

## Impact of COVID-19 Pandemic on routine childhood immunization services during lockdown and post lockdown in a tertiary care centre of Western Maharashtra, India.

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### Abstract

**Objective:** To study the impact of Severe Acute Respiratory Syndrome CoronaVirus-2 (SARS-CoV-2) disease Pandemic lockdown on routine childhood immunization, considering the limited healthcare and transport facilities while reaching the tertiary care hospital.

**Methods:** It was a hospital based observational study done in a tertiary care centre in Western Maharashtra comparing 4 periods of year 2020, each consisting of 4 weeks viz 1-28<sup>th</sup> of February, 1-28<sup>th</sup> of May and 1-28<sup>th</sup> of August and 1-28<sup>th</sup> of December.

**Results:** Total number of vaccine beneficiaries decreased significantly during lockdown from 2687 in February to 1688 in May and improved in August to 2091 and almost to pre-lockdown levels i.e. 2295 in December. The percent reduction was maximally seen in beneficiaries receiving DPT-b1 followed by DPT-1+MR-2, MR-1 and combination vaccines. The category least affected was the birth dose with reduction of 19% during lockdown and 15.6 and 14.3% reduction comparing pre-lockdown levels

**Conclusions:** Significant reduction is found in total number of children receiving immunization during lockdown period, compared to pre-COVID level. The reduction during unlockdown-1 and unlockdown-2 was not statistically significant. This difference was more significant in booster doses compared to birth doses. There was increase in the number of beneficiaries in August and still more in December 2020 after 7 months of un-lockdown but not more than the pre-lockdown levels, significant concern for public health was found only in lockdown.

**Keywords:** Combination vaccines, Lockdown, Pentavalent, Measles

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### I. Introduction

The covid-19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease 2019 (COVID-19), which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was first identified in December 2019 in Wuhan, China. The World Health Organization declared a Public Health Emergency of International Concern on 30 January 2020, and later declared a pandemic on 11 March 2020 for the first time since the swine flu (H1N1) in 2009. As of 22 June 2021, more than 178 million cases have been confirmed, with more than 3.87 million confirmed deaths attributed to COVID-19, making it one of the deadliest pandemics in history.<sup>[1-3]</sup> The COVID-19 pandemic has been unprecedented in its scale and impact and has necessitated measures such as regional or country-wide lockdowns, travel restrictions, and social distancing. Even where these restrictions have successfully reduced transmission, further waves of COVID-19 may require their reimposition. However, these measures have led to unintended health consequences, including disruption of routine immunization services. Timely vaccination is widely accepted as a highly successful public health intervention. Many rural vaccination clinics and many private hospitals suspended service during the pandemic and rerouted care to urban centers, creating transportation challenges for those seeking immunization in remote communities. If these individuals have to travel farther to access routine immunizations, they may be discouraged entirely and decide against it.

Once the recommended age of immunization or maximum interval for follow-up doses has passed, the utility of a catch-up dose may no longer be beneficial.

The immunization services had to bear the brunt of these unprecedented circumstances and various on-site and community immunization services were severely affected. Delayed or missed vaccination can make children susceptible to preventable diseases and may also affect herd immunity. Vaccine-preventable diseases (VPD) remains an important issue that requires adherence to recommendations to prevent severe illnesses in children. According to WHO, VPD is a threat to 80 million children under one year worldwide because of disruption in healthcare services due to COVID-19 pandemic. To avoid the impact of disruption in immunization, as per MoHFW guidelines, vaccination of institutionally delivered newborn was started. Further since July 2020, proper routine immunization sessions were started on daily basis.<sup>[4,5]</sup> Multiple factors like phasic unlock down, fear of catching COVID-19 infection from hospitals, unavailability of public transport and lack of awareness regarding priority of routine immunization have adversely affected health seeking behavior and routine immunization visits to health care facilities. Some data regarding the impact of lockdown on immunization coverage is available but published data showing immunization coverage during post lockdown period is still scarce. So, we conducted a study with an aim to analyze the impact of COVID-19 pandemic on routine childhood immunization during lockdown and post lockdown period over few months in phasic manner in a tertiary care centre of western Maharashtra. The similar study done in Meerut, UP has shown that there has been a significant negative impact of COVID19 pandemic on attendance of children availing routine immunization services even after 6 months of unlock down. The major setback has been seen for booster doses of Measles, Rubella, and DPT followed by pentavalent vaccines. BCG and other vaccines administered at birth are nearly approaching pre-COVID levels. <sup>[6,7]</sup>

