



Analysis of Basic Immunization Services during the COVID-19 Pandemic at Public Health Centers in Semarang

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Abstract

BACKGROUND: The Corona Virus Disease 2019 (COVID-19) pandemic has affected public health services, including routine immunization services. If this condition continues, the national immunization coverage will decrease, thereby potentially increasing the risk of immunization preventable diseases.

AIM: This study aims to determine the coverage of complete basic immunization services in Semarang before (December 2019) and during the pandemic (May 2020) and the factors that affect the coverage of complete basic immunization services.

METHODS: This study describes complete basic immunization based on data taken in June-August 2021 at three health centers in Semarang. The data used were the number of visits and the type of immunization obtained from the medical records of the Health Center Management Information System. In addition, in-depth interviews were conducted with the person in charge of the immunization program at the Public Health Center (Puskesmas) to determine the influence factors of the immunization coverage. The data from the interviews were then analyzed thematically.

RESULTS: There were 3594 infants who received immunization services, consisting of 2401 before the pandemic and 1193 during the pandemic. The average decrease in the number of basic immunization services was 50.31%. The decrease in the number of basic immunization services occurred in all network public health centers with an average of Puskesmas Genuk (-36.63%), Halmahera (-40%), and Pandanaran (-26.35%). The mother's fear of COVID-19 contagious, service time and patients restrictions by the PHC, and IPV vaccine stock out have reduced the basic vaccination coverage in all public health centers.

CONCLUSION: There was a decline in basic immunization coverage during the pandemic, so it is necessary to fulfill basic immunization needs and service innovations including the use of virtual engagement and optimization of social media for basic immunization campaigns.

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Introduction

Corona Virus Disease 2019 (COVID-19) was declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [1]. The COVID-19 pandemic has forced countries to conduct behavioral interventions to reduce the impact of the pandemic, such as national and regional lockdowns, curfew, and social restrictions. These efforts affect public health services including routine immunization for example, suspension of mass vaccination campaigns, restrictions on parents' access to health services, and bottlenecks in global vaccine supply chains [2].

Obstacles in routine immunization services that have been identified include limited resources for immunization services because they are allocated to various COVID-19 prevention programs. The emergence of large-scale social restriction regulations by the Indonesian government has also resulted in

parents not taking their children to health facilities. In addition, supply chain bottlenecks due to transportation disruptions in flight cancellations, trade restrictions by other countries, and closing of national borders have limited access to health services for essential medicines, including vaccines [3].

Eighteen out of nineteen countries in Southeast Asia and the Western Pacific Region reported approximately 91% barriers on implementing the vaccination programs. Under-five immunization is the program most affected in both public and private health facilities [4]. The Ministry of Health's and UNICEF rapid assessment on immunization services during the COVID-19 pandemic in Indonesia, 84% of Puskesmas stated that there was a delay or cessation of immunization services. The delay was due to the concerns of parents and the doubts of health workers in providing immunization services during the COVID-19 pandemic. If this condition continues, the national immunization coverage will decrease, reduce

community immunity, and increase the risk immunization preventable diseases [5].

At the beginning of the Pandemic, the local government of Semarang enacted a restrictions on community activities from April 27, 2020, to May 24, 2020 [6]. The number of new confirmed cases of COVID-19 throughout May 2020 ranged from 50 to 102 cases per day [7]. Semarang had 117,085 children under five in 2020 [8]. Before the pandemic, Semarang had complete basic immunization coverage of 102.2% [9]. The restrictions on community activities carried out by the Semarang government and the shifting of existing health service priorities to COVID-19 health services have had an impact on routine infant immunization services at the puskesmas but have not been widely reported. This study aims to assess the coverage of complete basic immunization services in Semarang before and during the pandemic and the influence factors of the basic immunization coverage during the pandemic. The results of this study were expected to be input for improving health services, especially in increasing complete basic immunization coverage.

