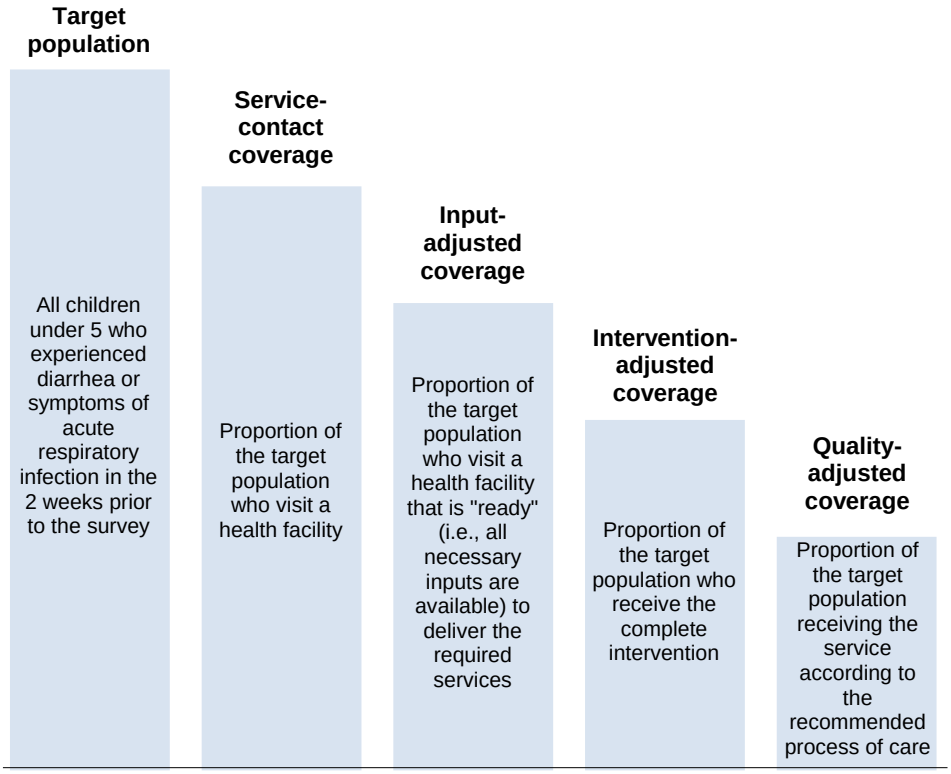
In 2020, Marsh and colleagues[21] outlined four essential measures necessary for computing the effective coverage cascade: service contact, service readiness, receipt of complete intervention, and process quality. In our study, service contact referred to when a sick child under 5 who had diarrhea or an acute respiratory infection (ARI) sought care at a health facility. Service readiness referred to whether a facility had the required trained staff, guidelines, equipment, diagnostics, and medication necessary to provide sick child care. The indicators used to measure service readiness were selected based on guidance from the World Health Organization (WHO) SARA manual[32] and the national integrated management of neonatal and

childhood illness (IMNCI) treatment chart booklet.[33] Receipt of complete intervention referred to whether the child received the full, correct treatment for the illness. For diarrhea, this was receipt of oral rehydration solution and zinc. For pneumonia, it was receipt of amoxicillin. Process quality referred to whether the provider followed the recommended process of care as defined by the IMNCI treatment chart booklet. This was determined by whether caregivers had been asked all recommended questions, whether they had been given all recommended counseling, and whether the provider treating the child had checked for all recommended vitals and signs of illness.

The specific indicators used to measure service readiness and process quality can be found in the appendix (see Tables A1 and A2, respectively). To measure service readiness and process quality, a simple additive score was calculated.[34] This procedure involved adding the proportion of facilities at which each indicator was available, dividing by the total number of indicators, and then multiplying by 100 to obtain a percentage-based score. For instance, to generate the service readiness score, we dichotomized each indicator (for example, availability of trained staff, guidelines, medicine, diagnostics, and equipment) and assigned a value of 1 if it was present. If the indicator was not present, we assigned a value of 0. If a facility had half of the required indicators available, the service readiness score would be 50%. We then averaged the readiness scores among facilities by province and at the national level. The same methodology was used to measure process quality with its own indicators.

Figure 2 outlines the steps in the effective coverage cascade. The first step within the cascade is the target population, encompassing all individuals requiring a service or intervention. The next step, service-contact coverage, is the proportion of the target population who sought care for their illness. Input-adjusted coverage is the service-contact coverage multiplied by the proportion of the target population who received the complete intervention for their illness. Subsequent steps then account for further elements of service delivery in the same fashion.

Figure 2 Steps in the effective coverage cascade



2.4 Data Analyses

After assessing the separate measures of service contact, service readiness, receipt of complete intervention, and process quality, we also assessed the effectiveness of IMNCI training on receipt of complete intervention. We conducted bivariate analysis using chi-square tests showing *p* values and 95% confidence intervals to determine whether children who received care from providers trained within the 24 months preceding the survey were more likely than other children to receive the complete intervention for pneumonia and diarrhea. A *p* value <.05 was considered statistically significant.

2.4.1 Calculating the effective coverage cascade

To estimate each component of the effective coverage cascade, the score for each measure listed in Table 1 (starting with service readiness) was multiplied by the score for the preceding measure. The designated target population for sick child care was all children under 5 who exhibited symptoms of ARI or diarrhea in the 2 weeks prior to the survey. Service-contact coverage was the result of multiplying the target

population by the service contact score. Adjusted for input, service-readiness coverage was then determined by multiplying the service-contact coverage by the service readiness score, and so forth (Table 1).

Table 1 Calculation of sick child care effective coverage cascade

	Measure			
Step in effective coverage cascade	**Service contact**	**Service readiness**	**Receipt of complete intervention**	**Process quality**
Service-contact coverage	Children who sought care at a health facility among children under 5 who had diarrhea or ARI symptoms in the past 2 weeks			
Input-adjusted coverage	Children who sought care at a health facility among children under 5 who had diarrhea or ARI symptoms in the past 2 weeks	***X*** Average readiness across sick child care facilities using the basic service readiness score		
Intervention-adjusted coverage	Children who sought care at a health facility among children under 5 who had diarrhea or ARI symptoms in the past 2 weeks	***X*** Average readiness across sick child care facilities using the basic service readiness score	***X*** Children under 5 who received appropriate treatment among children under 5 who were diagnosed with diarrhea or pneumonia at a facility	
Quality-adjusted coverage	Children who sought care at a health facility among children under 5 who had diarrhea or ARI symptoms in the past 2 weeks	***X*** Average readiness across sick child care facilities using the basic service readiness score	***X*** Children under 5 who received appropriate treatment among children under 5 who were diagnosed with diarrhea or pneumonia at a facility	***X*** Average process quality across sick child care facilities using the basic process quality score
Source	2022 NDHS	2021 NHFS	2021 NHFS	2021 NHFS

ARI = acute respiratory infection; NDHS = Nepal Demographic and Health Survey; NHFS = Nepal Health Facility Survey; ***X*** = multiplier

Note: Each coverage measure is the product of the previous measures except for service-contact coverage.

