



Impact of COVID-19 pandemic on routine immunization of under 5 children in Jabalpur district of Madhya Pradesh. A descriptive cross-sectional study

Mahendra Soni, Neelam A. Toppo, Aditya Thakur

ABSTRACT

Background

The WHO (world health organization) announced COVID-19 pandemic as public health emergency of international concern on January 2020. This pandemic has declined the acceptance of pediatric preventive care, like immunization coverage among under 5 children. This was because of total lockdown and fear among beneficiary and engagement of health care workers with different task related to pandemic. The aim of this study was to find out the routine immunization status of under five children registered in urban and rural anganwadis in pre and during COVID-19 pandemic.

Methods

A cross-sectional study conducted in urban and rural areas of Jabalpur district. We included 1250 under five children who were selected from urban and rural anganwadis through multistage random sampling. Record review of interview of mother / care taker, record review of anganwadi registers, mother child protection (MCP) cards was done for data collection. Data was collected and compared 12 months prior to first COVID case detection in Jabalpur district and 12 months during COVID pandemic.

Result

Overall, 22.24% of parents/primary care giver reported missing routine immunization during COVID-19 pandemic and it is statistically significant by McNemar test (McNemar's Chi-Squared = 134.815, $df=1$, p Value = 0.00 and McNemar's Chi-Squared = 36.91, $df=1$, p Value = 0.00) in both urban and rural area respectively. From them, 61.87% routine immunization was missed due to the closure of anganwadi. The most common missed vaccine were for 16 to 24 months of age group that was 35.61%.

Conclusion

We need routine immunization at high coverage level for dropping the risk of vaccine preventable diseases and as soon as have to identify missed-out children and planning catch-up sessions for sustain the gains of the routine immunization program of India.

Key words: COVID-19 pandemic, Childhood Routine Immunization, Vaccine Preventable Diseases, Under five children.

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INTRODUCTION

The COVID-19 pandemic is caused by a recently discovered virus known as Corona Virus^[1]. A new strain of corona is novel corona virus (nCoV) that has not been previously identified in humans and it was named the "COVID-19 virus". The main route of transmission of infection via droplets generated by infected person when he/she sneezes, coughs, or exhales^[2]. Although the infection occurs in all age groups, mortality is mostly seen in elder people and persons with co-morbidities^[3-5]. WHO declared the COVID-19 outbreak as a global pandemic on March 11, 2020. The first case of COVID-19 in India was on January 30, 2020 and first death was on March 12, 2020. On March 25, 2020, India went into nationwide lockdown. This continued till April 14, 2020 and extended till May 17^[6]. There was a closure of institutions, schools, anganwadis, markets, hotels, restaurants, wedding halls, flights, and gathering places^[7]. There were increasingly restrictive national and international activities through border closures near-lockdown called the "Circuit Breaker" (CB)^[8,9]. The current pandemic was declared as the 'worst public health crises in a generation' with over 1.2 crores confirmed positive cases and 5.57 lakhs reported deaths across 213 countries as of July 11, 2020 during peak time of pandemic. The provision of steady health services was interrupted globally due to unexpected spread of the virus^[10]. The COVID-19 pandemic disrupted the routine health services throughout the world due to the necessity for social distancing and shortage of staff/health care workers. Health workers were overwhelmed with COVID-19 cases^[11]. During the first wave of pandemic, there was a lack of health workers, medicine, ventilators, routine vaccines, oxygen, diagnostic kits, medical and nonmedical equipments. This limited the capacity for early diagnosis and prompt treatment of COVID-19^[7]. The pharmaceutical interventions (Including drugs and vaccines), non-pharmaceutical interventions (including lockdown, face mask, hand hygiene), canceling mass gathering activities, and mandatory travel restrictions and social distancing were implemented for the control of COVID-19^[12]. The Health Management Information System (HMIS) of National Health Mission reported that routine health services were harshly affected just after a week of applying lockdown, based on month-on-month comparison of data with

