International Journal of Community Medicine and Public Health
*Thapa S et al. Int J Community Med Public Health. 2023 Mar;10(3):943-950*
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20230605

**Original Research Article**

# Factors associated with full immunization coverage among under-2 years children in Nepal

**Salina Thapa[1]*, Pramodh Chaudhary[2], Raj Kumar Sangroula[2], Arati Dhoju Shrestha[1], Pabitra Balampaki[1], Janak Kumar Thapa[1,2]**

[1]Nepal Public Health Research and Development Center (PHRD), Nepal
[2]Department of Public Health, Little Buddha College of Health Science, Purbanchal University, Nepal

**Received:** 12 December 2022
**Revised:** 19 January 2023
**Accepted:** 20 January 2023

***Correspondence:**
Dr. Salina Thapa,
E-mail: tsalina409@gmail.com



## ABSTRACT

**Background:** Immunization is a cost-effective intervention; countries committed to improving child health and well-being by 2030 and assessing overall progress towards the sustainable development goals are required to reduce vaccine-preventable illness and deaths, which profoundly rely on immunization.
**Methods:** Cross-sectional study was carried out in Nepal using secondary data from the Nepal Demographic and Health Survey 2016 to fulfil the objective and find out the factors associated with full immunization coverage among under two years children in Nepal. This study was conducted in 21 districts based on a low human development index.
**Results:** Among the 306 respondents, this study found that full immunization coverage was (42.2%) and male respondents 51 % were more vaccinated as compared to female 49% of respondents. Similarly, there were mother occupations statistically associated with full immunization coverage. Instructional deliveries (51.7%) were not statistically associated with full immunization coverage. Agriculture and services were 1.6 times more likely to be immunized as compared to not working women [OR 1.6 (0.99-2.56)]. Child age was statically associated with full immunization and children aged 12-23 months were 39 (19.51-79.17) and 24 (17.99-64.23).
**Conclusions:** Immunization is the most cost-effective and universal public health weapon. The overall full basic immunization coverage was still lower than the global target. BCG coverage was high; however, only half of the respondents received the second dose of measles. Complete basic immunization was significantly associated with child age, child sex, and mother's occupation.

**Keywords:** Associated factors, Immunizations coverage, Nepal

## INTRODUCTION

The Expanded Programme on Immunization (EPI) was implemented by the World Health Organization (WHO) in 1974 to control morbidity and mortality of vaccine-preventable diseases worldwide.[1-3] According to the WHO 2020, 86% of children receive vaccines, and more than 13 million children have never been vaccinated. Despite the improvement in global immunization coverage, 6.3 million children under five die each year. Childhood vaccination continues to be one of the most cost-effective health policy interventions, preventing around 3 million deaths every year UNICEF, 2019. Currently, the EPI program, now called as National Immunization Program (NIP), is providing vaccination against 11 vaccine-preventable diseases (VPDs) in Nepal. The comprehensive multi-year plan (cMYP) 2017-2021 for immunization aims to reduce VPD-associated child morbidity and mortality, with the strategic objective to "reach every child for full immunization." The NDHS

survey 2016 reported that in 20 years, there was a significant improvement in the vaccination of children, with a subsequent reduction in infant and child mortality.[4] Immunization coverage has improved across the decades and significantly decreased inequity amongst the wealth quantile groups.[5] According to the NDHS 2016, full immunization has decreased from 87 percent in 2011 to 78 percent in 2016. Although there was no inequity according to the wealth quintile, inequity existed by education level with mothers with higher education having a higher rate of vaccination for their children compared to mothers with lower education.[6]