We determined the provincial-level data utilizing both NDHS and NHFS datasets, ensuring the availability of every step in the effective coverage cascade within the disaggregated population. For instance, the input-adjusted coverage for the population in Koshi province was computed by multiplying the proportion of the target population residing in Koshi who sought care by the average service readiness score among facilities in Koshi.

All analyses were conducted using Stata 17.0, with adjustments made for sampling design, and weights were incorporated at each step in the effective coverage cascade.

2.4.2 Estimating associations between effective coverage and under-5 mortality

We calculated the under-5 mortality rate (U5MR) using all deaths that occurred within the 10 years preceding the survey. We specifically focused on U5MR in the 10 years preceding the survey to demonstrate the correlation between the effective coverage cascade and U5MR across provinces. Additionally, presenting provincial-level U5MR data for only the past 5 years would have required a larger sample size. To explore the relationship between each step of the effective coverage cascade and U5MR, we conducted a bivariate analysis by creating a scatterplot in Excel and displaying the trendline, equation of the trendline, and R^2 value of the relationship between the two variables. We determined that any association with an R^2 value $\geq .5$ would be considered statistically significant.

3 RESULTS

3.1 Background Variables

Table 2 shows that 65% of children under 5 lived in urban areas and 59% lived in the Terai ecoregion. The highest proportion of children under 5 lived in Madhesh province (27%) and the lowest proportion in Gandaki province (less than 7%). Households in the lowest wealth quintile had the highest proportion of children under 5 (24%), and those in the highest wealth quintile had the lowest proportion (slightly more than 15%). Proportions and samples sizes for background variables by data source can be found in the appendix (see Table A3).

Table 2 Background variables for children under 5, 2022 Nepal DHS

	Children under 5	
Variable	**%**	**n = 5,040**
Place of residence		
Urban	65.0	3,276
Rural	35.0	1,764
Ecoregion		
Mountain	6.3	317
Hill	34.6	1,744
Terai	59.1	2,979
Province		
Koshi	17.0	859
Madhesh	26.8	1,352
Bagmati	16.2	814
Gandaki	6.6	331
Lumbini	17.1	862
Karnali	7.4	371
Sudurpaschim	8.9	451
Wealth quintile		
Lowest	24.1	1,213
Second	20.6	1,037
Middle	20.8	1,048
Fourth	19.2	969
Highest	15.4	774

According to data from the 2022 Nepal Demographic and Health Survey (NDHS), the national under-5 mortality rate (U5MR) was estimated to be 37.5 deaths per 1,000 live births in the 10 years preceding the survey (Table 3), down from 50.7 deaths per 1,000 live births reported by the 2011 NDHS. Moderate disparities were found in U5MR among provinces, with the highest U5MR at 48.8 deaths per 1,000 live births in Sudurpaschim and the lowest at 23.2 deaths per 1,000 live births in Gandaki.

Table 3 Under-5 mortality rate (deaths per 1,000 live births) at national and provincial levels, 2022 Nepal DHS

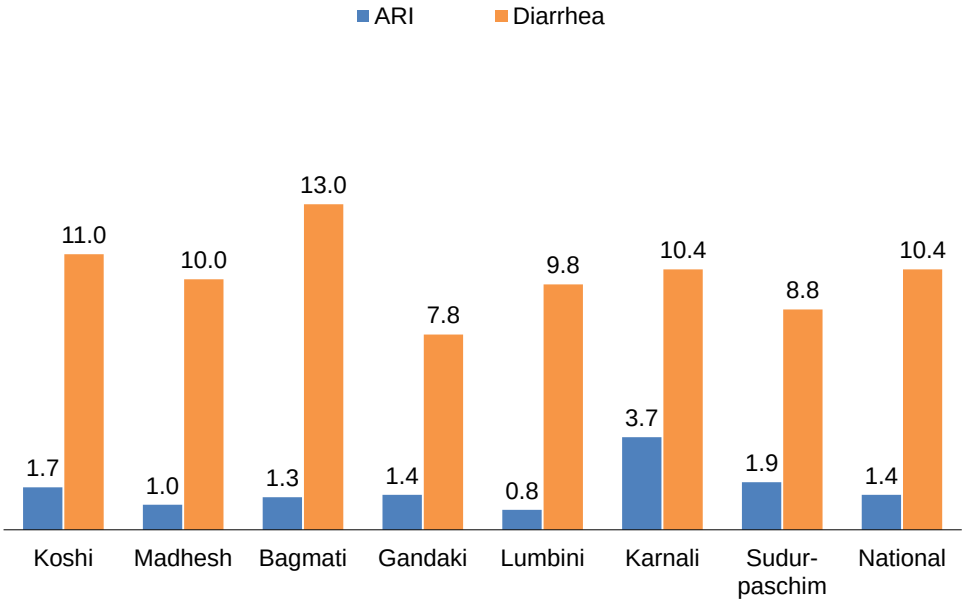
Province	U5MR	95% CI
Koshi	33.7	[23.6, 43.7]
Madhesh	43.2	[34.2, 52.2]
Bagmati	24.2	[13.6, 34.8]
Gandaki	23.2	[13.4, 33.0]
Lumbini	41.4	[31.2, 51.5]
Karnali	45.9	[36.1, 55.8]
Sudurpaschim	48.8	[37.4, 60.2]
All provinces	37.5	[33.8, 41.2]

CI = confidence interval; U5MR = under-5 mortality rate

Note: Estimates are for the 10 years preceding the survey.

Figure 3 shows the percentages of children under 5 in each province who experienced symptoms of acute respiratory infection (ARI) and who had diarrhea in the 2 weeks preceding the survey. Nationally, 1.4% of children had ARI symptoms and 10.4% had diarrhea. The lowest rate of ARI symptoms was in Lumbini province (0.8%) and the highest in Karnali province (3.7%).

Figure 3 Percentages of children with symptoms in the 2 weeks preceding the survey, by illness and province, 2022 Nepal DHS