previous year's data^[6] due to decline in medical care visits attended by parents and care giver of infants and young children during the first 6 months of the COVID-19 pandemic had led to lower vaccination rates^[13]. India's progress towards achieving Sustainable Development Goals (SDG) would include decline in the incidence of various vaccine preventable diseases (VPDs)^[14]. In the world, India's Universal Immunization Program is one of the biggest public health program which provides free vaccination against 12 VPDs (Vaccine Preventable Diseases), 11 national [Diphtheria, Pertussis, Tetanus, Oral Polio, Measles, Rubella, BCG, Hepatitis B, Hemophilus Influenza type B, Rota Virus and PCV (under expansion) and one regional (Japanese Encephalitis- only for endemic areas). Indicator 19 of SDG 3.2 measures the percentage of children with full immunization (as recommended by national immunization schedules). Thus, disruption of Routine immunization directly impacts India's ability to accomplish Sustainable Development Goals^[6]. This could lead to increased morbidity and mortality from VPDs in countries with already poor coverage rates of routine immunization. Incidentally, Indonesia, India, and Pakistan comprise the highest number of COVID-19 cases and these countries also have the highest number of children with missed immunization. Due to recent pandemic, routine health services were interrupted and it is critical to understand the impact of this pandemic on childhood routine immunizations, possible future VPD outbreaks and reappearance of polio cases in polio free countries^[10]. This study was conducted with an objective to find out the routine immunization status of under five children registered in urban and rural anganwadis in pre and during COVID-19 pandemic.

Materials And Methodology

It was a descriptive cross-sectional study conducted among under-5 children in urban and rural areas of district Jabalpur, Madhya Pradesh. Sample size for Urban and Rural area was calculated separately according to the formula:

$$N = Z^2 pq / d^2$$

According to NFHS 4, district Jabalpur, MP^[15] had 61.8% immunization coverage among children under-5 years of age in urban area. Taking it as a prevalence, relative error (d) as 5.5% of prevalence (P) and Z as 1.96 the sample size for urban area was calculated as 785. After adding 10% non-respondents, the final sample size was 864.

The selection of these 864 subjects was done by multistage random sampling technique. There are 79 wards under the Jabalpur municipal corporation. Of these, 10 wards were randomly selected. From each selected ward, 2 anganwadi centers were selected randomly. Then, 45 children were selected randomly from each anganwadi center by simple random sampling. Pre-designed and pretested structured questionnaire was used for interview of mother's and care giver.

According to NFHS-4 data for district Jabalpur, MP^[15], immunization among children under-5 years of age in rural area of Madhya Pradesh was 73.6%. Taking 73.6% as prevalence, relative error (d) as 7% of prevalence (P) and Z as 1.96, the sample size for rural area was calculated as 281. After adding 10% non-respondents, the final sample size came out to be 309.

The selection of study subjects of rural area was done by multistage random sampling technique. In rural area, there are 7 blocks, from them 2 blocks were selected randomly. From each block, 5 gram panchayats were selected by simple random sampling. From each gram panchayat, 1 village was selected. And From each village, 1 anganwadi center were selected randomly. Then, 35 children were selected from each anganwadi by using simple random sampling.

The face to face interview of the mother's / care giver of study participants was conducted after

explaining the aims and objectives of the study. The written informed consent was taken from mother / care giver. Pre-COVID-19 and during COVID-19 immunization data of under-5 children was collected by record review of anganwadis and Mother Child Protection (MCP) cards with the reference of National Immunization Schedule^[16]. Each mother/care giver had the freedom to opt out from the study. During the study, Mother of unimmunized or partially immunized children were counselled and motivated for getting the children immunized. And if any subject was found to be moderately malnourished, then nutritional and health education was given to mother or primary caregiver of child and for severely malnourished, child sent for nutrition and rehabilitation center (NRC).

The **inclusion** criteria were 1. The functional anganwadis equipped with staff and giving regular services. 2. Only under-5 registered children in urban and rural anganwadi in Jabalpur district. **Exclusion criteria:** 1. Registered children not available at the time of survey. 2. Critically ill children and 3. Mother not willing to participate in this study.

The data was recorded in the pre-designed proforma and then entered in Microsoft Excel 2016.

