

HEALTHCARE DELIVERY

Challenges around COVID-19 at a tertiary-level healthcare facility in South Africa and strategies implemented for improvement

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SARS-CoV-2 has resulted in a global pandemic within months following its initial detection. South Africa (SA), like many other countries, was not prepared for the impact this novel infection would have on the healthcare system. In this paper, the authors discuss the challenges experienced while facing COVID-19 at a tertiary-level institution in Gauteng province, SA, and the dynamic strategies implemented to deal with the epidemic.

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On 31 December 2019, the World Health Organization (WHO) China Country Office was informed of a cluster of pneumonia cases in Wuhan City, Hubei Province of China. The aetiology of the pneumonia was unknown. However, it was thought to have originated from a seafood, poultry and wildlife market in Jiangnan District in Hubei Province. On 7 January 2020, a novel coronavirus was identified by the Chinese authorities.^[1] Although transmission initially occurred from animals to humans, rapid human-to-human transmission followed. On 31 January 2020, the WHO declared the outbreak to be a public health emergency of international concern.^[2]

The resilience of health systems' responses to COVID-19, including those in high-income countries, is open to question.^[3,4] Health system resilience can be defined as the capacity of healthcare workers (HCWs), institutions and populations to prepare for and effectively respond to crises. This maintains core functions when a crisis hits and utilises lessons learned during the crisis to reorganise as necessary.^[5]

The African continent is likely to be severely impacted by COVID-19 as the pandemic unfolds. The continent's weak healthcare systems and sizeable immunocompromised populations (owing to a high prevalence of malnutrition, malaria, HIV/AIDS and tuberculosis compounded with the double burden of non-communicable diseases such as cardiovascular diseases, cancers, chronic respiratory diseases and diabetes mellitus) make it vulnerable for increased numbers of cases and more severe disease. In addition, the arrival of the winter 'flu' in southern Africa from May and poor economic status in many African countries has the potential to burden health systems even more.^[6]

South Africa's (SA) first COVID-19 case was reported on 5 March 2020. Since then, cases have been reported across all of the country's nine provinces. The number of infections has steadily risen since

lockdown restrictions were lowered from level 5 to level 3 at the beginning of June 2020. On 14 July 2020, SA had the tenth highest number of confirmed cases globally, with more than 275 000 cases and over 4 000 deaths. Gauteng, the smallest province in the country, currently has the highest number of COVID-19 cases. This is exacerbated by the fact that the province is the economic hub of the country and is the most densely populated, with approximately a fifth of South Africans residing in this region.^[7]

There are very few publications that have described the challenges faced by HCWs or institutions that are at the coalface of the COVID-19 outbreak.^[8,9] To the best of our knowledge, there are no such publications that have emanated from resource-limited settings. In this article, we discuss our experiences at a tertiary-level institution in Johannesburg, Gauteng, in the initial 4-month period (5 March - 5 July 2020) of the outbreak. The challenges encountered and strategies employed for improvement during this period are detailed below.

Challenges faced

The hospital is a university-affiliated, tertiary-level institution with ~1 100 beds and more than 4 000 professional and support staff. Since the WHO had declared COVID-19 a public health emergency of international concern, the institution had been designated as a COVID-19 facility in Gauteng province. At that stage, all staff members were novices in the activities that lay ahead. However, compared with primary- or secondary-level institutions, it was assumed that this institution would be better equipped to handle this novel infectious disease in view of the specialists, subspecialists and more advanced facilities available at the hospital. Despite this, several challenges emerged as suspected COVID-19 cases began to present to the hospital. These challenges included:

- **Lack of district-level referral pathways.** The lack of proper district-level co-ordination among hospitals and clinics, in terms of the referral pathways for suspected COVID-19 patients, led to an influx of cases to our centre. This occurred despite there being secondary- and tertiary-level hospitals that could have managed these cases adequately. This increased the strain on the emergency departments (ED).
- **Delay in creating designated COVID-19 areas.** A delay in the response by hospital managers to create COVID-19 designated areas in the ED and wards. Achieving adequate staff allocation to these areas was also problematic. Initially, there was a 'silo' mentality of specialties which prevented skills and resources from being redeployed towards the COVID-19 response. This may have potentially led to an increased risk of exposure and infection of non-COVID-19 patients in these areas.
- **Lack of on-site COVID-19 diagnostic testing during the initial stages** meant that all samples were referred to the reference laboratory at the National Institute for Communicable Diseases (NICD) in Johannesburg. This led to delays in test results and challenges in treatment and patient management. In addition, the virology department at the institution had to validate several kits and identify the most appropriate ones for use. This took several weeks prior to the introduction of COVID-19 testing at the hospital.
- **Protocols and guidelines.** The need for several documents to be drawn up urgently, including a COVID-19 screening questionnaire, clinical management protocols for suspected cases, laboratory protocols for testing of potentially infectious samples and infection prevention and control (IPC) protocols based on risk assessments in the various hospital areas. However, owing to the rapid evolution of scientific information globally, the introduction of guidelines from the Department of Health and NICD as well as the dynamic nature of the pandemic, many of these protocols required regular updating.
- **Impact on non-COVID-19 patients.** Significant impacts were observed on the management and outcome of patients presenting with non-COVID-19-related pathology. This was predominantly due to patient fears of contracting COVID-19 during hospital admission. Hence an increase in the number of delayed presentations with life-threatening conditions, such as myocardial infarction, acute stroke, acute abdomen, diabetic ketoacidosis, etc., was noted. Furthermore, since the institute's attention and focus on patient care were predominantly shifted toward the COVID-19 response, the redeployment of staff from other departments to these areas may have also negatively impacted on the overall management and outcome of non-COVID-19 patients. Also, there was a significant number of asymptomatic COVID-19 patients who were admitted with other illnesses but were incidentally diagnosed with COVID-19 upon routine testing. This, coupled with laboratory delays in processing of samples, resulted in increased exposure and heightened risk of non-COVID-19 patients contracting COVID-19 during hospital admission.
- **Conflicting recommendations regarding personal protective equipment (PPE).** Conflicting recommendations regarding PPE requirements from local and international bodies in the initial phase of the outbreak led to disagreements between staff at the institute. This was perpetuated by some experts claiming that the virus may be spread by the airborne route.
- **Work relations between staff members.** Certain members of staff, such as clerical, porters and cleaners, felt that PPE was prioritised for clinical staff. This led to dissatisfaction and impacted on work relations between staff members.
- **Anxiety, panic and fear among staff.** Significant feelings of anxiety, panic and fear among staff resulted in some refusing to manage COVID-19 patients or overcompensating with PPE usage, leading to its wastage.
- **Shortages, quality and procurement of PPE.** Shortages of PPE due to misuse and/or theft from ward areas where they were provided. Certain batches of PPE, including plastic aprons, coveralls and shoe covers, were of poor quality, not impermeable and tore easily. Mismanagement of funds without proper consultation of relevant stakeholders was also of concern.
- **Staff not donning PPE correctly** (or as per the situational requirements) due to lack of awareness or carelessness and despite continual training by IPC staff.
- **Environmental disinfection.** Shortages of hand-sanitising solution and biocide used for environmental disinfection.
- **Improper IPC practices** led to several staff members being infected with COVID-19 and requiring them to be booked off from work for several days to weeks based on the severity of their symptoms.
- **Exposure risks.** The risk of exposure to the virus through contact with contaminated patient files, particularly in wards, outpatient clinics and the pharmacy. This was thought to have contributed to the infection outbreak among staff in the pharmacy.
- **Stigmatisation.** A sense of stigmatisation from work colleagues was reported by a few confirmed COVID-19-positive HCWs when they returned to work.
- **Intermittent supply shortages** of viral test kits or consumables once testing in the institution had commenced. This led to delays of several days in reporting COVID-19 results to patients or HCWs.
- **Increases in other healthcare-associated infections.** Multiple factors contributed to observed increases in other healthcare-associated infections (i.e. multidrug-resistant pathogens and *Clostridium difficile*). Firstly, institutional IPC efforts were shifted towards the pandemic response. Secondly, empirical antimicrobial treatment for all possible causes of pneumonia (viral, bacterial and fungal) in the severely and critically ill patients was recommended by a few infectious diseases and respiratory physicians. Additionally, antimicrobial stewardship rounds in the hospital were discontinued in order to reduce contact with potentially infected patients. Clinician time spent with patients suspected or confirmed to be COVID-19-positive decreased, which negatively impacted on careful clinical assessment, leading to other infections being missed.
- **Confusion around decontamination guidelines** of patient examination rooms or ward areas resulted in delays in care being offered to other patients. Staff in some areas insisted on fogging contaminated areas following cleaning, despite lack of evidence to support these claims. In addition, there were insufficient fogging devices in the institution to support these demands.
- **Difficulty in stepping down patients requiring oxygen or other supportive care,** as most step-down facilities were not sufficiently equipped and did not have nurses or doctors on site.