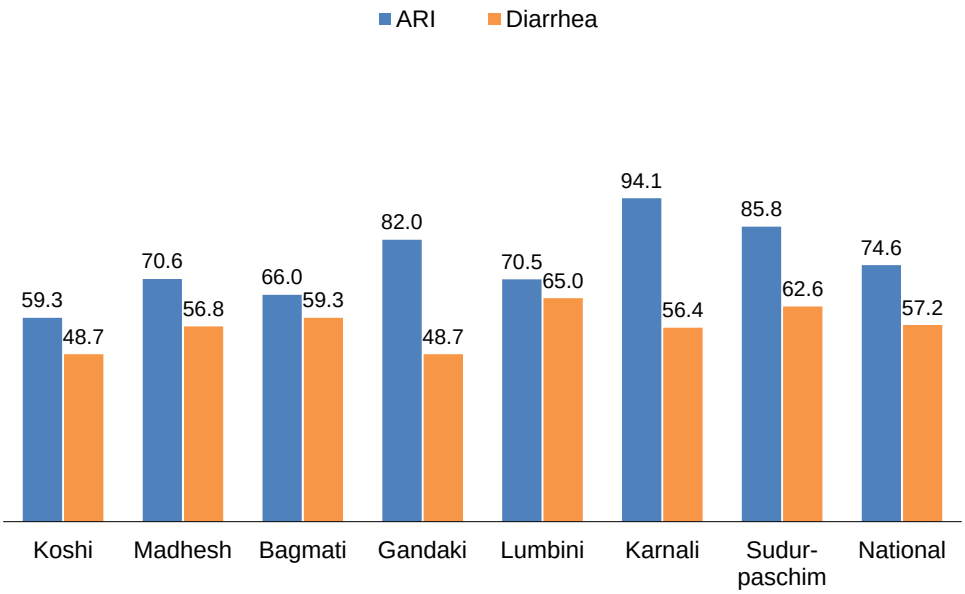


3.2 Effective Coverage Levels

3.2.1 Measures of effective coverage

Nationally, about 75% of children with ARI symptoms and 57% of children with diarrhea sought care from a health facility (Figure 4). The lowest level of care seeking for ARI was in Koshi province (slightly more than 59%) and the highest in Sudurpaschim (94%). For diarrhea, care seeking varied less among provinces; the lowest rate of care seeking was approximately 49%, in both Koshi and Gandaki, and the highest was 65% in Lumbini. Considering both illnesses together, 70% of sick children sought care from a facility.

Figure 4 Percentages of sick children who sought care at a health facility in the 2 weeks preceding the survey, by illness and province, 2022 Nepal DHS



Overall, 65% of facilities were ready to provide sick child care services (Table 4). However, service readiness varied substantially by facility type and managing authority, with 60% of privately managed hospitals ready to provide sick child curative services compared with 65% of publicly managed facilities. Among publicly managed facilities, a much higher proportion of public hospitals and primary health care centers (82% for both) than basic health care centers (64%) were prepared to provide services. Service readiness scores did not vary much by place of residence or by ecoregion but varied slightly by province, from a low of 62% in Madesh to a high of 69% in Lumbini. Scores for the individual indicators used to measure service readiness can be found in the appendix (see Table A4).

Among the children who sought care for ARI or diarrhea, 49% received the complete intervention for their illness (Table 4). This rate varied substantially by background variables, particularly by facility type and facility managing authority. Only 19% of children received the complete intervention in private hospitals compared with 64% in primary health care centers. Similarly, 19% children who visited privately managed facilities received the full intervention compared with 57% who visited publicly managed facilities. Receipt of complete intervention did not vary as drastically by location of the facility, but some differences were still observed. For example, 41% of children who visited facilities in urban areas versus 65% who visited facilities in rural areas received the complete intervention for their illness. By province, the lowest and

highest proportions of children who received the complete intervention were in Bagmati (32%) and Karnali (64%), respectively.

Table 4 Individual measures of effective coverage by background variables, 2021 Nepal HFS

Variable	Coverage 95% CI	Service readiness 95% CI	Receipt of complete intervention 95% CI	Process quality 95% CI
Total	**70.3 [65.8, 74.5]**	**64.9 [64.0, 65.8]**	**49.4 [40.6, 58.2]**	**34.2 [32.7, 35.7]**
Facility type				
Public hospital	na	81.6 [79.6, 83.6]	30.5 [22.6, 39.8]	36.5 [34.6, 38.5]
PHCC	na	81.9 [80.6, 83.2]	64.1 [51.3, 75.2]	34.9 [33.2, 36.5]
BHCC	na	64.1 [63.1, 65.1]	61.7 [50.4, 71.9]	31.8 [29.9, 33.7]
Private hospital	na	59.7 [57.0, 62.4]	19.3 [9.6, 35.0]	39.6 [35.8, 43.5]
Managing authority				
Public	na	65.3 [64.4, 66.2]	56.8 [48.0, 65.2]	33.0 [31.5, 34.4]
Private	na	59.7 [57.0, 62.4]	19.3 [9.6, 35.0]	39.6 [35.8, 43.5]
Place of residence				
Urban	70.0 [64.2, 75.2]	63.6 [62.4, 64.8]	40.7 [29.9, 52.5]	33.9 [31.9, 35.9]
Rural	71.1 [64.0, 77.2]	66.3 [65.0, 67.7]	64.9 [52.2, 75.8]	34.6 [32.0, 37.2]
Ecoregion				
Mountain	63.4 [42.9, 80.0]	64.6 [62.1, 67.1]	38.4 [24.0, 55.0]	38.6 [35.4, 41.8]
Hill	69.0 [61.2, 75.8]	65.3 [64.2, 66.5]	42.0 [27.9, 57.6]	39.0 [36.9, 41.0]
Terai	71.5 [65.7, 76.6]	64.3 [62.6, 66.0]	57.0 [45.5, 67.8]	29.4 [27.4, 31.3]
Province				
Koshi	64.2 [53.6, 73.5]	63.3 [60.6, 66.0]	39.3 [20.7, 61.6]	34.3 [31.2, 37.3]
Madhesh	71.5 [62.5, 79.0]	61.8 [59.1, 64.5]	59.2 [38.3, 77.2]	25.6 [22.7, 28.5]
Bagmati	70.1 [57.2, 80.5]	63.6 [61.7, 65.5]	31.9 [9.5, 67.8]	37.7 [33.3, 42.2]
Gandaki	68.7 [51.5, 81.9]	65.9 [63.9, 67.9]	61.2 [38.8, 79.7]	40.1 [37.3, 42.9]
Lumbini	71.1 [58.1, 81.3]	68.7 [66.9, 70.4]	55.2 [43.2, 66.6]	34.7 [31.9, 37.6]
Karnali	76.9 [64.9, 85.6]	62.3 [60.1, 64.4]	63.5 [44.6, 79.0]	35.7 [32.1, 39.4]
Sudurpaschim province	74.0 [62.6, 82.9]	69.7 [67.7, 71.8]	39.2 [23.2, 58.0]	42.3 [38.9, 45.7]
Wealth quintile				
Lowest	63.4 [55.2, 71.0]	na	na	na
Second	72.9 [62.8, 81.1]	na	na	na
Middle	69.9 [59.7, 78.5]	na	na	na
Fourth	70.7 [58.7, 80.4]	na	na	na
Highest	78.0 [62.7, 88.3]	na	na	na

BHCC = basic health care center; CI = confidence interval; na = not available; PHCC = primary health care center

At an aggregate level, an estimated 34% of providers in Nepal adhered to the recommended process of care as per the integrated management of neonatal and childhood illness (IMNCI) protocol (Table 4). The process quality score was lower in basic health care centers (32%) than in private hospitals (40%). Similarly, the proportion of providers who adhered to the recommended process of care was lower in publicly managed hospitals (33%) than in privately managed hospitals (40%). Providers in the Terai ecoregion had lower adherence (29%) than those in the Hill and Mountain ecoregions (39%). Adherence to process of care did not vary substantially by place of residence. Madesh province had the lowest rate of adherence at 26%, and Sudurpaschim had the highest at 42%.

Among children who were diagnosed with diarrhea and were seen by a provider who had not been trained on IMNCI in the past 24 months, most (about 56%) did not receive the complete intervention (Table 5). Comparatively, 37% of the children diagnosed with diarrhea who were seen by an IMNCI-trained provider did not receive the complete intervention. However, this association was not statistically significant.