Various codes were assigned to the variables and analyzed using McNemar as statistical test to find p-value by using software –SPSS version 16. Ethical consent was taken from the institutional ethical committee (IEC/2020/123).

RESULT

In the present study total 1250 under-5-year aged children participated. Of these 900 belonged to urban areas and 350 belonged to rural areas.

Table 1 Socio-demographic characteristics of study participants

Socio-demographic characteristics	Urban (N=900) N (%)	Rural (N=350) N (%)	Total (N=1250) N (%)
Gender			
Male	443 (49.22)	164 (46.86)	607 (48.56)
Female	457 (50.78)	186 (53.14)	643 (51.44)
Total	900 (100)	350 (100)	1250 (100)
Religion			
Hindu	746 (82.89)	338 (96.57)	1084 (86.72)
Muslim	154 (17.11)	12 (3.43)	166 (13.28)
Total	900 (100)	350 (100)	1250 (100)
Caste			
General	162 (18.00)	18 (5.14)	180 (14.40)
OBC	590 (65.56)	154 (44.01)	744 (59.52)
SC	119 (13.22)	67 (19.14)	186 (14.88)
ST	29 (3.22)	111 (31.71)	140 (11.20)
Total	900 (100)	350 (100)	1250 (100)
Education of Mothers of Child			
Illiterate	6 (0.67)	0 (00)	6 (0.48)
Literate	32 (3.56)	44 (12.57)	76 (6.08)
Primary school	162 (18.00)	156 (44.57)	318 (25.44)
Middle school	171 (19.00)	88 (25.14)	259 (20.72)
High school	216 (24.00)	32 (9.14)	248 (19.84)
Intermediate or Post high school	111 (12.33)	3 (0.86)	114 (9.12)
Graduate	99 (11.00)	10 (2.86)	109 (8.72)
Post graduate and Above	84 (9.33)	13 (3.71)	97 (7.76)
Professional degree	19 (2.11)	4 (1.14)	23 (1.84)
Total	900 (100)	350 (100)	1250 (100)
Occupation Of Parents			
Unemployed	5 (0.56)	0 (0)	5 (0.40)
Unskilled	313 (34.78)	231 (66.00)	544 (43.52)
Semi-skilled	116 (12.89)	46 (13.14)	162 (12.96)
Skilled	217 (24.11)	31 (8.86)	248 (19.84)
Clerk/Shopkeeper/Farmer	148 (16.44)	34 (9.71)	182 (14.56)
Semi-professional	65 (7.22)	6 (1.71)	71 (5.68)
Professional	36 (4.00)	2 (0.57)	38 (3.04)
Total	900 (100)	350 (100)	1250 (100)
Total Number Of Children			
1	225 (25.00)	63 (18.00)	288 (23.04)
2	444 (49.33)	183 (52.29)	627 (50.16)
≥ 3	231 (25.67)	104 (29.71)	335 (26.80)
Total	900 (100)	350 (100)	1250 (100)
Birth order number of child			
1	381 (42.33)	128 (36.57)	509 (40.72)
2	390 (43.33)	140 (40.00)	530 (42.40)

3	105 (11.67)	74 (21.14)	179 (14.32)
>3	24 (2.67)	8 (2.29)	32 (2.56)
Total	900 (100)	350 (100)	1250 (100)
Family Type			
Joint	264 (29.33)	119 (34.00)	383 (30.64)
Nuclear	326 (36.22)	75 (21.43)	401 (32.08)
Three generation	310 (34.44)	156 (44.57)	466 (37.28)
Total	900 (100)	350 (100)	1250 (100)

In Fig. A, the majority of childhood immunization was done in pre-COVID time was 868 (96.44) belonged to urban areas while during COVID it was only 278 (79.43) belonged to rural areas.