Strategies implemented for improvement

During infectious diseases epidemics, a co-ordinated and multi-disciplinary management plan between nursing managers, infectious diseases specialists, intensivists, emergency physicians, senior clinicians, IPC team, pathologists and hospital management is of paramount importance. For this purpose, the chief executive officer of the hospital formed a COVID-19 group consisting of these relevant stakeholders. This group would communicate daily via

WhatsApp on all COVID-19-related matters and meet once weekly to address issues faced in the previous week. This led to the quick and efficient identification and resolution of problems. In addition, the WhatsApp group facilitated the sharing of pertinent information around COVID-19 and of call rosters for the various role players. As the number of cases began to increase, the weekly meetings changed to a virtual format.

To assist staff with their 'fear of the unknown', daily morning and evening debriefing sessions were introduced in high-risk areas such as the intensive care unit (ICU). All staff members were given a chance to voice their concerns and receive feedback to address and alleviate their apprehension. This had an enormously positive impact on the staff. The institution also began bi-weekly training of all staff as well as staff from the referring clinics and hospitals around this novel disease. The training was offered by the IPC team, a clinical microbiologist and an intensivist. It included information on the causative virus, the global and local impact of the disease, risk groups for severe disease, natural progression of the disease, treatment and prevention strategies. In addition, the IPC team also provided focused training for specific groups of staff members such as radiographers, pharmacists, cleaners, security, mortuary and administrative staff.

Daily sessions on donning and doffing of PPE were instituted in the ICU until staff were absolutely comfortable with the procedure, and have been ongoing since. Adjustments to existing recommendations on PPE were made as information evolved to ensure appropriate staff protection. In addition, PPE donning and doffing videos were also created for quick reference by staff during their respective shifts.

All staff and patients are screened daily for COVID-19 with a questionnaire as they enter the hospital. HCWs who screen positive for COVID-19 symptoms or exposure are referred to the occupational health and safety clinic for immediate assessment. Additionally, this clinic assists staff with psychological or emotional issues that impact negatively on them. Patients who fit the criteria for possible infection are directed to the ED where they are seen in a designated COVID-19 examination room.

Due to space limitations in the ED, tents have been erected outside the hospital for COVID-19 screening purposes. Patients are separated as they enter these screening areas into 'high risk' (if they have respiratory symptoms) and 'low risk' (if they do not have any respiratory symptoms). Swab tests are performed in the tent on stable high-risk patients. As a proactive measure early on in the response, the infectious diseases team identified wards for patient admissions in the event that numbers would increase rapidly. In the initial phase, the hospital only used two high-risk and two low-risk wards for suspected cases who required admission or could not self-isolate while they awaited their test results. If results were negative and the patient required admission, he/she was transferred to the respective subspecialty department for admission. COVID-19-confirmed patients were transferred to two designated wards. With the increase in patient numbers over time, capacity has gradually increased to six wards (126 beds) for COVID-19 patients under investigation and five wards (152 beds) for patients with confirmed COVID-19. A separate ICU area (available at the hospital for viral haemorrhagic fever and other formidable epidemic diseases) with the capacity to accommodate six patients, was initially utilised for COVID-19 patients requiring intensive care and support. This was extended to a section of the adult multidisciplinary ICU to increase patient admission numbers to 19. With the assistance of the Roy McAlpine Charitable Foundation, a new 29-bed ICU with 15 high-flow nasal cannula devices was inaugurated during July 2020. Following social responsibility partner engagement, 200 mechanical ventilator and high-flow nasal cannula devices were approved for purchase.

