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Paediatrics Section

Missed Vaccinations in Children during the COVID-19 Pandemic

KIRAN BASAVARAJA[1], SUMAN MEENAKSHI GURURAJA[2], GEETHA MANNIVANAN[3], SANTOSH SRINIVASIAH[4]

ABSTRACT

Introduction: During the Coronavirus Disease 2019 (COVID-19) pandemic, lockdown was imposed to break the rapid spread of infection which hampered many essential services. This included medical services and particularly the scheduled vaccinations among children. Consequently, many children missed or delayed vaccinations.

Aim: To find the incidence and reasons for missed/delayed vaccination in children during the COVID-19 pandemic.

Materials and Methods: This was a prospective hospital-based cross-sectional study done in the Department of Paediatrics, East Point College of Medical Sciences and Research Centre, Bengaluru, Karnataka, India from March 2020 to February 2021. The total number of patients studied were 515. The samples included all children aged 0-10 years attending the Paediatric Outpatient Department (OPD) for vaccination. Details about age, gender, address, parental details of education, occupation and income were recorded, using a questionnaire. Immunisation card was checked to ascertain whether any of the vaccines were missed or delayed and advice about catch up vaccination was given. The reasons for delay or missed vaccinations were recorded. Multivariate logistic regression was used to compare different classes of population with delay and as per schedule classes of children for individual vaccines.

Results: The mean age of the population was 13.77 months. Delay in vaccinations was seen in 213 (41.35%) children, among among them were 94 (44.13%) girls, and 119 (55.86%) boys. Mean age of the population with delay/missed vaccinations were 21.23 months. Main cause cited in 88.2% cases for delayed/missed vaccination was fear of getting infected with Covid-19 during hospital visits. The vaccinations with most significant delay were pentavalent vaccination at 10 weeks with a mean age of delay being 1.1 month as per National Immunisation Schedule (NIS) and Typhoid vaccination as per in Indian Academy of Paediatrics (IAP) schedule with a mean age of delay of 5.2 months. The vaccinations were delayed in all socio-economic classes of the populations during the study period.

Conclusion: The COVID-19 pandemic has hampered all healthcare services including immunisation. Intentional vaccine delay due to any reason by parents should be avoided and catch up immunisation should be given at the earliest.

Keywords: Coronavirus disease 2019, Lockdown, Vaccine preventable diseases

INTRODUCTION

Delayed or missed vaccinations make children susceptible to certain Vaccine Preventable Diseases (VPD) and may also affect herd immunity [1]. It has to be emphasised that VPD can be a threat and cause significant illness in children if there is non compliance towards the recommended immunisation schedules [2]. According to World Health Organisation (WHO), VPD is a threat to 80 million children worldwide because of the disruption of the healthcare systems due to the COVID-19 pandemic [3]. As per Advisory Committee on Vaccine and Immunisation Practices (ACVIP) among essential health activities, continuing routine vaccinations as per schedule even during the COVID-19 pandemic was recommended [4].

The benefits of immunisations outweigh the associated risks. The importance of continued immunisation activities is further emphasised by the observation that during the 2014-15 Ebola outbreak, the increase in mortality due to measles, malaria, HIV/AIDS and tuberculosis due to failures in health system outnumbered mortality from Ebola itself [5]. In a benefit-risk analysis of health benefits versus excess risk of SARS-CoV-2 infection in Africa, it was estimated that in a high mortality scenario, for every one excess COVID-19 death attributable to SARS-CoV-2 infections acquired during routine vaccination clinic visits, 84 (95% CI 14-267) deaths in children could be prevented by sustaining routine childhood immunisation. The advantages of sustained immunisations extended to their siblings (<20 years) and to other family members also [5].

Studies have documented a huge decrease in immunisation coverage in higher income countries when countries had imposed social distancing and quarantine policies during the initial months of pandemic. In the study done in the USA, the number of children attending immunisation clinics dropped within a week when national emergency was declared [6]. In England, during initial phase of lockdown the uptake of measles, mumps and rubella dropped by 20% and similar reports were also documented from Scotland [7]. In rural Africa, number of children availing vaccinations dropped during the pandemic [8].