Due to COVID-19 pandemic, immunization was affected in both urban (with McNemar's Chi-Squared = 134.815, df= 1, p Value = 0.00) and rural (with McNemar's Chi-Squared = 36.91, df= 1, p Value = 0.00) areas and the difference found to be statistical significant. (Table 2)

Figure A: Locality wise distribution of immunization status

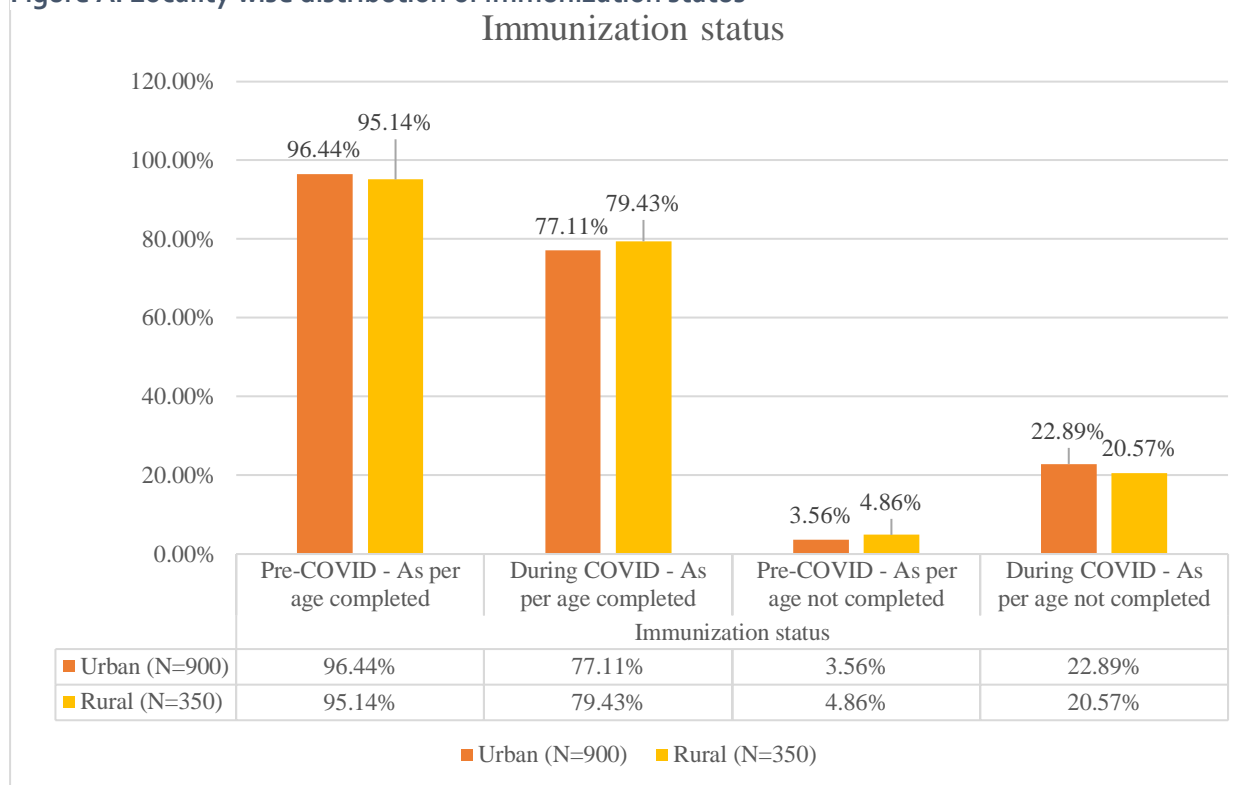


Table 2 Locality wise distribution of pre and During COVID routine immunization status

URBAN		During COVID routine immunization			p Value
		As per age completed	As per age not completed	Total	
Pre COVID routine immunization	As per age completed	670 (74.4%)	198 (22.0%)	868 (96.4%)	0.00
	As per age not completed	24 (2.7%)	8 (0.9%)	32 (3.6%)	
	Total (900)	694 (77.1%)	206 (22.9%)	900 (100%)	

*Mc Nemar's Chi-Squared = 134.815, df= 1

RURAL		During COVID routine immunization			p Value
		As per age completed	As per age not completed	Total	
Pre COVID routine immunization	As per age completed	266 (76.0%)	67 (19.1%)	333 (95.1%)	0.00
	As per age not completed	12 (3.4%)	5 (1.4%)	17 (4.9%)	
	Total (900)	278 (79.4%)	72 (20.6%)	350 (100%)	

