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COVID-19 VACCINATION MANAGEMENT PROCESS AND CHALLENGES: CASE OF BANGLADESH

Abstract. *The world is fighting an unexpected event of a pandemic. All over the world, people are living in fear of health of their own or family or the society World Health Organization says vaccination is the only solution to get rid of this COVID-19 pandemic. Vaccination needs effective and efficient management. Bangladesh, a developing South Asia with around 170 million population, is at high risk. On 8 March 2020, the first case of COVID-19 officially declared 1,580,559 confirmed cases and 28,041 deaths till now. This study aims to investigate and review the management and associated challenges of COVID-19 vaccination in Bangladesh. The study will review various existing literature including research articles, newspapers, government statements. The article will criticize the management efforts in different stages of the process. The scientific papers and renowned national and international newspaper articles are considered for examining the literature. The scope of the research kept limited to the extent management and challenges of COVID-19 vaccination of Bangladesh are relevant. This will be a basis to conduct further researches to know in-depth. This study also criticizes the fact that the government was not much in favor of taking suggestions from external bodies like UK Research and Innovation (UKRI) and the Centre for Disease Control and Prevention (CDC), which could improve and handle the situation in a much efficient way. The study dissects the whole COVID-19 vaccination of Bangladesh into significant segments. It tries to appreciate the good initiatives while denouncing the poor actions. It contributes by anatomizing, cherishing, and criticizing the management actions to bring attention to these points and develop the vaccine management process. It will help identify the flaws in the strategic implication of procuring the vaccine, which will further hint for the authority to consider arranging such initiatives. It will portray the lack of organizing and control, which is creating a chaotic situation in the vaccination campaign. Relevant authorities can consider the study to do further research to smooth the management process. As a result, the resources will be effectively used and efficiency will be ensured as the process will speed up.*

Key Words: Bangladesh, challenges, distribution, COVID-19, logistics, management, planning, vaccination.

Introduction. The world is fighting an unexpected event of a pandemic. All over the world, people are living in fear of health of their own or family or the society (Scott, 2020). The more this disease is spreading, the more health care professionals and relevant organizations are coming forward strongly by developing vaccines, providing medical treatments, and making people aware through updated information through communication (World Health Organization, 2020a). All over the world the health professionals and healthcare-related organizations are totally devoted to providing support to patients, co-workers, and authorities as they face this unexpected health crisis (OMS, 2020). Their major precedence is to put continuous effort into developing and provide reliable medicines while protecting families and communities (Wang et al., 2020c). Equally important, we learn from this pandemic, keep ourselves positive, and develop a strong health management system (Forman et al., 2020). COVID-19 spread through SARS-CoV-2 named as 'Corona virus', an infectious disease that is currently a global threat to public health with a remarkable mortality rate. Bangladesh, a developing South Asia with around 170 million population, is at high risk. On 8 March 2020 officially declared the first case of COVID-19 and since then 1,580,559 confirmed cases and 28,041 deaths till now (World Health Organization, 2021). As World Health

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Origination says, vaccination is the only solution to get rid of this pandemic. According to World Health Organization. (2009), program planning and management is the core element of a well-functioning immunization program system. The vaccination management involves logistic planning, vaccine prioritization, overall strategic plan, procurement, organizing the process, implementation and control.

Literature Review. The literature consists of the background of COVID-19, vaccination logistic planning, storing and administering, prioritizing, the master plan, vaccination registration, and drive initiatives.

Background on SARS-CoV-2 or Corona Virus: The microorganism which multiplies and works inside a living cell or host cell of our body is a virus. Through the host cell's cellular mechanism, a virus can replicate. The name 'Corona virus' is in fact came from a Latin word 'Corona' meaning 'crown' or 'Halo' meaning the infective characteristics- 'virions' by electron microscopy. The viral spike which regulates host tropism is formed by morphology. Coronavirus, inside a human body, causes respiratory tract infections which in general are not severe and just like a mild cold but, there are also some rare types of this virus that can be deadly as they cause respiratory failure, sepsis, and renal failure 12,13. (De Groot et al., 2013; Fehr & Perlman, 2015). COVID-19 which for the first time reported in 2019 is declared a pandemic (Figure 1). As of the time of reporting this study (19 December 2021), there are more than 274M total cases and 5.35M deaths due to this disease. Older people are at more risk with a higher mortality rate. Severe acute respiratory syndrome coronavirus (SARS-CoV-2) is the pathogen which causes COVID-19 is a form of beta coronavirus which is genetically homologous to the SARS coronavirus of the year 2003 epidemic (SARS-CoV) (Wu et al., 2020). The same way SARS-CoV enters into the host cell by binding to ACE2 (Angiotensin-converting enzyme 2), SARS-CoV-2 does it too (Lan et al., 2020). Recent researches show that 'Remdesivir' developed by Gilead, is the most advanced type of antiviral drug has shortened the patient's recovery time by 4 days from 11 to 15 days, and also it reduces the mortality by 14 days from 11.9 to 7.1%. (Beigel et al., 2020). Unfortunately, patients who are severely sick can't get effective output from Remdesivir. (Wang Y, et al. 2020b) Although many antiviral drugs are being in use, there is barely anyone found to be totally effective for all patients. This is why it is absolutely important to vaccinate the entire population as fast as possible as vaccination still is the most effective option available. It's a hard task to develop a vaccine but it is even harder to distribute and administer it effectively and efficiently, especially to the developing and underdeveloped countries which have a lack of proper distribution and administering logistics and expertise (Wang et al., 2020a).

