

Concepts in Disaster Medicine

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Optimizing Highly Infectious Disease Isolation Unit Management: Experiences From the Infectious Diseases Isolation and Research Unit, Fort Portal, Uganda

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Abstract

Infectious disease outbreaks on the scale of the current coronavirus disease 2019 (COVID-19) pandemic are a new phenomenon in many parts of the world. Many isolation unit designs with corresponding workflow dynamics and personal protective equipment postures have been proposed for each emerging disease at the health facility level, depending on the mode of transmission. However, personnel and resource management at the isolation units for a resilient response will vary by human resource capacity, reporting requirements, and practice setting. This study describes an approach to isolation unit management at a rural Uganda Hospital and shares lessons from the Uganda experience for isolation unit managers in low- and middle-income settings.

Emerging infectious diseases have dominated the global health agenda for the past 10 y. The world has recorded an increasing number of outbreaks, including those that required declarations of a public health emergency of international concern (Ebola virus disease [EVD] and polio in 2014, Zika in 2016, and most recently, coronavirus disease 2019 [COVID-19]).¹ Re-emerging infections strain health service delivery, especially in low- and middle-income countries (LMICs), where resources are scarce. Building resilient health systems will require investment in local leadership, collaboration, and an enabling environment so that health units are resilient in the face of an outbreak.

Multiple isolation unit designs with corresponding workflow dynamics and personal protective equipment (PPE) postures have been proposed for each pathogen, depending on the transmission mode.^{2–6} However, personnel and resource management at an isolation unit will vary by human resource capacity, reporting requirements, equipment availability, and practice setting. Clinical expertise for managing emerging infectious diseases is often limited in LMICs. Therefore, during outbreaks, health-care workers (HCWs) are required to focus from routine work to the more specialized tasks of an outbreak response and isolation unit management.^{7–9}

Uganda reported the first case of COVID-19 in March 2020. The Ministry of Health designated case management centers in all the 14 Regional Referral Hospitals in the country, and Fort Portal Regional Referral Hospital (FPRRH) admitted its first patient on May 17, 2020. This manuscript describes the FPRRH Isolation Unit's management approaches and linkages with hospital leadership at a rural Ugandan hospital during the COVID-19 pandemic response.

Setting

Joint Mobile Emerging Diseases Intervention Clinical Capability (JMEDICC) was established in 2017 through a partnership between United States and Ugandan research entities to set up a functional clinical research capability to rapidly implement research in medical countermeasures for emerging infectious diseases in austere settings.

The program is hosted at FPRRH in Western Uganda, approximately 300 km from the capital Kampala and less than 100 km from the Uganda-Democratic Republic of Congo

(DRC) border. The hospital serves the Rwenzori region, which has seen outbreaks of cholera, Crimean-Congo hemorrhagic fever (CCHF), EVD, and COVID-19. The past 2 outbreaks of EVD were a consequence of importation across the Uganda DRC border.^{10,11}

The JMEDICC, together with hospital leadership, jointly supports a 6-bed high dependency isolation ward within the hospital premises. The unit also has a Biosafety level 2 laboratory, with rapid containment devices to analyze samples from patients with highly infectious diseases under BSL-3 conditions. The unit also has a pharmacy and a logistics hub within the same campus.

In periods when there are no active outbreaks, this unit serves as a simulation exercise laboratory for local staff through weekly drills and national health worker training in collaboration with other stakeholders. This capacity has transformed FPRRH into a center of excellence for best practices in isolation unit management and created a hub of highly competent staff who champion best practices for safety, clinical care, and isolation unit management. Since its inception, the site has been used for training and mentoring local and regional health workers in infection control and outbreak preparedness.

The hospital's isolation unit capacity has since expanded in anticipation of a surge in patient numbers. Naluyima *et al.* and Martins *et al.* have published more information about JMEDICC and the isolation unit layout here.^{12,13}

Mapping of Functions for an Isolation Unit

Isolation units are a necessity for the safe management of highly infectious diseases. This novel requirement in the traditional hospital structure calls for contributions from pre-existing departments to establish and smoothly execute the isolation unit functions while maintaining essential services continuity. Infectious disease outbreak management and, by extension, isolation unit management calls for reporting requirements that support planning at the local and national levels.

Routine operations have flexible reporting requirements, allowing managers to study the situation and planning accordingly to ensure adequate resource allocation for day-to-day activities. Hospitals can also outsource several ancillary services like cleaning and security, which eases the management burden on the hospital. Specialist consultations for acute, elective, and chronic care are coordinated across departments, with minimal changes in the infection risk with exceptions of high dependency units and operating theaters.