Diseases which were previously controlled or eradicated can resurge in parts of population, if vaccinations are missed. Re-emergence of diseases like diphtheria has been documented recently in countries like Venezuela, Pakistan, Nepal, Bangladesh and Yemen due to cessation of vaccination campaigns [9]. In Pakistan, more than 50% decline in daily vaccination was reported in two large scale studies during the COVID-19 lockdown. Similar decline in vaccination was also seen in Senegal during lockdown [10-12].

In this study, the aim was to know the incidence and reasons for missed/delayed vaccinations in children during the COVID-19 pandemic in our hospital.

MATERIALS AND METHODS

This was a prospective, hospital-based cross-sectional study conducted in the Department of Paediatrics, East Point Hospital,

attached to East Point College of Medical Sciences and Research Centre, Bengaluru, Karnataka, India. The study was conducted from March 2020 to February 2021 after ethical committee approval. The Institutional Ethics Committee had approved the study (EPCMSRC/ADM/IEC/2020-21/10).

Inclusion criteria: The study included parents of all children, aged 0-10 years, attending paediatric OPD for vaccination and other children attending OPD for minor illnesses. They were enquired about vaccination status and catch up immunisation was done.

Exclusion criteria: The children of parents who did not give consent were excluded from the study.

Procedure

After obtaining informed consent details about the child's age, gender, parental education, occupation and income, family size, causes for missed and delay in getting vaccination in children were recorded using a questionnaire which was also interpreted in the local language by the doctors collecting the data. All parents and children were checked for fever and asked to wear masks, sanitise their hands and maintain social distancing as per COVID-19 protocol. Immunisation/vaccination card was checked to ascertain whether any of the vaccines were missed or delayed and advice about catch up vaccination was given. NIS (As per NIS schedule 2018) and IAP (As per IAP-ACVIP Recommended immunisation schedule for children 2018-19) immunisation schedule is followed in the institution [4].

For interpretation of data, the children were divided into two groups-children taking vaccination as per schedule for their age, and those who missed or delayed vaccination as per age according to vaccination card.

- 'As per schedule': when children reported for vaccination according to the date given in the vaccination card.
- 'Missed' or 'Delayed vaccination as per age': when children did not visit for the vaccination according to the date given in the vaccination card. The causes for missed vaccinations and delay in getting vaccination in children were recorded using a proforma with a questionnaire.

Primary outcome was to assess if there was a delay intentionally. Secondary outcome was to assess the incidence and reasons for missed/delay immunisations.

STATISTICAL ANALYSIS

The statistical analysis was carried out on the data collected using Statistical Package for Social Sciences (SPSS) version 20.0 for windows. The continuous data was represented in the form of mean and SD and categorical variable is expressed in frequency table and percentages. Multivariate logistic regression was used to compare different classes of population with delay and as per schedule classes of children for individual vaccines. Odds ratio was calculated for the vaccinations which were delayed and the statistically significant delay was considered when p-value was less than 0.05.

RESULTS

Total number of children who came for vaccinations were 515. The details of the population with various demographic details are presented in [Table/Fig-1]. The mean age of the entire population was 13.77 months. The majority of the children were from lower middle class, as per the Modified Kuppuswamy scale [13]. Vaccinations as per schedule was seen in 302 (58.64%) children. Delay in vaccinations were seen in 213 (41.35%) children, out of which 94 (44.13%) were girls and 119 (55.86%) were boys. Mean age of the population with delay was 21.23 months [Table/Fig-2].

Demographic variables		n (%)
Age of children	**Mean±SD**	
<1 year	10.44±2.58	335 (65.04)
1-5 years	25.06±14.06	163 (31.65)
>5 years	108±25.61	17 (3.3)
Mother's Education	Illiterate	18 (3.49)
	Primary schooling	86 (16.7)
	Higher secondary (upto 12th std)	296 (57.47)
	Undergraduate	109 (21.16)
	Post graduate	6 (1.165)
Monthly household income (in rupees)	<10,000	164 (31.84)
	10000-100000	349 (67.76)
	>100000	2 (0.38)
Socio-economic status	Upper	3 (0.58)
	Upper middle	25 (4.8)
	Lower middle	323 (62.71)
	Upper lower	135 (26.21)
	Lower	29 (5.6)

[Table/Fig-1]: Demographic details of the study population (N=515).

