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Bal Govind Chauhan, Usha Ram, J.S. Hallad, Bashir Bhat, Dilip Kalita, Dilip Kumar, M.R. Pradhan and Study Collaborators

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IIPS Working Paper No. 26

Utilization of Child Immunization Services during the First Wave of COVID-19 Pandemic

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Utilisation of Child Immunisation Services During the first wave of COVID-19 Pandemic

Abstract

The present study investigates the utilisation of child immunisation services during the first wave of the COVID-19 pandemic (that is, between March 2020 and February 2021). The study surveyed 2516 eligible women in the age group of 15-49 years in urban and rural areas of five states of India using the multi-stratified sampling design with Probability Proportional to Size (PPS) within each sampling domain of urban and rural areas. The units of analysis in the present study are the total number of children (1207 children) born between January 2019 and February 2021 to selected eligible women. Bivariate technique was used for data analysis. The findings indicated that the level of child immunisation at birth was satisfactory. However, age-appropriate immunisation indicators were below suboptimal levels during the COVID-19 pandemic. The results indicated that 79, 54, 55, 40.5 and 74.5 per cent of the children received the Measles-Rubella, Rotavirus-3, DPT Booster dose, last dose of Vitamin-A, and BCG vaccines, respectively, at a public health facility during the first wave of the pandemic. Results further indicated that 17.2 per cent of the mothers encountered difficulties while seeking/availing of immunisation services for their children. Among those who experienced problems, 88.5 per cent faced problems related to the COVID-19 pandemic. The frontline health workers, especially ASHAs, played a significant role in catering to the people for immunisation services during the reference period. A majority of the respondents (82.8 %) reported that ASHA workers visited them for child vaccination during the COVID-19 Pandemic.

Keywords: Immunisation, COVID-19, India, Pandemic, Lockdown, ASHA

Highlights

- The present study intended to measure the effect of lockdown due to the COVID-19 pandemic on child immunisation services.
- The study found that 17.2 per cent of the mothers encountered difficulties while seeking/availing of immunisation services for their children.
- Among those who experienced problems, 88.5 per cent faced problems related to the COVID-19 pandemic.
- The study shows that most women had contact with frontline workers for child immunisation, slightly higher in rural areas than in urban ones. Notably, contact with ASHA and getting help from them was satisfactory in rural and urban areas in all the districts, except for Patna
- Public health policies must build trust in general primary health care services, clearly communicating the importance of continuing immunisations even during a pandemic and ensuring that attending immunisation camps did not increase the risk of COVID-19 like infections.

Introduction

The COVID-19 pandemic caused relentless disruption to health services all over the globe. As health care resources were concentrated on responding to the pandemic, supply chains became disorganized, and travel restrictions and fear of contracting the virus disrupted health care utilisation (Birkmeyer *et al.*, 2020). Immunisation services were among the critical preventive health services that were affected in both wealthy and lower-income countries (Nelson, 2020).

In late March 2020, the WHO disseminated guidelines to countries to program immunisation as a central health service but temporarily cease mass vaccination campaigns and study local risks and benefits in decisions to continue immunisation

related outreach activities. The survey covered more than half of the 129 nations and reported complete suspension or substantial disruption in immunisation services in the following months, putting an estimated 80 million children under the age of one year at an increased risk of contracting vaccine-preventable diseases (Khatiwada *et al.*, 2021). Travel and access restrictions, supply-side disruptions due to provider shortages and suspended immunisation services, and fear among users of contracting COVID-19 emerged as critical reasons for the decrease in immunisation.

During large disease outbreaks, disruption to routine and critical care can affect health outcomes. Decline in routine Immunisation led to substantial outbreaks of vaccine-preventable diseases like measles (Colavita *et al.*, 2017). Even though children and females had lower COVID-19 mortality risk, early prediction models suggested that indirect mortality effects of the pandemic among women and children due to lower use of preventive services might be substantial. A modelling analysis of 54 African countries found that sustaining routine child Immunisations could substantially reduce mortality, thereby negating the risk of excess mortality due to COVID-19 through visits to vaccination clinics (Abbas *et al.*, 2020).

Studies had documented significant decreases in immunisation coverage in higher-income countries during the first few months of the pandemic when social distancing and quarantine policies had been newly imposed. A study of administrative immunisation data from fifteen African countries found more than a 10 per cent fall in monthly vaccinations in more than half of the countries (Masresha *et al.*, 2020). However, immunisation coverage recovered after lockdowns were lifted and immunisation activities resumed, but to what extent immunization coverage has improved remains unclear as data tracking immunisation status at the individual level is rare.

India recorded its first COVID-19 patient in January, 2020. As the patient count increased the Indian government announced a nationwide lockdown on March 24,

2020, which restricted people from leaving their homes and halted almost all commercial activities and transport services to control the spread of the virus. Even though health facilities and critical health services were exempted from the lockdown, immunisation outreach sessions were discontinued due to the spread of COVID-19. In late May, the Ministry of Health and Family Welfare issued revised guidelines telling states to resume outreach activities in areas that had prevented or contained COVID-19 and focusing on conducting catch-up Immunisation (https://www.mha.gov.in/notifications/circulars-covid-19).

Catch-up vaccinations were crucial components of the health system's response during and after the pandemic since missed immunisation increased the health risks of unvaccinated children and the population. Nevertheless, they made substantial additional demands on the already stretched resources since they required the identification of individuals and groups missed immunisation, communication to increase awareness and remove fears, additional supply chain management, and intensified follow-up activities in addition to continuing routine immunisation services and containing the spread of the pandemic. Understanding how catch-up efforts reached children who missed immunisation was critical for adapting and targeting policies and immunisation outreach activities in the coming months. However, publicly available administrative data was inadequate in throwing light on this question. Immunisation coverage is monitored through the Indian Government's Health Management Information System (HMIS), which collects data from primary health care systems and gives monthly reports on the total number of children immunised. The April 2020 data showed that monthly Immunisations dropped by 70 per cent nationwide, but then recovered substantially thereafter. While these aggregate changes provide an essential measure of the recovery of the health system, they cannot measure the level of follow-up among groups with missed immunisation

or identify unvaccinated groups, for which individual immunisation status is required.

In view of the above scenario, the present study uses primary survey data to examine disruptions in child immunisation during the COVID-19 lockdown in five districts across five states in the country.

Literature review

Studies indicate mixed results of the impact of COVID-19 on the utilisation of child immunisation services. Evidence showed all Sustainable Development Goals (SDGs) being impacted by the pandemic. Given their interconnected nature, health-related SDG-3 were severely hit. SDG-3 is interwoven with, and draws complementarity from SDG-1 (Poverty), SDG-2 (Zero Hunger), SDG-4 (Quality Education), SDG-5 (Gender Equality), SDG-6 (Clean Water and Sanitation), SDG-13 (Climate Action), SDG-14 (Life under Water), SDG-15 (Life on Land) and SDG-17 (Partnerships for Goals). The sudden occurrence of COVID-19, like other pandemics in the past, stonewalled achievements expected to be made through global collaborative efforts including SDGs (Khetrapal & Bhatia, 2020).