*Mc Nemar's Chi-Squared = 36.91, df= 1

The reasons for not taking vaccines by parents / caretaker were anganwadi closure during lockdown (66.67%) was found to be higher in rural areas followed by fear among them regarding COVID infection (28.64%) and mother were not aware about missed doses of vaccine (11.17%) were higher in urban areas.(Fig. B)

Fig B: Locality wise distribution of Reasons for not taking vaccine during COVID

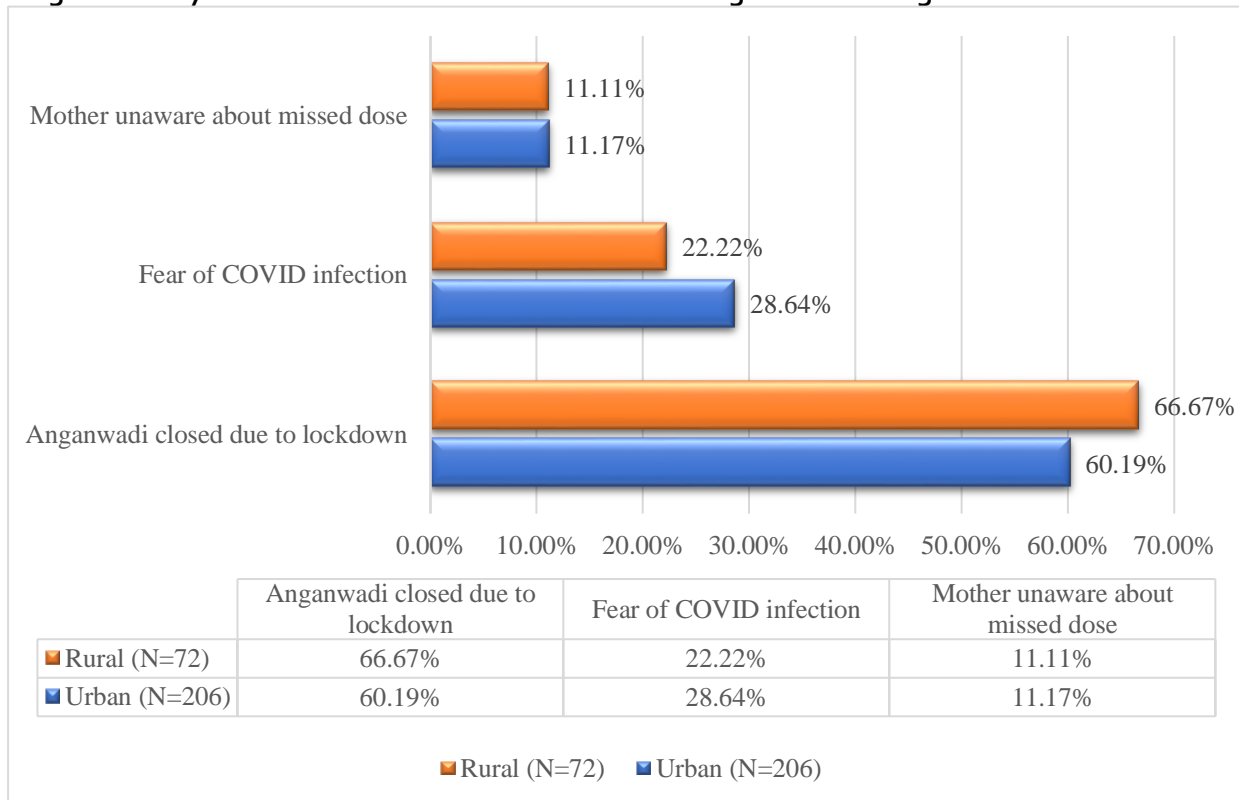
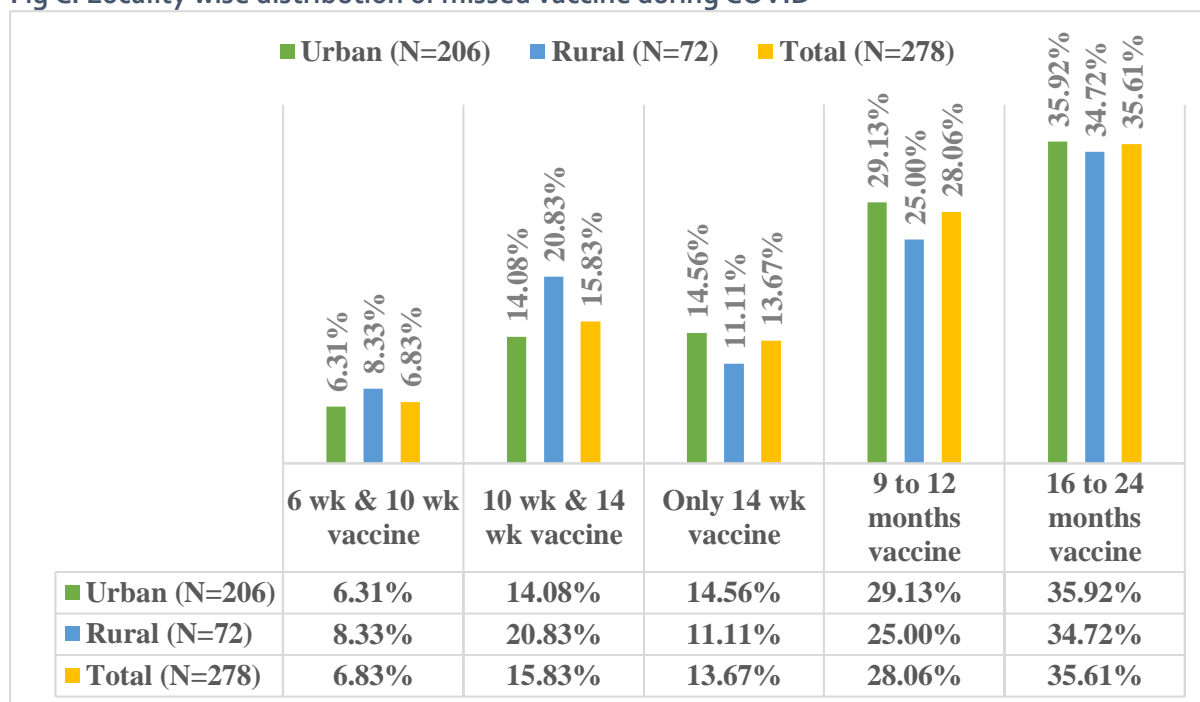