Table 5 Receipt of complete intervention and average process quality scores, by whether child was seen by a provider recently trained on integrated management of neonatal and childhood illness, 2021 Nepal HFS

	Diarrhea 95% CI			
	Did not receive complete intervention	Received complete intervention	Total	p = .2807
Seen by a provider who did not receive training in the 24 months preceding the survey	55.9 [46.1, 65.3]	44.1 [34.7, 53.5]	100	
Seen by a provider who received training in the 24 months preceding the survey	37.1 [13.4, 69.1]	62.9 [30.9, 86.6]	100	
Total	54.4 [45.1, 63.4]	45.6 [36.6, 54.9]	100	
	Pneumonia 95% CI			
	Did not receive complete intervention	Received complete intervention	Total	p = .0729
Seen by a provider who did not receive training in the 24 months preceding the survey	47.6 [33.0, 62.6]	52.4 [37.3, 67.0]	100	
Seen by a provider who received training in the 24 months preceding the survey	18.9 [5.6, 48.1]	81.1 [51.9, 94.4]	100	
Total	43.7 [31.0, 57.4]	56.2 [42.6, 69.0]	100	
	Process quality score 95% CI			
	Received care below the average process quality score	Received care above the average process quality score	Total	p = .1946
Seen by a provider who did not receive training in the 24 months preceding the survey	52.2 [47.1, 57.3]	47.76 [42.7, 52.9]	100	
Seen by a provider who received training in the 24 months preceding the survey	44.9 [35.6, 54.6]	55.1 [45.4, 64.4]	100	
Total	51.6 [46.9, 56.3]	48.4 [43.7, 53.1]	100	

CI = confidence interval

Note: Values for diarrhea, pneumonia, and process quality score are percentages with 95% confidence intervals in brackets.

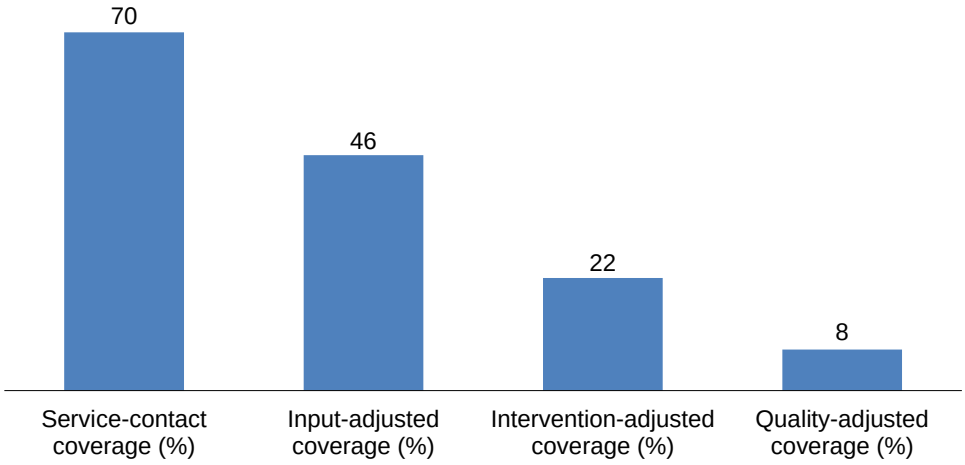
Among the children diagnosed with pneumonia who were seen by a provider who had not received recent IMNCI training, nearly half (48%) did not receive the complete intervention (Table 5). Comparatively, only 19% of children with pneumonia who were seen by an IMNCI-trained provider did not receive the complete intervention. This association was not statistically significant.

About 52% of sick children received care with a below average process quality score when they were seen by a provider who had not recently been trained on IMNCI (Table 5). Comparatively, 45% of sick children received care with a below average process quality score when seen by a provider with recent training. This association was not statistically significant.

3.2.2 Effective coverage cascade

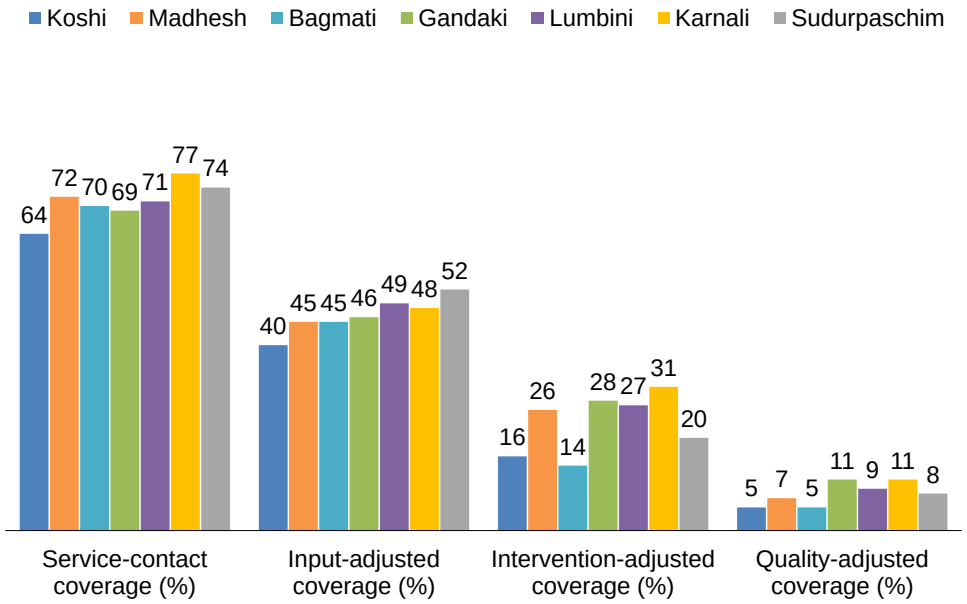
The effective coverage cascade started out at 70%, which is the proportion of sick children in Nepal who had contact with a health facility for their illness (that is, service-contact coverage) (Figure 5). After adjusting for the overall readiness of the facilities to treat children with ARI and diarrhea, the percentage of children accessing input-adjusted coverage was 46%. After adjusting for receipt of complete intervention, the percentage accessing intervention-adjusted coverage was 22%. Finally, after adjusting for whether children saw providers who followed the recommended process of care, the quality-adjusted coverage (percentage of sick children who received quality care for their illness) was 8%.

Figure 5 Effective coverage cascade for sick child care



At the provincial level, Koshi and Bagmati stood out as having particularly low effective coverage (Figure 6). Koshi had low input-adjusted (40%), intervention-adjusted (16%), and quality-adjusted (5%) coverage, and Bagmati had low intervention-adjusted (14%) and quality-adjusted (5%) coverage. The widest variation among provinces was for intervention-adjusted coverage, with a difference of 17 percentage points between the province with the lowest level (Bagmati at 14%) and the province with the highest level (Karnali at 31%).