A study conducted in Qassim region in Saudi Arabia found that out of the total participants, around three-quarters of the mothers had appointments for their children's vaccination during the pandemic, while a high number reported a delay of more than one month in the immunisation of their children. The fear of being infected by COVID-19 was a common problem. The paper further asserted that a large household size and lack of insurance were risk factors for the delay of immunisation. The COVID-19 pandemic affected the timeliness of routine childhood immunisation in Saudi Arabia (Masresha *et al.*, 2020). Another study using the registration data for Texas city observed a 47 per cent relative decline in immunisation rates between 2019 and 2020 among 5-month-old and a 58 per cent decline among 16-month-old

children. The declines were sharper in rural counties compared to urban ones (Nuzhath *et al.*, 2021).

Results from a survey of Indian paediatricians (Shet *et al.*, 2021) amplified the growing chorus around the globe, calling for a focus on vaccine-preventable illnesses, even as COVID-19 cases grew worldwide. The national immunisation programme run by the Government of India is one of the largest in the world, with an annual reach of over 26 million children and 29 million pregnant women. A working paper (Gurnani *et al*. 2018) sheds light on *'Mission Indradhanush'* to extend the reach and achieve full immunisation for 90 per cent of the children, and the programme was further intensified in 2019. The paper found that remarkable progress was made, however, there were evidences of inequalities in coverage.

Singh *et al.* 2021, attempted to assess the indirect effect of the pandemic on maternal and child health services provided in public health facilities. Data pertaining to maternal and child health services being provided under specific Government programmes, was collected from public health facilities of the District, Sant Kabir Nagar in Uttar Pradesh, India. Reduced coverage across all maternal and child health interventions was observed in the study. Immunisation services dramatically decreased by more than 20 per cent. The response of the public healthcare delivery system to the COVID-19 pandemic was negatively affected by both, the provision and utilisation of maternal and child healthcare services.

Data and method

This working paper is a part of the collaborative study titled "Utilisation of RCH services during the COVID-19 Pandemic: An assessment, Findings from IIPS-PRC multi-centric study". It was a joint venture of Five Population Research Centres (PRCs)-Dharwad (Karnataka), Guwahati (Assam), Srinagar (Jammu & Kashmir), Patna (Bihar), Pune (Maharashtra) and the International Institute for Population

Sciences (IIPS), Mumbai. Details of the survey design and data collection procedure have been given elsewhere (https://www.iipsindia.ac.in/sites/default/files/IIPS_Working_Paper_No_24_0.pdf). However, in nutshell, data was collected for the study from Kamrup district in Assam (AS), Patna in Bihar (BI), Pulwama in Jammu and Kashmir (JK), Pune in Maharashtra (MH) and Dharwad in Karnataka (KA) using the multi-stratified sampling design with Probability Proportional to Size (PPS). The collaboration period of the study was nine months, ending in March 2021. The information was collected from women aged 15-49 years. The study collected a wealth of information on the broader domains of maternal health care utilisation, child immunisation, treatment-seeking behaviour of currently pregnant women, abortion, stillbirth, contraceptives, menstrual problems, child health and contact with health or Integrated Child Development Services (ICDS) Scheme workers during the pandemic.

The data was collected through face-to-face interviews and telephonic interviews, as convenient, during the pandemic. Jammu & Kashmir and Assam PRCs did all the interviews through face-to-face interviews, Dharwad and Patna PRCs did all the interviews telephonically, and Pune PRC did 94 per cent of the interviews through face-to-face, and the remaining 6 per cent of the interviews telephonically.

The present paper analyses the data related to the utilisation of child immunisation services.

Results

Background Characteristics of Live Births

Table 1 provides the distribution of all live births enumerated during the reference period by selected maternal and household characteristics in different districts and places of residence. A total of 1207 live births occurred during the reference period.

The percentage of live births was comparatively higher in rural than in urban areas in all the districts under study, except Pune. About 49 per cent of the live births were male and 51 per cent were female. Hence the sex ratio at birth was 97 boys per 100 girls. The proportion of boys was comparatively more in rural areas than in urban areas. The sex ratio at birth was relatively higher in Kamrup and Patna, indicating that male births constituted a slightly higher share of live births in rural areas, especially in these two districts. Fifty-five per cent of the live births were of the first birth order, and 10 per cent of them were of birth order three or higher (more in urban areas than in rural areas). Thirty-eight per cent of the births occurred to mothers from poor households and 29 per cent to mothers from the high wealth tertile. In urban areas, the percentage of births in affluent households was more than those in rural areas. The percentage of live births in wealthy families was high in Pulwama, followed by Pune. On the other hand, more live births occurred in families having poor economic conditions in Patna and Dharwad. Regarding maternal age, 39 per cent of all births occurred to younger mothers, aged 15-24 years, while 56 per cent were born to mothers aged 25-34 years. The mean age of mothers was 26 years, 26.8 in urban and 25.8 in rural areas. The share of births among younger mothers was considerably greater in Patna and Dharwad and very little in Pulwama. The mean age of mothers was higher in Pulwama (30 years) and ranged between 25-26 years in the remaining districts. Majority of the births occurred to Hindu mothers (78.4 %). The same trend was observed in all the districts except Pulwama, where 96 per cent of the births occurred to Muslim mothers. The proportion of births among women belonging to other religions was comparatively higher in Pune. Twenty per cent of the births occurred to mothers from the Scheduled Castes and Schedule Tribes (SCs/STs). The proportion of births among SCs/STs was more in Patna, Kamrup and Pune, while the share of births among the OBC category was comparatively higher in Patna and Dharwad. 53.8 per cent of the births occurred to mothers who had

completed 10-12 years of schooling, and another 20 per cent of the total births were to mothers having more than 12 years of education. The mean years of schooling of the mothers was 10.5 years, slightly higher in urban areas (11.3 years) than in rural areas (10 years). The status of mothers' education was relatively better in Pune district than in others.

Table 1: Distribution of Live births covered by selected background characteristics by Districts and Place of residence (2020-21)

Characteristics	Name of DISTRICT - STATE/UT					ALL		
	Pulwama –JK	Patna-BI	Kamrup-AS	Pune - MH	Dharwad-KA	Urban	Rural	Combined
Age of the child								
0-6 months	55.3	21.6	28.8	36.7	35.1	37.2	31.7	33.6
7-12 months	23.4	21.6	34.8	29.3	25.8	27.5	29.3	28.7
More than 12 months	21.3	56.8	36.5	34.0	39.1	35.3	39.0	37.7
Mean age (in months)	*7.8*	*13.1*	*10.4*	*10.2*	*10.4*	*10.0*	*10.7*	*10.5*
Place of residence								
Urban	19.2	37.8	7.1	65.4	37.3			35.0
Rural	80.9	62.2	92.9	34.6	62.7			65.0
Gender								
Boy	46.8	52.0	53.9	43.6	49.1	45.7	51.0	49.1
Girl	53.2	48.0	46.2	56.4	50.9	54.3	49.0	50.9
Sex ratio (male per 100 female)	*88*	*108*	*117*	*77*	*96*	*84*	*104*	*97*
Birth order								
One	48.94	43.2	66.1	59.7	44.4	52.1	56.8	55.2
Two	34.04	30.4	33.3	33.7	39.1	34.6	34.3	34.4
Three or higher	17.02	26.4	0.6	6.6	16.5	13.3	8.9	10.4
Household wealth tertile								
Low	4.3	59.5	45.3	17.3	53.1	16.8	49.0	37.9
Medium	21.3	29.1	36.5	37.0	29.8	36.5	31.1	33.0
High	74.5	11.5	18.2	45.7	17.2	46.7	19.8	29.2
Maternal age								
15-24 years	10.6	46.6	39.6	37.3	43.7	31.8	42.2	38.5
25-34 years	63.8	49.3	56.7	59.1	53.1	62.8	52.6	56.2
35-49 years	25.5	4.1	3.7	3.6	3.2	5.5	5.2	5.3
Mean years	30.3	25.0	25.8	26.1	25.8	26.8	25.8	26.1
Maternal religion								
Hindu	1.1	94.6	88.3	83.6	77.1	73.7	80.9	78.4
Muslim	95.7	5.4	11.7	2.1	21.9	17.3	17.1	17.2
Others	3.2	0.0	0.0	14.3	1.1	9.0	2.0	4.5
Maternal caste								
SC/ST	1.1	23.7	26.8	25.4	10.0	21.3	19.5	20.1
OBC	7.5	55.4	6.0	17.0	39.1	27.0	20.6	22.9
Others	91.5	21.0	67.2	57.6	50.9	51.7	59.9	57.0