Vaccine	Total Immunised	As per Schedule (n, %)	Missed/ Delayed (n, %)	Mean Duration of Delay
BCG, OPV, Hep B	50	43 (86)	7 (14)	6 days
Pentavalent-1, IPV	83	56 (67.5)	27 (32.5)	11 days
Pentavalent-2	69	52 (75.36)	17 (24.63)	1.1 months
Pentavalent-3, IPV	60	39 (65)	21 (35)	13 days
Rotavirus 1st dose	9	5 (55.5)	4 (44.5)	11 days
Rotavirus 2nd dose	14	8 (57.2)	6 (42.8)	18 days
Rotavirus 3rd dose	6	4 (66.7)	2 (33.3)	12 days
PCV 1st dose	14	2 (14.2)	12 (85.8)	10 days
PCV 2nd dose	2	1 (50)	1 (50)	23 days
PCV 3rd dose	3	2 (66.6)	1 (33.3)	6 days
Flu vaccine 1st dose	23	9 (39)	14 (61)	2.1 months
Flu vaccine 2nd dose	2	nil	2 (100)	3 months
MMR 1st dose	23	9 (39)	14 (61)	2.2 months
MMR 2nd dose	2	1 (50)	1 (50)	1.3 months
TCV 1st dose	35	2 (5.7)	33 (94.3)	5.2 months
TCV 2nd dose	24	20 (83.3)	4 (16.7)	4.4 months
Hepatitis A 1st dose	52	38 (73)	14 (27)	5.1 months
Hepatitis A 2nd dose	11	nil	11 (100)	4.2 months
Varicella 1st dose	24	11 (45.83)	13 (54.16)	4.9 months
DPT booster-1	5	0	5 (100)	1 months
DPT booster-2	4	0	4 (100)	1.3 months
Total	515	302	213	

[Table/Fig-2]: Distribution of various vaccines and their mean duration of delay.
BCG: Bacille calmette-guerin; OPV: Oral polio vaccine; hep B: Hepatitis B; Rota: Rotavirus; PCV: Pneumococcal conjugate vaccine; MMR: Measles; Mumps, Rubella (MMR) vaccine; TCV: Typhoid conjugate vaccine; Hep A: Hepatitis A; DPT: Diphtheria-pertussis-tetanus vaccine; BCG:Bacille calmette-guerin; OPV: oral polio vaccine; hep B: Hepatitis B; Rota: Rotavirus; PCV: Pneumococcal conjugate Vaccine; MMR: Measles, Mumps, Rubella (MMR) Vaccine; TCV: Typhoid conjugate Vaccine; Hep A: Hepatitis A; DPT: Diphtheria-pertussis-tetanus vaccine

Causes for missed and delayed vaccinations: Parents reported fear of contracting COVID-19 in 88.2% of the study population, which was the most cited reason for delayed/missed vaccinations.

The other important reasons were COVID-19 related disruptions in immunisations due to lockdown restrictions and lack of transport seen in 75.58%. The other important reasons were vaccine hesitancy due to side-effects like fever which could create panic in parents in 61.97% [Table/Fig-3].

Reason	N (%)
COVID-19 scare	188 (88.2)
Lockdown restrictions	161 (75.58)
Vaccine hesitancy (side-effects)	132 (61.97)
Avoid COVID-19 hospital	119 (55.86)
Family with COVID-19	81 (38.02)
Economic Crisis	74 (34.74)
Non availability of doctors	32 (15.02)
Misinformation	30 (14.08)
Vaccine non availability	28 (13.14)
Ignorance	17 (7.98)

[Table/Fig-3]: Reasons for delay/missed vaccinations (N=213).

Using multivariate logistic regression there is no statistical difference found among different Socio-economic Status (SES) for delayed and non delayed group of children [Table/Fig-4]. Using logistic regression, based on duration of the vaccination, most significant delay were for pentavalent vaccination, at 10 weeks, with a mean age of delay being 1.1 month (as per NIS), and Typhoid vaccination with a mean age of delay of 5.2 months (as per in IAP schedule) [Table/Fig-5].