Figure C was showed about missed vaccine during COVID, vaccine taken during 16 to 24 months of age was found to be higher in urban

(35.92%) than rural (34.72%), followed by 9 to 12 months' vaccination, 10 weeks + 14 weeks and others.

Fig C: Locality wise distribution of missed vaccine during COVID



DISCUSSION

In the present study comprising of 900 under-5-year aged children from urban area, 457 (50.78%) were female and 443 (49.22%) were male children while in rural area out of 350 children 186 (53.14%) were female and 164 (46.86%) were male. And there was overall child sex ratio was found to be 1059 per 1000 males in present study.

According to NFHS 5 India^[17] and M.P.^[18], Overall child sex ratio was 929 and 956 per 1000 males respectively. Both India and M.P. NFHS data was almost similar while NFHS 5 Jabalpur^[19], had overall child sex ratio was 1,111 per 1000 males. The NFHS 5 Jabalpur data was improved in favor of girl child and also in concordance with that of the present study.

According to census 2011^[20], maximum proportion of population in District Jabalpur were Hindu (87.65%) followed by Muslims (8.27%). In rural areas the percentage of mothers who were educated up to middle class was found to be higher in rural population (99.12%) as urban population (85.76) while high school and above was found be higher in urban population (14.24%) as compare to rural population (0.88%). This data was in concordance with present study data.

It was evident that childhood vaccination was significantly affected by COVID-19 pandemic and it was reported by different studies from different part of the globe by C. A. Teasdale et al.^[21], Moura et al.^[22], Singh et al.^[22] and McDonald H.L. et al.^[23] within the range of 25% to 30% in year 2020 as compared to previous year. Among parents the most commonly reported reasons was fear of exposure to COVID-19, parents were more cautious as their child might get infected during vaccination session. Present study was also showing 22.24% routine vaccination was affected by COVID-19 pandemic and those studies results were in concordance with present study result.