Setting of the study

The study was conducted at the public health centers (Puskesmas) network of Medical Faculty of Universitas Islam Sultan Agung, namely Puskesmas Genuk, Puskesmas Halmahera, and Puskesmas Pandanaran. Puskesmas Genuk is located in the Genuk sub-district, northeast of Semarang. Most of Genuk sub-districts are industrial areas with the majority of the population working as factory workers. The immunization service room at the Genuk Health Center was 3x4 square meter, and waiting room with four people capacity and the waiting room occupied four people without social distancing. Puskesmas Halmahera is located in the East Semarang district. The East Semarang is an economic support area with the majority of the population working as factory workers and traders. The immunization service room at the Halmahera Health Center was 4x5 square meter and the waiting room occupied. was 4x5 square meter and the waiting room occupied 6 people without social distancing. Puskesmas Pandanaran is located in South Semarang sub-district. The South Semarang is an area of trade, housing, and education with the majority of the population working as traders, industrial workers, construction workers, and craftsmen/small industries. The immunization service room at the Halmahera Health Center was 3x4 square meter and waiting room with capacity 8 people without social distancing. There was no shortage of staff at the network public health centers. Existing human resources are prioritized for COVID-19 services so that there is a delay in basic immunization services at the beginning of the pandemic.

Research Methods

This a descriptive study used data which has collected in June-August 2021 in 3 network public health centers. The complete basic immunization criteria were following the regulation of the Minister of Health of the Republic of Indonesia Number 12 of 2017 concerning the Implementation of Immunization. Complete basic immunization consisting of dose of Hepatitis B at the age of 0–24 h, 1 dose of BCG and Polio (oral poliovirus [OPV]) at the age of 1 month, 3 doses of DPT-HB-HiB and OPV/IPV at the age of 1, 2, 3, and 4 months of age, plus 1 dose of measles immunization at 9 months of age. All infants who were immunized (December 2019) and during the pandemic (May 2020) at the three network public health centers. The data used were the number of visits and the type of immunization obtained from medical records of the Puskesmas Management Information System. The data obtained were analyzed descriptively to see the frequency of each type of immunization.

In-depth interviews were conducted to determine the factors of immunization coverage to health workers who provide the services at the three network PHC, including the person in charge of the program. The authors (EN, ABP, RLP) also observe the immunization services in the three PHC. The data from the interviews were then transcribed, coded, and analyzed thematically. The research has received ethical approval from the ethics unit of the Medical Faculty of Universitas Islam Sultan Agung.

Results

Three thousand five hundred ninety-four infants immunization services were conducted during December 2019 and May 2020, 2401 before the pandemic and 1193 after the pandemic (Table 1).

Based on Table 1, the average decrease of basic immunization services is 50.31% and the largest decrease occurred at Puskesmas Pandanaran by 62.54%.

Based on Table 2, that basic immunization services at Puskesmas Genuk during the pandemic experienced a decrease in all types of immunization compared to achievements before the pandemic except for Hb0 and DPT-HB-HiB 3. The decrease in IPV immunization services was the largest compared to other immunization services by 100%. Basic immunization services at Puskesmas Halmahera during the pandemic experienced a decrease in all types of immunization compared to the coverage before the pandemic except Hb0. The decrease in IPV immunization services was the largest compared to other immunization services

Table 1: Frequency distribution of basic immunization services at network public health centers before the pandemic and during the pandemic

Health centers	December 2019	May 2020	Decrease (%)
Puskesmas Genuk	518	318	38,61
Puskesmas Halmahera	565	327	42,13
Puskesmas Pandanaran	890	327	62,54
Total	2401	1193	50,31

by 100%. Basic immunization services at Puskesmas Pandanaran during the pandemic in May 2020 experienced a decrease in all types of immunization compared to achievements before the pandemic except for MR. Puskesmas Pandanaran in December 2019 did not provide IPV immunization. The largest decline in Hb0 immunization services during the pandemic was 90%. The decrease in the number of basic immunization services occurred in all network health centers with an average of: Puskesmas Genuk (-36.63%), Puskesmas Halmahera (-40%), and Puskesmas Pandanaran (-26.35%).