Socio-economic status	OR (odds Ratio)	p-value	95% CI (Confidence Interval)	
Lower/Upper	1.15	0.913	0.093	14.188
Upper Lower/Upper	0.17	0.153	0.015	1.934
Upper middle/Upper	0.379	0.43	0.034	4.224
Lower Middle/Upper	0.889	0.927	0.07	11.221

[Table/Fig-4]: Regression models for the delayed vaccinations group based on socio-economic status.

DISCUSSION

The most effective method of reducing childhood mortality and morbidity is timely immunisation, which helps to sustain herd immunity. Pandemics have significantly affected healthcare systems increasing the mortality and morbidity across the world. COVID-19 pandemic has caused severe disruptions to health services worldwide, as health system resources have been allocated to the pandemic response, supply chains have been disrupted and travel barriers and fear of contracting the virus have deterred healthcare utilisation [14-16]. In late March 2020, the WHO issued guidelines to prioritise immunisation as a core health service with a temporarily suspension on mass vaccination campaigns. Countries had to weigh the local risks and benefits in decisions on whether to continue immunisation outreach activities [17]. India recorded its first COVID-19 case in January 2020, while the number of cases started rising, the Government of India declared a lockdown all over the nation on March 24th 2020 restricting movement of public and stalling all commercial activities along with restriction on transportation activities to curb the spread of the virus [18]. The lockdown in the country went on till May 31st, 2020 following which areas with increased case numbers had on going restrictions. Services like health facilities and critical healthcare were exempted from lockdown however, immunisation outreach services were halted due to fear of spread in COVID-19 infections [19]. Studies have documented large decrease

Vaccination	As per schedule	Missed/ Delayed	Odd Ratio (OR)	95% CI (Confidence interval)	p-value
BCG, OPV, Hep B	43	7	4.8858	2.15-11.08	0.0011
Pentavalent-1	56	27	1.5682	0.95-2.57	0.0761
Pentavalent-2	52	17	2.3981	1.34-4.27	0.0080
Pentavalent-3	39	21	1.3558	0.77-2.38	0.2886
Rotavirus 1st dose	5	4	0.8796	0.23-3.31	0.8497
Rotavirus 2nd dose	8	6	0.9338	0.32-2.75	0.9082
Rotavirus 3rd dose	4	2	1.4161	0.26-7.80	0.6895
PCV 1st dose	2	12	0.1117	0.02-0.50	0.0044
PCV 2nd dose	1	1	0.7043	0.04-11.3	0.8046
PCV 3rd dose	2	1	1.4133	0.13-15.69	0.7782
Flu vaccine 1st dose	9	14	0.4366	0.4366	0.4366
Flu vaccine 2nd dose	0	2	0.1398	0.04-11.3	0.8046
MMR-1st dose	9	14	0.4366	0.4366	0.4366
MMR-2nd dose	0	2	0.1398	0.01-2.92	0.2049
TCV-1st dose	2	33	0.0364	0.01-0.15	<0.0001
TCV-2nd dose	20	4	3.7051	1.25-11.00	0.0183
Hepatitis A 1st dose	38	14	2.0460	1.08-3.88	0.0283
Hepatitis A 2nd dose	0	11	0.0291	0.001-0.49	0.0145
Varicella 1st dose	11	13	0.6931	0.30-1.57	0.3810
DPT booster-1	0	5	0.06	0.003-1.13	0.0612
DPT booster-2	0	4	0.07	0.004-1.146	0.0883

[Table/Fig-5]: Regression models based on duration of delayed vaccinations.
BCG: bacille Calmette-Guerin; OPV: Oral Polio Vaccine; Hep B: Hepatitis B; PCV: Pneumococcal Conjugate vaccine; MMR: Measles; Mumps, Rubella (MMR) vaccine; TCV: Typhoid conjugate vaccine; DPT: Diphtheria-pertussis-tetanus vaccine

in immunisation coverage in higher income countries during early months of pandemic, when most countries had imposed social distancing and quarantine policies. Movement restrictions, social distancing and avoiding hospital visits in younger age groups to avoid infections were cited as reasons for delayed vaccinations in the developed countries [20-23].