A study done among under five years age of children during COVID-19 pandemic by Sharma et al.^[6] on routine immunization, they reported declined due to suspension of vaccination campaigns and migration of people from urban to rural areas due to lockdown. Present study also showed that, cases of COVID-19 were found more in urban area as compare to rural area during pandemic and due to this people moved from urban to rural areas as well closure of Aanganwadis during lockdown. The Sharma et al.^[6] also reported that all supplementary immunization activities, polio eradication strategies were suspended due to COVID-19

crises. After pandemic started, parents were worried for them self or their kids for getting COVID infection during routine immunization was the most common cause of disruption (20%), immunization session cancellation (15%) and travel restrictions due to national lockdown (10%). Overall, the most common reason in present study was closer of anganwadis due to COVID-19 pandemic during lockdown, followed by fear of infection among parents and unaware mothers regarding vaccination schedule. Present study results were also showing that routine immunization was declined higher in urban areas as compare to rural areas.

Many more studies by various researchers, B. Walker, A. Anderson, C. Stoecker et al., H. Sell, A. Assi, S. Michelle Driedger et al.^[24], and M.F. Silveira, C.T. Tonial, A. Goretti K. Maranhao et al.^[11] found that many children missed their childhood immunization during COVID-19 pandemic which significantly affected the coverage of vaccination in their respective areas due to restrictions on movement, infection control measures were increased, closures of anganwadis, schools and clinics, and increased public hesitancy to attend clinics/appointments were also frequently reported due to pandemic. These study finding was similar with present study. Khan et al.^[25] and S. Chandir et al.^[10] in Pakistan this study on the childhood immunization and found that it was affected more in rural population than urban population due to lockdown in order to reduce the risk of COVID-19 transmission. Parents had fear of COVID exposure during vaccination session because personal protective measures like masks, goggles, sanitizers, hand wash etc were not available at rural vaccination sites in early period of pandemic. Present study was not in concordance with above study as childhood immunization was affected more in urban than rural areas because there was too much cases of COVID-19 in urban population and Anganwadi workers/helpers, Auxiliary nurse midwives (ANMs) were also engaged in COVID duties.

A multi-centric retrospective cohort study done by Y. Zhong et al.^[8] reported that significant drop in coverage of vaccination since start of COVID-19 pandemic and the coverage rate of all vaccines were significantly affected. In April 2020, The MR vaccination coverage got

significantly dropped by 25% in public sector. The most common reasons were closure of borders with closure of health facilities and hesitance of parent or caretaker to visit vaccination sites due to contagious infection of corona virus. A study on missed routine immunization during pandemic was done by M. F. Silveira et al.^[11] found that decline of BCG was 0%, Hepatitis B was 1%, Pentavalent and Polio was 18% and MMR was 27 % due to logistic difficulties and implementation of social distancing was strongest during lockdown period. Present study also showed that overall decline was more in Measles and Rubella vaccines (35.61%) followed by IPV, Pentavalent and Oral polio vaccines. These study finding was similar with present study.

Singh et al.^[22] and Abid et al.^[7] carried out a study, and also found that decline of Measles was 28% Due to disruption of global vaccines manufacturing, supply chains and healthcare services, also due to borders were closed and suspension of vaccine companies that led to lacks of vaccine and other health care related supplies in the county which is almost similar with present study. The study had the limitation of not being able to track those under five children who were not registered in anganwadi or vaccinated from private facility.

Conclusion

The most challenging and fearful public health crisis of this generation was COVID-19 pandemic and it had affected services with various reasons like lockdown, overburdened health workers, fear of infection among parents as well workers and adherence to COVID appropriate behaviours. Those who have missed their vaccination on schedule time for vaccination due to pandemic, they could be exposed to vaccine-preventable diseases like measles and polio. And there was chance of outbreak of VPD during and after COVID pandemic. The study findings showed that VPD can be prevented by vaccination of missed out children.

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