SECOND ROUND SEROPREVALENCE SURVEY FOR SARS-COV-2

July-August 2021

Government of Nepal

Ministry of Health and Population

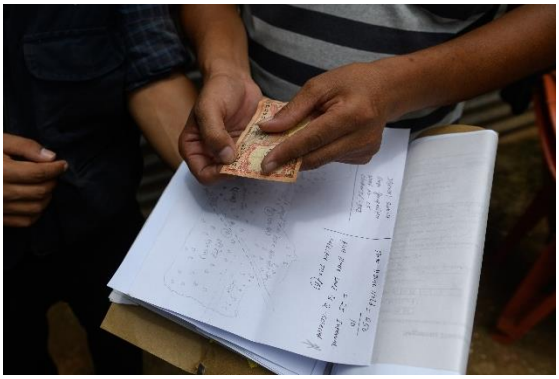
CONTENTS

BACKGROUND

The second round of national seroprevalence survey for SARS- CoV-2 in Nepal was conducted from 5th July to 23rd August 2021 to determine the current seroprevalence level in the general population. The objective was to estimate and understand the population-level immunity against SARS-CoV-2 and its change over time which are keys for understanding the spread of disease across the country. First round of seroprevalence survey for SARS-CoV-2 in Nepal was conducted from 9th October to 22nd October 2020.

METHODS

The recent seroprevalence study was based on a stratified multi-stage population proportionate to size, cluster sampling targeting household members aged 6 months and above who lived in Nepal for at least six weeks prior to blood sample collection, regardless of previous or current infection with COVID-19. The districts in each of the seven provinces have been categorized into three strata. Stratum one: districts where provincial capital is located. Stratum 02 (high) and Stratum 03 (low) were divided based on the proportional caseload contribution by constituent districts to the respective provincial caseload. For Bagmati province, Kathmandu Valley (Kathmandu, Bhaktapur, and Lalitpur districts) was chosen as a separate stratum considering its epidemiological and geopolitical importance, in addition to the usual 3 strata in other provinces. Hence, Bagmati province consisted four strata in this serosurvey, making 22 total strata across the country.



Picture 1: Using currency method during survey

Sample size was calculated based on the projected seroprevalence using the first serosurvey results. All provinces had projected seroprevalence above 50% as of 1st February 2021. Therefore, seroprevalence of 50% was used to derive the maximum sample size. Separate sample sizes were calculated for each stratum. The precisions were taken as 40% of the first serosurvey seroprevalence point estimate. The design effect of 2 was used to account for the chosen sampling technique. The total sample size calculated was 13,710 inclusive of 10% non-response. The sample size was reviewed and agreed upon by Central Bureau of Statistics, Nepal.

Picture 2: Signing consent form during the survey

Administrative wards of municipalities were taken as survey clusters. From each stratum, clusters were selected observing the probability proportionate to the cluster size measured by the number of households. Where In those clusters, where number of households numbers were considerably larger than the sampling interval, these selected clusters were further divided into segments and included in the sampling frame. Thus, some of the clusters were sub divided into 2, 3, 4 or 5 segments for inclusion in the sampling frame.

Systematic random sampling was used to select 10 households from each cluster (including the segmented ones). The A modified Kish grid was used to select one household member from amongst the eligible household members randomly.

Field teams of five members each were formed: a coordinator for overall supervision and coordination, an enumerator for data collection, a phlebotomist for blood sample collection, a Female Community Health Volunteer (FCHV), and a ward official or representative to guide the survey team through the selected cluster. Several monitoring mechanisms were implemented to ensure overall quality of the serosurvey. Monitoring mechanism included rechecking of geocoordinates of selected households, line list for tracking of each sample from place of collection to National Public Health Laboratory (NPHL) where the samples were tested. Detailed supervision throughout the duration of field work was carried out by joint monitoring teams of high-level officials of Ministry of Health and Population, local leaders, and WHO.