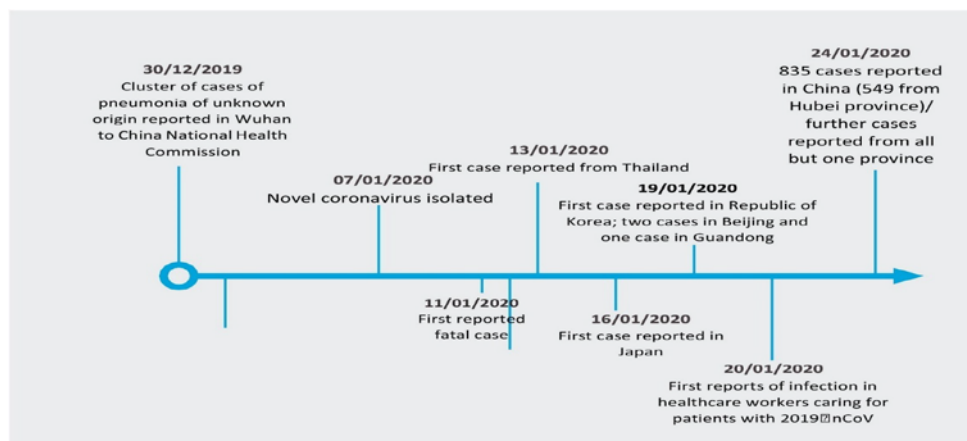


Figure 1. Timeline stages of COVID-19

Sources: developed by the authors on the basis of (ElBagoury et al., 2021).

Logistic planning. At that point, a positive effort was when through the support of UK Research and Innovation (UKRI), an international team of researchers led by scientists at the University of Birmingham and Heriot-Watt University initiated the project of assessing the capacity and preparedness of Bangladesh's cold-chain framework and creating a roadmap, a model for COVID-19 vaccination with the help of BRAC University in Bangladesh and Bangladesh University of Engineering and Technology (BUET) (University of Birmingham. 2020; UKRI, 2020). The designed procurement and logistic requirement plan later came in the master plan.

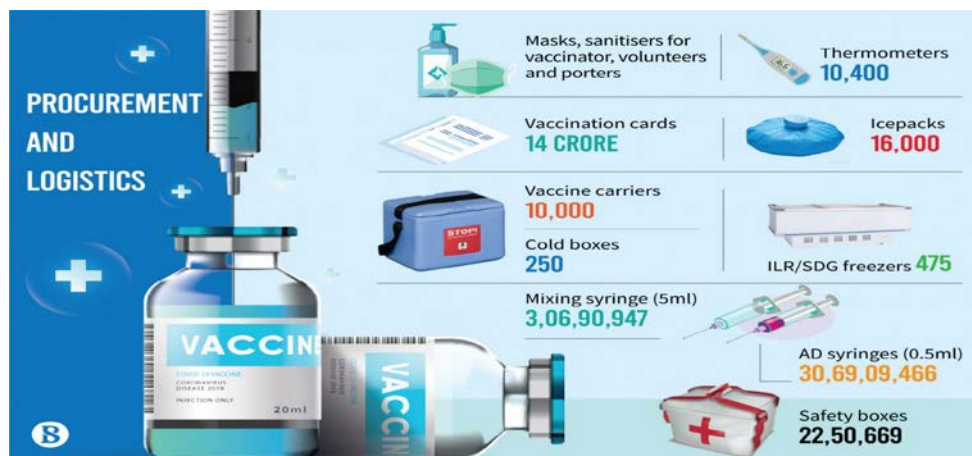


Figure 2. Procurement and logistic requirements

Sources: developed by the authors on the basis of (Kashem et al.,2020).

Vaccine priority and distribution Plan: In December 2020, CDC- The US health regulatory and research institute offered their expertise in setting the priority of vaccine takers, saying «Setting priority» will be a «major challenge» in the coming days. Centre for Disease Control and Prevention's (CDC) country director Dr. Michael Friedman also focused on the opportunities to produce vaccines in collaboration and to search for potential Russian and Chinese vaccines. The World Health Organisation (WHO) already declared that as soon as a vaccine is proved safe, it will be distributed to all countries proportionate to their population through the COVAX facility (The Financial Express, 2020). The experts in Bangladesh also raised the concern that in addition to procuring vaccines, Bangladesh needs to think about prioritizing, storage, and distribution challenges as the government will not be able to provide the vaccine to the country's people at the same time. Specially enhancing storage and distribution facilities in rural (Upazila) areas. Also, because of COVID-19, the 3.4 crore children couldn't have their anti-measles 'Measles-Rubella (MR) vaccine and if proper initiative is not taken, those vaccines will occupy the storage facility. In addition, Oxford-Astrazeneca vaccine experts suggested that Bangladesh intensify diplomatic efforts to procure vaccines developed by Russia, China, and others. (The Daily Star, 2020)

Deciding the cost of Serum's AstraZeneca vaccine from SII: In December 2020, Bangladesh confirmed that it is going to receive the first cache of 5m doses from Serum Institute of India in January, which is included in the 30 million dose deal for the next 6 months. Each amount is estimated to have a \$6.25 cost where vaccines will cost \$5 and local transport and administration price is \$1.25- information provided by Minister of Health and Family Welfare Zahid Maleq. It has long been alleged that DGHS does not give clear cost data. Deputy Project Manager (DPM - ARC and Hepa) Anindo Rahman was the designated

person to provide detailed data according to an official but when contacted, he responded by questioning the credibility of information journalists have (Hasan, 2020).