According to global health reports, strong immunization systems ensure that 32 million infants are fully immunized annually as well as more than 90% of the population took benefits from life-saving vaccines. The southeast Asia region was declared 'polio-free' in March 2014 and achieved MNT elimination in May 2016. The Sixty-sixth SEA Regional Committee declared 2020 as the target for eliminating measles and controlling rubella/congenital rubella syndrome (CRS) in the SEA Region. All countries in the region have added new antigens to their existing routine immunization programs, thereby expanding the lifesaving benefits of new and underutilized vaccines. In 2019, the overall vaccination of children against pertussis (provided through combined vaccines containing diphtheria and tetanus), measles, and hepatitis B was high in most Asia-Pacific countries. Conversely, the average vaccination rate in lower-middle and low-income Asia-Pacific countries for these diseases was around 85%, which is still high but insufficient to ensure the interruption of disease transmission and protection of the whole population. Nepal is ranked 142 out of 187 countries in terms of human development, and 34% of the people live below the poverty line. As per Goal number 3 of the Sustainable Development Goals (SDGs), neonatal mortality will reduce to less than 12 per 1000 live births and under-five mortality to 20 per 1000 live births in 2030.[7]

National Immunization Program (NIP) is Nepal's successful priority one public health program and it was started in 1977 AD. National Immunization Program has introduced several new and underutilized vaccines, contributing towards the achievement of the Global Vaccine Action Plan targets. In Nepal, the under-5 mortality rate (U5MR) has declined from 118 deaths per 1,000 live births in 1996 to 39 deaths in 2016 (4% annual reduction rate), while continued reductions are targeted. Nepal had made substantial progress in child survival since 1990 when 94,000 children died before reaching their fifth birthday.[8] More than 80% of children had immunization service delivery points at which they could utilize the immunization services. The same year, 52,150 children remained unimmunized with the third dose of DPT3, which represented a 58% reduction compared to the previous year.[9] Reaching all children with full immunization services is vital to meet Nepal's commitment to sustainable development goals. The National Immunization Program (NIP) success depends on vaccination coverage, quality of vaccination reporting, and strategies to reach Nepal's diverse and geographically dispersed population effectively. Nepal Health Sector Strategy 2015-2020 and its implementation plan aim to achieve more than 90% full vaccination coverage for children.

Various immunization strategies have been implemented globally and in Nepal to reach every child. The concepts of "reaching every district" and, more recently, "periodic intensification of routine immunization" were initiated to expand immunization services and reach the unreached. The "reaching every district" strategic approach, re-formed as "reaching every community," attempted to include every eligible individual, even those beyond government outreach services and geographically defined communities, in order to achieve equitable coverage.[10] Current exploration has shown that more than 60% of the total cost of the NIP goes to staff and less than 10% to vaccines. This needs critical judgment to increase the ratio of vaccines and related logistics.[6] The inclusion of new and underused vaccines, used elsewhere, based on the burden of diseases and current international practices, needs serious consideration, which is also the demand of time. Even though one of the agenda of the World Health Organization (WHO) is to make vaccination services available to everyone by 2030.[11] The finding of this study could critically inform policymakers to narrow the disparity in complete childhood vaccination status across residences and the wealth status of households. Therefore, the study aimed to determine the factors associated with full immunization coverage among children under two years in Nepal.

## METHODS

### *Data source and sampling procedure*

The cross-sectional study design was used and data were extracted from Nepal Demographic Health Survey (NDHS- 2016) to find out the factors associated with full immunization coverage among under two years children in Nepal. The NDHS survey covered socio-demographic, maternal, and child health indications including individual-level vaccination coverage.[6,12,13]

### *Criteria for sample selection*

In this study, data were extracted from the 21 Low Human Development Index (HDI) performing districts as per the 2011 census of Nepal.[14,15] The participants included under two years age of children who had registered in NDHS at the data collection point of time and had a mother.[15]

### *Sample size*

The Nepal Demographic and Health Survey (NDHS) is a standardized survey that collects household data on

population, health, and nutrition. The NDHS survey collects data from a nationally representative sample identified by multi-stage sampling. The data in NDHS includes health-seeking behavior, healthcare practices, nutrition, child health, immunization, etc. The study used raw data from the NDHS 2016. The sample for this study consisted of low HDI performing 21 districts. This study included all the registered children and the total sample size was 306.[11,16,17]

### *Data analysis*

After the approval of ICF, raw data coding and cleaning were done in SPSS by the study team and reviewed under the supervision of a database manager.[21] In a sample of 306 children under 2 years of age descriptive statistics were used to describe the level of full immunization coverage by socio-demographic characteristics. Bivariate logistic regression analyses were applied to identify the associated factors of full immunization coverage.

