






Original Article

The utility and sustainability of US Ebola treatment centers during the coronavirus disease 2019 (COVID-19) pandemic

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Abstract

Objective: In response to the 2014–2016 West Africa Ebola virus disease (EVD) epidemic, the Centers for Disease Control and Prevention (CDC) designated 56 US hospitals as Ebola treatment centers (ETCs) with high-level isolation capabilities. We sought to determine the ongoing sustainability of ETCs and to identify how ETC capabilities have affected hospital, local, and regional coronavirus disease 2019 (COVID-19) readiness and response.

Design: An electronic survey included both qualitative and quantitative questions and was structured into 2 sections: operational sustainability and role in the COVID-19 response.

Setting and participants: The survey was distributed to site representatives from the 56 originally designated ETCs, and 37 (66%) responded.

Methods: Data were coded and analyzed using descriptive statistics.

Results: Of the 37 responding ETCs, 33 (89%) reported that they were still operating, and 4 had decommissioned. ETCs that maintain high-level isolation capabilities incurred a mean of \$234,367 in expenses per year. All but 1 ETC reported that existing capabilities (eg, trained staff, infrastructure) before COVID-19 positively affected their hospital, local, and regional COVID-19 readiness and response (eg, ETC trained staff, donated supplies, and shared developed protocols).

Conclusions: Existing high-level isolation capabilities and expertise developed following the 2014–2016 EVD epidemic were leveraged by ETCs to assist hospital-wide readiness for COVID-19 and to support responses by other local and regional hospitals. However, ETCs face continued challenges in sustaining those capabilities for high-consequence infectious diseases.

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In response to the 2014–2016 West Africa Ebola virus disease (EVD) epidemic, the Centers for Disease Control and Prevention (CDC) developed a tiered network of treatment facilities with high-level isolation capabilities for safely managing patients with EVD in the United States.¹ Overall, 56 hospitals were designated as Ebola treatment centers (ETCs); 1 hospital in each of the 10 US Department of Health and Human Services (DHSS) regions was later selected as a Regional Ebola and Other Special Pathogen Treatment Center to further enhance domestic capacity to care for patients with EVD or other high-consequence infectious diseases (HCIDs).²

Following designation, federal funding streams supported ETC infrastructure investment, staff recruitment and training, clinical resources, and development of other high-level isolation capabilities. However, previous assessments by our team found that

despite significant financial investments in 2014–2015,³ designated units reported challenges in sustaining preparedness levels as the West Africa EVD epidemic was declared over in 2016 and attention and federal funding for HCID preparedness waned.^{4,5} By early 2019, at least 4 ETCs had decommissioned their unit and high-level isolation capabilities.⁵ Nearly all ETCs previously reported federal funding as their primary funding stream and a leading factor in sustaining high-level isolation capabilities.⁵ Despite this reliance, federal hospital preparedness program (HPP) funding for all but the 10 regional treatment centers expired in May 2020.⁶ Although COVID-19 supplemental funding has been allocated as potential temporary funding for these ETCs, and although states can elect to allocate state HPP funding to support state-designated ETCs, the status of most designated ETCs since HPP funding expiration is unknown.

HPP funding expiration for these facilities came amid a global pandemic that exposed vulnerabilities in hospital biopreparedness. Although COVID-19 is not considered a disease warranting high-level isolation care, its emergence as an unknown, novel disease positioned ETCs as the cornerstone of hospital and local

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preparedness.⁷⁻¹⁰ Our primary aim was to follow-up on our previous assessments of designated ETCs to determine ongoing sustainability, including how HPP funding expiration has affected the ability of hospitals to maintain ETC capabilities and, for units that no longer maintain those capabilities, reasons for decommissioning. We also sought to identify how the high-level isolation capabilities that ETCs invested in affected hospital, local, and regional COVID-19 readiness and response.