An investment in the preparedness of the workforce and cross-training of staff to enable task transfer during such emergency periods has been crucial in giving FPRRH an advantage in quickly adapting at the onset of the pandemic, to ensure timeliness of reporting, ensuring availability of information to decision-makers, and to optimize patient care.

At FPRRH, this has been mapped into 3 functional units, including leadership, isolation unit core team, and specialty care functions (Figure 1).

Oversight and Management Functions

In collaboration with other stakeholders, the management of the hosting hospital provides overarching supervision of all activities within the facility, including the allocation of resources to ensure continuity of essential services and timely response to incidents of emerging infectious diseases. Regular engagement between the elements of a hospital-based response and the community to mitigate the extent of the infectious diseases within the population informs

the hospital leadership in charge of apportioning resources such as staff, supplies, and medicines used at all levels and departments of health-care delivery.

The leadership also serves as the point of contact for all communication regarding infectious disease response to the media, regional and national structures, and local stakeholders' coordination to align priorities for the response plan.

A designated infectious disease case management focal person gathers information from all response-related functions within the hospital, including screening and triage, coordination of diagnostics, isolation, and ancillary services such as logistics and ambulance services considering both essential services continuity and optimal management of isolation units.

Core Functions

These represent the roles that must be established at baseline to activate an isolation unit for patient management. Staffing requirements for these roles can be increased depending on the number of patients and the isolation unit's size

Shift Lead/(Shift Nurse Lead/Manager): During an active outbreak response, this role supports coordination of all the functions of the isolation unit, including unit activation, communication with other structures within the hosting facility, and supporting safety functions for all patients and staff deployed on a work shift. For isolation units with low occupancy, these roles are executed by a single individual. Delegation of functions to smaller teams is also possible when the patient numbers at the unit increase. The shift lead is the point of contact for all communications to the isolation unit, provides updates to the hospital leadership, and is the focal person for staff occupational safety and custodian of all documentation for staff and patients at the isolation unit. During periods of low activity, the shift lead is responsible for coordinating staff training and ensuring that all prospective staff for deployment have up-to-date competencies in best practices of safety and patient care.

The shift lead role embodies the combination of technical expertise in infection control, communication, and team management in 1 person. It is a function that the most experienced person should assume on the team. Mentorship of peers through co-leading a shift provides a continuity plan to build capacities within the team to support other isolation areas within the hospital campus.

Medical Team: The medical team oversees patients' medical evaluation and gathers essential history to support contact-tracing efforts as part of a broader epidemiological investigation. Clinicians and nursing professionals of various cadres with a good command or experience in infection control for pathogens under investigation can support this function. They receive real-time support from the shift lead to make decisions regarding patient care, such as requesting referrals and the extent of medical interventions that can be safely executed in their operating environment.

Where settings permit the operation of onsite laboratory operations, the laboratorians would fall under this category. The use of bedside testing platforms means the clinicians can conduct rapid assessments to inform patient care in real-time and reduce the human resource footprint deployed in the high-risk zone. In the current Ministry of Health of Uganda approach to testing during the COVID-19 pandemic, only select laboratories have been accredited for running diagnostics. Current planning allows for flexibility to embed laboratorians in this core team when local diagnostic testing is approved.

Environmental Hygiene: Regular disposal of infectious waste is a crucial intervention in limiting the spread of infectious agents.

