



# Adherence to Compulsory Vaccination during Coronavirus Disease-19 Pandemic in Egypt

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## Abstract

**Edited by:** Slavica Hristomanova-Mitkovska  
**Citation:** Mahfouz NN, Ali WH, El Wakeel MA, Rabah TM, Elmowafi AA, Kamel IH. Adherence to Compulsory Vaccination during Coronavirus Disease-19 Pandemic in Egypt. Open Access Maced J Med Sci. 2021 Apr 29; 9(A):1-5. <https://doi.org/10.3889/oamjms.2021.6046>  
**Keywords:** Compulsory; Vaccines; Infants; Egypt; Coronavirus disease-19  
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**Received:** 08-Dec-2020  
**Revised:** 19-Mar-2021  
**Accepted:** 19-Mar-2021  
**Funding:** This research did not receive any financial support  
**Competing Interest:** The authors have declared that no competing interest exists  
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**BACKGROUND:** Nowadays, routine vaccination is taking the second rank after the emergence of Coronavirus disease (COVID-19) pandemic. The fear of catching COVID-19 rendered a lot of caregivers reluctant to give their child the obligatory vaccines.

**AIM:** The goal of our research was to assess awareness, commitment and adherence to compulsory immunization schedule during COVID-19 lockdown in Egypt.

**MATERIALS (SUBJECTS) AND METHODS:** An electronic questionnaire (Google form) was designed to evaluate the impact of the pandemic on adherence to compulsory vaccinations. Our target candidates were parents of infants in an age group from birth to 2 years old, that is, births from June 2018 to June 2020.

**RESULTS:** In our study, 96.3% of children received Bacillus Calmette–Guérin vaccine on time. About 32.8% did not receive the obligatory booster dose vaccines at 18 months. Among the infants of >1 year, 95.3% received the obligatory vaccination in time at 2, 4, and 6 months of age compared to only 73.3% of those ≤1 year ( $P = 0.001$ ). About 23% of those who missed the vaccine preferred to postpone until outbreak ended while, 27.2% missed vaccination due to fear of catching COVID-19.

**CONCLUSION:** The COVID-19 pandemic negatively affected the adherence to compulsory vaccines in Egypt. Therefore, it is mandatory to organize a plan to catch up the missed vaccines.

## Introduction

Immunization is the most cost-effective and the highest impact health intervention which reduces hospitalization, treatment costs, and mortality [1]. There are many obstacles against immunization as misinformation about vaccines and disease development after administration of vaccines [2].

Vaccination is proved to be a golden tool for preventing life-threatening infections which is estimated by the WHO to avert between 2 and 5 million deaths annually [3]. Parental attitudes regarding vaccinations are very essential in increasing vaccination rate and compliance to immunization schedule [4].

Parental practice depends on communication between parents and health-care providers as physicians, pharmacists, and nurses [5]. Improving this communication will enrich parents' awareness and knowledge concerning vaccination benefits and hazards [6].

All children should continue to be vaccinated as per their usual schedule with all relevant antigens whenever possible. The decision to maintain or suspend

routine immunization services should consider local mandates for physical distancing and health system responses [7].

The pandemic of Coronavirus disease (COVID-19) disease caused by severe acute respiratory syndrome corona virus and the risks it poses to families, communities, and nations have led to massive social and economic consequences, while less likely to cause severe illness in healthy children [8].

Some routine vaccinations for infants and young children were lost due to skipping routine doctor visits and staying home as a result of the corona virus pandemic. The CDC warned that some outbreaks could result from fewer vaccination doses [9].

The maintenance of vaccination services is a vital process for preventing children from communicable diseases and outbreaks during COVID-19 pandemic. However, it is remarkable that obvious declines in pediatric vaccine doses order and administration were observed during lockdown period [9]. Millions of infants and children all over the world have lost and will continue to lose their required obligatory vaccines with a high risk of returning back of some preventable diseases (Vaccine-Preventable Diseases [VPD]) as

measles and poliomyelitis. The WHO has determined children vaccination as a core health service that must be offered to target children during COVID-19 pandemic [10].

Special attention and extraordinary efforts are demanded to be applied rapidly for vulnerable children with higher risk of morbidity and mortality as refugees and children under custody. On the other hand, mass vaccination campaigns were recommended to be cancelled or postponed to maintain physical distancing and preventing the spread of COVID-19 infection [11].

Our study aimed to assess maternal awareness, commitment and adherence to compulsory immunization schedule during COVID-19 lockdown in Egypt and we hypothesized that some vaccinations were lost due to either lock down or fear from catching infection and that may lead to future outbreaks.