Variables in bivariate logistic regression analysis p values less than 0.05, odds ratio (OR), and 95% confidence interval (CI) were used to assess the associations between the outcome and the independent variables. The threshold for statistical significance was set at $p<0.05$. The whole analysis was performed using SPSS 21.0 version. In all analyses, a p value less than 0.05 was considered statistically significant.[19,20]

## RESULTS

### *Socio-demographic characteristics of respondents*

Table 1 showed the immunization status of NDHS 2016 data of low-performing 21 HDI districts. Among them, half of the respondents were (51 %) 0-11-month, and the proportion of male respondents was (51.5 %). Where the majority of respondents were Hindu (88.6%) and 45.5% of respondents belonged to Bhramin/Chhetri. More than half of the respondents were from less than and equal to 24 years age group. 47.4% of the respondents lived in rural residences, more than two-thirds (37.95) of respondents were from the poorest quintile and 44.8% of the mothers and 17.6% of fathers had no formal education.

**Table 1: Frequency distribution of socio-demographic characteristics of the respondents.**

| Characteristics | 2016_NDHS N (n=306) | Percentage |
|---|---|---|
| **Child age** | | |
| 0-11 month | 156 | 51 |
| 12-23 month | 150 | 49 |
| **Sex of child** | | |
| Male | 156 | 51 |
| Female | 150 | 49 |
| **Religion** | | |
| Hindu | 271 | 88.6 |
| Buddhist | 6 | 2 |
| Muslim | 27 | 8.8 |
| Christian | 2 | 0.7 |
| **Ethnicity** | | |
| Brahmin/Chhetri | 119 | 38.9 |
| Janajati | 34 | 11.1 |
| Dalit | 51 | 16.7 |
| Muslim | 27 | 8.8 |
| Other casts | 75 | 24.5 |
| **Mother age** | | |
| <24 years | 167 | 54.6 |
| >25 years | 139 | 45.4 |
| **Place of residence** | | |
| Urban | 145 | 47.4 |
| Rural | 161 | 52.6 |
| **Head of household** | | |
| Male | 218 | 71.2 |
| Female | 88 | 28.8 |
| **Wealth index** | | |
| Poorest | 116 | 37.9 |
| Poorer | 58 | 19 |

Continued.

| Characteristics | 2016_NDHS | Percentage |
|---|---|---|
| Middle | 71 | 23.2 |
| Richer | 46 | 15 |
| Richest | 15 | 4.9 |
| **Mother education** | | |
| Illiterate | 137 | 44.8 |
| Can read and write | 46 | 15 |
| Primary | 68 | 22.2 |
| Secondary | 16 | 5.2 |
| Higher level | 39 | 12.7 |
| **Mother occupation** | | |
| Not working | 134 | 43.8 |
| Professional/technical/managerial | 9 | 2.9 |
| Clerical | 13 | 4.2 |
| Sales and service | 147 | 48 |
| Unskilled manual | 2 | 0.7 |
| Agriculture | 1 | 0.3 |
| **Father education** | | |
| Illiterate | 54 | 17.6 |
| Can read and write | 37 | 12.1 |
| Primary | 113 | 36.9 |
| Secondary | 34 | 11.1 |
| Higher level | 68 | 22.2 |
| **Father occupation** | | |
| Professional/technical/managerial | 7 | 2.3 |
| Clerical | 21 | 6.9 |
| Sales and service | 23 | 7.5 |
| Skilled manual | 57 | 18.6 |
| Unskilled manual | 78 | 25.5 |
| Agriculture | 50 | 16.3 |
| Other | 69 | 22.5 |
| Don’t know | 1 | 0.3 |
| **ANC visit** | | |
| No ANC visit | 17 | 5.6 |
| Any ANC visit | 106 | 34.4 |
| At list 4 and >4 ANC visit | 183 | 59.8 |
| **Place of delivery** | | |
| Home delivery | 148 | 48.3 |
| Government health facilities | 120 | 39.2 |
| Private hospital | 17 | 5.6 |
| Private health institution | 21 | 6.9 |
| **Time to Visit HF** | n=142 | |
| <30 minute | 70 | 49.2 |
| 30-60 | 34 | 23.9 |
| >60 minute | 38 | 26.7 |
| **BCG** | | |
| No | 45 | 14.7 |
| Yes | 261 | 85.3 |
| **Polio-1** | | |
| No | 53 | 17.3 |
| Yes | 253 | 82.7 |
| **Polio-2** | | |
| No | 78 | 25.5 |
| Yes | 228 | 74.5 |