Based on in-depth interviews the barrier factors of visits and the achievement of basic immunization in all network health centers were as follows:

Worried about contracting COVID-19

All respondents said that there were concerns of being infected by COVID-19 when accessing health services at the puskesmas. This feeling was triggered by public doubts about the safety of health facilities against exposure to SARS-CoV-2. This condition is illustrated in the following quotes:

"The decrease in immunization visits is... due to the COVID-19 pandemic. Usually, on average, before there was a pandemic, it was stagnant. But since the beginning of the pandemic, immunization has been postponed because (parents) are afraid too" (Immunization Midwife of Puskesmas Halmahera).

"... apart from that, we also have a problem that during a pandemic like this there is a stigma in the community who is afraid of COVID-19. As a result, people do not want to go to the puskesmas" (Coordinator of the Immunization Program at Puskesmas Genuk).

Limitation of service time and number of patients

The coordinator of the immunization program at the two puskesmas stated that the puskesmas had limited the number of visits and the time of service to prevent direct contact between infants and adult patients and the emergence of crowds of patients, as illustrated in the following quote:

"Puskesmas Pandanaran is also aware of the increase in the number of Covid patients at the Fever Polyclinic. As a result, we require that vaccine registration must be via online and a maximum of

1 day serving 15 people and that is also carried out in the afternoon to avoid direct contact with Covid patients. During a pandemic, the implementation time is changed from noon to evening starting at 14.00 to 16.00 WIB with the aim of avoiding the risk of babies/toddlers coming into direct contact with adult patients. Puskesmas Pandanaran has limited the arrival of visitors" (Head of the coordination of Puskesmas Pandanaran Immunization service).

Based on observation and document review, the three puskesmas made various adjustments to services including: service delays, appointments made before the service day, separation of service rooms, limiting service time which was divided into several days a week, and services carried out only 2 hours.

IPV vaccine stock out

All respondents from the three network health centers said that during the pandemic there was stock out of IPV vaccine at the puskesmas. This condition is illustrated in the following quote:

"At this time of PPKM, vaccine stocks were limited by the government for all health centers in Central Java. The only vaccines currently available are DPT, HB0, and BCG. The measles, IPV, pentabio, and others vaccines have run out, and there is no stock from the government regarding this PPKM period." (Head of Coordination of Immunization Services at Puskesmas Pandanaran).

The vaccine stock out occurred due to delivery barrier of the vaccine from the central government to the network health centers.

Discussion

This study found a decrease in basic immunization visits in May 2020 (during pandemic) compared to December 2019 (before the pandemic) in the three puskesmas. Based on the number of visits to basic immunization at the puskesmas, there was a decrease between before and during the pandemic by 1191 visits (-50.31%). The average decrease in the number of basic immunization visits at the network health centers was 47.76% with the largest decline occurring at the Pandanaran Health Center by 62.54%. The decrease of basic immunization visits in Semarang was similar with the visit decreasing in East Jakarta from 3890 services in February 2020 to 2009 services in April 2020 (-48.35%). This number is the lowest number of immunization services in the past 1 year in East Jakarta [10]. In addition, the decline in the Semarang Health Center was higher than Massenga Polewali Mandar Public Health Center. The decline

Table 2: Distribution of basic immunization services before and during the COVID-19 pandemic at the Semarang health center