Maternal education								
0-4 years	16.0	14.9	4.8	3.9	4.7	6.2	6.9	6.6
5 to 9 years	38.3	17.6	21.1	10.8	23.3	14.9	22.2	19.6
10 to 12 years	24.5	54.1	63.8	53.1	51.6	48.3	56.7	53.8
More than 12 years	21.3	13.5	10.3	32.2	20.4	30.6	14.3	20.0
Mean years of schooling	*9.4*	*9.3*	*10.3*	*11.6*	*10.5*	*11.3*	*10.1*	*10.5*
Overall (%)	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Number of Live Births	**94**	**148**	**351**	**335**	**279**	**422**	**785**	**1,207**

Immunisation services utilisation

Table 2 shows the immunisation indicators for selected background characteristics. The overall results reflect that 79 per cent of the children were immunised for Measles-Rubella (MR), whereas, only 40.5 per cent received the last dose of Vitamin-A. Gender-wise, a higher proportion of males were immunised for MR, Rotavirus-3 and DPT booster, whereas a higher proportion of female children were administered the last dose of Vitamin-A. A larger number of children belonging to the higher wealth tertile were vaccinated for MR, Rotavirus-3 and a DPT booster. 43.5 per cent of the children belonging to the lower wealth tertile were administered the last dose of Vitamin-A. According to the place of residence, a higher proportion of children belonging to rural areas were immunised for all the selected vaccines. The results suggested that the highest immunisation was among children of women aged 35-49 years. Evidence further shows that Muslims received the highest vaccination for MR, Rotavirus-3 and DPT booster but the lowest for the last dose for Vitamin-A. Immunisation of children belonging to the general castes was the most significant for all the immunisation indicators. Around 82 per cent of the children, whose mothers' education was less than five years or more than 12 years, were immunised with measles-rubella. The proportion of children being administered the last dose of Vitamin-A was 28.2 per cent among mothers educated for 5 to 9 years. District-wise, the proportion of children vaccinated for all the immunisation indicators was the lowest in Patna among all the districts.

Table 2: Immunisation indicators during the first wave of COVID-19 by selected background characteristics, 2020-21

Characteristics	% received Measles Rubella (Age eligibility-9 months)	% received Rotavirus 3 (Age eligibility-4 months)	% received DPT booster (Age eligibility-15 months)	% received Vitamin-A last dose (Age eligibility-11 months)
Gender				
Male	81.9	54.4	56.8	38.6
Female	76.0	53.4	53.5	42.4
Household wealth tertile				
Low	75.4	51.5	54.7	43.5
Medium	76.6	50.7	53.6	37.8
High	87.4	61.3	57.8	39.0
Place of residence				
Urban	74.9	53.2	52.9	35.7
Rural	81.0	54.3	56.4	42.8
Maternal age (years)				
15-24	77.1	49.9	55.8	39.3
25-34	80.0	55.1	52.2	40.0
35-49	82.4	74.5	80.0	55.6
Maternal religion				
Hindu	78.6	51.9	54.6	43.7
Muslim	82.1	63.6	60.5	23.8
Other	76.7	57.5	50.0	34.8
Maternal caste				
SC/STs	78.1	54.1	46.7	39.3
OBC	70.8	51.5	46.1	29.9
Others	82.9	54.9	64.2	46.0
Maternal education				
0-4 years	81.8	61.5	57.7	33.3
5 to 9 years	73.2	54.6	47.6	28.2
10 to 12 years	79.9	52.1	57.2	44.9
More than 12 years	81.5	56.4	55.2	43.4
District-States				
Pulwama –JK	87.9	79.7	73.3	11.5
Patna-BI	41.8	20.5	36.1	29.6
Kamrup-AS	89.0	57.2	58.9	51.0
Pune –MH	86.5	51.6	60.2	47.9
Dharwad-KA	81.4	64.5	58.8	33.8
Overall	**79.0**	**53.9**	**55.1**	**40.5**
Sample	**689**	**979**	**350**	**556**

Table 3 provides the details of each vaccine received by children during the pandemic, along with the age of eligibility for their administration. The information is presented for both, urban and rural areas, combined as well as separately.

Out of the total 1207 births, almost every child was immunised with BCG, Polio-0 and Hepatitis B0. At the aggregate level, 74.5 to 76.6 per cent children received these doses at a Public Health Facility (PHF), and more than 62 per cent reported that they had changed the place where they got their dose due to the pandemic. Around 32.8 per cent reported not taking the pentavalent-3 dose due to the pandemic. Seventy-nine per cent received the Measles and Rubella-1 vaccines after nine months of birth, 75 and 81 per cent in urban and rural areas, respectively. Around 94.5 per cent of the children received these at a PHF while 33.1 per cent of the children did not get immunised to these due to the pandemic. Results for DPT boosters showed that 55.1 per cent of the children were vaccinated at 15 months of age; 92.8 per cent of the children claimed to have received the vaccination at a PHF while 42 per cent did not get immunised with the DPT booster due to the pandemic. 40.5 per cent of the children claimed to have received the last dose of vitamin-A; 92.9 per cent had received it from a PHF, while 29.9 per cent of the children did not get the dose due to the pandemic.

In urban areas, the utilisation of basic vaccinations such as BCG, Polio-0 and Hepatitis B0 was almost universal, ranging from 98.3 to 99.3 per cent. About 64 per cent of the children received these doses at a Public Health Facility (PHF), while 37.8 per cent to 41 per cent reported having changed the place of vaccination due to the pandemic. 37.3, 25.9 and 17.9 per cent of the children did not get the pentavalent-3, DPT booster and the last dose of Vitamin-A, respectively, due to the pandemic. For Pentavalent-2 and 3 doses, almost 90 and 81.8 per cent, respectively, reported changes in the place of immunisation due to Covid-19. The results show a gradual decrease

in the percentage of children immunised against rotavirus, for which three doses of vaccine are given in the 2nd, 3rd and 4th months.