Continued.

| Characteristics | 2016_NDHS | Percentage |
|---|---|---|
| **Polio-3** | | |
| No | 123 | 40.2 |
| Yes | 183 | 59.8 |
| **Measles -2** | | |
| No | 161 | 52.6 |
| Yes | 145 | 47.4 |
| **Penta-1** | | |
| No | 54 | 17.6 |
| Yes | 252 | 82.4 |
| **Penta-2** | | |
| No | 78 | 25.5 |
| Yes | 228 | 74.5 |
| **Penta-3** | | |
| No | 122 | 39.9 |
| Yes | 184 | 60.1 |

**Table 2: Relationship between socio-demographic characteristics and full immunization.**

| Characteristics | | Full immunization | | | |
|---|---|---|---|---|---|
| | | NDHS-2016 | | | |
| | | No n (%) | Yes n (%) | P value | OR (95% CI) |
| **Child age** | 0-11 month | 136 (87.2) | 20 (12.8) | 0 | 24 (17.99-64.23) |
| | 12-23 month | 25 (16.7) | 125 (83.3) | | Ref |
| **Sex of child** | Male | 70 (44.9) | 86 (55.1) | 0.006 | Ref |
| | Female | 91(60.7) | 59 (39.3) | 0.201 | 1.22 (0.33-0.83) |
| **Ethnicity** | Brahmin/Chhetri | 61 (51.2) | 58 (48.7) | 0.73 | Ref |
| | Janajati | 21 (61.8) | 13 (38.2) | 0.28 | 0.65 (0.29-1.42) |
| | Dalit | 26 (51) | 25 (49) | 0.97 | 1.01 (0.52-1.94) |
| | Other casts | 51(52) | 49 (48) | 0.91 | 0.97 (0.57-1.65) |
| **Wealth index** | Poorest | 67 (57.8) | 49 (42.2) | 0.21 | Ref |
| | Poorer | 30 (52) | 28 (48) | 0.45 | 1.27 (0.67-2.4) |
| | Middle | 30 (42) | 41 (58) | 0.04 | 1.86 (1.02-3.39) |
| | Richer | 34 (55.7) | 27 (44.3) | 0.79 | 1.08 (0.58-2.02) |
| **Mother occupation** | Not working | 80 (59.3) | 55 (40.7) | 0.11 | Ref |
| | service | 11 (45.8) | 13 (54.2) | 0.22 | 1.71 (0.728-4.11) |
| | Agriculture | 70 (47.6) | 77 (52.4) | 0.05 | 1.6 (0.99-2.56) |
| **ANC visit** | No ANC visit | 10 (59) | 7 (41) | 0.8 | Ref |
| | Any ANC visit | 57 (54) | 49 (46) | 0.55 | 0.73 (0.27-2.02) |
| | 4 ANC and >4 ANC visit | 94 (51.4) | 89 (48.6) | 0.69 | 0.9 (0.56-1.46) |
| **Place of delivery** | home delivery | 78 (53) | 70 (47) | 0.93 | Ref |
| | Gov. health facilities | 64 (53) | 56 (47) | 0.91 | 0.97 (0.60-1.58) |
| | private hospital | 19 (50) | 19 (50) | 0.77 | 1.11 (0.54-2.27) |