## Materials (Subjects) and Methods

An electronic questionnaire (Google form) was designed to cover a number of aspects starting with an informed consent for participating in the study followed by some non-obligatory personal questions, then two main parts, the first one regarding awareness about COVID-19 and hygienic practices of families, then the second part including questions about vaccination behavior of families since the beginning of the pandemic.

The questionnaire targets parents or caregivers of children in an age group from birth to 2 years old, that is, births from June 2018 to June 2020. It includes multiple choice questions, dropdown and check boxes for an easy smooth accomplishment of the questionnaire in duration between 5 and 7 min before submitting it.

The questionnaire was electronically sent to groups of patients from pediatric and lactation consultants clinics, nurseries and school groups, friends, and families including children with the required age. Collection of data will continue over a period of a month, and then statistically analyzed and correlations of results with other studies done internationally, to come up with important recommendations regarding vaccinations during COVID-19 pandemic.

### Statistical analysis

All test data were collected through online model by Google form. Data were converted and manipulated using SPSS software program version 20.0. Data were analyzed, mean and standard deviation was calculated as regarding quantitative data while qualitative data were presented by number and percent. The quantitative data were compared and *t* test was applied for normally distributed data or Mann–Whitney for non-parametric

data if needed and P value was established to determine the statistically significant difference between groups. While, Chi-square was calculated among groups as regard qualitative data. Odds ratio and 95% confidence interval were computed accordingly. The difference between the two groups was considered statistically significant when  $P < 0.05$ , and considered highly statistically significant when  $P < 0.01$ .

## Results

In our study, age of children ranged between 1 and 24 months, mean was  $11.32 \pm 6.8$  months. The study included 805 children, 51.6% were males. About 76.1% of our studied group lived in cities. Fathers and mothers' education was university or more in 79.3% and 73.4% of participants, respectively (Table 1).

**Table 1: Socio-demographic characters of studies parents and children**

Variable	Frequency n = 805 no. (%)
Child sex	
Male	415 (51.6)
Female	390 (48.4)
Child age (in months) mean±SD	11.32±6.8
Range	1–24
Median (IQR)	10 (6–17)
Residence	
City	613 (76.1)
Village	192 (23.9)
Father education	
Postgraduate	98 (12.2)
University	540 (67.1)
Average	152 (18.9)
Primary or prep	15 (4.3)
Mother education	
Post graduate	101 (12.5)
University	490 (60.9)
Average	198 (24.6)
Primary, preparatory	16 (2.0)

About 93.7% of children in the current study received hepatitis B vaccine also; about 96.3% of them received Bacillus Calmette–Guérin (BCG) vaccine on time. 82.5% of the children eligible for obligatory vaccines at 2, 4, and 6 months showed adherence to vaccination while, 32.8% did not receive the obligatory booster dose at 18 months of age. Primary health-care (PHC) center was the most common place for vaccination (46.2%). About 51.6% of children did not receive any addition vaccination. About 70.8% of children complained of vaccination side effects. About 23% of who missed vaccinations preferred to post pone until outbreak end while, 27.2% missed vaccinations due to fear of catching infection. About 84.1% of parents within the studied group found that it was important to catch up any lost vaccinations (Table 2).

Children over 1 year were noticed to be adherent to vaccinations at 2, 4, 6, and 12 compared to those below 1 year ( $P = 0.001$  and  $0.038$ , respectively) (Table 3).

No gender differences were found in our studied children regarding adherence to vaccination schedule.

**Table 2: Descriptive data according to vaccination history of studied children**

Variable	Frequency n = 805 no. (%)
The child received 1 <sup>st</sup> dose of hepatitis B vaccine	
No, didn't know it was obligatory	51 (6.3)
Yes	754 (93.7)
BCG vaccine on time	
No	30 (3.7)
Yes	775 (96.3)
If no, why? (% out of 30)	
Child was underweight	15 (50.0)
Vaccine was unavailable at the primary health-care center	13 (43.3)
Didn't know it was obligatory	2 (6.7)
Did the child receive his obligatory vaccination at 2, 4, and 6 months of age (pentavalent and polio) (% out of 771 the children eligible for the vaccine)	
No or Some	135 (17.5)
Yes	636 (82.5)
Did the child receive his obligatory vaccination at 1 year of age (MMR) (% out of 391 the children eligible for the vaccine)	
No	72 (18.4)
Yes	319 (81.6)
Did the child receive his obligatory booster dose vaccination at 18 months of age (trivalent bacterial and trivalent viral and polio) (% out of 235 the children eligible for the vaccine)	
No	77 (32.8)
Yes	158 (67.2)
Place of vaccination	
PHC center	774 (96.2)
Private clinic	21 (2.6)
VACSERA	8 (1.0)
Private Hospital	2 (0.2)
Did the child receive additional vaccination	
Didn't receive any	415 (51.6)
Chickenpox	87 (10.8)
Meningococcal	52 (6.5)
Pneumococcal	241 (30)
Rota	314 (39)
Regularly give the child booster doses for polio and measles	
Yes, every time	384 (43.2)
All polio doses	57 (7.1)
Some polio doses	197 (24.5)
Measles	10 (1.2)
Didn't receive any	165 (20.5)
Reason for missing vaccines	
Booster dose is not important	34 (4.2)
Preferred to postpone until outbreak relief	185 (23.0)
Received all vaccines according to age	466 (57.9)
Fear of catching infection	219 (27.2)
Unavailability of vaccination services because of shutting down health care centers or private clinics	6 (0.7)
Unavailability of vaccines at PHC center,	21 (2.6)
Vaccination side effects	
No	280 (29.2)
Yes	525 (70.8)
After the outbreak is over do you think it is important to catch up your child vaccination schedule	
Do not know	113 (14.0)
No	15 (1.9)
Yes	677 (84.1)