Picture 3: Verification of participants selected for receiving samples

Ethical approval was obtained from National Health Research Council (NHRC). Informed consent was obtained prior to commencement of interview for each participant in the study.

Computer Aided Personal Interviewing (CAPI) tool was used for demographic data collection. Blood sample collection was done by trained phlebotomist. All samples were immediately transferred to NPHL, using reverse cold chain, for test using WANTAI SARS-CoV-2 antibody ELISA kits for total antibody (both IgM and IgG).

DATA ANALYSIS

Survey design weights were calculated using selection probabilities of the multiple stages of sampling and used to derive weighted seroprevalence estimates. Base R version 4.0.2 which included survey package version 4.1-1 was used for survey data analysis.

Picture 4: Selection of household from the assigned sites

RESULTS

This analysis was based on data from 13,439 study participants. The non-response rate was 1%. The overall weighted seroprevalence at national level was 70.7% (95% CI, 69.6- 72.0)-Table 01.

Table 1: The National and Provincial Seroprevalence of COVID-19, Nepal

Geography	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Province 1	1,474	931	63.2	63.1	60.0	66.1
Province 2	1,403	1,200	85.5	84.8	82.1	87.1
Bagmati	1,917	1,318	68.8	70.0	66.6	73.2
Gandaki	1,872	1,183	63.2	63.9	61.1	66.7
Lumbini	2,003	1,463	73.0	72.2	69.7	74.5
Karnali	2,091	1,325	63.4	62.9	59.9	65.8
Sudurpaschim	2,679	1,733	64.7	64.6	62.1	67.0
Nepal	**13,439**	**9,153**	**68.1**	**70.7**	**69.6**	**72.0**

$X^2 = 410.5$, $df = 6$, $p < 0.001$

As given below in Table 02, amongst all age groups, seroprevalence was highest in the age group 65-74 with weighted seroprevalence of 79.4% (95% CI, 75.8 - 82.6), and the lowest for age group 6 months-4 years with weighted seroprevalence of 56.2% (95% CI, 48.0 – 64.0).

Table 2: Seroprevalence of COVID-19 by Age Group, Nepal

Age Group	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
0-4	221	124	56.1	56.2	48.0	64.0
5-14	1,242	675	54.3	58.8	55.0	62.4
15-24	1,936	1,302	67.3	69.6	66.4	72.6
25-34	2,216	1,507	68	70.7	67.9	73.4
35-44	2,342	1,644	70.2	73.3	70.9	75.6
45-54	2,216	1,499	67.6	71.1	68.4	73.6
55-64	1,686	1,181	70.0	73.9	71.0	76.6
65-74	1,087	850	78.2	79.4	75.8	82.6
75-84	418	318	76.1	78.6	73.5	83.0
85+	75	53	70.7	73.7	60.3	83.7

$X^2 = 197.9$, df = 9, p < 0.00

The weighted seroprevalence for male is 72.3% (95% CI, 70.8 – 73.7) and female is 68.7% (95% CI 67.0 – 70.4) and the difference is statistically significant-Table 03.

Table 3: Seroprevalence of COVID-19 by Sex, Nepal

Sex	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Male	7,187	5,008	69.7	72.3	70.8	73.7
Female	6,252	4,145	66.3	68.7	67.0	70.4

$X^2 = 20.0$ df = 1, p < 0.00

The weighted seroprevalence for eco-zones terai, hills and mountain were 76.3% (95% CI, 74.8 – 77.7), 65.3% (95% CI 63.4 - 67.3) and 60.5% (95% CI 55.2 - 65.6) respectively. The difference between seroprevalence of terai and mountain is statistically significant.

Table 4: Seroprevalence of COVID-19 by Ecozone, Nepal

Eco-Zone	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Terai	6,167	4,559	73.9	76.3	74.8	77.7
Hill	6,270	3,984	63.5	65.3	63.4	67.3
Mountain	1,002	610	60.9	60.5	55.2	65.6

$X^2 = 225.93$, df = 2, p <0.00

The urban and rural weighted seroprevalence is 71.8% (95% CI, 70.2- 73.3) and 68.6% (95% CI, 66.5- 70.6) respectively – Table 5. The observed differences of seroprevalence among urban and rural areas were not statistically significant.