The Masterplan: The Bangladesh government chalks out a 'Masterplan' to vaccinate 14 crore people or 80% of the population – in two years as it hopes to get the first consignment of the vaccine in February 2021. Prioritizing the frontline workers, the blueprint includes three phases with five stages. Phase-1 will include two stages wherein stage 1 it will vaccinate 5.1 million people or 3 percent of the population. In stage 2 of Phase-1, it will vaccinate 12 million, or 7 percent of the population where 60+ aged will be prioritized. In Phase-2, 17.2 million people, or 9 percent of the population will be vaccinated. Phase-3 includes two stages; stage-2 has 34.5 million, or 20 percent of the population, and stage 2 has 69.1 million, or 40 percent of the population for vaccination. The people who will be included in this priority vaccination are given in table 1.

Table 1. Priority vaccination

Phases	Stages	Number	Population definition
Phase-1 (1,72,80,939 people)	Stage 1 (51,84,282 people)	10,52,000	Health workers and health assistants
		2,10,000	Freedom fighters
		9,07,532	Law enforcement officials, army and other forces
		50,000	Government officials
		50,000	Frontline journalists
		1,78,298	Public representatives
		5,41,000	Religious leader
		75,000	People engaged in burial and cremation
		4,00,000	Workers of Wasa, Desa, Titas and Fire Service
		1,50,000	Workers of the sea and airports
		1,97,621	Bank officials and employees
		6,25,000	Patients with poor immunity
		77,804	Workers engaged in emergency services and pandemic management
			Stage 2 (1,20,96,657 people)
Phase-2 (1,72,80,000 people)	Stage 1 (1,72,80,000 people)	55,66,757	Citizens aged up to 55 years
		30,21,936	Elderly people having comorbidities
		17,88,053	Teachers and workers of all types of educational institutions
		50,000	Media personnel left out in the first phase
		10,11,228	Citizens living in the remote areas
		10,00,000	Members of indigenous community
		5,00,000	Workers of public transport
		2,42,964	Workers of hotel, restaurants, and medicine shops
		36,00,000	RMG workers
		1,50,000	Sex workers and members of the third gender

Continued Table 1

Phases	Stages	Number	Population definition
Phase-1 (1,72,80,939 people)	Stage 1 (51,84,282 people)	10,52,000	Health workers and health assistants
		38,15,201	Pregnant women (based on approval)
		12,17,062	Other government employees
		43,00,000	Other members of the law enforcement agencies
		6,00,000	Excluded employees of the city corporations and municipalities
		22,00,000	Employees of the autonomous and semi-government organization staff
		20,81,884	Workers of export and industrial establishments
		25,00,000	Workers of private power plants and ports
		1,00,586	Prisoners and jail workers
		22,32,114	Urban slum dwellers or floating people
		16,50,000	People engaged in agriculture and food supply
		5,00,000	Dormitory residents
		2,00,000	Homeless people
		51,54,844	Workers of different other industrial establishments
		3,00,000	Other public transport workers left out in the first two phases
		65,46,323	Excluded citizens aged 50 to 54
		4,96,6594	Other workers engaged in emergency and pandemic management
3,22,34,000	Young citizens excluded in the previous phases		
3,22,47,157	Children and school students		
8,42,597	People left out in the previous phases		

Sources: developed by the authors on the basis of (Dhaka Tribune. 2021).

According to the Bangladesh government, the infrastructure currently is enough for routine vaccination, but to implement the master plan, there will be special security for storage locations, transportation, and vaccination centers during vaccination sessions. Ensuring the proper implementation from the capital to villages will be in three phases. Logistics and equipment purchase to strengthen the cold chain and the distribution network, recruitment of 80000 vaccinators, and ensuring safety and waste management are among the challenges. A competent vaccine administration was mandatory for the success of this Herculean task. By taking the challenge into cognizance, Bangladesh government established planning and coordination committees at all levels to facilitate, coordinate, and support the development of the COVID-19 vaccine deployment plan and granted TK6,815 crore during that time. (Masum, 2020; Dhaka Tribune, 2020)