Immunization	Distribution of basic immunization services								
	Puskesmas Genuk			Puskesmas Halmahera			Puskesmas Pandanaran		
	December 2019	May 2020	Difference (%)	December 2019	May 2020	Difference (%)	December 2019	May 2020	Difference (%)
Hb0 <7 days	40	49	+22.50	44	48	+9.09	519	48	-90.75
OPV 1	52	34	-34.62	70	33	-52.86	47	33	-29.79
BCG	52	35	-32.69	48	33	-31.25	51	33	-35.29
OPV 2	50	26	-48.00	51	34	-33.33	45	34	-24.44
DPT-HB-HIB 1	49	31	-36.73	51	34	-33.33	47	34	-27.66
OPV 3	52	29	-44.23	50	29	-42.00	35	29	-17.14
DPT-HB-HIB 2	52	25	-51.92	51	29	-43.14	39	29	-25.64
OPV 4	52	29	-44.23	50	28	-44.00	44	28	-36.36
IPV	50	0	-100.00	50	0	-100.00	0	0	0
DPT-HB-HIB 3	17	27	+58.82	50	28	-44.00	34	28	-17.65
MR	52	33	-36.54	50	31	-38.00	29	31	+6.90
Total	568	352	-	565	327	-	890	327	-
Average difference	-	-	-36.63	-	-	-40	-	-	-26.35
Complete basic immunizations	50	34	-32.00	163	70	-57.05	38	31	-18.42

OPV: Oral Polio Vaccine, IPV: Inactivated Polio Vaccine, BCG: Bacille Calmette Guerin, DPT-HB-HIB: Diphtheria, Pertussis, Tetanus - Hepatitis B - hemophilus influenzae type B, MR: Measles Rubella.

was 11.33%, from 4271 infants before the pandemic to 3787 infants during the pandemic ($p = 0.032$) [11]. The decline of immunization services also occurred in all health facilities. Patriawati reported downward trend in immunization visits at the UKI Hospital at the beginning of the pandemic (March-May 2020) with the number of visits 6 and 5 immunization services at the children's polyclinic of [12]. In addition, based on Felicia and Suarca's study (2020) the immunization visits in pediatric polyclinic during on January-July 2019 to 2020 significantly decrease in coverage of 21.9–13.1% ($p < 0.001$) [13]. Chandir *et al.* (2020) compared Karachi routine immunization registry in Pakistan and found that 608,832 children (aged 0–23 months) were immunized within 6 months before the lockdown and only 92,492 out of 701,324 children were immunized during the lockdown. In Pakistan, the number of immunization visits decreased by 52.8% during the lockdown period [14].

Based on Table 2, basic immunization services in the three health centers in Semarang during the pandemic were decrease in almost all types of immunization than the achievement before the pandemic. These findings are consistent with the report of Pambudi *et al.* (2021) which stated that there was a decrease in basic immunization achievements during the pandemic in all types of immunization in all provinces in Indonesia [15]. Based on the report of Mansour *et al.* (2021) there was a decrease in the use of routine vaccines in Lebanon by 31%, in the private sector the provision of immunization services decreased by 46.9%, while the dose of vaccine administered in the public sector decreased by 20% [16]. Based on an analysis of immunization information system in 10 United States jurisdictions, there was a substantial decrease in vaccine doses administered during March-May 2020. Although doses administered increased during June-September 2020, it can not catch up the vaccination coverage [17]. According to the Bramer study in the United States, there was a decrease in vaccination on infants aged five months of 49.5% in May 2020 [18].

In Table 2, the decrease in IPV immunization services was the largest (-100%) of other basic immunization services, its mean During the pandemic

the puskesmas did not provide IPV immunization services. This finding was the same as reported by Mansour *et al.* (2021) that the highest vaccine decline occurred in the OPV vaccine, hepatitis A, followed by measles and pneumococcal conjugate vaccines [16]. The biggest decrease in immunization coverage was the IPV vaccine by 100%. This condition was due to the depletion of IPV vaccine stocks during the pandemic.