## **II. Materials And Methods**

This is a hospital based retrospective analytic study done at a tertiary care centre in Western part of Maharashtra. We divided the study group in 4 phases over an equal duration of 4 weeks. Pre-COVID phase: 1-28th February 2020. COVID Lockdown phase: i.e. 1-28th May 2020. Unlockdown-1: Two months after the end of lockdown i.e. 1-28th August 2020. Unlockdown-2: Six months after the end of lockdown. All children attending immunization clinic of pediatric OPD age 0 days to 5 years were included in the study group. Data was collected from hospital records including name, date, age, sex, vaccine administered and entered in Microsoft excel version 2016. Calculations were done and data was analyzed to see total number of children receiving vaccines for all the four periods on weekly basis to study any change in trend of number of vaccine beneficiaries over time and also aggregated count over 4 weeks duration. The hospital follows National immunization schedule which targets 11 VPDs beginning at birth and subsequently at 6, 10 and 14 weeks, 9 months, 16-24 months and 5 years. The vaccines are against tuberculosis, hepatitis B, diphtheria, tetanus, pertussis, Polio, H. influenza B, rotavirus, pneumococcus, measles and rubella.<sup>7</sup> We divided the vaccines in 5 groups as below.

1. Children receiving birth dose vaccine including BCG, Hepatitis B and OPV- 0 dose.
2. Children receiving primary doses of combination vaccine including pentavalent, OPV, IPV, and rotavirus vaccine.
3. Children receiving MR1.
4. Children receiving MR-2 with DPT 1 booster.
5. Children receiving DPT booster 2.

Comparative study was done between February and May data i.e. pre COVID and lockdown, February and August i.e., pre COVID and unlockdown-1 and February and December i.e. pre COVID and Unlockdown-2 and appropriate statistical tests were applied.

We hypothesized that lockdown has impacted the beneficiaries receiving routine immunization. The aim of study was to observe the impact of immunization prior, during and post lockdown, where facility to reach tertiary care hospitals during lockdown period were limited and many of the primary and peripheral health care centers were closed because of the lockdown.

## **III. Results**

The present study shows that during the lockdown period the absolute number of children receiving routine immunization was significantly lower in May 2020 ((n=2295) as compared to the pre COVID period of February 2020 (n=2687) with the p-value of 0 which is not statistically significant using unpaired t test of equal variance (Table 1, Figure 1). Table 2 shows the comparison among different vaccines group between February 2020 and August 2020 with percent reduction and p value. Table 3 shows the comparison among different vaccines group between February 2020 and December 2020 with percent reduction and p value.

**Table 1: Vaccination received during February, May, August and December study period.**

Variables	February	May	August	December
Birth dose*	1874	1531	1581	1606
Combination Vaccine**	639	157	431	546
MR-1	48	5	25	39
MR-2+DPT-1	110	3	49	94
DPT-2	16	0	5	10
Total	2687	1688	2091	2295

\*Birth dose includes BCG, OPV and Hepatitis B.

\*\*Combination Vaccine includes Pentavalent, IPV, Rota Virus and Pneumococcal vaccines

There was 19% reduction in number of children receiving birth dose in May 2020 (n=1531) as compared to February 20 (n=1874) with the p value of 0.005 which was statistically significant. Whereas, in August and December '20 the number of infants receiving birth dose are n=1581 and 1606 respectively with p values being 0.00 in both August and December which is not statistically significant, those approached nearly to pre COVID time of February 2020 (n=1874) with reduction of just 15.6%.

Similarly, there was an alarming decline in the number of beneficiaries receiving primary doses of combination vaccines, with a 75% reduction in number of children in May '20 (n=157) comparing pre-lockdown (February n=639) with p value of 0.005 which was statistically significant. And also, in Unlockdown-1 i.e. August '20 (n=431) and in Unlockdown-2 i.e. December as compared to February '20 (n=639), there was 32.5 and 14.6 % respectively reduction in combination vaccines with p value of 0.00 which was statistically not significant. The number of vaccines started showing increase in trend in December '20 as compared to August '20 and in August '20 as compared to May '20. Although the number was less than the pre-lockdown phase, there was no statistically significant reduction during unlockdown-1 and 2 comparing pre-lockdown, though it was present during lockdown. (Table-2, Table-3, Table-4).

