The Journal of Teachers Association
ISSN 1019-8555 (Print) & ISSN 2408-8854 (Online)
Frequency: Bi-Annual
DOI: https://doi.org/10.62469/taj.v037i02.01

OPEN ACCESS
Website: www.tajrmc.com
Email: editor@tajrmc.com
Volume-37 | Issue-2 | Jul-Dec 2024

Editorial

PCR Test for SARS-CoV-2, Rajshahi Medical College Perspective

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The global COVID-19 pandemic has drastically altered the landscape of healthcare, presenting unparalleled challenges to medical professionals and systems.[1] At the heart of the effort to manage the crisis is the polymerase chain reaction (PCR) test, which has emerged as the gold standard for diagnosing COVID-19. PCR testing has been pivotal in identifying SARS-CoV-2, the virus responsible for the disease, owing to its high sensitivity and specificity. In Bangladesh, particularly in institutions like Rajshahi Medical College (RMC), PCR testing has been crucial in shaping the country's response to the pandemic. This editorial provides a critical analysis of PCR testing at RMC, considering its implementation, impact, challenges, and lessons learned. The PCR test operates on a principle of amplifying viral genetic material to detectable levels, even in individuals with low viral loads. This attribute made it the preferred diagnostic tool early in the pandemic. The global health community rapidly adopted PCR testing due to its ability to detect infections with high accuracy, thus enabling early isolation, contact tracing, and treatment decisions.[2]

In Bangladesh, PCR testing became the cornerstone of the national testing strategy, with major medical institutions like Rajshahi Medical College at the forefront. Rajshahi Medical College's transition from routine diagnostics to mass COVID-19 testing illustrates how healthcare systems worldwide had to adapt in the face of a sudden global health crisis. Establishing PCR testing infrastructure required upgrading laboratories, acquiring specialized equipment, and training personnel in molecular diagnostics.[3] However, the pandemic's demands far exceeded the existing healthcare infrastructure, leading to significant challenges, especially in resource-limited settings like Bangladesh. Rajshahi Medical College, one of the most prominent healthcare institutions in Bangladesh, played a crucial role in COVID-19 diagnostics, particularly for the northern region of the country. The significance of RMC's involvement extends beyond serving as a diagnostic center; it became a critical hub for regional healthcare management and epidemiological data collection. This data was instrumental in guiding national decisions on lockdowns, resource allocation, and public health interventions.

The process of establishing PCR testing at RMC involved overcoming considerable logistical hurdles. The lack of adequate testing infrastructure and a shortage of trained personnel posed immediate challenges. Global supply chain disruptions, which affected the availability of PCR reagents and consumables, further compounded the difficulties.[4] This scarcity of resources delayed testing during the early stages of the pandemic, contributing to challenges in managing the outbreak effectively. Despite these setbacks, RMC's laboratory team, supported by national and international collaborations, worked relentlessly to establish PCR testing as a mainstay in their COVID-19 response. RMC's testing efforts extended across the Rajshahi Division, serving not only the city but also the surrounding districts. By acting as a central node for testing, RMC helped mitigate the public

health risks posed by the virus in densely populated urban and rural areas alike.

One of the main advantages of PCR testing is its high sensitivity, particularly in detecting the presence of SARS-CoV-2 RNA. PCR tests have been able to detect viral genetic material even in asymptomatic carriers or those with mild symptoms, making them more reliable than other diagnostic methods like antigen testing.[5] This is critical for effective public health interventions, particularly in regions like Rajshahi, where high population density can facilitate rapid viral transmission. At Rajshahi Medical College, PCR testing has been essential for identifying COVID-19 cases early, enabling quick isolation of positive cases and breaking transmission chains. However, the reliability of PCR testing is not without limitations. False negatives can occur if samples are mishandled, collected incorrectly, or transported improperly, particularly in resource-constrained environments like Bangladesh (Peeling et al., 2021). RMC addressed this by enforcing strict protocols for sample collection, storage, and processing, ensuring that test accuracy remained high despite these challenges. A notable outcome of RMC's PCR testing efforts has been the identification of asymptomatic cases in the region. According to data published by the RMC laboratory team, nearly 20% of the total positive cases identified were asymptomatic, underscoring the importance of widespread testing in pandemic management.[6] These asymptomatic individuals would likely have continued to spread the virus without early detection through PCR testing, demonstrating the test's critical role in controlling the pandemic's spread.