Methods

In February 2021, a link to an electronic survey was sent to all 56 originally designated ETCs, including the 10 regional treatment centers. The 4 hospitals that had previously reported in our assessments that they were no longer an ETC were also included, because we wanted to understand the reasons their unit was decommissioned. The survey was emailed to representatives from each facility and collected using Qualtrics software (SAP, Provo, UT). Data were exported and analyzed using descriptive statistics in an electronic spreadsheet (Excel, Microsoft, Redmond, WA). Qualitative data were coded using open coding; codes were collated into initial themes using content analysis; and themes were reviewed and defined through an iterative process.

The survey was structured into 2 sections: operational sustainability and role in coronavirus disease 2019 (COVID-19) response (Supplementary Material online). Using skip logic, the latter was not made available to units that had decommissioned before 2020. The survey included both multiple-choice questions and open-ended qualitative questions. The sustainability section queried units on whether they still had the capability to provide HCID care. Those that did not were asked reasons for decommissioning. Units that maintained capabilities were asked about funding sources, annual expenses, and the intent to continue ETC designation. In the second section, ETCs were asked how their capabilities affected unit, hospital, and local readiness and response to COVID-19 through multiselection options. ETCs were also asked to describe capabilities they had to rapidly develop as well as capabilities they had developed but never utilized. The survey ended with 3 qualitative questions for ETCs to share lessons learned and best practices. The survey was open for 60 days. Also, 2 reminder e-mails were sent to nonrespondents to encourage completion. The University of Nebraska Medical Center Institutional Review Board declared the study exempt from review (no. 0922-20-EX).

Results

Overall, 37 ETCs (66%) responded; 32 completed the survey, and 5 only responded with hospital name and whether the hospital maintains high-level isolation capabilities. Respondents included institutions from all 10 DHHS regions (Table 1). Also, 33 hospitals (89% of those responding) reported that they still had the intent and capability to serve as an ETC for care of patients with EVD and other HCIDs requiring similar specialized isolation.

Facilities that have decommissioned

Moreover, 4 hospitals reported they no longer maintained high-level isolation capabilities, including 2 which reported they had been decommissioned in spring 2019 and 1 which was decommissioned in summer 2020. Therefore, these 3 had not been identified in our prior assessments. The other facility decommissioned its unit and capabilities in 2015 and had previously reported doing

Table 1. Geographic Distribution of Responding Ebola Treatment Centers (N = 37)^a

Department of Health and Human Services Region	No.	%
Region 1 (CT, MA, ME, NH, RI, VT)	3	8.1
Region 2 (NY, NJ)	3	8.1
Region 3 (DC, DE, MD, PA, VA, WV)	9	24.3
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	1	2.7
Region 5 (IL, IN, MI, MN, OH, WI)	6	16.2
Region 6 (AR, LA, NM, OK, TX)	2	5.4
Region 7 (IA, KS, MO, NE)	1	2.7
Region 8 (CO, MT, ND, SD, WY, UT)	3	8.1
Region 9 (AZ, CA, HI, NV)	7	18.9
Region 10 (AL, ID, OR, WA)	2	5.4

^aStates listed by postal abbreviation.

so in a 2019 assessment.⁵ All 4 of these facilities reported that the program had decommissioned and/or had discontinued serving in its role as a designated ETC because of discontinuation of HPP Ebola Preparedness & Response Activities funding. Other factors that led to the decision for programs that decommissioned before COVID-19: 3 programs cited diminished perceived threat of EVD or emerging special pathogens, 2 cited lack of administrative support, 2 cited barriers to facility preparedness for proper patient placement, 2 cited staffing difficulties, and 2 cited additional training requirements. For the ETC that decommissioned in June 2020, other deciding factors beyond discontinued funding were reported. Both unit space and consumable supplies and PPE were needed for COVID-19 response, leaving the unit without capabilities to handle an HCID case outside COVID-19. If adequate funding existed to reestablish the ETC program, 25% of the units reported that they would agree to serve in this role again.