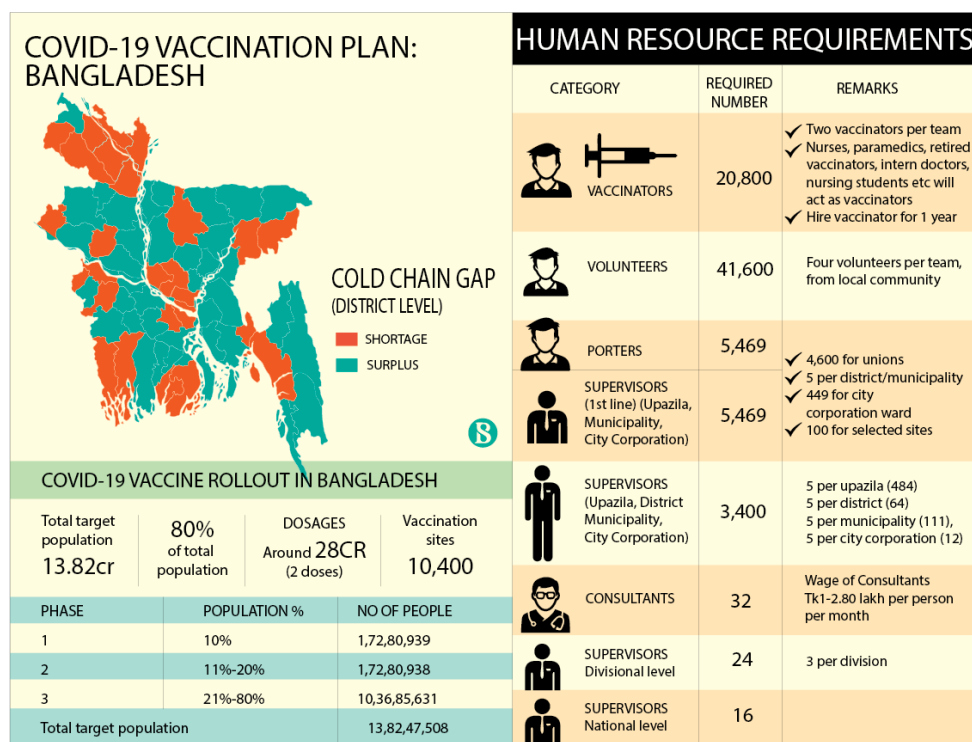


Figure 3. Human Resource requirement

Sources: developed by the authors on the basis of (Kashem et al.,2020).

First vaccine consignment: On January 21, 2021, Bangladesh received the first-time vaccine amounting to 2 million doses as a gift from India (Awasthi P. 2021; The Financial Express, 2021a). On 25 January 2021 received the first consignment of the 5 million doses of AstraZeneca Covishield vaccines from the 30 million dose purchase deal from SII. A particular Air India flight brought it to Hazrat Shahjalal International Airport and was later stored at a private Beximco Pharmaceuticals Ltd warehouse. Health officials stated that before sending it to distribution, the efficacy will be checked if it has changed because of any temperature fluctuation and the expiry dates. After this process, Beximco Pharma will get the approval of the Drug Administration and send it to 64 (administrative) districts. The government already established 7,344 distribution teams of six health workers in each and trained 42,000 health workers in this purpose (Rahman, 2021).

Vaccine registration: People could register for the COVID vaccine from 27 January 2021 through the website of Shurokkho or App. This Surokkha app was available on Google play store & also on Apple's app store. By providing address, names, NID Card numbers, medical history, & much other information, one had to start the registration process through the Shurokkha app or website. After completing the process, an OTP is sent to the vaccine candidate's mobile number with which the candidate could be able to complete the whole process of registration. According to DGHS officials, one could download the registration card in case they lost it. The user manual was also available in the website. All the features are still the same as of the date. Emergency hotline numbers are introduced for receiving information on vaccination are 16263, 333, and 10655 (Dhaka Tribune, 2021b).

Vaccination drive starts: 27 January 2021 was the day of celebration and relief when Bangladesh started its COVID-19 vaccination campaign in the capital Dhaka's Kurmitola General Hospital with AstraZeneca-Oxford vaccine. The government was giving the vaccine free from the beginning using full subsidy (Dhaka Tribune, 2021c). The first group to take the vaccines includes a nurse, a doctor, a military official, a traffic policeman, and a senior official of the government's health department. A senior nurse of Kurmitola General Hospital named- Runu Veronica Costa was the first to receive the COVID-19 vaccine while Prime Minister Sheikh Hasina inaugurated and was virtually present at the pilot program. An interesting event was when Bangladesh Cricket Board (BCB) declared that it will start a vaccine campaign by vaccinating 500 players within February and after that, the domestic cricket will resume.

After the pilot program on 7 February, Bangladesh launched a nationwide COVID-19 vaccination drive to vaccinate 3.5 million people in the first month with the Oxford University-AstraZeneca vaccine. As the government has got very little response from people as only a little over 328,000 people had registered, the country has almost halved its target for the first month, initially 6 million. To motivate the general people Health Minister Zahid Maleque stated in media that people who took vaccine at the pilot program had no difficulties or side effects, he mentioned COVISHIELD as «the best and the safest vaccine». He requested all to get the vaccine and not get confused by any rumors (Alam, 2021; The Daily Star, 2021a). From April 7 2021 government started providing the second dose of the Oxford-AstraZeneca vaccine to people who have taken the first dose-measuring the interval time (Xinhua, 2021a).

Plenty of vaccines but few takers: According to Globalhealthnow – «A speedy vaccine rollout is Bangladesh's shining victory during the pandemic, but there aren't enough takers for the shots, says Taufique Joarder, MBBS, DrPH, MPH, executive director of the Public Health Foundation, Bangladesh». Although it was a huge success to procure the vaccine, it seemed less effective for the government to distribute and communicate the information. Engaging private organizations in the process created more vagueness and confusion. People were less informed about how it will be distributed resulted in a smaller number of participants in the registration process. To solve this problem, the government lowered the age bar from 55 to 40 which attracted some enthusiasts in the short term, but again the vaccine centers started emptying again (Simpson, 2021). People had confusion regarding the vaccine of Oxford-AstraZeneca from Serum Institute India which was the only jab available at that time. Especially some people decided not to take vaccines because of the safety issues raised by several countries at that time regarding the AstraZeneca vaccine. The people who refused to take vaccines are high in percentage from the group of elderly, rural, semi-urban, and slum communities, farmers, day-laborers, homemakers, low-educated people, and those who had low confidence in the country's healthcare system (Abedi, et al. 2021).