Despite the undeniable efficacy of PCR testing, its implementation at Rajshahi Medical College has been fraught with challenges. The most immediate issue has been testing capacity. In the early days of the pandemic, RMC was equipped to handle only a few hundred tests per day. However, as the virus spread and case numbers surged, the demand for testing rapidly overwhelmed the available infrastructure. At the peak of the pandemic, the demand for tests in Rajshahi exceeded 1,000 per day, far outstripping the college's testing capabilities.[7] The procurement of PCR reagents and consumables posed another significant hurdle. Bangladesh, like many other low- and middle-income countries, struggled with the global competition for medical supplies during the pandemic. The disruption of international supply chains made it difficult for institutions like RMC to consistently acquire the necessary reagents, primers, and probes. This often led to delays in testing and reporting, which in turn affected the speed of contact tracing and isolation efforts. Such delays had the potential to exacerbate the spread of the virus, particularly in densely populated areas like Rajshahi. Financial constraints also presented a major challenge. PCR testing is expensive, particularly in resource-constrained settings. While the Bangladesh government subsidized testing for the most vulnerable populations, the overall cost of maintaining large-scale testing operations remained a significant financial burden for institutions like RMC.[8] The financial strain was further compounded by the need to frequently import expensive reagents and testing materials from abroad.

Additionally, human resource shortages posed significant operational challenges. Although RMC rapidly trained a number of healthcare workers and laboratory technicians in PCR testing, the prolonged duration of the pandemic led to burnout and fatigue among healthcare staff. As the pandemic continued, laboratory staff were often working extended hours under difficult conditions, contributing to high levels of stress and fatigue. Despite these challenges, RMC demonstrated significant adaptability in its PCR testing approach. Technological advancements, including the introduction of automated RNA extraction machines and advanced real-time PCR platforms, helped improve the efficiency of testing and reduce the turnaround time for results. Automation also mitigated the issue of human error, which is more likely to occur when laboratory staff are overworked and fatigued. RMC also made significant strides in digital health solutions,

integrating data management systems that allowed for real-time reporting of test results. This innovation proved critical in enabling public health authorities to monitor the spread of the virus and implement timely interventions. By digitally linking the test results to the national COVID-19 database, RMC helped facilitate better coordination between local and national health authorities, contributing to more effective pandemic management.

Moreover, the college partnered with local universities, private laboratories, and international institutions to expand its testing capacity. Through these partnerships, RMC was able to access additional resources, including reagents and personnel, which allowed the college to keep pace with the growing demand for PCR testing .[9] These collaborations also fostered knowledge sharing and the exchange of best practices, further enhancing the quality and efficiency of testing at RMC. One of the critical ethical concerns surrounding PCR testing at Rajshahi Medical College—and in Bangladesh more broadly—has been ensuring equitable access to testing. While urban areas like Rajshahi city had relatively better access to testing facilities, rural and underserved populations faced significant barriers to accessing PCR tests. These included geographical constraints, financial limitations, and a lack of awareness about the importance of testing.[10] Rajshahi Medical College sought to address this issue by deploying mobile testing units in rural areas, bringing PCR testing closer to underserved communities. Additionally, RMC implemented community outreach programs to raise awareness about COVID-19 symptoms, testing, and preventive measures. These efforts were essential in ensuring that marginalized populations were not left behind in the fight against COVID-19.

The experience of Rajshahi Medical College with PCR testing during the COVID-19 pandemic highlights both the potential and the challenges of deploying molecular diagnostic tools in resource-limited settings. Despite the significant obstacles posed by limited infrastructure, supply chain disruptions, and financial constraints, RMC rose to the occasion, playing a central role in the regional and national response to the pandemic. Moving forward, the lessons learned from this experience underscore the importance of strengthening healthcare infrastructure and investing in molecular diagnostic capabilities. Governments and healthcare institutions must prioritize the development of robust laboratory networks and invest in training programs to prepare for future pandemics. Rajshahi Medical College's efforts in PCR testing have demonstrated the resilience and adaptability of Bangladesh's healthcare sector, proving that even in the face of overwhelming challenges, progress can be made with determination, innovation, and collaboration.

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The Journal of Teachers Association
Abbreviated Key Title: TAJ
Official Journal of Teachers Association Rajshahi Medical College

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