Facilities that maintain high-level isolation capabilities

Overall, 33 facilities reported that they maintained high-level isolation capabilities; among them, 28 completed the survey. All 28 responders reported that they plan to maintain those capabilities following the COVID-19 pandemic. To date, these ETCs have incurred a mean of \$234,367 (median, \$175,000; range, \$30,000–600,000) in annual expenses per year, funded by either external or internal sources, to maintain capabilities and capacity. Also, 6 units reported shortfalls in funding, which averaged \$163,667 (median, \$175,000; range, \$30,000–300,000). When asked to list shortfall expenses not covered, 5 ETCs reported full-time equivalent (FTE) funding, 4 reported replacing expired supplies or equipment depreciation, 3 listed overhead costs, and 2 cited major construction.

Several primary funding mechanisms to sustain ETC operations were reported on the survey. Of 27 responding institutions, 23 (85%) reported HPP funding, 18 (67%) reported institutional mechanisms, and 8 (30%) reported state funding (other than through HPP). Funding for ETC capabilities through the HPP Ebola Preparedness and Response Activities lapsed or decreased for 7 (25%) of 28 facilities. Of these 7, 4 (57%) reported that their estimated operational budget for this fiscal year had decreased by a mean of \$153,000 (median, \$150,000; range, \$109,000–200,000). Also, 5 (71%) of these ETCs reported they were uncertain whether