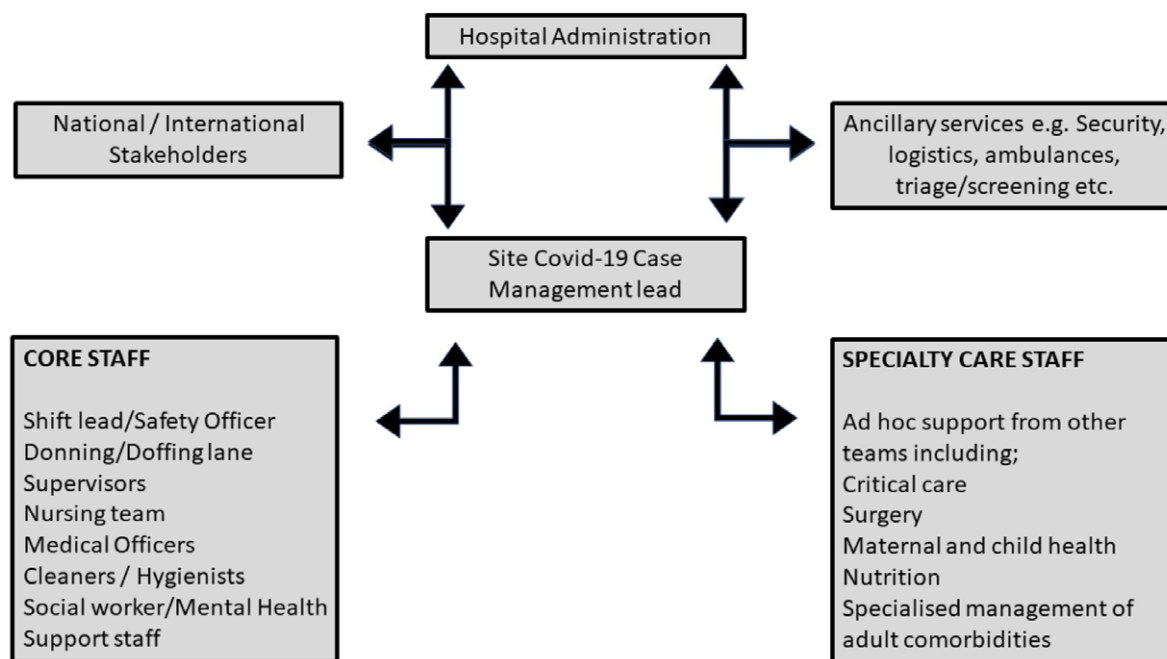


Figure 1. Isolation unit roles organogram.

Infectious disease isolation units present a unique situation. Most of the janitorial staff rarely receive training in environmental hygiene and core skills such as the use of advanced PPE. The high staff turnover rate of janitors also means the team does not stay around long enough to receive adequate training or undergo appropriate competency assessments.

An approach of having clinicians and nurses participate in environmental hygiene functions, especially when there is low isolation unit occupancy, or when most of the patients are mildly ill, and ambulatory has been instrumental in reducing the number of staff exposed to patients, reduces the amount of PPE used per day. This approach further gives the team confidence, having cleaned their environment, knowing the surfaces or equipment they touch most.

Social Workers/Mental Health: The dilemma of minimally symptomatic patients isolated either due to mild illness or awaiting a negative diagnostic test presents a challenge of ensuring these individuals are compliant with the safety measures and ensuring their needs for communication, movement, and general wellness are met. The role of mental health support staff and social workers has become a vital element of the core team constitution. Most of the patients presenting with COVID-19 in the first wave in Uganda had mild and moderate COVID-19. Social workers provide communication and planning for discharge, linkage of families to community support structures, and assessment of mental health wellness. These staff members also play a role in bridging the core team and access to specialty care, especially for children and special needs patients, supporting daily requirements such as delivering meals and personal effects. As the pandemic evolved and the second wave came with higher numbers of very ill patients, this role largely shifted to support patients under home-based care and lucid patients in admission.

Burnout, anxiety, and occupational exposure to patients or contaminated environments can hinder the staff's performance if they are not supported. Embedding mental health staff in the team provides an avenue for other deployed HCWs to quickly access mental health support

Donning/Doffing Instructors: PPE is an element of the multimodal approach that staff use to limit nosocomial transmission of infectious agents. Advanced PPEs are required for highly infectious pathogens. However, more PPE elements translate into an increased risk of infection, especially during doffing.¹⁴ Donning lane and doffing lane instructors act as quality assurance marshals for PPE procedures and safely support staff to doff when there has been more than usual soiling of PPE or breaches in the outfit's integrity. This is critical for the doffing process when team members are tired and prone to taking shortcuts if not supervised. The utility of donning and doffing posters or standard operating procedures means this role can be passed around peers so that smaller teams can function without compromising safety.

Specialty Care Functions

Specialty functions come into play as the patient numbers increase and patients with comorbidities are isolated. The scarcity of highly trained staff to support both routine services in the hospital and isolation units means such expertise is called upon on a case-by-case basis.

Hosting an isolation unit in a hospital setting enables access to consultations and planning interventions in the shortest time possible. HCWs who provide specialized care such as surgery, maternal and child health, or nutrition interventions might require just-in-time orientation to the operations and established workflow within an isolation unit.

The other challenge is that the environment in many isolation units is not configured to provide the needed interventions. There are a few isolation units with the capacity to provide additional environmental controls to manage emergencies and surgical interventions. Staff have compensated for this shortcoming by using higher-level PPE for these special procedures.

Teleconsultations coordinated by the shift lead are leveraged primarily when local consultants were unavailable. The isolation unit boasts of information technology infrastructure to support

patient monitoring by telemetry and real-time communications with HCWs in other units in Uganda and internationally. This robust capability can be expanded further to optimize staffing and bring more expertise to the patient management process. Telemedicine consults have covered all aspects from clinical consults to infection control approaches, management of safety incidents, and mitigation of breaches in containment measures.