Table 5: Seroprevalence of COVID-19 by Urban-Rural Areas, Nepal

Urban/Rural	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Urban	8,539	5,879	68.8	71.8	70.2	73.3
Rural	4,900	3,274	66.8	68.6	66.5	70.6

X^2 =15.0, df = 1, p =0.019

The estimated coverage of full vaccination against COVID-19 was 8.4% (95% CI, 7.8 – 9.0)-Table 6. The coverage of one dose of vaccination against COVID-19 was 15.1% (95% CI 14.2 – 16.0) while 77.7% (95% CI, 75.2 - 78.0) of survey participants were not vaccinated (Table 6) at the time of this serosurvey.

Table 6: Vaccination coverage for COVID-19 (survey period: 2021-07-05 to 2021-08-23)

Vaccine Coverage	Total Samples*	Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Fully Vaccinated (Includes Janssen single dose)	978	7.3	8.4	7.8	9.0
One Dose	2,021	15.0	15.1	14.2	16.0
Not Vaccinated	10,440	77.7	76.4	75.2	78.0

** Out of tested 13,439 samples*

The Table 7 shows that the weighted seroprevalence among fully vaccinated was 89.1% (95% CI, 86.0 – 91.6). The weighted seroprevalence among those who had one dose of vaccine (excluding Janssen) was 82.0% (95% CI, 79.8 – 84.0), while those who were not vaccinated was 66.5% (95% CI, 65.1 – 67.8).

Table 7: Seroprevalence of COVID-19 by Vaccination Status against SARS-CoV-2

Vaccine Coverage	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
Fully Vaccinated *(includes Janssen single dose)*	978	877	89.7	89.1	86.0	91.6
One Dose	2,021	1,621	80.2	82.0	79.8	84.0
Not Vaccinated	10,440	6,655	63.7	66.5	65.1	67.8

X2= 397.7, df = 2, p < 0.00

The weighted seroprevalence for Kathmandu valley was 75.7% (95% CI 69.3 – 81.1). The weighted seroprevalence for the three strata of capital (Stratum 1), high case load (Stratum 2) and low caseload (Stratum 3) were 70.1% (95% CI 68.2 – 71.9), 74.8% (95% CI 73.0 – 76.5), 67.0% (95% CI 65.1 - 68.7) respectively.

Table 8: Seroprevalence of COVID-19 by survey stratum, Nepal

Stratum Type	Total Samples	Positives	Sample Percentage	Weighted Percentage	Lower 95% CI	Upper 95% CI
KTM Valley	468	355	75.9	75.7	69.3	81.1
Capital	4,309	2,947	68.4	70.1	68.2	71.9
High	4,410	3,123	70.8	74.8	73.0	76.5
Low	4,252	2,728	64.2	67.0	65.1	68.7

X^2= 87.7, df = 3, p < 0.00

Results Comparison: First and second serosurveys for COVID-19 in Nepal

Picture 5: Discussion after the survey on use of mask

First national serosurvey for SARS-CoV-2 in Nepal was conducted from 9th October to 22nd October 2020. The second national serosurvey for SARS- CoV-2 in Nepal was conducted from 5th July to 23rd August 2021. Following tables compare the serosurvey results in some selected indicators. The full report of the first survey can be found here.