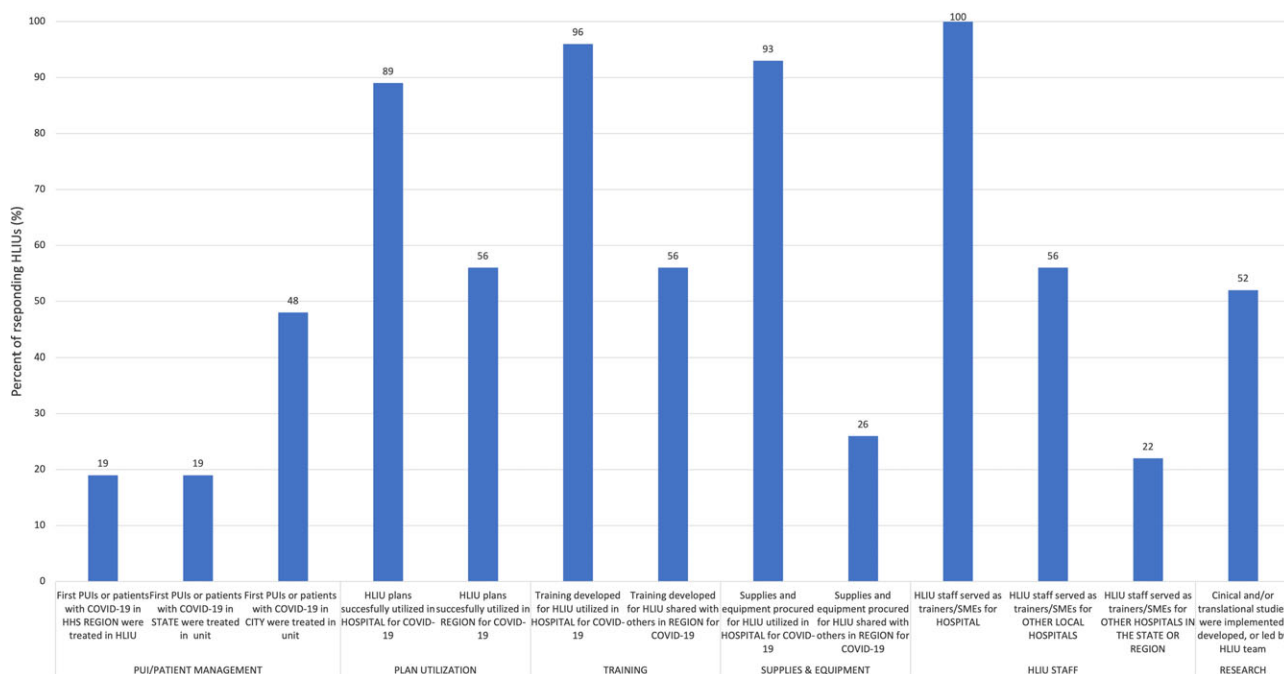


Fig. 1. Role of Ebola treatment center (ETC) high-level isolation capabilities in hospital, local, and regional response to COVID-19, by percentage (N = 27). Note. PUI, patient under investigation; HLIU, high-level isolation; SME, subject-matter expert.

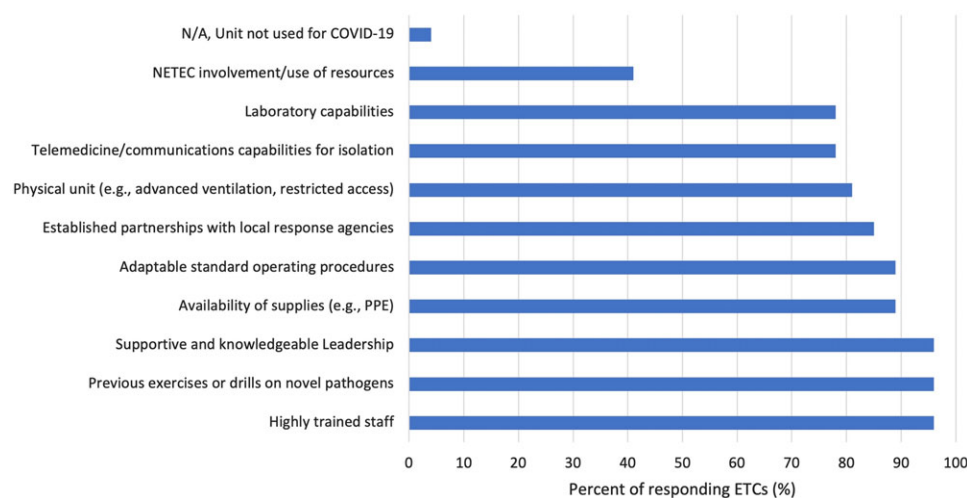


Fig. 2. Pre-existing high-level isolation capabilities that Ebola treatment centers (ETCs) perceived enhanced unit readiness and response to COVID-19, by percentage (N = 27). Note. PPE, personal protective equipment; NETEC, National Emerging Special Pathogens Training and Education Center.

the facility would continue to have the financial ability to maintain the unit and capabilities without federal funding. Of the 2 units that reported they would have that ability without federal funding, both estimated that the facility would be able to maintain capabilities for >3 years, and both identified institutional (hospital) funding as other sources of funding or support. Also, 1 institution identified state funding as alternative support.

Role in COVID-19 response

Overall, 29 ETCs (the 28 ETCs that maintained high-level isolation and the ETC that decommissioned mid-2020) completed the section on their role in the COVID-19 response. All but one unit (28 of 29, 97%) reported that existing capabilities (eg, trained staff, infrastructure) before COVID-19 positively affected their hospital’s COVID-19 readiness and response. Respondents detailed

the roles the capabilities played in hospital, local, and regional COVID-19 responses (Fig. 1) and unit readiness (Fig. 2). The single unit that reported that those capabilities did not impact COVID-19 readiness and response cited lack of available laboratory testing and cases immediately exceeding capacity as barriers to ETC capabilities that played an early role in the response.