Figure 6 Effective coverage cascade for sick child care by province

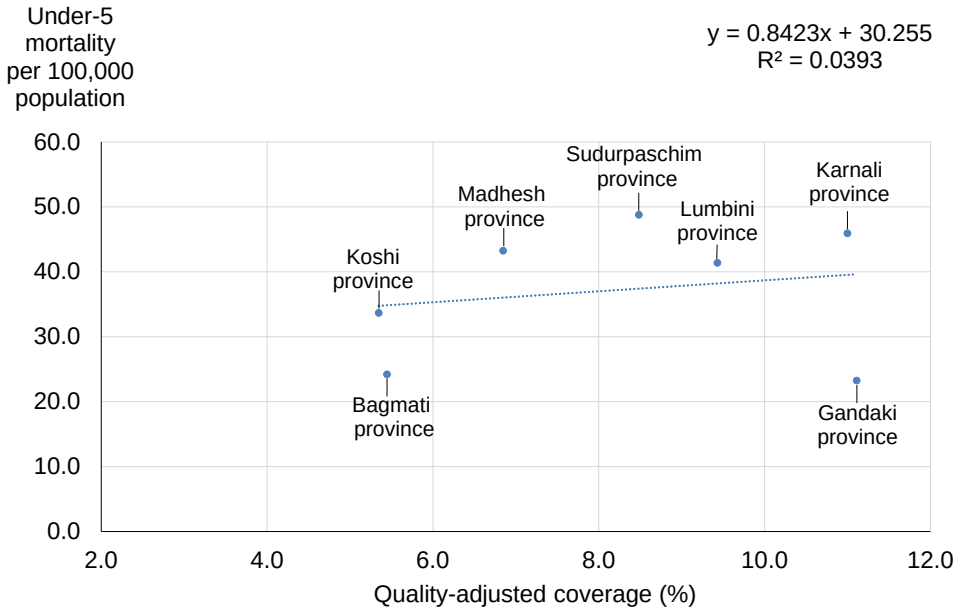


3.3 Under-5 Mortality

Results of the bivariate analysis showed no significant relationship between quality-adjusted coverage and U5MR (Figure 7). Although a slight positive trend was found, the R^2 value of the trendline was 0.0393, which was not high enough to conclude that the trend reflected a true relationship between the two variables. (See Figures A1, A2, and A3 for results related to service-contact coverage, input-adjusted coverage, and intervention-adjusted coverage, respectively).

Figure 7 also shows that Gandaki, the province with the lowest U5MR (23 deaths per 1,000 live births), had the highest quality-adjusted coverage (11%). However, Karnali had the same quality-adjusted coverage (11%), even though its U5MR was among the highest of the provinces (46 deaths per 1,000 live births). Sudurpaschim, the province with the highest U5MR (49 deaths per 1,000 live births), represented the median quality-adjusted coverage (8%).

Figure 7 Under-5 mortality rate by quality-adjusted coverage



4 DISCUSSION

Individually, the Nepal Demographic and Health Survey (NDHS) and the Nepal Facility Health Survey (NFHS) can address essential questions about access, utilization, and service quality. However, linking them offers deeper insights into the underlying reasons and mechanisms behind individuals' care-seeking behaviors and how proximity to or quality of care at local facilities might influence their decisions. Together, these two surveys serve as powerful tools for researchers, program managers, and decisionmakers who must tackle critical questions concerning program targeting and impact.

The concept of effective coverage is gaining broader application to help program managers and policymakers better comprehend program weaknesses and provide more specific and actionable measures of coverage. However, interpretations of effective coverage measures may vary depending on how countries and programs define them in their calculations. The aim of this report was to show the status of effective coverage of sick child care services at the provincial level in Nepal and to improve our understanding of the association between effective coverage and under-5 mortality rate (U5MR).

4.1 Effective Coverage

Our findings showed that Karnali province had the highest 2-week prevalence of acute respiratory infection (ARI) in children under 5 (3.7%), which aligns with findings from the 2023 annual health report from the Ministry of Health and Population of Nepal.[12] However, according to the 2023 health report,[12] diarrhea incidence was highest in Karnali, but we found it to be highest in Bagmati (13%), followed by Karnali (10.4%). This discrepancy is notable, especially considering that the annual health report recorded one diarrhea-related death each in Bagmati, Karnali, Madhesh, and Sudurpaschim.[12] The 2030 Sustainable Development Goal target for children under 5 with diarrhea in the past 2 weeks is 1%, so all provinces should employ efforts to reduce the incidence of diarrhea.

Our finding that care seeking was less common for diarrhea than for ARI may be because diarrhea is treated with oral rehydration salts, which can be bought over the counter without a facility visit. The 2023 annual health report also indicated that, for the past 3 fiscal years, care-seeking rates have been lower for diarrhea than for ARIs.[12] A recent qualitative study in Nepal by SHOPS PLUS[35] found that caregivers of about half of sick children under 5 sought care immediately at a health facility for diarrhea, while the other half preferred traditional treatments like hot water or homemade solutions. Those who sought immediate care often still used home remedies. Severe illness, including symptoms lasting more than 24 hours, constant crying, fever, vomiting, or refusal to eat, triggered care seeking, especially if initial treatments failed. The qualitative SHOPS PLUS study also revealed that caregivers lack knowledge about treating childhood diarrhea.[35]

The service readiness score for sick child care was particularly low in private hospitals. This was not surprising, as Nepal's integrated management of neonatal and childhood illness (IMNCI) strategy has not been enforced in the private sector; most service providers in private hospitals would not have received training on IMNCI and the associated guidelines at the time of our study. Exceptions would include providers trained by donor organized health projects providing IMNCI training in private hospitals.

Further analysis of the 2015 NHFS results revealed a correlation between overall child care service readiness and public-sector facilities.[36] However, the 2016 and 2022 NDHS reports indicated that the proportion of sick children seeking care in the private sector is increasing.[9,10] Therefore, it would be beneficial for private hospitals to formally implement the IMNCI strategy to provide comprehensive treatment for children in a single visit, reducing out-of-pocket expenses while minimizing hospital visits. It is worth noting, however, that the financing structure of private health facilities would benefit from more frequent visits because they would generate more revenue from user fees. Therefore, private facilities may not have financial incentive to implement the IMNCI strategy.

For both diarrhea and pneumonia, receipt of complete intervention scores were much lower in private hospitals than in public facilities, which also may be because the IMNCI strategy is not widely implemented in private hospitals. Although the overall process quality score for sick child care was higher in the private sector in both surveys (possibly due to the presence of specialized doctors and health providers), rates of treatment of diarrhea and pneumonia have not increased significantly since 2015.[20] Therefore, it is imperative that the growing private sector, especially private hospitals, be monitored to ensure correct treatment of diarrhea and pneumonia. Overall, our findings for diarrhea suggest that both supply-side strategies to improve receipt of complete intervention and demand-side strategies to improve care seeking are necessary to increase zinc use in diarrhea treatment.

Training is one of the indicators of service readiness, and its effectiveness relies on the availability of other indicators. Professionalism among health care workers, which is demonstrated through adherence to a code of conduct and the application of learned knowledge to maximize patient benefits, is imperative. The results from our chi-square tests for receipt of complete intervention and provider IMNCI training should be interpreted with caution due to the small sample sizes and consequent higher *p* values and wide confidence intervals. However, it is notable that children seen by providers who had been recently trained on IMNCI received the complete intervention for both pneumonia and diarrhea more often than children seen by providers who had not been recently trained.