Lessons Learnt

Uganda's COVID-19 pandemic trajectory is still evolving and, until recently, had realized only 1 wave of the disease in late 2020. This approach was practical, ensuring continuity of essential services through optimized staffing, rational use of resources, especially PPE, and timely reporting for local planning and national reporting to the Ministry of Health. The strategy promotes rapid decision-making and is intended to cut down bureaucratic approaches, which can potentially delay urgent medical interventions. Still, managing a highly contagious infection such as COVID-19 requires strict observation of infection prevention and control principles to prevent incidences of health worker infections that could jeopardize outbreak response. Therefore, catering for occupational health and exposure incident logging provides HCW infection surveillance and quality improvement opportunities through analysis and correction of recurring themes in HCW exposures. Availability of additional information on equipment status, upcoming validation dates for laboratory equipment, staff health monitoring logs, and aggregated patient reports to the shift lead mean there is always a list of priority items to follow up.

One of the tenets of the proposed isolation unit management model is the need for flexibility among team members covering the unit. Flexibility among staff means that a small number of health workers can effectively manage the different tasks that relate to patient care, waste management, and patient audits, among others. This model, however, could potentially be undermined by the fact that the prevailing culture excludes clinicians and laboratorians from environmental hygiene and non-clinical tasks in routine care of patients outside infectious disease outbreaks—tasks they might not be willing to take on to bridge the human resource gap.

Furthermore, the model premises on the principle that only HCWs trained and proficient in infection control and prevention should be permitted to work in isolation wards of diseases of a highly infectious nature. Where investment in HCW and hospital preparedness planning has not been made, there is a bottleneck of providing adequate training when the need is immediate.

In the second wave of the pandemic starting in late May 2021, this approach was modified to support continuity of operations as the hospital opened 2 large cohort wards to admit the increasing numbers of patients. Although the human resources are not infinite, the experience from the first wave had built enough flexibility within the team so that there was not significant crippling of activities when HCWs had to self-isolate either due to infection or high-risk exposures. There was willingness and commitment from the hospital leadership during surges of patient numbers for more liberal resource allocation to support the continuity of activities on wards managing COVID-19 patients, which was not observed in the pre-surge period. Also, the experience of staff from the first wave has been leveraged to mentor and train newly introduced HCWs to isolation unit operations to meet the high demand for staff to care for the high patient numbers.

Recommendations

As the world continues to fight the COVID-19 pandemic, we have a unique opportunity to prepare better for the next pandemic and other emerging infectious diseases. Investing in health workforce capacity development and building hospital infrastructure to support rapid source control of infections are vital steps in helping the health navigate the dynamic needs of a hospital-based emergency response to outbreaks to mitigate the risk of amplification in health care.¹⁵ The proposed approach has been piloted at other isolation units in the country with the JMEDICC team's support to form a basis for the country's best practices of isolation unit management, improving reporting, staff deployment, and continuity of essential services within the host hospitals. The successful implementation of this management approach hinges on HCWs being cross-trained in a way that encourages everyone's participation in safety and environmental hygiene efforts, on top of other professional and specialty care functions.

Olaifa and colleagues demonstrated that poor practice in key environmental hygiene roles such as waste management is closely correlated with low knowledge and inappropriate attitudes among all staff members in South African hospitals.¹⁶ Mentorship and training of the janitorial staff by clinicians or laboratorians who understand disease transmission's scientific basis build the hygienists' confidence and competence. Furthermore, it acts as a stopgap early in the outbreak where identification of competent ancillary service providers is not practical.

Proactive efforts to link HCWs supporting isolation unit management functions (such as the shift lead) with the host institution administrative structures provide a channel for informed contributions in the broader planning and external communication efforts. Although this approach empowers the shift lead on the hospital case management point-of-contact person to make decisions regarding operations on the isolation unit, critical decisions regarding facility budgeting, staff numbers, and equipment purchases still reside with the overarching hospital administration. This model's advantage is availing additional information to the higher-level decision-makers to inform assumptions around resource allocation.

Evaluation of this model is a moving target since the needs change depending on the phase of the pandemic. Nevertheless, it offers a framework for hospitals in LMICs to scale up or scale down pandemic response activities without compromising any critical elements of providing quality patient-centered care. Embedding isolation services, with solid nurse leadership as a critical service within the health-care structure at health facilities in Uganda and other LMICs, would be an excellent outcome from the current COVID-19 pandemic.

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site at the FPRRH this capability was leveraged by the Ugandan government and Ministry of Health (MoH) to support the COVID-19 pandemic.

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