Based on Table 2, the achievement of Hb0 immunization at the Halmahera and Genuk Health Center increased. The increase of Hb0 immunization visits at the two Health Centers is in line with a cohort study in the United States in May 2020 in infants aged 1, 3, 5, 7, 16, 19, and 24 months which showed a decrease of immunization coverage in all age groups except Hepatitis B which is usually given in hospital [18]. This is not in accordance with the report of Pambudi *et al.* (2021), a decrease in basic immunization coverage occurred in all provinces of Indonesia from 93.7% before the pandemic to 76.7% during the pandemic (-17.0%). All types of basic immunization decreased, including Hb0, DPT-HB-HIB, and MR [15].

Several factors affect the achievement of basic immunization including the fear of contracting COVID-19 when accessing health services at the puskesmas. This fear is the same as reported by on with a case study in East Jakarta, there was a decrease in antenatal care visit during the COVID-19 pandemic, which was exacerbated by the concerns of mothers taking their pregnancy to health facilities [10]. The similar finding was also conveyed by Harris *et al.* who expressed fear of parents being infected with COVID-19 during visited immunization services. This reasoning was most frequently cited in reports across Southeast Asia and the Western Pacific [4]. This finding was in line with the report of the WHO study in 2020, which was conducted between April 14 and 24, with 801 responses from 107 countries indicating that disruption of routine immunization programs is widespread and affects all WHO regions, the barrier factor was fear of contracting COVID-19 while visiting health facility [19]. The WHO study also found 48% of respondents mentioned user concerns about the risk of exposure to COVID-19 as the reason for disruption of immunization services [4].

A survey conducted by IMPRINT in April 2020 found that more than 50% of countries reported disruptions to maternal and infant/toddler immunization services due to parental concerns (especially fear of infection and wider vaccine doubts) [20]. In addition, immunization officers are also worried the risk of COVID-19 transmission when providing immunization services. The decline of immunization coverage in Indonesia was related to highly increase in daily COVID-19 case in March to April 2020. Immunization officers are worried about the risk of transmission of COVID-19 can occur during immunization services. Indonesia has also implemented Large-Scale Social Restrictions (PSBB) in several areas which have an impact on limited activities outside the home and difficulties in transportation to health services. The Ministry of Health of the Republic of Indonesia said that almost 83.9% of health services, especially the Immunization Program, were suspended due to the COVID-19 pandemic [21].

The second factor in decreasing basic immunization achievement is the limitation of service time and the number of patients by the puskesmas as an effort to adjust health services during the pandemic to health protocols. This change is in accordance with Indonesian government regulations concerning Large-Scale Social Restrictions in the Context of Accelerating Handling of COVID-19. The document states that restrictions on population activities and restrictions on crowds of people in public facilities in an area suspected of being infected with COVID-19 are in accordance with existing health protocols. The call for preventing the spread of COVID-19 by carrying out activities from home and limiting community activities outside the home affects access to and restrictions on health service activities in health facilities.

The third factor in the decline in the achievement of basic immunization is the empty stock of IPV vaccine. During the pandemic, IPV immunization services at the three health centers did not exist, so the decline reached 100%. Based on observations, the IPV vaccine stock out because the vaccine has not yet been sent from the central government to the health center. Based on the news submitted by Farasonalia (2020), the IPV vaccine has been empty since January 2020 due to the IPV vaccine has not been sent from the central government [22]. The shortage of IPV vaccine stocks does not only occur in the city of Semarang, but also in Kudus [23], Bantul [24], Gunungkidul [25], and Denpasar [26]. This is similar to that reported in a survey conducted by IMPRINT in April 2020 which found that more than 50% of countries reported that there were interruptions in delivery of maternal or infant/toddler vaccines, although only two SEAR/WPR countries were included in the study. One of the reasons is the problem of providing human resources and supply of vaccines [20]. The issue of vaccine supply was also conveyed by UNICEF in depth at a press conference in May 2020 which stated that there was a decline in

vaccine deliveries that had been planned by 70–80% due to logistical constraints that occurred due to the lockdown carried out by several countries, commercial flights that experienced many problems. delays, and limited availability of cargo transportation [27]. Harris *et al.* stated that one of the reasons for the impediment to immunization was the disruption in the supply of vaccines [4].