***Utilizations of ANC services and Immunization status***

Table 1 showed the utilization of ANC services, approximately 60% of the respondent mothers visited at least 4 ANC and >4 ANC services, While Half of the respondent mothers (51.7%) were doing instructional delivery. Regarding the distance of facilities from their household, 49.2% of respondents' mothers visited health facilities in less than 30 minutes. Most children had received the BCG vaccine (85.3%) where 82.7% of respondents received the polio-1 vaccine, and 59.8% of respondents received the polio-3 vaccine. Similarly, the majority (82.4%) of the respondents received the penta-1 vaccine, but only 60.1% received the penta-3 vaccine. The study found that 46.2% of the children were fully immunized. The second dose of measles is given to the children after the completion of other basic vaccines so in this study measles was considered full immunization coverage.

***Relationship between socio-demographic characteristics and Full immunization***

Table 2 shows the relationships between socio-demographic characteristics and full immunization coverage among under 2 years children. Respondents'

age was statistically associated with full immunization and children aged 12-23 months were 24 times higher immunized than 0-11-month children OR 24, (17.99-64.23). Males were 1.2 times more likely vaccinated OR 1.22, (0.33-0.83) compared to females. Similarly, there was no statistically significant association between Janajati, Dalit, and other castes among Brahmins/Chhetri with full immunization. However, there was a statistical association with full immunization of the poorer, middle, and richer poorest. Poorer were 1.2 times more likely to be immunized as compared to the poorest, the Middle was 1.8 times more likely to be vaccinated as compared to the poorest and the richer were equally immunized as compared to the poorer. Similarly, there was a statistically associated with the full immunization of services. There was no statistically significant association between full immunization of at least 4 ANC or more than 4 ANC visits and Any ANC visit about ANC visits. Similarly, the Place of delivery was not significantly associated with full immunization coverage.

## DISCUSSION

In this study, the total number of respondents was 306. It found that 47.4% were full immunization coverage among under two years children according to low HDI performing 21 districts by using NDHS 2016 raw data and measles to be considered full immunization coverage. In the NDHS 2016, full immunization coverage was 78%, while NMICS-2019 showed 70.2% of full immunization coverage.

Home delivery was 48.3% and instructional deliveries were 39.2%. About two-thirds (65.3%) of the children were born at home. For women who delivered in health facilities, the odds of full vaccination to children were 1.76 (AOR=1.76, 95% CI: 1.38, 2.24) times higher compared to those of children whose mothers delivered at home.[2] There was a statistically associated between full immunization with services, agriculture as a reference to mothers' occupations who did services were 1.7 times more likely immunized as compared to those who did not work and the women who did agriculture were 1.6 times more likely to be immunized as compared to those who did not work. A similar study was conducted in children aged 12-59 months in health structures in Lomé, it shows that the odds of full immunization for the children of employed mothers were 1.62 (AOR=1.62, 95% CI: 1.31, 2.0) times higher compared to those of unemployed mothers. The odds of full immunization of children whose mothers had primary (AOR=1.38, 95% CI: 1.07, 1.78) and secondary (AOR=2.19, 95% CI: 1.43, 3.36) school, as well as diploma and above (AOR=1.99, 95% CI: 1.09, 3.61) level of educational, were higher than those of children whose mothers had no formal education. Which was different from the current result. Another similar study was conducted in 12-23 months It shows that children of a higher educated mother were significantly 4.93 times (95% CI 3.37 to 7.22, p<0.001) and children of a higher educated father were 4.03 times (95% CI 2.98 to 5.44, p<0.001) more likely to fully immunized than children of uneducated mothers and fathers.[3,12,21]