Units reported multiple ways that they shared capabilities with the broader hospital and the perceived outcomes of having those existing capabilities in overall hospital-wide readiness and response to COVID-19 (Table 2). Of 29 ETCs, 22 (76%) reported that they had to rapidly develop or implement capabilities they did not have prior to the COVID pandemic. Also, 15 (52%) reported they had capabilities that they never needed to utilize. Themes from qualitative responses from both questions are detailed in Table 3. Furthermore, 9 (31%) of 29 units reported having capabilities that did not exist prior to the COVID-19 pandemic that

Table 2. Reported Ways Ebola Treatment Centers Shared High-Level Isolation Capabilities With the Broader Hospital and Perception of How Those Capabilities Affected Overall Hospital-Wide Readiness and Response to COVID-19 (N=27)

Inquiry Topic	Responding Units (N=27), No. (%)
HILU Capabilities Shared With Hospital	
Unit leadership played key roles in developing hospital-wide operating plans	27 (100)
Highly trained staff shared training and expertise across organization	26 (96)
Just-in-time training strategies, tools, and checklists deployed	26 (96)
Availability of supplies that were shared hospital-wide	24 (89)
Adaptable standard operating procedures shared with entire hospital	24 (89)
Staff available that understood how to access the most up-to-date information on the emerging virus including treatment, PPE needs, transmission	23 (85)
Established partnerships and previous coordination with local response agencies (eg, EMS, public health department)	22 (81)
Stockpiled pandemic respiratory supplies	21 (78)
Telemedicine/communications plans and equipment for patients in isolation	20 (74)
Robust emergency management pandemic planning	20 (74)
Laboratory capabilities provided advantage in early stages of testing	18 (67)
Previous exercises or drills on novel pathogens with multiple departments or units in the hospital had identified gaps that had been addressed before the pandemic	16 (59)
Previous relationship with PPE vendors allowed for earlier access to supply needs	15 (56)
NETEC involvement/use of resources (eg, education, technical assistance, SPRN involvement)	8 (30)
Perception of how HILU and associated capabilities affected overall hospital-wide readiness and response to COVID-19	
Adopted safety protocols led to safer early infection prevention and control practices	26 (96)
Earlier adoption of updated protocols/processes based on evolving information	25 (92)
Use of incident command structure for pandemic/special pathogen scenario	25 (92)
Improved infection control practices across the hospital	24 (89)
Staff were more proficient on PPE donning/doffing than in peer hospitals	23 (85)
Improved hospital-wide access to respiratory protection options	22 (81)
Improved coordination with pre-hospital agencies and stakeholders	19 (70)

Note. HILU, high-level isolation unit; EMS, emergency medical services; PPE, personal protective equipment; NETEC, National Emerging Special Pathogens Training and Education Center; SPRN, Special Pathogens Research Network.

they were unable to implement during the pandemic but would work toward for future pandemics. These included flexible and stronger respiratory protection programs, robust records of surge strategies utilized, definitive protocols to address location and level of interaction with parents and affected patients for pediatric care, and improved communication platforms with all caregivers. Table 4 presents ETC lessons learned and innovative practices reported.

Discussion

As reported by responding ETCs, high-level isolation capabilities and expertise developed following the 2014–2016 EVD epidemic were leveraged to assist hospital-wide readiness for COVID-19 and to support the responses of other local and regional hospitals. When COVID-19 was emerging and information was scarce, ETCs reported caring for the first patients with COVID-19 in their city, state, or region. They also assumed a role in educating and training other staff in their hospital or other area hospitals, donating supplies and equipment stockpiled for HCID response, and adapting and utilizing plans developed for HCIDs for COVID-19 hospital-wide.