Vaccine shortage as India halts export: Experts expressed their fear that the vaccination campaign of Bangladesh could be severely hit by a decision by India taken on March about not to export vaccines due to the high number of COVID cases. It's a troublesome situation where the Serum Institute of India (SII) could not say a certain date of when the export will be resumed. According to Zafrullah Chowdhury, the founder of Bangladesh's Gonoshasthaya Kendra health center, which offers low-cost treatment to people said- «We had the opportunity to take vaccines from other countries, including Russia, but the government failed to act promptly to seize those chances». «We have to take the initiative to produce the coronavirus vaccine locally to fulfill the growing demand. The government needs to work in that direction», he added (Islam, 2021). On 24 March 2021 India decided to hold the Oxford-AstraZeneca coronavirus vaccine export temporarily due to rising cases of COVID-19 in the country. The decision came when the country noticed the sharpest rise of the year with more than 47,000 new cases and 275 deaths. So, the country planned to vaccinate over 45 aged from 1 April, and thus the vaccine demand raised domestically (BBC, 2021).

The April Crisis: The country has already given 7.6 million doses to the registered residents which means it has 2.6 million doses in inventory, according to DGHS data. As of that time, 7.2 million people

have registered for inoculation, meaning the country needed 14.4 million doses to complete the 2 doses vaccination of registered people. Showing a shortage of 4.2 million doses. In addition to that, 16000 people are newly registered for vaccines every day, and 150000 doses are given a day. Following the above rate, the vaccine supply was about to be finished by the first week of May 2020 if no vaccine arrives.

On April 2021 the country was passing through the second wave with 100 each day, while the total death was 10,781 and infections were 736,074 according to the 22 April 2021. On the other hand, the CEO of Serum Institute of India (SII) said in an interview that they wouldn't be exporting any vaccine before June-July.

Although the government was assuring, people saying there wouldn't be any crisis because it has multiple sources of the vaccine including Russia and China. The Chinese Embassy in Dhaka on 20 April 2021 requested the Bangladeshi Health Ministry for the letter of emergency authorization and a letter of commitment for receipt of 500,000 doses of Chinese vaccines as a gift from China. The health minister of Bangladesh said that the positive feedback will be immediately given in one or two days.

While in this situation the experts were concerned about second dose fulfillment for the people who have already taken Oxford/AstraZeneca as the first dose. It's because if the government can't arrange any Oxford/AstraZeneca and bring vaccine from Russia or China then they either have to wait for a long, uncertain time or take the second dose with a different brand of vaccine and it won't be a wise decision as there is no study done about the effectiveness of cross-massing vaccines in a single person at that time (Kamruzzaman, 2021). On 24 April 2021 Bangladesh government gave the order to stop providing the 1st dose of the vaccine because of insufficient supply but to continue providing the second dose (Sakib & Kamruzzaman, 2021). The Notice was signed by the secretary-general of the COVID-19 Vaccine Management Taskforce Committee. In the meantime, DGHS requested Beximco Pharma to procure the remaining vaccines ASAP (The Daily Star, 2021b).

Beximco Pharmaceuticals on the other hand requested the government to step in the process as they were unable to collect it from the Serum Institute of India (SII) (Dhaka Tribune, 2021d). As of 29 April 2021, more than 8.6 million doses of the COVID-19 vaccine were given where 5.8 million have received the vaccine, 2.8 million have received both doses and nearly 7.25 million people got registered, according to the Directorate General of Health Services (DGHS). The campaign was operated using 50 hospitals in Dhaka city and 1,005 hospitals outside the capital, according to DGHS. Considering the month of Ramadan as fasting continues, the vaccine campaign ran from 8:00 AM to 2:30 PM every day. By this time, Bangladesh approved the emergency use of China's Sinopharm and Russia's Sputnik V vaccine (Dhaka Tribune, 2021e).

Bangladesh is offering the second dose of vaccine from 8 April 2021. Previously, people have to take a second dose from the same center they took the first dose. But because of lockdown and restrictions, many people are staying away from the first dose taking center, and it is sometimes impossible to reach that center in the limitation and lockdown. This created another challenge for the government to ensure the vaccination. To solve the problem government amended the policy and now anyone with such a problem can take the second dose from a nearby state-run hospital but it's not applicable if the first dose-taking center is in the same city corporation (Dhaka Tribune, 2021f).

New registration halts and shortage in the second dose becomes a reality: On 5 May 2021, Bangladesh had to suspend the new vaccine registration temporarily. According to DGHS, the decision came as there wasn't enough vaccine stock. The government only was going to continue the second dose in the vaccine centers (Times of India, 2021).

Stopping the first dose wasn't enough to tackle the vaccine shortage. The country started having a crisis for the second dose vaccine as well. In Chittagong city, several vaccination centers stopped providing even the second dose due to vaccine shortage without any prior notice. Chattogram Civil Surgeon's Office data said around 1.5 lakh people are waiting for the second dose where only 27,380

doses are currently available in the Chattogram health department's stock. Meanwhile, people who were not getting a second dose vaccine were protesting by blocking the road in front of Chittagong General Hospital (The Business Standard, 2021).