The current study shows that most of the respondents were Hindu 88.6%) and most of the mother age group was ≤24 years (51.1%), (54.6%), and more than 25 years age group was 45.4%. Another study conducted in Zimbabwe shows that most of the respondents belong to the Christian religion (46%) and apostolic sects (46.6). Also, most respondents are in the 15-24 (42.4%) and 25-34 (44.2%) age groups.[16] Another similar study was conducted among 12-59 months in Bangladesh, it shows findings revealed that full immunization coverage was slightly higher in urban areas (88.5%) as compared with rural areas (85.1%), which was similar to the current study.[6,21,22] This study shows that respondent age was statistically associated with full immunization, and children aged 12-23 months were 24 times higher immunized than 0-11-month children OR 24, (17.99-64.23), A similar study was conducted in infants and inequalities by wealth quintile and maternal education by using analysis from four recent demographic and health surveys in Nepal where males were oversampled in 2006 and 2016 NDHS compared to female children. Female children were slightly oversampled in 2001 whereas an almost equal proportion in 2011 was similar results found in both studies.[6] According to a place of residence among 306 respondents only (43.7%) lived in a rural area. In a similar study the trend of vaccination coverage in infants and inequalities by wealth quintile and maternal education shows, that the proportion of respondents dwelling in urban areas increased from 6% in 2001 to 54% in 2016. The percentage of mothers with no formal education decreased from 71% in 2001 to 31% in 2016. There has been little change in the proportion of respondents from mountain areas, the proportion of respondents from hills has decreased from 43.0% in 2001 to 37.7% in 2016. Whereas the proportion of respondents from the terai region has increased from 49.8% in 2001 to 55.0% in 2016 which was similar to the current results. Another similar study shows that the study sample's characteristics consisted of 979 respondents after filtering out those without children of the required age range. Seventy-three percent of the respondents reside in rural areas while the remaining 28% reside in urban areas. Which was also a similar result to the current study. According to mother education, more than one-third of the respondents were illiterate 44.8%. A similar study was conducted among 12-59 months children in health facilities in Lomé, which shows that respondent's knowledge of immunization was higher in primary level health structures (75.0% with a score of 3/5) compared with that of respondents of tertiary level health structures (25.0% with a score of 3/5) (p=0.076). Which was a dissimilar result from the current study.[22]

According to immunization status, this study shows that the majority of the children had received the BCG vaccine 85.3%, vaccination against polio-1 was 82.7%,

polio-2 was 74.5% and measles vaccine received was only 47.4%. A similar study conducted in Zimbabwe shows that 88% had received BCG vaccination, and 80% had received the measles vaccine. Eighty-seven percent had received polio-1 vaccine; while 83% had received the polio 2 and 75% had received polio-3 vaccine. There was a 12% dropout between polio-1 and polio-3 vaccines. Eighty-seven percent of children had received the pentavalent one vaccine, while 82% and 75% had received pentavalent 2 and 3 respectively. Which was a similar result to the current study. Another similar study was conducted in a slum area of Kathmandu valley children, it shows that for specific vaccines, 249 (95.0 %) children received BCG, 216 children (84.0 %) received the three doses of OPV, 223 children (85.1 %) received the three doses of pentavalent and 211 (80.5 %) received measles vaccine. One child (0.4 %) received BCG only. Similarly, 247 children (94.3 %) were given BCG + penta-1, 238 (90.8 %) BCG + penta-2, and 219 (83.6%) BCG + penta-3. Likewise, 252 children (96.2%) were immunized with OPV1 + penta-1, 240 (91.6%) with OPV2 + penta-2, and 216 (82.4 %) with OPV3 + penta-3. Five children (1.9%) were given penta-1 (no BCG), 4 (1.5%) were given penta-2 (no BCG), and 4 (1.5%) were given penta-3 (no BCG). BCG + penta-3 (no measles) was given to 25 children (9.5 %) while penta-3 + measles (no BCG) was given to 4 children (1.5%). Among the partially immunized children, the dropout rate from pentavalent first to third was 44.6% and BCG to measles vaccine was 61.3%. The vaccination card was the evidence of immunization among 43.6% of the total children which was a similar result to the current study.[12,22]