In rural areas, the coverage of BCG and Polio-0 vaccination was almost universal. More than 80 per cent of the vaccines were administered at public health facilities. Regarding the dose for pentavalent 1, 2, and 3, which is given in the 2nd, 3rd and 4th months of a child's life, more than ninety-four per cent of the children had received pentavalent-1, but the percentage gradually decreased for the second and third doses. Results show a gradual decrease in the percentage of children immunised with three doses of rotavirus vaccine, which is given in the 2nd, 3rd and 4th months. In rural areas, almost everybody claimed to have changed their place for most of the vaccinations due to the pandemic. Furthermore, 51.5 per cent of the children did not receive DPT boosters due to the pandemic.

Table 3: Impact of pandemic on utilisation of immunisation services and place of immunisation, 2020-21

Vaccinations	Age eligibility	% of children received	% of immunized children immunized at a PHF	% reported place not a usual choice	% changed place due to pandemic, among those who reported place was not usual choice	% of non-immunized children did not immunize due to pandemic	No. of eligible children for immunisation
Combined							
BCG	At birth	99.4	74.5	10.7	62.5	100.0	1207
Polio – 0	At birth	99.0	75.7	10.5	64.0	8.3	1207
Hepatitis B0	At birth	97.2	76.6	9.6	63.4	5.9	1207
Pentavalent – 1	2 months	94.1	90.4	7.2	88.2	10.5	1127
Pentavalent – 2	3 months	87.6	92.1	6.8	98.4	28.2	1056
Pentavalent – 3	4 months	81.0	94.0	7.7	98.4	32.8	979
Measles & Rubella 1	9 months	79.0	94.5	8.8	NA	33.1	689
Rotavirus – 1	2 months	62.3	92.5	9.1	95.3	10.7	1127
Rotavirus – 2	3 months	60.6	93.4	9.7	96.8	16.4	1056

Rotavirus – 3	4 months	53.9	95.1	11.2	96.6	20.8	979
Vitamin A – 1st dose	6 months	54.1	91.6	12.5	94.8	23.9	858
DPT booster	15 months	55.1	92.8	18.7	97.2	42.0	350
Vitamin A - last dose	11 months	40.5	92.9	19.6	97.7	29.9	556
Urban							
BCG	At birth	99.3	63.5	**9.3**	41.0	100.0	422
Polio – 0	At birth	98.8	63.6	9.4	41.0	20.0	422
Hepatitis B0	At birth	98.3	64.3	8.9	37.8	0.0	422
Pentavalent – 1	2 months	93.5	85.0	4.7	70.6	12.0	386
Pentavalent – 2	3 months	84.3	86.0	3.7	90.9	28.6	356
Pentavalent – 3	4 months	79.6	86.3	3.8	90.0	37.3	329
Measles & Rubella (MR) 1	9 months	74.9	90.0	4.1	NA	38.6	227
Rotavirus – 1	2 months	57.0	90.0	5.5	83.3	9.6	386
Rotavirus – 2	3 months	55.6	90.9	5.1	90.0	15.2	356
Rotavirus – 3	4 months	53.2	91.4	6.3	81.8	16.9	329
Vitamin A – 1st dose	6 month	50.4	93.7	7.7	72.7	14.2	284
DPT booster	15 months	52.8	89.2	9.2	83.3	25.9	123
Vitamin A - last dose	11 months	35.7	92.3	9.2	83.3	17.9	182
Rural							
BCG	At birth	99.5	80.4	11.4	71.9	100.0	785
Polio – 0	At birth	99.1	82.1	11.1	74.4	0.0	785
Hepatitis B0	At birth	96.6	83.3	9.9	76.0	7.4	785
Pentavalent – 1	2 months	94.3	93.1	8.4	93.2	9.5	741
Pentavalent – 2	3 months	89.3	95.0	8.3	100.0	28.0	700
Pentavalent – 3	4 months	81.7	97.7	9.6	100.0	30.3	650
Measles & Rubella 1	9 months	81.0	96.5	11.0	NA	29.6	462
Rotavirus – 1	2 months	65.7	93.6	10.7	98.1	11.4	741
Rotavirus – 2	3 months	63.1	94.6	11.8	98.1	17.1	741
Rotavirus – 3	4 months	54.3	96.9	13.6	100.0	22.9	650
Vitamin A – 1st dose	6 month	44.1	90.7	14.6	100.0	29.3	574
DPT booster	15 months	56.4	94.5	23.4	100.0	51.5	227
Vitamin A - last dose	11 months	42.8	93.1	23.8	100.0	36.5	374

Note: the denominator for column 6 and 7 are different.

Difficulties experienced in getting vaccination services during the pandemic

Among 1207 births, 17.2 per cent of the children's mothers experienced problems in vaccinating their children, 9.7 per cent in urban areas and 21.3 per cent in rural areas during the COVID-19 pandemic **(Table 4).** Mothers in rural areas faced more problems in vaccinating their children than urban mothers across all the background characteristics. The difficulties experienced decreased from lower to higher wealth tertile. 24 per cent of the mothers from low wealth tertile reported having problems in vaccinating their children in urban areas, similar to those in rural areas. Women aged 35-49 years experienced the most difficulties in vaccinating their children in rural areas. 19.2 per cent of the Hindu mothers reported experiencing problems in vaccinating their children. The proportion of SCs/STs experiencing problems was higher than the problems faced by all the other castes, among them 22.9 per cent reported experiencing difficulties in rural areas. 22.3 per cent of the women with more than twelve years of education experienced difficulties in rural areas for vaccinating their children. Women from Pune and Dharwad districts were least likely to face any issue. On the other hand, a higher proportion of women from Kamrup and Patna districts experienced problems in vaccinating their children.

MR vaccination status was studied to detect the proportion of women who experienced difficulties, and yet vaccinated their children. Among women who experienced problems, only 17.1 per cent of their children were vaccinated for Measles & Rubella MR, 8.9 per cent in urban and 20.9 per cent in rural areas.

Table 4: Percentage of women experiencing difficulties in vaccinating their children by place of residence according to selected background characteristics during COVID-19 pandemic, 2020-21

Characteristics	% Experienced problems			Sample
	Total	Urban	Rural	
Gender				
Male	18.4	9.8	22.5	593
Female	16.1	9.6	20.0	614
Household wealth tertile				
Low	25.0	23.9	25.1	457
Medium	16.3	9.7	20.5	398
High	8.2	4.6	12.9	352
Maternal age (years)				
15-24	18.9	11.2	22.1	465
25-34	15.8	9.1	20.1	678
35-49	20.3	8.7	26.8	64
Maternal religion				
Hindu	19.2	10.9	23.3	946
Muslim	10.1	4.1	13.4	207
Christian	9.3	10.5	6.3	**54**
Maternal caste				
SCs/STs	18.9	12.2	22.9	243
OBC	17.0	12.3	20.4	276
Others (General castes)	16.7	7.3	21.1	688
Maternal education				
Fewer than 5 years	16.3	23.1	13.0	80
5 to 9 years	17.7	14.3	19.0	237
10 to 12 years	19.1	10.8	22.9	649
More than 12 years	12.0	3.1	22.3	241
District-States				
Pulwama –JK	5.3	5.6	5.3	94
Patna-BI	40.5	33.9	44.6	148
Kamrup-AS	34.2	20.0	35.3	351