Vaccine purchase from Sinopharm: On 19 May 2021 a senior Cabinet Division official assured that Bangladesh was going to purchase vaccine from Sinopharm of China. This was reported just after a week after receiving the 500000 vaccines as a gift. The health minister informed that the frontline health professionals were going to get the vaccine from 25 or 26 May 2021 (Ians, 2021)

Rohingya vaccination: Bangladesh as a partner of the National Deployment and Vaccination Plan (NDVP) is closely working with WHO. Through a team of The Immunization and Vaccine Development (IVD), WHO provides government guidance and technical advice for effective and safe vaccine deployment across the country, including providing vaccines to the world's largest refugee camp-Rohingya camp in Cox's Bazar. In addition, a surveillance system was established in vaccine centers on Adverse Events Following Immunization (AEFI) for timely collection, monitoring, and dissemination of public health data (WHO, 2021).

Pfizer vaccine storing and distribution: Bangladesh approved Pfizer vaccine for emergency use as the fourth vaccine. Bangladesh never tried to import Pfizer before because the country does not have enough logistics to store and transport the vaccine.

At the begging of May, the health ministry confirmed the arrival of 100000 Pfizer vaccines in Bangladesh as a part of the COVAX program, wherein total it is supposed to get 68 million doses of COVID vaccines although brand specification was not sure. The Pfizer vaccine was about to arrive in a frozen state, which later will be liquidated at normal temperature to mix in a solution before administering. The mix can be stored at 2 to 25 C for six hours.

In February 2021 US announced that the Pfizer vaccine can be kept and transported between -25C to -15C for two weeks, stored in ultra-cold freezers, and transported in thermal shipping containers and ultra-freezer vans. A line director at DGHS said that they can keep 200000 doses in existing facilities, which can be increased up to 1 million. They were taking all preparation, including 24-hour uninterrupted power supply. He added that Bangladesh's ability to store this vaccine depends on the type and size of vials and Bangladesh at that moment can keep the multi-dose vials. The line director also mentioned that at that moment the Pfizer can only be administered inside the capital-Dhaka city and probably only in a few specific centers (Masum, 2021). Later on, 31 May 2021, Bangladesh received 1.06 lakh doses of the Pfizer COVID-19 vaccine under the COVAX initiative. The vaccine was immediately moved to government-designated warehouses (The Daily Star, 2021c).

Vaccine Passport: On June 2021 State Minister for ICT expressed the plan to introduce a COVID-19 vaccine passport. This will help travelers in foreign countries which require vaccination for traveling. A form of digital documentation named 'Vaccine certificates' is automatically generated on the 'Surokha website' (Vaccine registration website) once the second dose is (The Financial Express, 2021b).

Vaccination resumes: The vaccination of COVID-19, which was suspended due to vaccine shortage, was again resumed on 19 June 2021 with the announcement by Health Minister Zahid Maleque. According to the minister, as the situation was worsening, it was essential to resume it. Earlier, health directorate chief Dr. ABM Khurshid Alam stated that the Pfizer and Sinopharm vaccine will be administered from the upcoming week. DGHS stated that newly registered people waiting for the vaccine would get SMS to get vaccinated. (Dhaka Tribune, 2021i; Alamy, 2021; Xinhua, 2021b)

Vaccinating 10m in 8 days through Walk-in vaccination: While Bangladesh had the slowest vaccination rate, the government declared to vaccinate 10 million people in 8 days which will be held from Aug 7 to Aug 14 with the launch of the vaccination program at unions. The country needed to vaccinate around 1.2 million people a day to achieve the target in eight days (BDnews24, 2021). To achieve the target to vaccinate 10 million people in eight days, the government planned to start a walk-in COVID-10 vaccination

campaign for anyone 18 years of age or above at city corporation and municipality level across the country from 7 August 2021. The people who wanted to get the vaccine from this campaign had to bring their National Identity (NID) cards or on unavailability, the birth registration certificates to the inoculation centers to receive the vaccine (Dhaka Tribune, 2021j).

A stampede-like situation was seen on 8 August in Dhaka-the capital city of Bangladesh as people rushed to get their COVID 19 vaccines in walk-in centers. Many people left the centers without taking vaccines because of overcrowding, long queues, breach of safety measures, and vaccine shortage. Many centers are out of vaccines with just two to three hours of starting vaccination. The campaign is planned to run for five days. The government expressed to vaccinate 3.2 million people during the campaign. The volunteers working in those walk-in centers struggled to cope with the significant number of interested vaccine takers. Many of these people were angry by not getting the shots. The allegation came that people favored by local representatives are getting priority for the vaccine (Rabbani & Hossain, 2021; ANI news, 2021)

Chaos in Walk-in-Mass-vaccination: The Dhaka Metropolitan Police (DMP) recovered two ampules containing 20 doses and 21 empty packets and ampules from the drug store named «Sheba Sangstha» at Hazipara's Chalaban. Shree Bijoy Krishna Talukdar was arrested and sent to jail for more investigation in this regard. The man was working as a volunteer in one of the 'Walk in vaccination centers' and was assumed to have stolen the vaccines from there (The Daily Star, 2021d; The Financial Express, 2021c). On 24 August 2021 government decided to stop the 'Walking vaccination' program. Health and Family Planning Affairs Minister Dr. Zahid Maleque stated that this is done due to insufficient vaccines. Now people will only get the vaccine after receiving SMS after the registration and only a specific number of people get vaccines through this process depending on vaccine availability, he added. He also said this will stop people to wait in long queues for long hours (The Financial Express, 2021d).