It is also notable that an unacceptably high proportion of children seen by recently trained providers did not receive the complete intervention (37% for diarrhea and 19% for pneumonia). This could indicate a couple of issues. First, this phenomenon could be occurring because the IMNCI training is not effective at teaching providers the appropriate treatments for pneumonia and diarrhea. This could result in providers both underprescribing correct drugs and overprescribing unnecessary drugs. For example, if a provider gives a child amoxicillin for pneumonia, but also gives the child an additional antibiotic, that child is not counted as receiving the complete intervention. Alternatively, this phenomenon could be due to medicine shortages that restrict providers' ability to administer the correct treatment. Shortages likely explain some of the lack of adherence to the recommended process of care for both illnesses; only 61% of facilities offering sick child care had amoxicillin in stock, while 96% had oral rehydration solution and 91% had zinc (see Table A4). Further evaluation of IMNCI training, such as pre- and post-tests, is recommended to understand what providers are learning from the training. Implementation monitoring and/or focus groups are also recommended to learn more about why trained providers are not following the guidelines.

Moreover, process quality is contingent upon factors such as workload, patient flow, number of health care workers, and the overall working environment of the health facility. Although improving adherence to the care process is influenced by these contextual factors, adherence can be enhanced through the

implementation of an effective supervision and monitoring mechanism. Our findings indicate that providers do not commonly conduct a proper history, assess general danger signs, or perform a physical examination (see Table A5), resulting in low process quality scores across all background variables. The overall adherence to the process of care—quality process score—for sick children under 5 was 28% in 2015 and 34% in 2021, reflecting a significant percentage-point increase over time.[20] Improving implementation of the IMNCI training could help further improve quality of care because it could improve patient outcomes by addressing multiple illnesses during the same visit. However, results of the chi-square tests showed that IMNCI training is not sufficient by itself to get providers to adhere to the recommended process of care. Of the children who were seen by a provider who had recent IMNCI training, 45% received care with a below average process quality score. Comparatively, 52% of children seen by a provider who was not recently trained received care with a below average process quality score.

Cumulatively, our results underscore the need for government prioritization of the monitoring and scale-up of IMNCI training, particularly focusing on the correct treatment of illnesses like diarrhea and pneumonia. Improvements in the availability of supplies and medications to treat these conditions will also be necessary, as reflected by the low availability of some of these items (see Table A4). Additionally, the government should strictly enforce the rational use of drug protocols; without it, antimicrobial resistance will escalate, posing further burdens on countries. A 2019 study also highlighted the growing antibiotic resistance in Nepal.[37]

4.2 Under-5 Mortality

The lack of a significant relationship between quality-adjusted coverage and U5MR has several possible explanations. First, many factors beyond the care that children receive can influence U5MR, which puts the low slope of the trendline into context. Second, having only seven data points led to a very small R^2 value, which contributed to the lack of a statistically significant relationship.

Our results suggest that other factors are at play in this relationship, as some provinces had low mortality and relatively high effective coverage, while others had high mortality and median effective coverage (see Figure 7). Notably, quality-adjusted coverage was very low in all provinces, with a small range (only six percentage points) across all provinces. This relationship may become clearer if studies are repeated in areas where the range in quality-adjusted coverage is larger.

Although our bivariate analysis did not show a significant relationship between quality-adjusted coverage and U5MR, there is a logically sound argument for investing in the effective coverage cascade for sick child care. The leading causes of death in children under 5 are pneumonia and diarrhea. The 2022 NDHS revealed that, in the 2 weeks before the survey, 25% of children under 5 with symptoms of ARI and 43% with diarrhea did not seek advice or treatment. It is crucial to address these gaps in seeking medical assistance to improve overall child health outcomes.

Even when children do seek care at a facility, their illness cannot be treated unless the facility has everything needed to provide sick child care. If the facility is ready but providers do not follow the recommended process of care, then important information needed to determine the best treatment can be missed. Even when providers adhere to the process of care, children may still not receive the complete intervention for their illness. Sick children can slip through the cracks at several stages in the care process, so improving these coverage issues will improve intervention- and quality-adjusted coverage and reduce deaths from

illness among children. According to the results of this study, 92% of sick children under 5 who seek care at a facility in Nepal are not receiving quality care. Therefore, investment in IMNCI implementation monitoring, facility readiness, and provider capacity are strongly recommended.

4.3 Strengths and Limitations

This analysis fills a gap in understanding effective coverage at the provincial level in Nepal. Because several background variables were included in the analysis, the results will allow policies and programs to target the populations in which they can make the biggest improvements.

The NFHS used for this study was completed in 2021, and the NDHS was completed in 2022. Therefore, all information about service readiness, receipt of complete intervention, and process quality was collected before data about the children and their care-seeking behaviors were collected. Therefore, the group of children who received care (described in the NHFS data) was not the same group of children who sought care for their illness (described in the NDHS data) in our analysis.

Additionally, U5MR was calculated using all deaths in the past 10 years, while the data used to calculate effective coverage was cross-sectional, describing events that happened just before the surveys were conducted. This means that our effective coverage estimates are more representative of the care received by children at the time of the survey than of the care received by children who died 10 years prior to the survey (yet all these children were included in our analysis).

Another limitation of our effective coverage analysis is that it included only two childhood illnesses. Although ARI and diarrhea are responsible for a large proportion of child mortality, other leading causes were not included in this analysis. For example, the NDHS collects information on whether children experienced fever in the 2 weeks preceding the survey; however, due to the time available to conduct this analysis and the complicated nature of fever as a symptom of illness, fever could not be included here. Since fever can indicate a wide range of illnesses with unique treatment recommendations, coding the service readiness, receipt of complete intervention, and process quality scores for all these illnesses would be complex.

Finally, the variable created in this analysis for care seeking included care sought only at facilities, so non-facility or community-level care was not included. It is therefore possible that the care-seeking estimates presented here are underestimates.

5 CONCLUSION

5.1 Key Findings

- Data from the 2022 Nepal Demographic and Health Survey and the 2021 Nepal Health Facility Survey showed that overall, 70% of sick children under 5 in Nepal (75% with symptoms of acute respiratory illness and 57% with diarrhea) had contact with health facilities. Approximately 65% of facilities were ready to provide sick child care services, 49% of children who sought care received the complete intervention for their illness, and an estimated 34% of providers adhered to the recommended process of care.
- Among children with diarrhea, those seen by a provider trained in the past 24 months on integrated management of neonatal and childhood illness (IMNCI) were significantly more likely to have received the complete intervention than those seen by a provider who had not received recent IMNCI training. Results were similar among children diagnosed with pneumonia, but the association was not statistically significant.
- Analysis of the effective coverage cascade showed that 92% of sick children under 5 who seek care at health facilities in Nepal are not receiving quality care. Service-contact coverage (the proportion of sick children who had contact with a health facility) was 70%, input-adjusted coverage (accounting for the service readiness of facilities) was 46%, intervention-adjusted coverage (accounting for whether children received the complete intervention) was 22%, and quality-adjusted coverage (accounting for whether providers followed the recommended process of care) was only 8%.
- No statistically significant relationship was observed between under-5 mortality rate and quality-adjusted coverage.