Pune –MH	3.9	5.0	1.7	335
Dharwad-KA	3.6	4.8	2.9	279
MR vaccination status of children (aged 9 or more months)				
Vaccinated	17.1	8.9	20.9	544
Not vaccinated	31.0	28.1	33.0	145
Overall	**17.2**	**9.7**	**21.3**	**1207**

Table 5 provides information on the nature of problems experienced by mothers while vaccinating their children. 'No transport facility' and 'Family did not allow due to COVID-19' were the most common difficulties experienced by 52.4 and 58.2 per cent of the mothers, respectively. 'Financial problem' was mentioned by only 2 per cent of the mothers who faced difficulties. 'The family did not allow due to COVID-19' was mentioned more frequently by rural mothers (63.5%) than urban mothers (36.6%). Similarly, refusal of family to accompany was frequently mentioned by rural mothers (24.6%) compared to urban mothers (12.2%). On the other hand, comparatively more urban mothers complained of 'Too much time for travel' and 'Long waiting time at the facility' compared to rural mothers. 'No transport facility' was quoted by mothers in most of the districts, except for Pulwama. Restrictions imposed by family were comparatively more at Patna and Kamrup. 'Facility closed' was the main reason (23.3%) in Patna. Financial reasons were mentioned more frequently in Pune district. This clearly indicates that very few mothers experienced difficulties in seeking immunisation for their children and mostly the problems were facility- related except in Patna and Kamrup, where the difficulties were more family-related.

Table 5: Nature of difficulties experienced by mothers in seeking child immunisation due to the pandemic by District and place of residence (2020-21)

Characteristics	Name of DISTRICT - STATE/UT					ALL		
	Pulwama – JK	Patna-BI	Kamrup-AS	Pune – MH	Dharwad-KA	Urban	Rural	Combined
Nature of difficulty experienced (%)*								
No transport facility	0.0	56.7	57.5	30.8	20.0	51.2	52.7	52.4
Family did not allow due to COVID-19	0.0	71.7	61.7	15.4	20.0	36.6	63.5	58.2
Family refused to accompany due to COVID-19	0.0	21.7	27.5	0.0	0.0	12.2	24.6	22.1
Facility was closed	20.0	23.3	1.7	15.4	10.0	17.1	7.8	9.6
Staff not available at health facility	0.0	25.0	0.8	0.0	10.0	12.2	7.2	8.2
Staff refused to provide service due to COVID-19	60.0	28.3	0.8	7.7	0.0	9.8	10.8	10.6
ASHA/ANM was not available	20.0	30.0	0.8	15.4	20.0	14.6	10.8	11.5
No Money	0.0	3.3	0.8	7.7	0.0	2.4	1.8	1.9
Facility converted to COVID-19 Hospital	0.0	11.7	1.7	0.0	10.0	4.9	4.8	4.8
Too Much time spent on travel due to COVID-19 Checking	0.0	38.3	3.3	15.4	20.0	22.0	13.2	14.9
Too Long wait at facility due to COVID-19	0.0	60.0	5.0	0.0	20.0	29.3	19.2	21.2
Stressed due to Strict COVID-19 Protocols	40.0	86.7	6.7	30.8	30.0	53.7	28.1	33.2
Stress fear of COVID-19 while waiting at facility	0.0	68.3	20.0	7.7	10.0	31.7	32.3	32.2
Others	20.0	3.3	0.8	0.0	30.0	7.3	2.4	3.4
Total cases	**5**	**60**	**120**	**13**	**10**	**41**	**167**	**208**

* Total will not add up to 100% as mothers experienced more than one difficulty.

The first wave of the COVID-19 pandemic affected women vaccinating their children. Out of 208 women, who claimed to have faced issues, 88.5 per cent reported

facing problems due to the pandemic. **Table 6** draws the proportion of women who faced problems due to other reasons or due to COVID-19. The proportion of women who experienced difficulties due to the COVID-19 pandemic was higher among women belonging to rural areas, middle household wealth tertile, age group of 35-49 years, Hindu religion and Other Backward caste (OBC) groups compared to others. Further, more women who completed more than 12 years of schooling followed by those completing less than five years of education experienced a problem in child vaccination due to the COVID-19 pandemic. Women in Pune (61.5%) and Dharwad (60%) were least likely to face issues due to the pandemic. On the other hand, women from Patna and Kamrup experienced the most problems due to the pandemic.

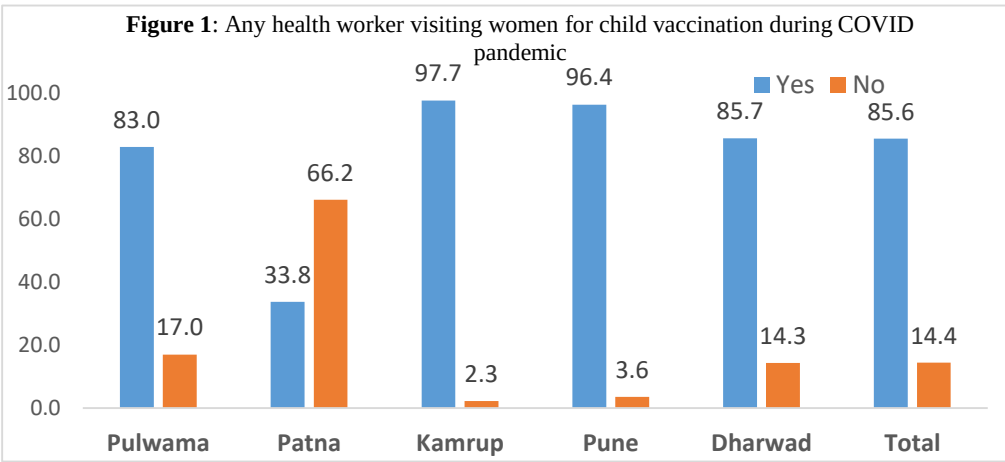
Table 6: Women experiencing difficulties in getting vaccination services for their children during COVID-19 Pandemic- wave-1 by background characteristics, 2020-21

Characteristics	% Due to COVID-19 Pandemic	% Due to other reasons	Sample
Gender			
Male	92.7	7.3	109
Female	83.8	16.2	99
Place of residence			
Urban	78.1	22.0	41
Rural	91.0	9.0	167
Household wealth tertile			
Low	89.5	10.5	114
Medium	90.8	9.2	65
High	79.3	20.7	29
Maternal age (years)			
15-24	88.6	11.4	88
25-34	87.9	12.2	107
35-49	92.3	7.7	13
Maternal religion			
Hindu	90.1	9.9	182
Muslim	85.7	14.3	21
Others	40.0	60.0	5
Maternal caste			
SCs/STs	89.1	10.9	46
OBC	93.6	6.4	47

Others	86.1	13.9	115
Maternal education			
0-4 years	92.3	7.7	13
5 to 9 years	85.7	14.3	42
10 to 12 years	87.9	12.1	124
More than 12 years	93.1	6.9	29
District-States			
Pulwama –JK	80.0	20.0	5
Patna-BI	95.0	5.0	60
Kamrup-AS	90.8	9.2	120
Pune –MH	61.5	38.5	13
Dharwad-KA	60.0	40.0	10
Overall	**88.5**	**11.5**	**208**

Contact with the Health Worker / ASHA

Figure 1: Any health worker visiting women for child vaccination during COVID pandemic



85.6 (N=1033) per cent of the total (1207) respondents asserted that health workers had visited them for child vaccination (**figure 1**). A higher proportion of respondents from Kamrup (97.7%) reported the same, followed by Pune (96.4%) and Dharwad (85.7%) and the least were from Patna (33.8%).