Residents in cities showed better adherence to vaccination schedule at 2, 4, 6, and 12 months compared to residents in villages ( $P < 0.001$ ) (Table 4).

Mothers with high education showed better adherence to vaccination schedule at 2, 4, 6, and 12 months of age compared to mothers with average or below average education (Figure 1) while, fathers with high education gave better adherence to vaccination schedule at 2, 4, and 6 months of age than mothers with average or below average education.

**Table 3: Comparison between age groups of studied children as regard immunization schedule commitment**

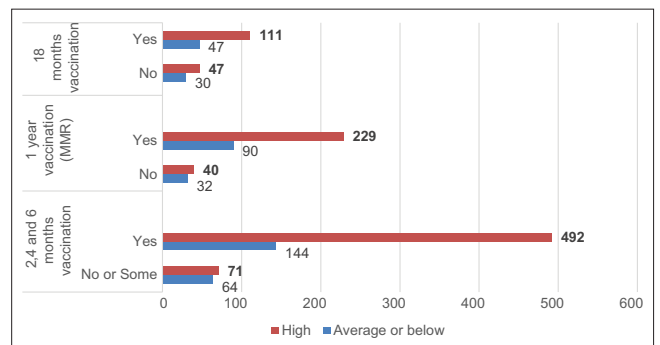
	≤1 year no. (%)	>1 year no. (%)	p value	OR (CI)
Receive his obligatory vaccination at 2, 4, and 6 months of age (pentavalent and polio)				
No or some	120 (26.7)	15 (4.7)	0.001**	7.4(4.2–13.0)
Yes	330 (73.3)	306 (95.3)		
Receive his obligatory vaccination at 1 year of age (MMR)				
No	19 (27.1)	53 (16.5)	0.038*	1.9 (1.0–3.4)
Yes	51 (72.9)	268 (83.5)		

\*\*statistically highly significant difference ( $p < 0.01$ ) \*statistically significant difference ( $p < 0.05$ )

**Table 4: Comparison between studied children according to residence**

	City n = 613 No. (%)	Village n = 192 No. (%)	p value	OR (CI)
Did the child receive 1 <sup>st</sup> dose of Hepatitis B vaccine				
No	45 (7.3)	6 (3.1)	0.036*	2.5 (1.0–5.9)
Yes	568 (92.7)	186 (96.9)		
BCG vaccine on time				
No	25 (4.1)	5 (2.6)	0.347	1.6 (0.6–4.2)
Yes	588 (95.9)	187 (97.4)		
Did the child receive his obligatory vaccination at 2, 4, and 6 months of age (pentavalent and polio)				
No Some	78 (13.3)	57 (31.2)	<0.001**	0.34 (0.2–0.5)
Yes	510 (86.7)	126 (68.9)		3.0 (2.0–4.4)
Did the child receive his obligatory vaccination at 1 year of age (MMR)				
No	39 (13.8)	33 (30.3)	<0.001**	0.37 (0.2–0.6)
Yes	243 (86.2)	76 (69.7)		2.7 (1.6–4.6)
Did the child receive his obligatory booster dose vaccination at 18 months of age (trivalent bacterial and trivalent viral and polio)				
No	54 (31.0)	23 (37.7)		0.74 (0.4–1.4)
Yes	120 (69.0)	38 (62.3)	0.340	1.4 (0.2–2.5)

\*\*Statistically highly significant difference ( $p < 0.01$ ) \*statistically significant difference ( $p < 0.05$ ).



**Figure 1: Comparison between studied children according to mother education in obligatory vaccination (2, 4, 6, 12, and 18 months) compliance. \*\*Statistically highly significant difference ( $P < 0.01$ ).**

## Discussion

The issue of commitment to routine vaccines has been in focus by the WHO with special emphasis on developing African countries which are at higher vulnerability to VPD [12]. For decades, in Egypt, many studies and national projects have been dedicated to this subject through the National Research Centre to promote health in the community, among which, a large project involving six Egyptian governorates done recently by Salama *et al.*, [13]. Hence, it would be a major fall back, if we prevent a new disease by paving the way back to an old one.