**Table 2: Vaccine comparison between February and May study period**

Variables	February(pre-lockdown)	May(lockdown)	% Change	P value #
Birth dose*	1874	1531	19	0.005
Combination vaccine**	639	157	75	0.0001
MR-1	48	5	90	0.0001
DPT-1 + MR-2	110	3	97	0.0001
DPT-2	16	0	100	NA
Total	2687	1688	37.17	0.001

\*Birth dose includes BCG, OPV and Hepatitis B.

\*\*Combination Vaccine includes Pentavalent, IPV, Rota Virus and Pneumococcal vaccines. #P value determined by unpaired t test of equal variance

**Table 3: Vaccine comparison between February and August study period:**

Variables	February(pre-lockdown)	August(unlockdown-1)	% Change	P value #
Birth dose*	1874	1581	15.6	0.000
Combination vaccine**	639	431	32.5	0.000
MR-1	48	25	47.9	0.003
DPT-1+MR-2	110	49	55.5	0.000
DPT-2	16	5	68.8	0.004
Total	2687	2091	22.2	0.000

\*Birth dose includes BCG, OPV and Hepatitis B.

\*\*Combination Vaccine includes Pentavalent, IPV, Rota Virus and Pneumococcal vaccines. #P value determined by unpaired t test of equal variance.

**Table 4: Vaccine comparison between February and December study period:**

Variables	February(pre-lockdown)	December(unlockdown-2)	% Change	P value#
Birth dose*	1874	1606	14.3	0.00
Combination vaccine**	639	546	14.6	0.00
MR-1	48	39	18.8	0.98
DPT-1+MR-2	110	94	14.5	0.08
DPT-2	16	10	37.5	0.08
Total	2687	2295	14.6	0.00

\*Birth dose includes BCG, OPV and Hepatitis B.

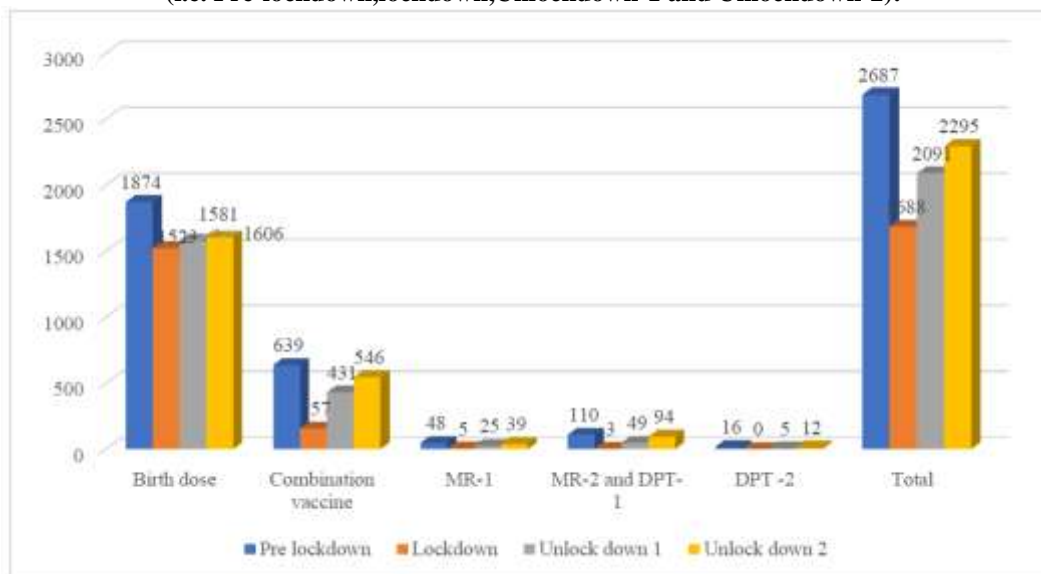
\*\*Combination Vaccine includes Pentavalent, IPV, Rota Virus and Pneumococcal vaccines. #P value determined by unpaired t test of equal variance

There was 90% reduction in May'20(n=5) in beneficiaries receiving MR-1 vaccination comparing pre-lockdown i.e. February'20 (n=48) and 47.9 and 18.8% reduction in Unlockdown-1 i.e. August '20 (n=25) and Unlockdown-2 i.e. December'20 (n=39) respectively for MR-1 beneficiaries as compared to February'20 with a p value of 0.0001 during lockdown and 0.003 during Unlockdown-1 and 0.98 during unlockdown-2 . Overall there was statistically significant reduction in MR-1 beneficiaries during lockdown and Unlockdown-1 as compared to pre-lockdown, though during Unlockdown-2, number was less than the pre-lockdown phase, the reduction was not statistically significant.