Adaptable, highly trained teams and developed training programs and materials were the most cited ETC capabilities that aided in hospital and unit readiness. All responding ETCs reported that unit staff served as trainers or subject-matter experts for the hospital, and half also served as trainers or experts for other local hospitals. Training developed by ETCs was widely shared within the hospital and regionally. Training for healthcare workers providing care for patients with HCIDs is critical: healthcare workers consistently have higher rates of HCID infection than the general public,^{11–13} a trend also reflected during the COVID-19 pandemic.¹⁴ A lack of infection prevention and control (IPC) training can lead to improper or inconsistent safety practices, such as PPE use, that heighten exposure risks.¹⁵ Trained staff that have had extensive and recurring (eg, quarterly) training on enhanced IPC practices and rehearsed those skills during exercises and drills are well positioned to serve as trainers and safety observers for other hospital units in surge situations. Despite all ETCs reporting training capabilities enhanced local and, in many cases, regional response to COVID-19, ETCs have previously cited recurring training as the biggest challenge to sustaining operations, apart from financial support, due to its intensive time and resource requirements.¹⁶

Table 3. Reported Pre-existing High-Level Isolation Capabilities Ebola Treatment Centers Used or Did Not Use During the COVID-19 Pandemic Response, as of April 2021 (N = 29)

Theme	Subtheme	Selected Comments
Capabilities that did not exist prior to the COVID-19 pandemic that had to be rapidly developed or implemented (22 of 29, 81%)	Expanded capacity	“We needed to rapidly expand ICU isolation capacity.”
		“The extent of the need for care of patients outside of our HLIU.”
		“Had not planned for having more than 1–2 patients . . . needed to put together surge plans and staffing/training.”
		“Having to go from a plan that accounted for 1–2 patients to hundreds rapidly was a challenge but easier due to concept understanding.”
	Laboratory	“The sheer volume of needs surpassed the HLI laboratory capabilities.”
		“Laboratory workflows for PUI/COVID patients.”
	Training	“Needed to ramp up training efforts for a larger group of staff.”
		“Regular training on special pathogen response and PPE [for all staff] would be beneficial.”
		“While we had developed just-in-time training, we had to adapt this for an organizational level.”
	PPE	“We did not have the quantity of PAPRs and other PPE needed”
		“Scalability—both volume and changes in PPE recommendations varied.”
		“N95 reprocessing program.”
Capabilities prior to COVID-19 pandemic were never utilized (15 of 29, 52%)	Unit space	“We pivoted quickly to using various units throughout the hospital instead of transferring early patients directly to the HLIU. It was easier to ‘take the training/equipment to the patient.’ ”
		“We surpassed the capabilities of the unit on the second day.”
		“We did not need the unit because 2 beds were a drop in the bucket.”
		“Biocontainment team was activated but the unit itself was never activated because it was only 2 rooms in 1 ICU, and COVID-19 care was delivered throughout the hospital.”
	Category A waste management	“We did not need to use our in-unit autoclaves for COVID-19.”
		“Waste management strategy for category A.”
	Certain stockpiled PPE	“We found that multiple layers of PPE stockpiled for Ebola were not necessary for the management of a pandemic caused by a respiratory pathogen.”
		“PAPRs selected for our special pathogens unit were not used for COVID because the hoods are designed for the prolonged care of a single patient, rather than intermittent care of multiple patients . . . if the hood was discarded with each doffing, we would have burned through our supply within 1 day.”
		“Higher level Ebola PPE.”

Note. HLIU, high-level isolation unit; PUI, patient under investigation; PPE, personal protective equipment; PAPR, powered air-purifying respirator.

As reported in this study, the specialized, concentrated expertise that ETCs have developed over the preceding 5 years has been leveraged to support and improve hospital-wide and, in many cases, local and regional readiness and response to the COVID-19 pandemic; however, there is still a national gap in proliferating that expertise to frontline facilities, as was unfortunately demonstrated in the numbers of COVID-19 cases in many skilled nursing facilities.¹⁷ The pandemic has highlighted the need for IPC practices to be ingrained in all healthcare activities and for every healthcare worker to have a baseline IPC excellence.^{18,19} Moreover, cases and outbreaks of HCIDs in 2021 alone, including 2 different imported monkeypox cases in Texas and Maryland, outbreaks of EVD in the Democratic Republic of the Congo and Guinea, and the endemicity of Lassa fever in Nigeria, are important reminders that every hospital must always be ready to identify and isolate potential HCID cases, even as attention and resources remain focused on the COVID-19 pandemic.