According to ANC visits, no ANC visits were 5.6%, at list 4 more than 4 ANC visits were 59.8%. A similar study was conducted in Ethiopia, it shows that more than 74.0% of the mothers had at least one ANC visit during their last pregnancy. Which was a different result from the current study. Another study was conducted in Ethiopia among 12-23-month children, and it shows that about one-third (33.2%) of the respondents had attended ANC at least four times during their latest pregnancy which was a different result from the current study.[2,23] Boundaries of the study were secondary data used and only 21 districts were analysed.

## CONCLUSION

This study reveals that out of 306 respondents, 85.3% of respondents received the BCG vaccination while 82.7% received the polio-1 vaccination but only 59.8% of respondents received the polio-3 vaccination. Only (60.1%) of the respondents received the penta-3 vaccination while 82.7% of respondents received the penta-1 vaccination. Age, sex, and mother occupations of respondents were statistically significant with full immunization coverage.

## ACKNOWLEDGEMENTS

I would like to thank the Public Health Department, Little Buddha College of Health Science, for the excellent opportunity to carry out the thesis.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Nepal Health Research Council (Ref. No.457-2020). The quantitative data for this study was obtained from NDHS-2016 approved by ICF International USA*

## REFERENCES

1. Girmay A, Dadi AF. Full Immunization coverage and associated factors among children aged 12-23 months in a hard-to-reach areas of Ethiopia. Int J Pediatr. 2019;2019.
2. Tamirat KS, Sisay MM. Full immunization coverage and its associated factors among children aged 12-23 months in Ethiopia: further analysis from the 2016 Ethiopia demographic and health survey. BMC Public Health. 2019;19(1):1019.
3. Compaore WIC, Ekouevi DK, Gbeasor-Komlanvi FA, Sewu EK, Blatome T, Gbadoe ADet al. Immunization coverage and factors associated with incomplete vaccination in children aged 12 to 59 months in health structures in Lomé. BMC Res Notes. 2019;12(1):84.
4. DOHS. DoHS-Annual-Report-FY-2076/77-for-website, 2019. Available at: https://dohs.gov.np/wp-content/uploads/2021/07/DoHS-Annual-Report-FY-2076-77-for-website. Accessed on 01 December 2023.
5. Kc A, Nelin V, Raaijmakers H, Kim HJ, Singh C, Målqvist M. Increased immunization coverage addresses the equity gap in Nepal. Bull World Health Organ. 2017;95(4):261-9.
6. Acharya K, Paudel YR, Dharel D. The trend of full vaccination coverage in infants and inequalities by wealth quintile and maternal education: analysis from four recent demographic and health surveys in Nepal. BMC Public Health. 2019;19(1):1673.
7. Thapa JK, Stöckl D, Sangroula RK, Thakur DN, Mehata S, Pun A, et al. Impact of investment case on equitable access to maternal and child health services in Nepal: a quasi-experimental study. BMC Health Serv Res. 2021;21(1).
8. Hug L, Alexander M, You D, Alkema L; UN Inter-agency Group for Child Mortality Estimation. National, regional, and global levels and trends in neonatal mortality between 1990 and 2017, with scenario-based projections to 2030: a systematic analysis. Lancet Glob Health. 2019;7(6):e710-20.
9. Bocquenet G, Chaiban T, Cook S, Escudero P, Franco A, Romo C, et al. Stateb of the World's children: A fair chance for every child. 2016;184.
10. Pinna C, Kaewkungwal J, Hattasingh W, Swaddiwudhipong W, Methakulchart R,