Among 73, Global Alliance for Vaccinations and Immunisations (GAVI) eligible countries, Indonesia, India and Pakistan holds the highest number of COVID-19 cases. Incidentally, they also have highest number of Zero dose children {a child who has not received any of Expanded Programme on Immununisation (EPI) recommended vaccination}. Study showed that a fully immunised child stands a chance of 66% with frequent polio and measles outbreaks in Pakistan. COVID-19 pandemic plays a significant role in this situation of suboptimal immunisations in the country. The countries which are now polio free are at risk of resurgence. Delay in vaccination can cause upto 6% more deaths from VPD, such as, pneumonia in Pakistan due to lack of herd immunity [11].

In the present study, delayed vaccinations were found among 43% of the children, similar to studies in Pakistan where delayed vaccination was seen in 52% [10,11]. A study from Saudi Arabia showed that prior to the pandemic, vaccinations were intentionally delayed by 24%, which increased to 37% during the pandemic [24].

Fear of contracting COVID-19 was the reason for delayed immunisations in 88% in a study from United Kingdom (UK) [7] and it is the most common reason reported for delayed/missed immunisations in the present study too. During 2009-2010 swine flu and 2015-16 Zika virus pandemics, fear of contracting infections remained the leading reason for delayed vaccinations [25]. The

other important reasons were lockdown restrictions imposed along with transport issues in 75.58% patients. Vaccine hesitancy, to avoid side-effects of vaccinations, were found as a reason in 26.9% in a study done by Baghdadi LR et al., which was also found as a reason for delay in 62% children in the present study [24]. Myths and misinformations regarding vaccinations and around COVID-19 compounded existing problems of vaccine hesitancy. These can be the reasons for delaying vaccinations even during non pandemic times as well.

Individual-level Electronic Immunisation Registries (EIRs) are replacing health facilities and ensure better reporting in many Low and Middle Income Countries (LMIC). According to the Pan-American Health Organisation (PAHO) and the WHO, an EIR is a "confidential, population-based information system that contains data on vaccine doses administered". It allows for the monitoring of vaccination coverage by provider, vaccine, dose, age, target group and geographical area, which facilitates the monitoring of individuals receiving immunisation. The data can be used to identify immunity among children during a VPD outbreak response to quickly vaccinate only those susceptible, allowing for resources to be conserved [26]. The above steps done in other countries can be implemented in order to be meticulous and avoid lapse in the vaccinations.

Coordinated campaigns across India targeting children who missed critical routine vaccinations during lockdown as well as covering low-coverage areas could prevent additional health disasters [27]. Routine immunisations which are the right of every child must continue. Delay in vaccinations has to be discouraged as pools of un-immunised children expanding during a pandemic can make them susceptible to VPD.

Non availability of vaccines due to supply issues or production issues should be dealt as priority. Many patients who visited the vaccination centres in the vicinity did not get vaccinated due to shortage of vaccinations. Doctors and nurses were allocated for COVID-19 duties everywhere creating shortage of personnel for vaccination duties. Shortage of manpower leading to missing of vaccinations can be avoided by training health workers to regularly assist doctors, to avoid delay by parents in vaccinating children. Steps to curb the delay/missed vaccinations have to be prioritised by policymakers, Paediatricians or family physicians caring for children. The reasons quoted in this study should alert the possibility of repetition of issues in the future during the pandemic or non pandemic times. Involving online messaging services, social media and empowering health workers to educate the society and create awareness and ensure follow-up should be planned to restore baseline vaccination levels. Systematic planning with databases covering larger populations with timely follow-up and reminders can help avoid delay/missed vaccinations.

Limitation(s)

The data is limited to patients visiting a single hospital. More data needs to be collected from different centres and their patient population.

CONCLUSION(S)

COVID-19 scare remains the common reason for delayed/missed vaccinations. Irrespective of socio-economic status of patients, delays were seen across all classes of population due to the pandemic fear along with other reasons which compounds the existing problems of missed immunisations. The vaccination schedules have been impacted negatively with the delay or missing of vaccinations. The current immunisation service models will require adaptation, including physical distancing measures, personal protective equipment, and good hygiene practices for infection control at the vaccination clinics. Routine childhood immunisation should be sustained in India as much as possible, while considering other factors such as logistical constraints, staff shortages, and reallocation of resources during the COVID-19 pandemic. Necessary arrangements for transport and travel needs to be provided during lockdown, to ascertain adherence to vaccination schedule. Use of mass and social media to bust myths, about visit to hospitals and curb the fears associated with COVID has to be done. Availability of trained manpower for coordinated campaigns with improved databases and infrastructure as anticipatory preparation to prevent disruption of immunisation services even during pandemics is the key to handle such situations in the future.