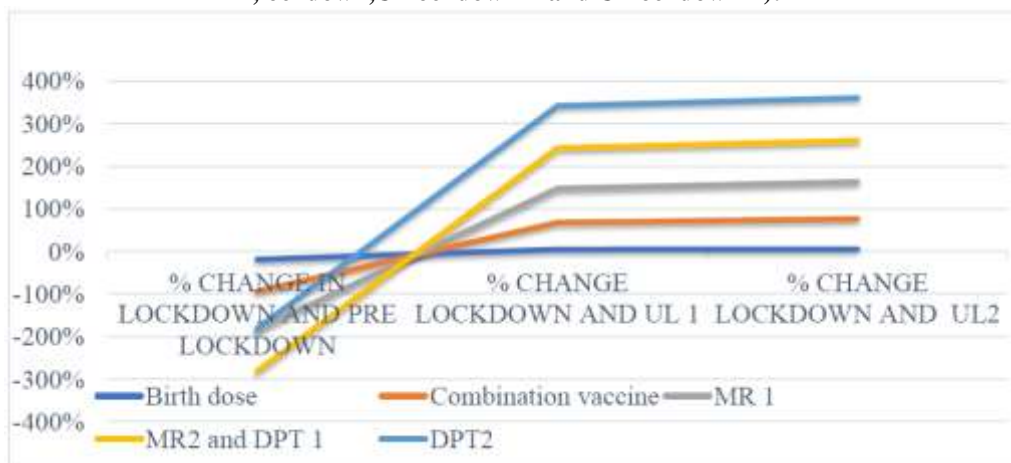
In case of beneficiaries receiving DPT-1+MR-2 category, the reduction was 97%,55.5% and 14.5% during lockdown i.e. May'20(n=3),Unlockdown-1 i.e. August'20(n=49) and Unlockdown-2 i.e. December(n=94) respectively comparing pre-lockdown i.e. February (n=110).The corresponding p values are 0.0001,0.000 and 0.08 which implies, though there was reduction in beneficiaries receiving DPT-1+MR-2 ,it was statistically significant only during lockdown phase and not during Unlockdown-1 and Unlockdown-2 comparing pre-lockdown.

Finally in beneficiaries receiving DPT-2 category, the reduction was 100,68.8 and 37.5 % respectively during lockdown i.e. May'20(n=0),Unlockdown-1 i.e. August'20(n=5) and Unlockdown-2 i.e. December(n=10) respectively comparing pre-lockdown(n=16).The corresponding p values were 0.0001,0.004 and 0.08 respectively. Though there was reduction in DPT-2 beneficiaries during lockdown,Unlockdown-1 and Unlockdown-2 comparing pre-lockdown, it was statistically significant only during lockdown and Unlockdown-1 and not during Unlockdown-2.

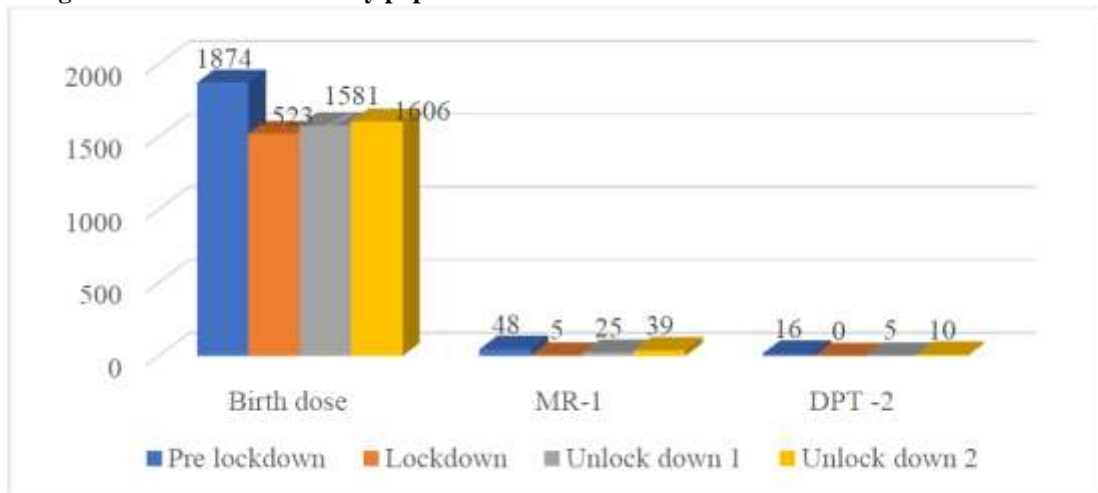
**Figure-1: Distribution of study population based on vaccines at four different time intervals (i.e. Pre-lockdown,lockdown,Unlockdown-1 and Unlockdown-2):**