Methodology and research methods. This study aims to investigate and review the management and associated challenges of COVID-19 vaccination in Bangladesh. The study will review various existing literature including research articles, newspapers, government statements. The article will criticize the management efforts in various stages of the process. For reviewing the literature, the scientific articles and renowned national and international newspaper articles are considered. The scope of the research kept limited to the extent management and challenges of COVID-19 vaccination of Bangladesh are relevant and political, diplomatic perspectives were excluded. Statements of relevant authorities like the Ministry of Health and family welfare of the government of the Peoples Republic of Bangladesh and the World Health Organisation, UKRI, CDC, and various United Nations agencies are included in the literature. As the COVID19 vaccination is ongoing, the data will keep evolving constantly.

Discussion. Bangladesh started its vaccination planning strongly. The logistics planning was essential as the country has weak logistic support in vaccine storage and distribution facilities. Affiliating UKRI was a sage initiative. The UK's scientist team provided valuable expertise. Criticism comes at the poor implementation, which is observed when the Pfizer and Moderna vaccine arrived, but the storage and distribution were not prepared enough to support the vaccination program. A vital part of vaccine management was to bring specialized institutions for the prioritizing. As the country has a considerable population, it won't be possible to vaccinate all at a time or within a short time frame. But in many cases, the corrupted or power influence is seen to be used to prioritize facilities. What difference the engagement made is that the logical reasoning behind the priority has been established. Affiliation with CDC-Centre for Disease Control of US for prioritizing vaccine was necessary for planning. Unfortunately, the CDC's advice regarding availing alternative sources of the vaccine was not carefully handled at the begging and there wasn't any visible action reflected regarding it at that time.

The vaccine selection and cost management carried significance as the government had the plan to vaccinate the 80% of the population of 170 million people with a hundred percent subsidized vaccination

facility. A major portion of the cost was relevant to purchasing, storing, and administering the vaccine. It was necessary to bring a vaccine with the optimum low purchase price, low keeping, and transportation cost. If compared, the Oxford AstraZeneca vaccine has low price than mRNA vaccines like- Pfizer or Moderna (The WHO did not clear Chinese vaccines at that time for use). In addition, the existing storing facility Bangladesh had could only support a small quantity of mRNA vaccine. If Bangladesh had to increase the facilities, then it would cost a considerable amount of money, the cost would be increased and most importantly, it would need more time. On the other, hand the AstraZeneca vaccines could be stored at regular freezer temperature which is convenient using current facilities and if compared to the amount of the vaccine for 136 million people (80% of the total population) then it is a cost-saving option.

Vaccinating around 14 Crore people in just two years is not possible without chalking out a strategic plan. The most vital and appreciable task of the whole vaccine campaign was the Masterplan, the strategic plan Bangladesh needed the most to conduct the most extensive vaccination program in the country's history. The plan answered the critical questions of- Who to provide priority? What level of importance? And when to give priority as far as COVID-19 is concerned. As most vaccines have short expiry dates, it was necessary to know how much vaccine has to be kept in hand, and the master plan drove the answer. This plan shows the Phases where the category of people is defined based on priority level. As the most prioritized people are the frontliners-Health workers and health assistants; then freedom fighters, Law enforcement officials, army and other forces, and others, including people over the age of 60 years. If anyone misses the first chance of getting a vaccine from the priority level, the phases were designed for them such a way that creates a chance in the next phase; for example, the 'Teachers were in phase 2, but there is also scope in Phase 3 for Teachers who left out in the last stage. The master plan was obvious in terms of priority and was designed to keep the suggestions of CDC, US; it was very specific in terms of how many people would take the vaccine in which stage later helped the government manage the vaccine demand. The master plan also gave a clear indication of the logistics and human support necessary to administer the vaccination. The logistics included masks, thermometers, vaccination cards, ice packs, vaccine carriers, ILR/SDG freezer, mixing syringe, ad syringe, etc. This was important as the cost calculation would be irrelevant without these elements and funding needs to be confirmed before the program's initiation. The human resources requirements were also prioritized in the master plan. In addition, there were also training facilities kept under the plan under the program 80000 vaccinators were recruited and 42000 health workers were trained for 64 districts.

In terms of process design, the initiation of 'Registration' was a significant initiative and the management has shown excellent visionary quality. It was brilliant to bring digital technologies assistance in the process. The registration process through website and app has reduced the registration time, reduced bureaucratic impact, probable corruption scopes, and supported the planning, organizing, and control of the vaccination campaign. As social media nowadays are popular, it was impressive to see its utilization in registration where 'Imo' was used. Also, other social media like Facebook and WhatsApp could have been considered.

Organizing efforts deserve appreciation as there were plenty of vaccines available at the early stage, but again people were less motivated to take them. The engagement of privatized organization (Beximco) has created some misconception and confusion in the process. A criticism of the motivation stage can be the less clarification about the vaccination process. This has made the opportunity to spread rumors and misleading information. To attract people in vaccination the authority has only tried to lower the age range which temporarily increased the number of participants but after a while, the same picture came back. In fact, lowering the age has broken the order of priority set in the master plan. As the vaccine recipients are the general people including educated-uneducated, urban residents-rural residents, higher-mid-lower social class; it is essential that the correct information is communicated through a proper channel to reduce the misapprehension among all these types of people and motivate them to partake.