Moungsookjareoun A, et al. Evaluation of immunization services for children of migrant workers along Thailand-Myanmar border: Compliance with global vaccine action plan (2011-2020). Vaccines. 2020;8(1):1-11.
11. Dheresa M, Dessie Y, Negash B, Balis B, Getachew T, Ayana GM, et al. Child vaccination coverage, trends and predictors in eastern Ethiopia: Implication for sustainable development goals. J Multidiscip Healthcare. 2021;14(July):2657-67.
12. Mukungwa T. Factors associated with full immunization coverage amongst children aged 12-23 months in Zimbabwe. Et Popul Afr. 2015;29(2):1761-74.
13. Tesema GA, Tessema ZT, Tamirat KS, Teshale AB. Complete basic childhood vaccination and associated factors among children aged 12–23 months in East Africa: a multilevel analysis of recent demographic and health surveys. BMC Public Health. 2020;20(1):1-14.
14. Thapa JK, Stöckl D, Sangroula RK, Pun A, Thapa M, Maskey MK, et al. Investment case approach for equitable access to maternal neonatal and child health services: Stakeholders' perspective in Nepal. PLoS One. 2021;16(10).
15. Noh JW, Kim YM, Akram N, Yoo KB, Park J, Cheon J, et al. Factors affecting complete and timely childhood immunization coverage in Sindh, Pakistan: a secondary analysis of cross sectional survey data. PLoS One. 2018;13(10):1-15.
16. Eze P, Agu UJ, Aniebo CL, Agu SA, Lawani LO, Acharya Y. Factors associated with incomplete immunisation in children aged 12-23 months at subnational level, Nigeria: a cross-sectional study. BMJ Open. 2021;11(6):e047445.
17. Debie A, Lakew AM, Tamirat KS, Amare G, Tesema GA. Complete vaccination service utilization inequalities among children aged 12-23 months in Ethiopia: a multivariate decomposition analyses. Int J Equity Health. 2020;19(1):65.
18. Ekouevi DK, Gbeasor-Komlanvi FA, Yaya I, Zida-Compaore WI, Boko A, Sewu E, et al. Incomplete immunization among children aged 12-23 months in Togo: a multilevel analysis of individual and contextual factors. BMC Public Health. 2018;18(1):952.
19. Yismaw AE, Assimamaw NT, Bayu NH, Mekonen SS. Incomplete childhood vaccination and associated factors among children aged 12-23 months in Gondar city administration, Northwest, Ethiopia 2018. BMC Res Notes. 2019;12(1):241.
20. Wemakor A, Helegbe GK, Abdul-Mumin A, Amedoe S, Zoku JA, Dufie AI. Prevalence and factors associated with incomplete immunization of children (12-23 months) in Kwabre East District, Ashanti Region, Ghana. Arch Public Health. 2018;76:67.
21. Sarker AR, Akram R, Ali N, Sultana M. Coverage and factors associated with full immunisation among children aged 12-59 months in Bangladesh: insights from the nationwide cross-sectional demographic and health survey. BMJ Open. 2019;9(7):e028020.
22. Shrestha S, Shrestha M, Wagle RR, Bhandari G. Predictors of incompletion of immunization among children residing in the slums of Kathmandu valley, Nepal: a case-control study. BMC Public Health. 2016;16(1):970.
23. Kinfe Y, Gebre H, Bekele A. Factors associated with full immunization of children 12-23 months of age in Ethiopia: A multilevel analysis using 2016 Ethiopia Demographic and Health Survey. PLoS One. 2019;14(11):e0225639.

**Cite this article as:** Thapa S, Chaudhary P, Sangroula RK, Shrestha AD, Balampaki P, Thapa JK. Factors associated with full immunization coverage among under-2 years children in Nepal. Int J Community Med Public Health 2023;10:943-50.