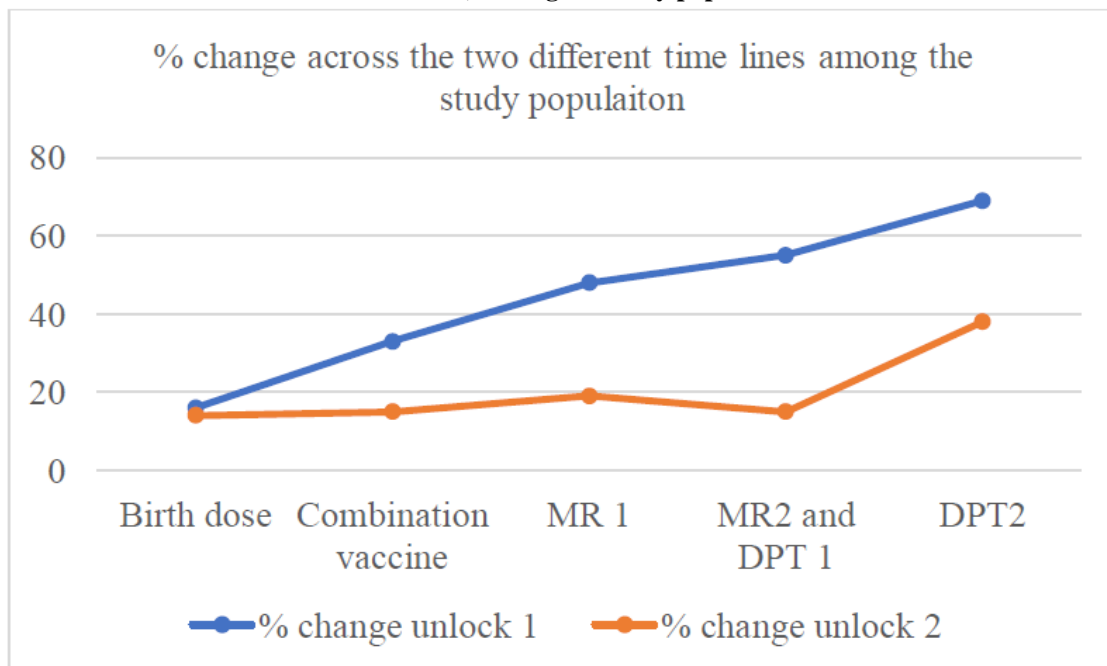
**Figure-2: % Change across the four different time lines among the study population (i.e Pre-lockdown ,lockdown,Unlockdown-1 and Unlockdown-2):**



**Figure-3: Distribution of study population based on vaccines at four different time intervals:**



**Figure 4: Comparison of % change across the two different time lines(i.e. unlockdown-1 and unlockdown-2) among the study population.**



#### IV. Discussion:

The present study shows that during the lock-down period absolute number of all beneficiaries receiving routine immunization was lower in May 2020(lockdown) as compared to February 2020(pre-lockdown).The present study also shows that during unlock down period also number of beneficiaries receiving routine immunization was lower in August(unlockdown-1) and December(unlockdown-2) comparing February(pre-lockdown) in the year 2020 but comparatively more during August(unlockdown-1) than December(unlockdown-2).Similar results were shown by a study conducted in Gujarat by Patel et al where they compared the period of lockdown with same period of previous year.8 and in Uttar Pradesh by Archana et al where they compared the period of pre-lockdown and unlockdown-1 and unlockdown-2.