The current cross-sectional retrospective survey in the form of questionnaires explored all the pitfalls and obstacles confronted by caregivers in adhering to the Egyptian immunizations schedule during the COVID-19 pandemic. This same topic has been addressed by Abbas *et al.*, [14] who tackled this dilemma of practicing compulsory vaccination during the pandemic.

The study group involved 805 Egyptian mothers of infants from birth to 24 months (mean age was  $11.32 \pm 6.8$ ). Gender distribution was almost equal, males were 415 (51.6%) and females were 390 (48.4%). Both urban and rural areas were presented in a percent of 76.1% and 23.9%, respectively, with urban predominance.

PHC center was noted as the most common place for vaccination (96.2%). This governmental service is free of charge and trusted by parents. About 97.8% of mothers reported that these centers maintained the same competence during the pandemic as before. However, there were shortening in the resources as 9.7% of mothers complained of unavailability of vaccines. This crisis was taken into consideration by Nelson who revealed a concern about difficulties in the transferring procedure of vaccines to low- and middle-income countries during the pandemic [15]. While, in a similar study, conducted by Buonsenso *et al.*, [16] in sub-Saharan Africa, the centers were in full capacity and the vaccines were available.

The commitment to vaccination was not influenced by the gender of the infant. On the other hand; it was impacted by the level of parental education and residency. The mothers with higher level of education were found to skip routine vaccines less frequently than those with lower educational level ( $P = 0.03$ ). Furthermore, the number of missed obligatory vaccines was significantly higher in rural compared to urban regions ( $P = 0.002$ ). In accordance, Hussin and Marzo [17] concluded that parental education has great influence on adherence to vaccination schedule. Furthermore, this goes in agreement with Alamri *et al.*, [18] who mentioned the same two main influencers' parental education and residency in their study in Saudi Arabia.

We compared the percent of fulfilled appointments in the immunization schedule for infants. We found that the 2, 4, and 6 months visits were followed by 82.5%, similarly for the 12<sup>th</sup> month visit was respected by 81.6% while the adherence to the 18<sup>th</sup> month booster dose was only 67.2%. Thus, the most frequently skipped vaccine was the obligatory booster dose at 18 months. This was matching with the study done by Buonsenso *et al.*, [16] who found that booster doses were the mostly missed ones. On the other hand, the most frequently administered vaccines were the birth doses of both BCG (96.3%) and Hepatitis B (93.7%) as they are given immediately post-delivery; therefore, no extra health-care visit is required. Abbas *et al.* confirmed the same finding in their large study involving all 54 African countries [14]. The WHO and the UNICEF confirmed that vaccinations should not be skipped meanwhile appropriate precautions should be followed. This will achieve the double gain of averting an outbreak of a VPD and avoiding the exposure to COVID-19 [19].

The COVID-19 pandemic negatively affected the adherence to compulsory vaccines. Among the infants of  $>1$  year, 95.3% received the obligatory vaccination in time at 2, 4, and 6 months of age compared

to only 73.3% of those  $\leq 1$  year ( $P = 0.001$ ). This highly significant gap was due to the non-identical timing of these doses in each age group. These visits dated before the pandemic in those  $>1$  year while conversely dated during the pandemic for those  $\leq 1$  year. The reasons behind skipping vaccines were the preference of 23% of mothers to postpone vaccination until end of pandemic and 27.2% of mothers missed vaccination due to fear of catching infection. In accordance, Buonsenso *et al.*, [16] detected a 50–80% decrement in routine immunization in 2020 in comparison to 2019 ( $P < 0.005$ ). Similarly, in the United States, a drop of 50% was documented in vaccination with MMR during the COVID-19 pandemic [20].

## Conclusion

COVID-19 pandemic has more threats that cross beyond those of direct viral infection that unfavorably affect children specially those beyond 2 years. Prolonged lockdown and home confinement leads unfortunately to reluctance and lacking in immunization schedule commitment. There are probabilities of increased health risks of avoidable diseases later in life.

## Recommendations

Revising vaccinations and catch up mechanism both are a must. Allowing cooperative network and plan to face quarantine and lockdown impacts as regards children immunizations.

## Ethical Considerations

Parental informed consent was obtained from all study's participants at the beginning of the questionnaire. The ethical committee approved the conduction of this study (Ethical approval number 20093). No names were recorded on the questionnaires and all questionnaires were kept safe.

## Acknowledgment

We are, therefore, grateful to the local researchers and to the collaborators in the society who

helped in spreading the questionnaires and to parents who have spent some time replying them.

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