The role of frontline health workers in catering to vaccination services during the first wave of the COVID-19 pandemic was also checked in the present study. Overall, 25.0, 30.9 and 82.8 per cent reported that Aganwadi workers (AWW), Auxiliary Nurse and Midwife (ANM) and Accredited Social Health Activist (ASHA),

respectively, had visited them for child vaccination during the first wave of COVID-19 (**Table 7**). The proportion of ASHAs who met women for child vaccination was higher than those of AWW and ANM across all the background characteristics. The proportions of women visited by AWW and ANM decreased with an increase in wealth tertile. A greater number of AWW visited women in rural areas (29.2%), whereas ANMs visited in urban areas (33.9%). AWW and ANM visits were higher for women aged 15-24 years compared to other age groups. Only 12.6 per cent of ANMs visited Muslim women for child vaccination. In Patna, only 26.4 per cent of the women reported ASHAs visits for child vaccinations, while in the rest of the districts, more than 80 per cent of the women reported the same. Only 2.1 per cent of the women from Pulwama reported AWW visits for child vaccination, whereas 51.3 per cent of the respondents from Dharwad reported the same. None of the respondents reported the visit of ANMs for child vaccination in Pulwama, whereas 55.8 per cent of respondents reported visits made by ANM in Pune district.

Table 7: Health Workers visiting women for child vaccination during first wave of COVID-19 Pandemic, 2020-21

Characteristics	AWW		ANM		ASHA	
	Yes	N	Yes	N	Yes	N
Gender						
Male	27.3	593	29.3	593	84.3	593
Female	22.8	614	32.4	614	81.3	614
Household wealth tertile						
Low	35.5	457	31.1	457	81.2	457
Medium	22.9	398	34.9	398	82.9	398
High	13.9	352	26.1	352	84.7	352
Place of residence						
Urban	17.3	422	33.9	422	78.7	422
Rural	29.2	785	29.3	785	85.0	785
Maternal age (years)						

15-24	27.5	465	32.0	465	81.1	465
25-34	24.0	678	31.4	678	83.8	678
35-49	17.2	64	17.2	64	84.4	64
Maternal religion						
Hindu	26.3	946	33.0	946	83.1	946
Muslim	20.3	207	12.6	207	78.7	207
Other religions	20.4	54	64.8	54	92.6	54
Maternal caste						
SC/STs	17.3	243	32.9	243	84.0	243
Other backward classes	29.4	276	21.0	276	70.7	276
Others (General castes)	26.0	688	34.2	688	87.2	688
Maternal education						
Fewer than 5 years	18.8	80	16.3	80	71.3	80
5 to 9 years	27.4	237	24.9	237	81.4	237
10 to 12 years	26.4	649	33.3	649	85.2	649
More than 12 years	21.2	241	35.3	241	81.3	241
District-States						
Pulwama -JK	2.1	94	0.0	94	81.9	94
Patna-BI	3.4	148	2.0	148	26.4	148
Kamrup-AS	23.1	351	33.6	351	95.7	351
Pune -MH	21.2	335	55.8	335	94.9	335
Dharwad-KA	51.3	279	23.3	279	82.1	279
Overall	25.0	1,207	30.9	1,207	82.8	1,207

Of the total 1207 women who gave birth during the reference period, 74.2 per cent contacted ASHA for vaccination of their children and almost all of them (99.4 %) received help (**table 8**). The results depict the gender differentials regarding contact with ASHA for child immunisation: 74.4% of the mothers approached ASHA for vaccination of a male child and 73.9%, for a female child. The table also reflects the rich-poor gap since 71.3 per cent of the women from the low-wealth tertile and 73.3 per cent from the high-wealth tertile contacted ASHA for help related to their children's vaccination. Interestingly, the percentage of women who contacted ASHA

for help related to their children's immunisation was lower in urban areas (69.4%) than in rural areas (76.7%). 64.1 per cent of the mothers aged 35-49 years contacted ASHAs for their children's immunisation, while 74 per cent aged 15-24 years did the same.

Contact with ASHA was relatively higher among SCs/STs than OBCs, however, contact with ASHA was even greater among other caste groups. As expected, contact with ASHA was greater among mothers who had completed more than 12 years of education (96.7%). As far as differences among districts was concerned, 27.7 per cent of the children's mothers contacted ASHA in Patna, whereas the highest contact was noted in Kamrup (97.2%).

Almost all those, across all socio-economic characteristics, who had contacted ASHA related to their children's immunisation had received help, ranging from 98.3 to 100 per cent.

Table 8: Percentage of women contacting ASHA and receiving help related to child vaccination during Covid-19 Pandemic, 2020-21

Characteristics	% Contacted ASHA		% Received help from ASHA	
	Yes	Sample (n)	Yes	Sample (n)
Gender				
Male	74.4	593	99.1	441
Female	73.9	614	99.8	545
Household wealth tertile				
Low	71.3	457	99.7	326
Medium	78.1	398	99.4	311
High	73.3	352	99.2	258
Place of residence				
Urban	69.4	422	98.3	293
Rural	76.7	785	100.0	602
Maternal age (years)				
15-24	74.0	465	99.4	344
25-34	75.2	678	99.4	510

35-49	64.1	64	100.0	41
Maternal religion				
Hindu	74.6	946	99.4	706
Muslim	68.1	207	99.3	141
Others	88.9	54	100.0	48
Maternal caste				
SC/STs	79.0	243	99.5	192
OBCs	55.1	276	99.3	152
Others	80.1	688	99.5	551
Maternal education				
0-4 years	60.0	80	100.0	48
5 to 9 years	73.0	237	100.0	173
10 to 12 years	78.0	649	99.4	506
More than 12 years	96.7	241	98.8	168
District-States				
Pulwama –JK	67.0	94	100.0	63
Patna-BI	27.7	148	100.0	41
Kamrup-AS	97.2	351	100.0	341
Pune –MH	84.5	335	98.6	283
Dharwad-KA	59.9	279	99.4	167
Overall	**74.2**	**1207**	**99.4**	**895**

Table 9 depicts the distribution of women who had received help related to children immunisation from ASHA, by district and place of residence. Out of the total eligible mothers (i.e., 895), 293 were in urban and 602 in rural areas. Among those who had received help from ASHAs, a higher proportion belonged to the low wealth tertile, rural areas, 25-34 years' age group, Hindu religion, other caste group and completed 10 to 12 years of education. Similar patterns of the help received from ASHAs were observed in urban and rural areas across all the selected background characteristics, except in urban areas where more women (50%) from the high wealth tertile had received help related to their children's immunisation than their counterparts.