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REFERENCES

[1] Centres for disease control and prevention: Risks of delaying or skipping vaccines. Available online:https://www.cdc.gov/vaccines/parents/why-vaccinate/risks-delaying- vaccines.html(access on 30 July 2020)

[2] Bianchini S, Argentiero A, Camilloni B, Silvestri E, Alunno A, Esposito S. Vaccination against paediatric respiratory pathogens. Vaccines. 2019;7:168. [cross ref]

[3] Burton A, Monasch R, Lautenbach B, Gacic-Dobo M, Neill M, Karimov R, et al. WHO and UNICEF estimates of national infant immunisation coverage: Methods and process. bnll. World health Organ. 2009;87:535-41. (cross ref)

[4] Indian Academy of Paediatrics. Advisory Committee on vaccines and Immunisation Practices (ACVIP).ACVIP Guidelines on immunisation during COVID 19 pandemic .Accesed December 2020.Available from: https://iapindia.org/pdf/1455-FINAL- ADVISORY-ACVIP-Guidelines-on-immunisations-during-covid-19-Pandemic-skd.pdf.

[5] Abbas K, Procter SR, Van Zandvoort K, Clark A, Funk S, Mengistu T, et al. Routine childhood immunisation during the covid-19 pandemic in Africa: A benefit versus risk of SARS-Cov-2 infection. Lancet Glob Health. 2020;8:e1264-e72.

[6] Ackerson BK, Sy LS, Glenn SC, Qian L, Park CH, Riewerts RJ, et al. Pediatric vaccination during the COVID-19 pandemic. Paediatrics. 2021;148(1):e202004709.

[7] Saxena S, Skirrow H, Bedford H. Routine vaccination during covid-19 pandemic response. BMJ. 2020;369:m2392. Erratum in: BMJ.2am 20:369:m2435.

[8] Buonsenso D, Cinicola B, Kallon MN, Iodice F. Child healthcare and immunisations in sub-saharan Africa during the COVID-19 pandemic. Front Pediatr. 2020;8:517. Doi: 10.3389/fped.2020.00517.

[9] Hoffman J, Maclean R. Slowing the coronavirus is speeding the spread of other diseases. Newyork: The New York Times; 2020 [cited 2021 feb 3] Available from: http://www.nytimes.com/2020/06/14/health/coronavirus-vaccines-measles.html

[10] Chandir S, Siddiqi DA, Setayesh H, Khan AJ. Impact of Covid-19 lockdown on routine immunisation in Karachi, Pakistan. Lancet Glob Meal. 2020;8:e1118-20. Doi:10.1016/S2214-109X(20)30290-4.

[11] Chandir S, Siddiqi DA, Mehmood M, Setayesh H, Siddique M, Mirza A, et al. Impact of Covid-19 pandemic response on uptake of routine immunisations in Sindh, Pakistan: An analysis of provincial electronic immunisation registry data. Vaccine. 2020;38:7146-55. Doi: https//doi.org/10.1016/j.vaccine.2020.08

[12] Sow A, Guege M, Boiro D, Ba ID, Ba A, Thiongane A, et al. Impact of Covid-19 on routine Immunisation: A cross-sectional study in Senegal. World Journal of Vaccines. 2021;11(1):1-6. Doi: http//doi.org.31546/JPCI.1001.

[13] Modified Kuppuswamy Scale | PSM Made Easy [Internet]. [cited 2021 Mar 2]. Available from: http://www.ihatepsm.com/blog/modified-kuppuswamy-scale.

