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COVID-19 Pandemic in Bangladesh: Our Learning from a Narrative Review

Asish Kumar Ghosh[1], Tarek Mahbub Khan[2], Sarwar Mahboob[3]

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Abstract

The COVID-19 pandemic had given challenges in health systems that placed Bangladesh at a special risk owing to its dense population, absence of adequate laboratories, and excessive volume of patients demanding health services. A number of fluctuations of changes (Alpha, Beta, Delta, and Omicron) in viral variants altered the burden of infectionsand clinical outcomes in the country. Although many constraints in the biosafety and resource issues hadbeen observed, the rapid establishment of RT-PCR testing facilitiesand massive collaboration between the publicand the private sector played major roles in the development of diagnostic services. Bangladesh had made one of the largest vaccination campaigns in South Asia against COVID-19. Vaccine diplomacy had enabled a largedeal of the population to receive immunization which led to fewer cases of severe disease and death. The ongoing emergence of immune-evasive variants highlighted the necessity of genomic surveillance, booster immunization, and persistent public health vigilance. Bangladesh's experiences showedthat we need strong laboratory systems, research and appropriate communication of scientific information, fair access to vaccines and adequate test facilities to be prepared for future pandemics. In this paper, the authors review the cases of SARS-CoV-2 infectioninBangladesh, introduction of vaccinations and the spread of the disease in the context of global scientific progress.

Introduction:

The severe acute respiratory syndrome betacoronavirus-2 (SARS CoV-2), the causative agent of 2019 coronavirus infectious disease (COVID-19) is unequivocally a highly capable human pathogen. There hadbeen several waves of infectionscaused by changing variants of concern (VOCs) and over 800 million COVID-19 cases and 7 million COVID-19 deaths have been reported worldwide[1]. In Bangladesh, among the most densely populated countries in the world with 1270 people per square kilometer, the first cases of SARS CoV-2 infection, were reported in March 2020. Bangladesh government reported 30 thousand COVID-19 related deaths so far since the infection has started[2].The COVID-19 pandemic fundamentally altered the public health infrastructures of the countries across the globe, as well as unveiled unprecedented spur in the scientific communication and access to real-time information by the population. Bangladesh had to cope with those issues at the same time when this country confronted acute health capacity crisis, lack of laboratory facilities, and socio-vulnerability. Bangladesh conducted one of South Asia's largest vaccination rollouts, which drastically decreased the number of cases[3]. The emergence of SARS-CoV-2 variants in Bangladesh, the immune response of the populace influenced by vaccination and natural infection and the practical difficulties of viral surveillance in an environment with limited resources are summarized in this review.

1. Assistant Professor, Department of Virology, Sir salimullah Medical College, Dhaka, Bangladesh
2. Associate Professor, Department of Virology, Sir salimullah Medical College, Dhaka, Bangladesh
3. Associate Professor, Community Medicine & Public Health, Sir salimullah Medical College, Dhaka, Bangladesh

Correspondence: Dr Asish Kumar Ghosh, Assistant Professor, Department of Virology, Sir Salimullah Medical College, Dhaka, Bangladesh. email: asish127kumar@gmail.com

Health system and Measures:

With the beginning of the pandemic, the active dissemination of new scientific knowledge all over the world supported the growing interest of the population in virology and immunology[4]. However, there were some issues that accompanied some false information by those who are not experts, mistrust in government advice and reluctance to practice evidence-supported measures like wearing masks and isolation. Even insome developed countries, social media increased the vaccine misinformation and distrust of the official health guidelines[5]. Wearing masks and distancing, which have been shown to be protective, were unevenly accepted. The lack of compliance and political polarization also led to the perpetual transmission of viruses and offered a favorable environment in which viruses evolved[6]. These factors favored the evolutionand emergence of new variants ofSARS-CoV-2. SARS-CoV-2 has proven to have mutation rate similar to other RNA viruses, such as mutational pressures, host immunity and recombination events. Different lineages have been developed in the specific S glycoprotein. Certain amino acid replacements in the receptor-binding domain and the furin cleavage site significantly enhanced receptor affinity altering the receptor use of proteases and thereby facilitating immune evasion[7]. The successive waves in the world were characterized by Alpha, Beta, Gamma, Delta and later Omicron[8].

Immune response and vaccine performance:

COVID-19 vaccines based on ancestral SARS-CoV-2 spike demonstrated protection against hospitalization and death. While breakthrough infections expanded with immune-evasive variants, vaccines continued to induce durable cellular immunity. Viral-vector and mRNA platforms produced strong CD4+ and CD8+ responses by using their immunostimulatory qualities to trigger innate signaling. Booster doses restored declining immunity and increased the memory T-cell pool[9].

Even though vaccine hesitancy was stoked by false information, adverse events were uncommon and did not significantly hinder global adoption[11]. Although early hesitancy in Bangladesh was associated with sociodemographic factors, national campaigns and domestic production partnerships were able to achieve high primary series completion rates of over 80% as early as 2023. In February 2021, Bangladesh began distributing the ChAdOx1-nCoV-19 vaccination, also known as Covishield. Seven vaccine formulations have been in use since July 2021. A memorandum of agreement was signed in August 2021 between Sinopharm, China, and Incepta Vaccine Limited (IVL), the country's largest human vaccine production facility, to produce the Sinopharm BBIBP-COVID-19 vaccine in Bangladesh. Bangladesh's attempts to produce COVID-19 vaccines have undoubtedly accelerated because of this collaboration and astute vaccine diplomacy, which has also lessened Bangladesh's reliance on a single vaccine supply[11-12].