5.2 Key Recommendations

Because effective coverage levels are low across provinces in Nepal, interventions to improve them should be prioritized. Many factors influence mortality rates, and improving effective coverage will likely contribute to lowering mortality rates in the long term. Following are recommended courses of action to improve effective coverage for sick child care in Nepal:

- Focus service readiness improvements for sick child care in privately managed facilities and in basic health care centers and private hospitals.
- Ensure that all facilities have providers who have been recently trained on facility-based IMNCI, targeting private health facilities. Enhance IMNCI training across all levels, emphasizing the importance of thorough physical examinations, inquiries about danger signs, and counseling for caregivers.
- Increase supervision and monitoring at all health facilities, with a priority on private hospitals, on-site coaching for adherence to the IMNCI protocol, and the rational use of drugs.
- Monitor basic health care centers to ensure children receive the complete intervention for their illnesses.
- Further evaluate IMNCI training to determine how to improve its ability to increase providers' adherence to recommended treatments and processes of care.

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APPENDIX

Table A1 Indicators included in service readiness measure for sick child care

	Domain of indicators			
Measure	**Staff and guidelines (2 indicators)**	**Equipment (5 indicators)**	**Diagnostics (3 indicators)**	**Medicines and commodities (7 indicators)**
Service readiness for sick child care	Guidelines on sick child care (e.g., IMNCI) Staff trained in sick child care in past 24 months (e.g., IMNCI)	Child and infant scale Length/height measuring equipment Thermometer Stethoscope Growth chart	Hemoglobin (Hb) Test parasite in stool (general microscopy) Malaria diagnostic capacity	Oral rehydration solution Amoxicillin (dispersible 250- or 500-mg tablet OR syrup/suspension) Injectable gentamycine Paracetamol syrup or suspension Vitamin A capsules Albendazole capsules/tablets Zinc sulphate tablets, dispersible tablets, or syrup

IMNCI = integrated management of neonatal and childhood illness

Note: The World Health Organization (WHO) SARA manual and IMNCI protocol were used as references to define the indicators (tracer items) for each domain.

Table A2 Indicators included in the process quality measure for sick child care services

Taking client history
Fever
Cough or difficult breathing (e.g., fast breathing or chest in-drawing)
Diarrhea
General danger signs asked by provider or mentioned by caregiver
Child is unable to drink or breastfeed
Child vomits everything
Child has had convulsions with this illness
Information asked to caretaker
Asked about normal feeding or breastfeeding habits or practices when the child is not ill
Asked about feeding or breastfeeding habits or practices for child during this illness
Mentioned the child's weight or growth to the caretaker, or discussed growth chart
Asked if child received vitamin A/deworming within past 6 months or asked vaccination status
Provider performed physical examination on the sick child
Took child's temperature by thermometer or felt the child for fever or body hotness
Counted respiration (breaths) for 60 seconds
Auscultated child (listened to chest with stethoscope) or counted pulse
Checked skin turgor for dehydration (e.g., pinched abdominal skin)
Checked for pallor by looking at palms or conjunctiva
Looked into child's mouth
Looked in child's ear or felt behind child's ear
Weighed the child
Provider recorded on child health card
Counseling given to the caregiver
Provided general information about feeding or breastfeeding the child even when not sick
Told the caretaker to give extra fluids to the child during this illness
Told the caretaker to continue feeding the child during this illness
Told the caretaker what illness(es) the child has
Described signs and/or symptoms in the child for which to immediately bring child back
Provider discussed follow-up visit with caregiver

Note: Adherence to the process of care under different indicators was based on the Government of Nepal/Ministry of Health and Population's integrated management of neonatal and childhood illness protocol and health facility quality improvement module for health services strengthening.

Table A3 Alignment of population percentages and sample sizes across background variables and data sources

	NHFS (facility level)[1]		NHFS (client level)[2]		NDHS (children under 5)	
Variable	**%**	**N**	**%**	**N**	**%**	**N**
Facility type						
Public hospital	2.8	44	16.3	389	na	na
PHCC	3.3	51	6.2	148	na	na
BHCC	86.9	1,350	59.5	1,418	na	na
Private hospital	7.0	108	18.0	429	na	na
Managing authority						
Public	93.0	1,445	82.0	1,954	na	na
Private	7.0	108	18.0	429	na	na
Place of residence						
Urban	53.0	824	64.5	1,538	65.0	3,276
Rural	47.0	730	35.5	845	35.0	1,764
Ecoregion						
Mountain	13.5	210	8.4	201	6.3	317
Hill	52.5	816	41.9	998	34.6	1,744
Terai	34.0	528	49.7	1,184	59.1	2,979
Province						
Koshi	16.7	260	14.3	341	17.0	859
Madhesh	15.7	244	24.9	593	26.8	1,352
Bagmati	20.6	319	17.5	416	16.2	814
Gandaki	12.7	198	7.2	171	6.6	331
Lumbini	15.2	236	19.7	470	17.1	862
Karnali	8.2	128	6.0	143	7.4	371
Sudurpaschim	10.9	169	10.4	248	8.9	451
Total		**1,554**		**2,383**		**5,040**
Wealth quintile						
Lowest	na	na	na	na	24.1	1,213
Second	na	na	na	na	20.6	1,037
Middle	na	na	na	na	20.8	1,048
Fourth	na	na	na	na	19.2	969
Highest	na	na	na	na	15.4	774

BHCC = basic health care center; na = not available; NDHS = Nepal Demographic and Health Survey; NFHS = Nepal Facility Health Survey; PHCC = primary health care center

[1] Number of facilities offering outpatient sick child care services

[2] Number of observed sick children at the facilities

Table A4 Percentages of facilities with availability of selected indicators of service readiness for sick child care services

	%	95% CI
Guidelines and trained staff	**38.8**	**[36.2, 41.2]**
IMNCI guidelines observed	54.1	[50.5, 57.6]
Staff trained in IMNCI in past 24 months	23.4	[20.4, 26.8]
Equipment	**73.0**	**[71.7, 74.3]**
Child and infant scale	54.7	[51.1, 58.3]
Length/height measuring equipment	38.6	[35.1, 42.3]
Thermometer	95.9	[94.1, 97.2]
Stethoscope	98.3	[96.9, 99.1]
Growth chart	77.4	[74.8, 79.9]
Diagnostics	**25.7**	**[23.4, 28.0]**
Hemoglobin (Hb)	25.4	[22.7, 28.2]
Test for parasite in stool (general microscopy)	16.1	[13.9, 18.7]
Malaria diagnostic capacity	35.6	[32.3, 39.1]
Medicines and commodities	**83.3**	**[82.3, 84.4]**
Oral rehydration solution packet	96.4	[94.9, 97.4]
Amoxicillin (dispersible 250- or 500-mg tablet OR syrup/suspension)	60.8	[57.2, 64.2]
Injectable gentamycin	67.2	[63.7, 70.4]
Paracetamol syrup/suspension	89.0	[86.4, 91.1]
Vitamin A capsules	82.3	[80.3, 84.2]
Albendazole capsule/tablet	96.8	[95.6, 97.7]
Zinc sulphate tablets, dispersible tablets, or syrup	91.0	[88.9, 92.6]
Service readiness score	**64.9**	**64.0, 65.8**