Table 9: National and provincial level seroprevalence by serosurvey, Nepal

Geography	First Serosurvey			Second Serosurvey		
	Weighted Percentage	Lower 95% CI	Upper 95% CI	Weighted Percentage	Lower 95% CI	Upper 95% CI
Province 1	7.8	4.5	13.1	63.1	60.0	66.1
Province 2	27.3	21.0	34.8	84.8	82.1	87.1
Bagmati	20.7	12.1	33.0	70.0	66.6	73.2
Gandaki	8.8	4.7	15.8	63.9	61.1	66.7
Lumbini	7.4	5.1	10.7	72.2	69.7	74.5
Karnali	7.6	4.8	11.9	62.9	59.9	65.8
Sudurpaschim	5.3	3.0	8.9	64.6	62.1	67.0
Nepal	**14.4**	**11.8**	**17.0**	**70.7**	**69.6**	**72.0**

Table 10: Distribution of seroprevalence among age groups by serosurvey, Nepal

Age Group	First Serosurvey			Second Serosurvey		
	Weighted Percentage	Lower 95% CI	Upper 95% CI	Weighted Percentage	Lower 95% CI	Upper 95% CI
0-4	9.5	4.6	18.6	56.2	48.0	64.0
5-14	8.5	5.4	13.3	58.8	55.0	62.4
15-24	14.3	10.1	19.8	69.6	66.4	72.6
25-34	13.9	10.5	18.1	70.7	67.9	73.4
35-44	19.5	14.4	25.9	73.3	70.9	75.6
45-54	16.0	10.9	22.9	71.1	68.4	73.6
55-64	17.0	12.0	23.6	73.9	71.0	76.6
65-74	16.2	10.3	24.7	79.4	75.8	82.6
75-84	6.0	1.6	20.5	78.6	73.5	83.0
85+	2.1	0.2	15.3	73.7	60.3	83.7

Table 11: Distribution of seroprevalence among sex by serosurvey, Nepal

Sex	First Serosurvey			Second Serosurvey		
	Weighted Percentage	Lower 95% CI	Upper 95% CI	Weighted Percentage	Lower 95% CI	Upper 95% CI
Male	15.8	13.0	19.1	72.3	70.8	73.7
Female	12.2	9.0	16.4	68.7	67.0	70.4

Table 12: Distribution of seroprevalence among eco-zones by serosurvey, Nepal

Eco Zone	First Serosurvey			Second Serosurvey		
	Weighted Percentage	Lower 95% CI	Upper 95% CI	Weighted Percentage	Lower 95% CI	Upper 95% CI
Terai	17.7	14.7	21.2	76.3	74.8	77.7
Hill	11.7	7.5	17.9	65.3	63.4	67.3
Mountain	4.6	2.2	9.5	60.5	55.2	65.6

SUMMARY

The second seroprevalence survey for COVID-19 was conducted during the period of 5th July to 23rd August 2021 using a sample size and sampling framework to estimate seroprevalence at provincial and national levels. Based on analysis of 13,439 samples collected, the estimated national seroprevalence at national level was 70.7%. Province 2 showed the highest seroprevalence of 84.8% while the lowest seroprevalence of 62.9% was reported by Karnali province. The seroprevalence reported for male and female were comparable at 72.3% and 68.7% respectively. The age group 65-74 reported the highest seroprevalence of 79.4% while the 6-months to 4-year age group reported the lowest seroprevalence of 56.2%. The eco-regions terai, hills and mountains reported seroprevalences of 76.3%, 65.3%, and 60.5% respectively. All of which increased in comparison to the first serosurvey results. The seroprevalence reported for urban and rural were comparable at 71.8% and 68.6% respectively. Fully vaccinated (including Janssen single dose) group showed the highest seroprevalence of 89.1% followed by the group that had one dose with seroprevalence of 82.0% and those who haven't had vaccination with seroprevalence *of* 65.5%. The reported non-response rate was 1%.

Picture 7: Household visit during the survey

Picture 6: Monitoring and supervision during the survey

Children had 35% less risk of getting seroconverted for SARS-CoV-2 compared to the working group. Males had a slightly higher and statistically significant risk of getting SARS-CoV-2 infection with females. Acquiring SARS-CoV-2 was more likely in people who lived in terai and hill eco zones than mountain ecozones. The terai zone has approximately 2.5 times the risk than the mountain region. Living in an urban area also pose a 12% increased risk which is statistically significant compared to a rural area.

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