As far as district-wise information was concerned, the proportion of mothers receiving help from ASHA was higher among children born to mothers in the high wealth tertile in Pulwama (69.8%), and Pune (45.2%), whereas, it was higher among

mothers in the low wealth tertile in Patna (68.3%), Kamrup (45.2%) and Dharwad (56.3%). In all the districts, the percentage of women who received help from ASHA was higher in rural areas than in urban areas, except in Pune. More of the women belonging to the 25-34 years' age group received help from ASHA compared to others in all the districts. In case of caste, a higher proportion of mothers belonging to other caste households were reported to have received help from ASHA in all districts except in Patna wherein, a higher percentage of women from the OBC had received help from ASHAs. Children born to women who had completed 10 to 12 years of education were greater beneficiaries of help from ASHAs in all the districts, except Pulwama, where women with 5-9 years of education were the main beneficiaries.

Table 9: Percentage of women receiving help from ASHAs related to child vaccination during COVID-19 Pandemic, by District and place of residence 2020-21

Characteristics	Name of DISTRICT - STATE/UT					ALL		
	Pulwama -JK	Patna-BI	Kamrup-AS	Pune - MH	Dharwad-KA	Urban	Rural	Combined
Gender								
Male	49.2	58.5	53.7	42.8	49.1	46.4	50.7	49.3
Female	50.8	41.5	46.3	57.2	50.9	53.6	49.3	50.7
Household wealth tertile								
Low	6.4	68.3	45.2	16.3	56.3	12.3	48.2	36.4
Medium	23.8	26.8	36.1	38.5	31.7	37.5	33.4	34.8
High	69.8	4.9	18.8	45.2	12.0	50.2	18.4	28.8
Place of residence								
Urban	15.9	41.5	7.3	70.0	25.8			32.7
Rural	84.1	58.5	92.7	30.0	74.3			67.3
Maternal age (years)								
15-24	11.1	41.5	39.9	37.8	46.1	33.1	41.0	38.4
25-34	58.7	56.1	56.3	59.7	53.3	63.1	54.0	57.0
35-49	30.2	2.4	3.8	2.5	0.6	3.8	5.0	4.6
Maternal religion								
Hindu	0.0	100.0	88.6	82.3	77.8	74.4	81.1	78.9
Muslim	95.2	0.0	11.4	2.1	21.6	14.3	16.5	15.8

Other religions	4.8	0.0	0.0	15.6	0.6	11.3	2.5	5.4
Maternal caste								
SC/STs	1.6	17.1	26.7	26.2	11.4	22.9	20.8	21.5
OBC	7.9	65.9	5.9	15.2	34.1	18.1	16.5	17.0
Others	90.5	17.1	67.5	58.7	54.5	59.0	62.8	61.6
Maternal education								
0-4 years	17.5	14.6	4.4	3.9	3.0	3.8	6.2	5.4
5 to 9 years	34.9	17.1	20.8	11.0	25.2	13.0	22.4	19.3
10 to 12 years	25.4	68.3	64.2	53.0	55.7	51.5	59.0	56.5
More than 12 years	22.2	0.0	10.6	32.2	16.2	31.7	12.5	18.8
Number of Live Births	**63**	**41**	**341**	**283**	**167**	**293**	**602**	**895**

Conclusion and Discussions

Immunisation is one of the important public health interventions against vaccine-preventable diseases. The vaccination schedule differs in different parts of the world. It is determined by the number and epidemiology of the targeted infections and the capability of vaccines to induce the required immune response in the child. The vaccine intervals are designed to protect children from the diseases. The World Health Organisation (WHO) provides guidelines on the age at which each vaccine should be given and the intervals between the vaccinations. These recommended vaccination schedules reduce the risk of a child contracting the disease under consideration whilst achieving general herd immunity that protects against outbreaks of the disease. Apart from the increase in global morbidity and mortality and disruptions to economic and social well-being of individuals and communities worldwide, the COVID-19 pandemic and its associated restrictions have contributed to the delay in providing vital medical services such as vaccination. The present study assessed the reach of childhood vaccinations during the COVID-19 pandemic. Abbas *et al.* (2020) had suggested that the risk of death due to vaccine-preventable diseases outweighed the risk of death due to possibly contracting COVID-19 during clinic visits. After the declaration of national emergency in the USA, a reduction in routine

vaccinations was observed, primarily in children older than one month (Santoli, 2020).

The present study also observes a decline in child immunisation rates across all background characteristics, more commonly seen in rural areas and among low and medium wealth tertile. The social pattern of missed doses was not unexpected, since coverage typically increased with family wealth in most of the low and middle wealth countries. Higher frequencies of missed doses among the poor may be attributed to the characteristics of health facilities (geographic distribution, staffing, opening hours), concerns about infection by bringing children to crowded facilities, and the need to rely on public transportation with consequent exposure to the virus. In contrast, better-off families were more likely to rely on private transportation and private clinics (Lassi *et al.*, 2021). The study also indicated that higher maternal education, higher wealth tertile, belonging to rural areas, higher maternal age, belonging to other caste groups and facility-based births were associated with higher immunisation uptake; similar results were observed in Pakistan (Chandir *et al.*, 2020).

Another important finding was that BCG-0 and the first dose for hepatitis B, often administered in a maternity hospital or the first postnatal visit to a facility, were least affected by the pandemic. In contrast, vaccines administered to older children showed an apparent dip. The magnitude of the decline for pentavalent and rotavirus vaccines was large. The last dose of Vitamin-A was reportedly administered to 40 per cent of the children. A possible explanation for this difference is that virtually all children in the country are born in a hospital. Even if BCG or hepatitis-B vaccines were not administered in the maternity ward, families are more motivated to attend the first postnatal check-up rather than take older children for immunisation appointments, which may be perceived as less urgent (Silveira *et al.*, 2021). Risk-

benefit analysis shows that deaths prevented by sustaining routine childhood immunisations cancel out the excess fear of COVID-19 mortality associated with visits to vaccination clinics, especially for children. Efforts are needed to assure continuity in vaccine uptake, given that lockdown and isolation measures had negatively affected the national immunisation programme in 2020, especially in rural areas. Even though successful efforts were made to reduce rural/urban inequalities, new vaccination agendas-including those proposed for COVID-19 containment must include certain behaviour to overcome lags in routine childhood immunisation for at-risk regions (Moreno-Montoya *et al.*, 2022). In such circumstances (Adlhoch & Pebody, 2020), and given that confinement has been associated with rapid decreases in other infectious diseases, a rise in the number of cases of vaccine-preventable conditions among children who missed vaccinations during COVID-19 is expected, posing a twofold threat to the public health system. Factors associated with slackening of the vaccination processes include public actions like, infection control measures and isolation, individual characteristics such as poverty/ socioeconomic status or cultural traits (Adamu *et al.*, 2020) and lack or wrong information on diseases and vaccinations, including people's concerns about contagion and the safety of vaccines and their potential side effects (which increased during the pandemic). These threats affect conventional vaccination programmes operating amid new vaccination processes against COVID-19 and need to be addressed urgently to reactivate normal immunisation processes. Mass communication and health education strategies aimed at the general population are recommended to address these concerns. The present study showed that most women had contacted frontline workers for child immunisation in all the districts, slightly more in rural areas than in urban ones. Notably, contact with ASHAs and getting help from them were satisfactory in rural and urban areas in all the districts except for Patna. Rao (2014), in his study, found that in terms of crude increase in the number of mothers

who claimed to have been motivated by a doctor/health worker to get their child immunised, direct motivation by an ASHA worker accounted for a substantial increase. A good part of the increase was due to the increased number of Anganwadi workers. ASHA workers do not work in isolation but as an intrinsic part of the public health system, working together with other health personnel to ease their work pressures and assist them in performing their duties more efficiently. While direct motivation by an ASHA worker towards immunisation was the most obvious way for outreach, there are undoubtedly indirect ways in which an ASHA worker can positively influence mothers. Thus, the frontline health workers, especially ASHAs, played a major and significant role in child immunisation during the first wave of the COVID-19 pandemic.