CI = confidence interval; IMNCI = integrated management of neonatal and childhood illness

Table A5 Frequency of adherence to the recommended sick child care process by indicator of process quality

Indicator	%	95% CI
Taking client history	**65.1**	**[62.9, 67.3]**
Fever	82.1	[79.3, 84.5]
Cough or difficult breathing (e.g., fast breathing or chest in-drawing)	73.2	[69.9, 76.2]
Diarrhea	40.0	[36.4, 43.8]
General danger signs asked by provider or mentioned by caregiver	**19.6**	**[17.3, 21.8]**
Child is unable to drink or breastfeed	22.0	[19.4, 24.8]
Child vomits everything	31.2	[27.2, 35.5]
Child has had convulsions with this illness	5.6	[4.3, 7.2]
Information asked to caretaker	**16.3**	**[14.8, 17.8]**
Asked about normal feeding or breastfeeding habits or practices when the child is not ill	27.0	[24.0, 30.3]
Asked about feeding or breastfeeding habits or practices for child during this illness	18.6	[16.0, 21.5]
Mentioned the child's weight or growth to the caretaker or discussed growth chart	5.3	[4.1, 6.8]
Asked if child received vitamin A/deworming within past 6 months or asked vaccination status	14.2	[12.0, 16.7]
Provider performed physical examination on the sick child	**41.8**	**[39.8, 43.9]**
Took child's temperature by thermometer or felt the child for fever or body hotness	80.4	[76.7, 83.7]
Counted respiration (breaths) for 60 seconds	56.6	[53.2, 60.1]
Auscultated child (listened to chest with stethoscope) or counted pulse	54.0	[49.6, 58.3]
Checked skin turgor for dehydration (e.g., pinched abdominal skin)	21.4	[18.3, 24.9]
Checked for pallor by looking at palms or conjunctiva	12.4	[10.1, 15.2]
Looked into child's mouth	14.1	[10.8, 18.1]
Looked in child's ear or felt behind child's ear	8.4	[6.5, 10.8]
Weighed the child	75.5	[70.7, 79.7]
Provider recorded on child health card	53.7	[48.5, 58.7]
Counseling given to the caregiver	**26.4**	**[24.5, 28.3]**
Provided general information about feeding or breastfeeding the child even when not sick	18.3	[15.8, 21.2]
Told the caretaker to give extra fluids to the child during this illness	23.7	[20.9, 26.7]
Told the caretaker to continue feeding the child during this illness	20.8	[18.0, 23.9]
Told the caretaker what illness(es) the child has	49.7	[45.2, 54.1]
Described signs and/or symptoms in the child for which to immediately bring child back	15.6	[13.2, 18.3]
Provider discussed follow-up visit with caregiver	30.4	[26.9, 34.1]
Process quality score	**34.2**	**[32.7, 35.7]**

CI = confidence interval

Figure A1 Under-5 mortality rate by service-contact coverage by province

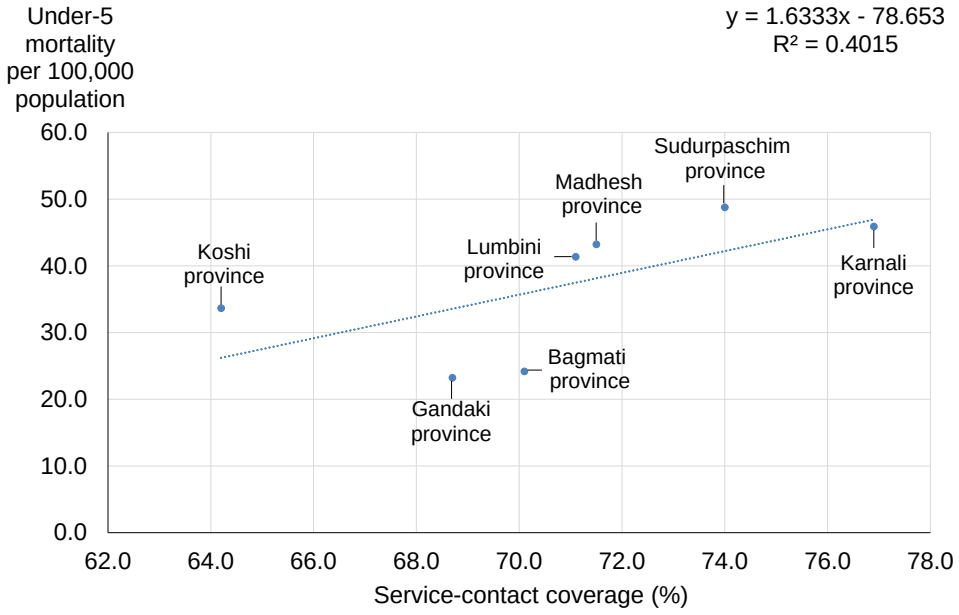

Figure A2 Under-5 mortality rate by input-adjusted coverage by province

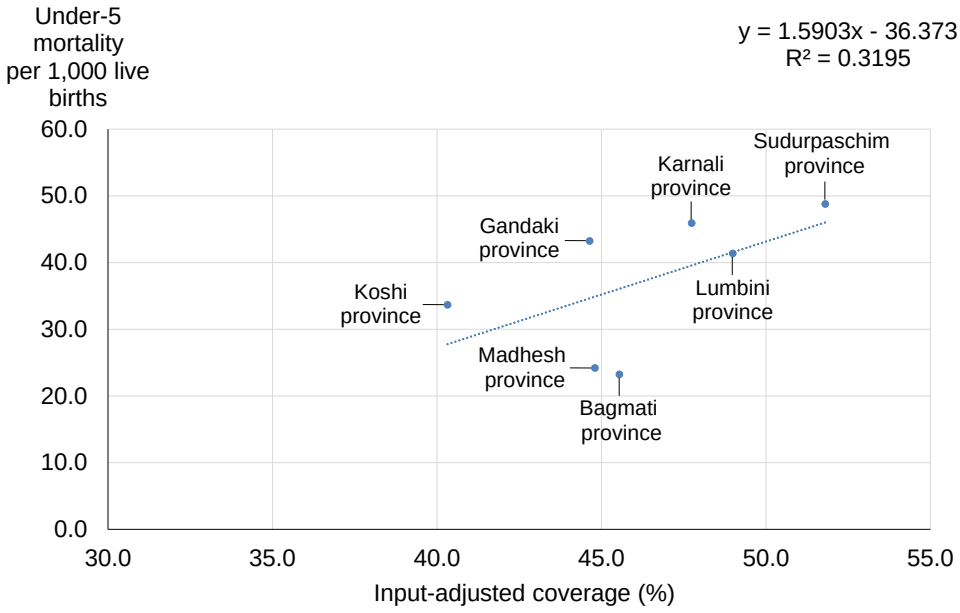

Figure A3 Under-5 mortality rate by intervention-adjusted coverage by province