However, due to procurement delays, these are only expected to arrive at the end of August 2020.

Three nearby facilities were identified for referral of stable patients who could not self-isolate in their own homes while awaiting test results. As the pandemic progressed, all hospitals in the province were required to screen suspected COVID-19 cases and manage their positive patients. Strict criteria regarding when to refer to their referral centres was discussed among institutions.

To reduce patient numbers within the hospital, all elective surgical cases were cancelled. Stable patients were assessed briefly at the outpatient clinics and were given repeat scripts for treatment for 3 months. Some patients on oral vitamin K antagonist anticoagulant therapy (warfarin) were transitioned onto direct oral anticoagulant therapy following negotiations with manufacturers. These agents require no routine laboratory monitoring, decreasing laboratory and hospital visits. The reduced patient numbers at the hospital enabled staff to be mobilised to the burdened EDs and COVID-19 wards.

Initially, staff members did not want to move from non-COVID-19 areas to assist in COVID-19 designated areas. A few staff members volunteered their services and agreed to move. Subsequently, they gave feedback to colleagues about their positive experiences and the satisfaction they felt assisting during the pandemic. This motivated more staff to volunteer their services. A roster for the specialities to redeploy staff to COVID-designated areas is currently in place at the institution, should the need arise.

Owing to worsening PPE and disinfectant shortages, it was decided that stock of these items be controlled by the IPC team. Previously it was managed and dispensed by stores and no clear records of ward orders were kept. The items are dispensed based on staff and patient numbers in the respective areas. N-95 masks are re-used due to the supply shortages experienced. One mask is used per staff member for the whole day. All PPE that is dispensed is recorded in a logbook. Similarly, hand-sanitiser stock is being overseen and supervised by the pharmacy. Operational managers of the different ward areas are held accountable with disciplinary action if PPE or disinfectant stock goes missing. The hospital was also fortunate to receive some donations of PPE from the Gift of the Givers and a few other non-governmental organisations.

Last, but definitely not least, the design of a prototype aerosol box in March 2020 paved the way for barrier devices. These would assist in further protecting frontline staff from being exposed to COVID-19 viral particles during aerosolising procedures. Challenges with the prototype box led to the ED team at our institution significantly modifying the device into the Intubox (Fig. 1).^[10] Funding for the production of the box was made possible with support from the private sector by the South African Pandemic Intervention Relief Effort (SPIRE) and the Paramount Group, an Aerospace company. Five hundred boxes were produced and distributed to hospitals across the province.

Conclusions and recommendations

The challenges faced at our institution have most likely been encountered by other healthcare facilities as well. The numbers of confirmed COVID-19 infections continue to increase in SA as lockdown restrictions are lowered. As a result, the sharing of this information can assist in modifying practices in order to be better prepared to control this outbreak at facility level.

Challenges still facing our institution include insufficient staff, shortages of testing kits and consumables, including PPE and disinfectants. Facilities need to have leadership teams to address various aspects of the response such as operations teams, clinical



Fig. 1. The Intubox.

advisory teams, human resource teams and finance teams.

Facilities also need to consider maintaining staff numbers above what would normally be expected. This is to cover for eventualities such as days off due to COVID-19 exposures, leave days to cater for childcare due to school closures and for staff shift systems to be operational for social distancing purposes. In addition to this, facilities need to anticipate for stock shortages due to production plant shutdowns or importation delays by catering for extra stock.

First-World countries have the added luxury of having telehealth and digital/paperless systems in place to ease connectivity and limit exposures to individuals. There are some initiatives towards introducing these systems in our setting. However, they need to be prioritised and fast-tracked.

The institution and staff continue to learn a lot from this experience. The

support and leadership offered by hospital management, various clinical heads of units, matrons, IPC team and the pathologists ensured better organisation and execution of several of the improvement strategies. The accountability of area managers to ensure staff are well trained and to oversee sufficient stock of all consumables also enables better management of the patients. This epidemic has shown us that within an institution multi-disciplinary team effort, open communication about challenges as well as supportive management structures enable hurdles to be identified and the vast majority overcome.

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