Summary and Conclusion

The utilisation of birth doses of child immunisation services was satisfactory in the sample areas whereas, other child immunization services were not up to the mark. Among 2516 women interviewed, 1207 live births occurred during the reference period, and the patterns of immunisation in these live births were analysed further in this paper. The percentage of live births was comparatively higher in rural than in urban areas in all the districts under study, except Pune. The highest live births were in Pune, whereas the lowest were in Pulwama among all the districts. About 49 per cent of the live births were male and 51 per cent, female. Hence, the sex ratio at birth was 97 boys per 100 girls. The sex ratio at birth was relatively higher in Kamrup and Patna, indicating that male births constituted a slightly higher share of live births in rural areas, especially in these two districts. The proportion of live births was higher among the low wealth tertile in Patna (59.5%) followed by Dharwad (53.1%), Kamrup (45.3%) and least in Pulwama (4.3%). The percentage of live births

decreased with wealth tertile in Kamrup. In urban areas, the percentage of births were higher in affluent households than in rural areas.

The percentage of births among younger mothers (15-24 years) was considerably greater in Patna and Dharwad and very little in Pulwama. The mean age of mothers was 30 years in Pulwama and ranged between 25 and 26 years in the remaining districts. Majority of the births were to Hindu mothers.

Out of the total 1207 births, almost every child was immunised with BCG, Polio-0 and Hepatitis B0. Almost three fourths of these doses were administered at Public Health Facilities (PHFs), and more than 62 per cent reported that they had changed their dosage due to the pandemic. More than four fifths of the total live births reported immunisation at a PHFs in rural areas. A large proportion of children were administered the last dose of Vitamin-A and BCG at a PHFs.

The proportion of children vaccinated for MR, Rotavisrus-3 and DPT was higher among children belonging to the high-wealth tertile. Moreover, only 43 per cent of the children from the low-wealth tertile had received the last dose of Vitamin-A.

The study shows the effect of COVID-19 on child immunization services as 17% of the women reported experiencing difficulties in vaccinating their children during the COVID-19 pandemic, and the percentage was higher in rural areas than in urban areas. The percentage of women who experience problems decreases as their wealth status increases, irrespective of place of residence. Women from Pune and Dharwad districts were the least affected by the COVID-19 pandemic among all the study districts. On the other hand, higher percentage of women from Kamrup and Patna experienced problems in vaccinating their children, irrespective of their place of residence. The percentage of ASHAs visiting women for child vaccination ranges

from 71-95 per cent across various background characteristics. The percentage of AWW and ANM visiting women for child vaccination decreases as wealth tertile increases. Results further show that about three fourths of the women contacted ASHA for help related to child vaccination, and almost all of them received help from them. More than one-fourth of the women of Patna district and 97 per cent of the women of Kamrup district contacted ASHA, and all of them received service from them.

To sum up, although the first wave of the COVID-19 pandemic affected the uptake of Child immunisation, it varied across study districts and place of residence. All immunisation had been hit by the first wave of the COVID-19 pandemic in all districts in some way or the other. The present study also noted that more women in rural areas experienced difficulties in seeking immunisation services. A significant barrier to utilizing services such as transportation to the health facility suggests a need to provide transportation services during future pandemics for efficient utilisation. The study found that some respondents did not use the benefits due to fear of getting the infection while visiting a health facility. Therefore, it is essential to consider additional initiatives during the pandemic to reassure the clients that the facility has taken all possible steps to prevent the spread of infection when children visit. This would help to elevate the uptake of these services. Factors associated with the slackening in vaccination processes include public actions like infection control measures and isolation, individual characteristics such as poverty/ socioeconomic status or cultural traits and lack of or wrong information on diseases and vaccinations, including people's concerns about contagion and the safety of vaccines and their potential side effects (which increased during the pandemic). Our study also shows that most women had contact with frontline workers for child immunisation in all the districts, slightly higher in rural areas than in urban areas. Notably, contact with

ASHA and getting help from them were satisfactory in rural and urban areas in all the districts except for Patna.

Recommendations

Primary health care services, including immunisation, were disrupted putting children at risk for vaccine-preventable diseases such as measles, rotavirus, etc. In this regard, coordinated campaigns targeting children who missed critical routine vaccinations during the national lockdown and targeting low-coverage areas could prevent such public health disasters. Prioritising catch-up with measles vaccine should be most urgent given its potential outbreak with even a marginal reduction in herd immunity (Masters *et al.,* 2020). Planning catch-up campaigns is crucial to minimise the risk of vaccine-preventable diseases. Vaccination catch-up could include ingenious strategies such as implementing visits on an appointment basis or designated walk-in clinics for healthy children, separating Immunisation visits, minimizing overcrowding from sick children's visits, prioritizing concentrated efforts to address caregivers' fears of contracting COVID-19 and sending reminders to caregivers of the importance of routine vaccinations (Oyo-Ita *et al.*, 2016). In addition, healthcare strategies like the Integrated Management of Newborn and Childhood Illnesses can strengthen their focus on immunisation. Training community health workers to trace children who missed vaccination appointments can help restore baseline vaccination levels. Gaining provider opinion on effective strategies is essential to establishing context-specific mechanisms to prioritise catch-up for missed vaccines. A WHO pulse survey indicated partial disruption of critical health services beyond Immunisations in many regions of the world, particularly in lower-

income countries[1], which prompted a solid need for health systems and governments across the globe to incorporate health system resilience and maintain essential health services during and after the COVID-19 pandemic.

There is a need to strictly follow SMS (social distancing, mask, sanitization) (Kasi *et al.*, 2020) and the recommended COVID-19 norms in the immunisation session. The logistics may be divided into the preparation of space, personnel, vaccine, maintaining the waiting area and post-vaccination care. The vaccine provider should track children who have missed the vaccine and immunize them as soon as the vaccination becomes feasible. Public awareness should also be done to sensitize them about the catch-up vaccination. Parents should be aided and informed that there is a window period in which the vaccines could be given and once delivered, they would have similar efficacy in future.

An effective post-pandemic response is to ensure that low income and backwards caste groups are not left out. Public health policies will need to alleviate these difficulties by building trust in general primary care services, clearly communicating the importance of continuing Immunisations even during a pandemic, and ensuring that attending immunisation camps does not increase the risk of COVID-19 infection.

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[1] World Health Organization. Available: Pulse survey on continuity of essential health services during the COVID-19 pandemic: interim report, 27 August 2020 (who. int)

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