In addition to national resources such as the National Emerging Special Pathogens Training and Education Center, ETCs are primed to disseminate their best practices, lessons learned, and subject-matter expertise to other local and regional hospitals in real time; indeed, most ETCs reported doing so during the early phase of the COVID-19 pandemic. Nevertheless, improved regional communication was still cited by several ETCs as an area in need of continued improvement. Specifically, ETCs noted a need for better information, sharing best practices, and other resource sharing, as well as greater collaboration across the entire tiered HCID network, which includes regional treatment centers, ETCs, Ebola assessment hospitals, and frontline facilities. Moreover, several units referred to challenges in managing, synthesizing, messaging, and disseminating the sheer volume of information in a meaningful way to their internal teams. This sharing of critical information and messaging strategies can position ETCs within the larger preparedness

Table 4. Reported Lessons Learned and Innovative Practices Shared by Responding Ebola Treatment Centers (N = 29)

Theme	Subtheme	Select Comments
Lessons learned: what went well	Highly trained staff	“Continual PPE training and drills for staff was critical in building confidence.”
		“Our trained team was instrumental in education across our healthcare system.”
		“Having trained staff . . . was invaluable in our initial response, in just-in-time training and in ongoing training in our hospitals and community.”
		“Quarterly training and solidification of a highly trained team (over 5 years) was inviable—especially in early months and in training others.”
		“Previous training aids.”
	PPE acquisition	“Our knowledge of PPE and expiration dates was very helpful in acquisition of new PPE prior to the COVID pandemic to replace expired supplies.”
		“PPE supply – often challenging to find space and funding to maintain, critical for supporting organization in early stages where supply chain greatly impacted.”
		“Early in response, there were cases where staff would make requests of the HLIU for additional PPE supplies rather than go through supply chain management.”
	Existing policies/procedures	“Had easily adaptable policies and procedures already developed”
		“Our response procedures were easily adjusted as more information was learned about COVID-19.”
“Activation and response procedures were already in place”		
HLIU enabled more time to prepare	“By caring for the first PUIs and confirmed cases, we provided the health system almost a month to prepare for the surge of cases.”	
	“The number of SMEs we had . . . and a physical unit to begin cohorting patients gave us time to figure out our hospital surge plan.”	
Previous exercises/drills	“Since our leadership team and multiple departments are regularly engaged in our program and exercises/drills, they were also familiar with response.”	
	“Previous responses to MERS PUIs better prepared us during initial phases of the outbreak.”	
	“We believe that having a special pathogens unit had the effect of paving a path for years prior to the pandemic . . . towards the senior leadership’s understanding of the threat of special pathogens and their ability to quickly pivot and to prioritize resources.”	
Lessons learned: what needs to be improved	Improved regional communication	“We need better regional communication and sharing of resources related to ICU capacity for HCIDs.”
		“These types of disasters [pandemics] require . . . more collaboration across groups in the tiered response network (RESPTCs, ETCs, EAHs, frontline hospitals” so that RESPTCs and ETCs can better share best practices and we can all support education and response for frontline hospitals.”
		“We feel there’s an opportunity to pull together leaders from hospitals to collaborate and create best practices as a group or templates/standards to be implemented for consistency.”
	Better internal communication	“Create systems to manage information meaningfully . . . to manage the sheer amount of information.”
		“Varying messaging techniques and timing is critical.”
		“Communication of changes to existing protocols were most successfully disseminated when shared with HLIU teams, enabling them to have access to the most updated information and share/teach/mentor accordingly.”
		“Pulling in leaders from all areas of the hospital was crucial.”
	Funding	“Proactive initiation and utilization of incident command center for communication and situational awareness among stakeholders.”
		“The COVID-19 pandemic uncovered deep and dangerous problems on a national level with chronic underfunding of public health . . . the problems could be fixed on a federal level by developing domestic policies that support a robust public health infrastructure, redundant supply chains, pandemic stockpiles, and financial support for hospitals so that the bottom line does not compete with infection control.”
	PPE/Supply chain	“Financial element was a lesson learned as the hospital paid for everything until we had a grant opportunity provided.”
“Increased focus on having PPE stockpiled in the event of a pandemic.”		
		“Supply chain instability and early changes in needed PPE ensembles proved challenging. Standing up analytical support to gain a clearer picture of inventory levels and burn rates assisted in longer-term planning for supply needs.”