Table 3 data shows the number of Human Resources at the puskesmas is sufficient to provide immunization services, but there is a diversion of Human Resources for the prevention program of COVID-19. This is the same as reported by the Ministry of National Development Planning/National Development Planning Agency (Bappenas) which stated that the decline in the availability of essential health services such as vaccinations was due to a lack of Personal Protective Equipment, an increase in the workload of medical personnel, and the fear of transmitting COVID-19 to families and patients. According to the WHO, the decrease in immunization coverage in Indonesia by 10–40% was due to the impact of COVID-19 which was presented in March-April 2020 compared to March-April 2019. This was because health workers (immunization officers) were focused on handling COVID-19 cases. The government has made efforts to overcome the decline in immunization coverage by issuing a Circular Letter of the Director General of P2P in March 2020 regarding Immunization Services for Children during the COVID-19 Pandemic followed by Technical Instructions for Immunization Services during the COVID-19 Pandemic in May 2020 [28]. However, research data shows that in May 2020 there was a decline in basic immunization coverage. This condition is related to the process of implementing basic immunization according to the guidelines that have just been set by the government. This condition occurred in 107 countries in the world which stated that the decline in immunization coverage was due to the involvement of immunization officers in the COVID-19 emergency response [19].

Immunization services should be available at puskesmas or mobile health centers, but these services are stopped during the pandemic in areas that have local transmission of COVID-19. This condition was exacerbated by the large-scale social restriction policy, especially in April 2020, when COVID-19 was announced as a pandemic. The postponement of Integrated Service Post activities during the COVID-19 pandemic had a major impact on basic immunization services. The Ministry of Health has handed over the responsibility for the operation of the Integrated Service Post to the local government [28]. The Technical Instructions for Immunization Services during the COVID-19 Pandemic states the importance of implementing immunization in accordance with the principles of Infection Prevention and Control (PPI) by implementing health protocols. These changes are

Table 3: Characteristics of the network public health center

Characteristics	Puskesmas Genuk	Puskesmas Halmahera	Puskesmas Pandanaran
Human resources			
Doctor	2	5	2
Nurse	6	10	4
Midwife	3	10	3
Facility			
Immunization room	3 m × 4 m	4 m × 5 m	3 m × 4 m
Waiting room capacity	4	6	8
Services			
Obgyn and birth control	+	+	+
Ill toddlers management	+	+	+
Childbirth	+	+	+
Outpatient	+	+	+
Inpatient	-	+	-
Emergency room	-	+	+

arrangement of space for immunization services so that sick adults and health people including infants are separated and between introductions having a safe distance of 1–2 m, limiting the number of targets to avoid crowds, limiting immunization service hours, scheduling visit via telephone or SMS appointments and so on, postponement and rescheduling of immunization if the child has symptoms of fever, cough, runny nose, diarrhea, and if he has a history of contact with suspected/probable/confirmed patients [29].

The limitation of this study is that data collection was only carried out in the city center so that it could not provide a comprehensive picture of public health centers in Semarang. In addition, the interviews could not be conducted on all parties involved in immunization services, including patients, so that the identification of factors affecting basic immunization coverage during the pandemic period was limited.

Conclusion

There was a decrease in basic immunization attainment in infants at the Semarang network health centers before and during the COVID-19 pandemic. Several obstacles of basic immunization program during the pandemic, including fears of contracting COVID-19, restrictions on service time and number of patients by the puskesmas, and the stock out IPV vaccines, hence stock out. Hence, it is necessary to optimize the of social media for immunization campaigns and virtual use engagement among the baby's parents and the health center. It is necessary to socialize the implementation of immunization according to health protocols to reduce parental concerns in accessing immunization services.

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