Following an initial transmission caused by Alpha and Beta variants, a severe wave of Delta with high hospitalization and case fatality rates transpired in mid-2021. The course of the epidemic in Bangladesh followed waves of global variants. Bangladesh's epidemic progressed in waves, mirroring variations around the world[13]. In 2022, when vaccination rates were high and prior infections were common, Omicron lineages took over but resulting in lower clinical severity rather than high transmissibility. Early genomic surveillance in Bangladesh led to the discovery of XBB sub-variants in the middle of 2022[14].The recombinants in the sub-lineages such as XBB had advanced evasion of neutralizing antibodies. Unlike the neutralizing antibody titer that declines over time or when a variant occurs, T-cell immunogenicity to conserved epitopes has stayed largely intact in favor of retained vaccine-mediated protection against severe outcomes[15].

Diagnostic Capacity and Field Experience:

Only a small number of labs were permitted to perform PCR testing, and early diagnostics were centralized. The quick setup of RT-PCR testing facilities has required a great deal of logistical work, creative biosafety adaptation, and collaboration between the public and private sectors. By late 2020, the testing capacity had significantly increased, despite early shortages of supplies and protective gear. Cost disparities between public and private testing raised concerns about access, but coordinated resource sharing enabled Bangladesh to avert forecasted catastrophic mortality. This experience has underlined the imperative of flexible public-private partnership requirements in pandemic response.

The Bangladesh Institute of Epidemiology, Disease Control and Research (IEDCR) in Dhaka originally oversaw and managed the SARS CoV-2 outbreak in March 2020[16]. The laboratory teams received little assistance since coworkers were hesitant to have a testing facility because of the widespread dread of transmitting the infectious respiratory virus and the unknown consequences of COVID-19 sickness, colleagues were hesitant to establish a testing laboratory, which resulted in little support for the pioneering team[17]. Other government and private laboratories began establishing their own testing facilities throughout the time. Personal safety equipment (PPE) and chemicals were scarce and highly costly during the first two to three months. Implementing the CDC's infection, prevention, and control guidelines and the WHO's isolation, tracing, and treatment guidelines facednumerous difficulties. In particular, it was difficult for the laboratories to strictly adhere to Biosafety level 3 (BSL-3). Setting up PCR testing during the COVID-19 pandemic taught us how important it is for employees at all levels to work together and be committed; skilled scientists, laboratory technicians, and healthcare professionals are crucial for a successful emergency response. The lack of negative pressure rooms with regulated HEPA-filtered air flow and the lack of on-site autoclaving and effluent decontamination were the disadvantages of setting up COVID-19 testing restriction forthe brief period between April and December 2020.

Key findings:

Since the first detection of COVID-19 in March 2020 by the Institute of Epidemiology, Disease Control and Research (IEDCR), IEDCR along with few other institutes like Bangladesh Medical University (former BSMMU), National Institute of Laboratory Medicine and Referral Centre, Institute of Public Health and later on other government and private hospitals gradually starts COVID-19 testing. During that period initial constraints to development of molecular lab with RT-PCR facilities, optimum training of laboratory and other healthcare professionals, formulating guidelines on testing and infection prevention and control restricted number of tests at minimum. Therefore, cases weren't detected accurately in numbers hence the scope of early test, trace and treat policy was hampered. It became more convenient to detect and trace adequate number of cases as RT-PCR labs grew slowly throughout the country. The first wave of illnesses in 2020 and the number of daily cases reached its highest point in June and July, when it was between 2,500 and 4,000. There was no mass vaccination at that time, and the intensity was somewhere between mild and high. There was a big rise in cases during the Delta wave in the middle of 2021. In July 2021, there were as many as 16,230 new cases every day[18]. At first, the severity was high and the vaccine coverage was low. The Omicron wave in early 2022, mostly caused by the BA.1 and BA.2 variants showed high number of new case rate but the symptoms were less severe, most probably as more people were getting vaccinated. Mass immunization began in early 2021. As coverage grew, rates of infection, hospitalization, and death went down, notably during Omicron. The Delta wave in the middle of 2021 caused the most infections and deaths could be explained by the virulent nature of this viral variant and the short post vaccine immune response time since the inception of initial vaccination program. The Omicron wave (2022) spread swiftly, but it didn't produce as many serious complications because individuals were already immune or had beenvaccinated. This shifting from initial high infection and transmission rate of SARS-CoV-2 to an optimum level was possible due to an early intervention in development of RT-PCR laboratories, formulating infection prevention and control guidelines, training and professional development and public-private collaboration for adequate accessible to infection prevention and control logistics, vaccine diplomacy and public health awareness strategies.

Conclusion:

Emergency response preparedness in any pandemics is crucial in prevention of transmission of infection and fatalities from the disease. Hence establishment of new and development of existing molecular laboratories,continuous training and knowledge sharing among healthcare professionals at all level are essential.Government and political commitment in research and development particularly in medical biotechnology and enhancing public health facilities for easy access and availability to vaccine, protective gear and awareness program should be the major strategies to fight against future pandemics.

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