[14] World Health Organization. Coronavirusdisease (Covid-19) pandemic. 2020,https://www.who.int/emergencies/diseses/novel-coronavirus-2019 (Accessed-3rd April 2021)

[15] Birkmeyer JD, Barnato A, Birkmeyer N, Bessler R, Skinner J. The Impact of Covid-19 pandemic on hospital admissions in the United States. Health Aff. 2020;39:2010-17. Doi;10.1377/hlthaff.2020.00980
[16] Covid-19 significantly impacts health services for noncommunicable diseses. Available health-services-for-non communicable-diseses. [accesed]
[17] World health organisation. Guiding principles for immunisation activities during the covid-19 pandemic. 2020. A novel-coronavirus-2019/ technical guidance (Accessed-16th April 2021)
[18] Ministry of Home Affairs. Government of India annexure to ministry of home affairs order no.40-3/2020-D.2020. Availabe:https//www.mha.gov.in/sites/default/files/guidelines.pdf
[19] Ministry of health and family welfare Government of India. Enabling Delivery of essential health services during Covid-19 outbreak: Guidance note.2020. Available:https//www.mohfw.gov.in/pdf/essential Services during Covid 19 updated 0411201.pdf (Accessed-22nd April 2021)
[20] Santoli JM, Lindley MC, DeSilva MB, Kharbanda EO, Daley MF, Galloway L, et al. Effects of the Covid-19 pandemic on routine pediatric vaccine ordering and administration-united states, 2020. MMWR More Mortal Wkly Rep. 2020;69:591-93. Doi:10.15585/mmwr.mm6919e2.
[21] Bramer CA, Kimmins LM, Swanson R, Kuo J, Vranesich P, Jacques-Carroll LA, et al. Decline in Child Vaccination Coverage During the COVID-19 Pandemic-Michigan Care Improvement Registry, May 2016-May 2020. MMWR Morb Mortal Wkly Rep. 2020;69(20):630-31. Doi: 10.15585/mmwr.mm6920e1. PMID: 32437340.
[22] McDonald HI, Tessier E, White JM, Woodruff M, Knowles C, Bates C, et al. Early impact of the coronavirus disease (COVID-19) pandemic and physical distancing measures on routine childhood vaccinations in England. Eurosurveillance. 2020;25(19):2000848. Doi: https//doi.org/10.2807/15607917.ES2020.25.19.2000848
[23] Alrabiaah AA, Alshaer AH, Estrella SMC, Inclan KAS, Aljammaz HA, Almoosa KM, et al. Effects of the Coronavirus disease 2019 pandemic on routine pediatric immunisation coverage rates at the main University Hospital in Saudi Arabia. Saudi Med J. 2020;41(11):1197-203. doi: 10.15537/smj.2020.11.25457. PMID: 33130839; PMCID: PMC7804220.
[24] Baghdadi LR, Younis A, Al Suwaidan HI, Hassounah MM, Al Khalifah R. Impact of the COVID-19 Pandemic lockdown on routine childhood immunisation: A Saudi nationwide cross-sectional study. Front Pediatr. 2021;9:692877. Doi: 10.3389/fped.2021.692877
[25] Mertens G, Gerritsen L, Duijndam S, Salemink E, Engelhard IM. Fear of the coronavirus (COVID-19): predictors in an online study conducted in March 2020. J Anxiety Disord. 2020;74:102258. Doi: 10.1016/j.janxdis.2020.102258
[26] Dolan SB, Carnahan E, Shearer JC. Redefining vaccination coverage and timeliness measures using electronic immunisation registry data in low and middle-income countries. Vaccine. 2019;37(13):1859-67. [PMC free article] [PubMed] [Google Scholar]
[27] Shet A, Dhaliwal B, Banerjee P, DeLuca A, Carr K, Britto C, et al. Childhood immunisations in India during the COVID-19 pandemic. BMJ Paediatrics Open. 2021;5:e001061. Doi:10.1136/ bmjpo-2021-001061.

PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Paediatrics, East Point College of Medical Sciences and Research Centre, Bangalore, Karnataka, India.
2. Assistant Professor, Department of Paediatrics, East Point College of Medical Sciences and Research Centre, Bangalore, Karnataka, India.
3. Assistant Professor, Department of Paediatrics, East Point College of Medical Sciences and Research Centre, Bangalore, Karnataka, India.
4. Professor, Department of Paediatrics, East Point College of Medical Sciences and Research Centre, Bangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Suman Meenakshi Gururaja,
Kutir, No.22,Skyline Estate, #Rd Cross, P & T Layout Horamaavu,
Bangalore, Karnataka, India.
E-mail: dr.sumanmg@gmail.com

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