Handling the vaccine procurement has shown lacking in strategic issues of management. The risk analysis was not properly conducted and there was no PLAN-B. The geopolitical pressure could be a reason for not keeping any alternative source of vaccine available and it could be a scope of further research. This is the major flaw of the management of this vaccine campaign. People were waiting for their vaccines at one stage, and the vaccine centers refused them showing the vaccine shortage. One of the examples is also cited in this paper about the Chittagong vaccine shortage were without any prior notice, several vaccination centers stopped providing even the second dose due to vaccine shortage.

The slow rate of vaccination is the result of inefficiency in organizing campaigns. People waited months and still didn't get any response from the vaccine-registered centers. Technological inefficiency in vaccine centers could be a probable cause of the inefficient management of vaccines. The government introduced a Walk-in-vaccination program that couldn't be adequately managed to solve the slow rate problem. Allegations came and it created demotivation in people. Waiting long hours and not getting vaccines demotivated many to get vaccines. The stealing of the Moderna vaccine was due to a lack of control over the program, which should be investigated transparently and results should be communicated with general people.

Conclusion. A vaccination drive requires effective and efficient management of the process. The process includes vaccination planning logistics and distribution, a master plan which will guide the whole process, prioritizing. A strong organizing initiative is needed to mobilize the vaccines throughout the country quickly. Also, as all the country's people are related to this campaign, it is very important that they understand the importance, know the exact process to participate, and be motivated enough to be involved. Lastly, a strong control is required to assess how the vaccine campaign is running, align it with the master plan, and if any deviation is found, necessary actions will be taken to bring it back on track.

Bangladesh at the beginning, started with a proper master plan. The appreciation goes where it involves the global expertise organizations like UK Research and Innovation (UKRI) and Centre for Disease Control and Prevention (CDC). Unfortunately, their suggestions were not followed in some cases, especially in terms of vaccine procurement from alternative sources. The geopolitical issues could be a reason behind the action and more research is needed to explore this area. In addition, motivating initiative was not enough. Finally, the implementation and control initiatives were not proper. A walk-in-vaccination was arranged to speed up the vaccination but lack of control over the process has created demotivation and frustration in vaccine recipients and created a chaotic situation. The authority should consider this issue to bring a strong campaign that will speed up the vaccination and reduce the risk of COVID-19 spreading.

The study dissects the whole COVID-19 vaccination of Bangladesh into segments. It tries to appreciate the good initiatives while denouncing the poor actions. It contributes by anatomizing, cherishing, and criticizing the management actions to bring attention to these points and develop the vaccine management process. It will help identify the flaws in the strategic implication of procuring the vaccine, which will further hint for the authority to consider arranging such initiatives. It will portray the lack of efficiency and control, which is creating a chaotic situation in the vaccination campaigns and tries to direct the scope of improvements. Relevant authorities can consider the study as a basis for further research to make the management process much effective, organized, and efficient. Overall, the study will help the authority to organize and manage such initiatives further in a better way.

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Процес управління вакцинацією проти COVID-19 та його виклики на прикладі Бангладешу

На сьогоднішній день знаходиться в стані протидії пандемії COVID-19. За твердженнями Всесвітньої організації здоров'я вакцинація є єдиним рішенням, щоб позбутися пандемії COVID-19. Процес вакцинації потребує ефективного управління. Бангладеш, країна Південної Азії, що розвивається, з населенням близько 170 мільйонів людей, знаходиться в зоні високого ризику в умовах пандемії. 8 березня 2020 року тут зареєстровано перший випадок COVID-19. Усього ж 1 580 559 підтверджених випадків та 28041 смертельних випадків. Це дослідження має на меті проаналізувати процес управління вакцинацією та пов'язані з ним проблеми. У дослідженні проаналізовані різні джерела інформації, включаючи наукові статті, газети, заяви уряду. Піддаються критиці зусилля уряду на різних етапах цього процесу в Бангладеші. Це є підґрунтям для подальших досліджень. Також автором піддається критиці той факт, що уряд не дуже прихильно приймає пропозиції від зовнішніх органів, таких як UK Research and Innovation і Центр контролю та профілактики захворювань, які могли б покращити ситуацію з поширенням COVID-19 у Бангладеші. Процес вакцинації у Бангладеші поділено на окремі сегменти. Аналізуються сильні та слабкі сторони щодо управління процесом вакцинації COVID-19. Це допомагає виявити недоліки в стратегічних діях керівництва, процесі закупівлі вакцини, а також причини хаотичності ситуації в кампанії з вакцинації населення. Піднімається також питання щодо ефективності використання різних ресурсів у процесі управління вакцинацією від COVID-19. Дослідженням та висновки автора допоможуть органам державної влади в організації більш ефективного управління процесом вакцинації проти COVID-19 серед населення. Крім того, у статті детально розглядається процес планування логістичного забезпечення вакцинації, що потрібно для організації та швидкої мобілізації вакцин по всій країні. Автор підкреслює, що відсутність достатнього контролю за процесом вакцинації викликає явище демотивації та розчарування у вакцинованих та формує хаотичність в ухваленні рішень.

Ключові слова: Бангладеш, виклики, розподіл, COVID-19, логістика, менеджмент, планування, вакцинація.