Also, similar results have been documented in a study of Saudi Arabia, Pakistan and England. [9-11]The least affected group was children receiving birth doses as after the guidelines of Ministry of Health and Family Welfare on 15th April, our hospital resumed administration of birth doses to all institutionally delivered babies and by December end it has reached almost to the Pre- covidnumbers. This is comparable to the study conducted by Archana et al.

Patel et al has shown a significant decrease in vaccination of birth doses in the month of May 2020 during lockdown compared to May 2019.From the present study it is clear that there was massive decline in the

number of beneficiaries receiving primary doses of combination vaccines in August (n=157) as compared to February (n=639) and also as compared to the beneficiaries in the month of August (n=186) itself. This was in coherence with the finding of Patel et al in Gujarat. <sup>[11]</sup>

In comparison to August, the children receiving combination vaccine increased in December by 21% and the gap was not much statistically significant in comparison to pre-COVID (February) levels. A major setback has been there for measles and rubella (MR-1) vaccine as the coverage dropped to only 5 during lockdown and 25 beneficiaries during the entire four weeks of August with reduction of 90 and 48% in comparison to February, it later improved in December in comparison to August period (39 versus 25) but still far from pre-COVID target. Helen et al found 19% reduction in first 3 weeks of lockdown compared to 2019 which rose later despite continuation of lockdown.<sup>11</sup> Similarly, Patel et al showed reduction of MR vaccination count by 78.57% in the month of May 2020 compared to 2019.

Also massive decrease has been found in children receiving booster doses of DPT-b1 and MR-2 with a decline of 97% in the month of May and 55.5% in August and 14.5% in the month of December showing that there was good catch up in the last four weeks of the year. Even other vaccines like BCG and combination vaccines have shown improving trend to a larger extent by the end of this year. It also highlights that for the children of older age group, the parents are still avoiding routine immunization (RI) sessions which is a cause of great concern for the resurgence of VPD epidemics as well as it is mitigating the positive impact of MR campaign conducted in 2018-19 in India. Similar findings were also observed during Ebola outbreak in 2014.

The worst hit category was children receiving DPT 2nd booster coverage during lockdown and unlockdown-1, which is due at 5 years of age as per National immunization schedule which decreased from 16 (pre-lockdown) to 0 (during lockdown) and to 5 (during unlockdown-1) and which become near to pre-lockdown range during unlockdown-2 (10), re-emphasizing the parents lack of concern for booster doses as against the fear of exposure to COVID infection, findings of which is similar to the study conducted Archana et al and by Patel et al. <sup>[8]</sup>

Measles is one of the most transmissible infections, and immunization rates tend to be lower than for other Extended Program of Immunization (EPI) vaccines, due in part to the older age at which measles vaccine must be administered i.e. 9 months versus 6 weeks or younger for the first dose of other vaccines. For this reason, explosive measles outbreaks are often an early result of health system failure. Outbreaks have followed disruptions due to war, natural disasters and any other calamities.

The benefits of immunization far outweigh the risk associated with it. WHO and thereafter MoHFW has declared immunization as an essential health care activity even during covid-19 pandemic. Advisory Committee on Vaccine and Immunization Practices (ACVIP) recommends even for practitioners that all routine vaccinations be administered as scheduled, even during the COVID-19 pandemic as it is an essential health activity.

## V. Conclusion

There is significant improvement among the beneficiaries of routine immunization during unlockdown-1 comparing during lockdown and still more during unlockdown-2, but which is still lower than that of the pre-lockdown times. Hospitals in areas where the pandemic has caused devastation continue to struggle as many challenges remain unmet due to the speed of transmission, the lack of accurate knowledge regarding the benefits or pitfalls of the current available therapies, and the uncertainty of being able to provide adequate care if the rate of transmission continues. The pool of un-immunized children was expanding during lockdown, leaving them susceptible to vaccine-preventable diseases. There is a need for tailored interventions to promote immunization visits and safe service delivery. Higher maternal education, facility-based births, and early enrollment into the immunization program anticipating further waves of covid-19 pandemic, parents were counselled regarding continuation and follow up for routine immunization practices according to the National immunization schedule even during the lockdown as all the above measures continue to show a positive association with immunization uptake. When a lot of lives are on the line, it's hard for health authorities to make decisions. This is where science can help. It may seem cold to assess lives as numbers, but it's the best way to save as many people as possible – and keeping up with vaccination programs will do that.

**Conflict of interest:** None

**Funding strategies:** None as this was a database observational study

**Ethical committee response:** clearance taken from institutional ethics committee.

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