Note. PPE, personal protective equipment; HLIU, high-level isolation unit; PUI, patient under investigation; SME, subject matter expert; MERS, Middle East Respiratory Syndrome; HCID, high-consequence infectious disease; RESPTC, Regional Ebola and Other Special Pathogens Treatment Center; ETC, Ebola treatment center; EAH, Ebola assessment hospital.

and response infrastructure as drivers of best practices and future pandemic and HCID policies and actions.

In this study, we identified 3 ETCs that have decommissioned since 2019. Coupled with the 4 facilities that previously reported they are no longer ETCs,⁵ our assessments have identified that at least 7 former ETCs no longer maintain high-level isolation capabilities, representing 13% of the originally designated units. This finding is concerning, albeit not completely surprising, given the substantial annual costs facilities reported that they incurred: an estimated \$234,000 (similar to previous findings of \$225,000). These costs did not include the significant investments in establishing the unit, which averaged >\$1.4 million per facility.⁵ Although 75% of the ETCs that maintain capabilities reported HPP funding had not lapsed or decreased, that could well change when temporary COVID-19 supplemental funding is expended. Most ETCs that have experienced a decrease or lapse in HPP funding reported uncertainty regarding whether the facility will have the financial ability to maintain capabilities without federal funding, something other ETCs may soon have to face without mechanisms for continued investments to these units.

Despite the roles ETCs reported filling during the early, evolving COVID-19 response, the uncertainty of future funding to maintain this wider network of ETCs comes at a time when broader public health and biopreparedness funding continue to decline. Repeated patterns of a funding influx for public health and healthcare during a crisis, followed by underfunding during times of calm, threaten to continue despite the significant vulnerabilities the COVID-19 pandemic have exposed. The cost of sustaining these units' highly trained and adaptable teams, physical infrastructure, resources, and programs (at ~\$234,000/year) is far less than the millions it would cost to reestablish those capabilities. HCID threats will only continue to increase, and the United States will need the capability to respond. By making long-term investments in these ETCs, the capabilities that have already been established can be further expanded and developed. Facilitating more rapid and effective responses to future outbreaks will decrease the funding required for those responses. And, as highlighted during this pandemic and in this study, these investments can be leveraged to enhance broader healthcare system response to non-HCID threats.²⁰ Although originally designed for EVD, ETCs have strengthened capabilities over the years to include respiratory pathogens, and regional treatment centers are expected to care for up to 10 patients with high-consequence respiratory pathogens.² However, COVID-19 reinforced the need for ETCs to be more universal in their response capabilities for HICIDs, maintain an HCID-agnostic approach, and plan for flexibility based on mode of transmission. COVID-19 also highlighted the need for ETCs to support surge capabilities during a pandemic response, that is, to create adaptable standard operating procedures for use when physical space is exceeded, to develop local and regional training materials, and to serve in train-the-trainer roles.

This study had several limitations. Responses were self-reported by site representatives. The response rate (66%) was similar to our 2019 assessment of ETCs; however, 5 units only responded to the first question. The survey was disseminated amid many states' early 2021 COVID-19 surge; as such, many nonresponding facility representatives (often, the unit medical or nursing director) may not have had the bandwidth to complete the survey. We also recognize that over the last several years many facilities have made significant investment into improving hospital preparedness for HICIDs that are not reflected in this survey. Indeed, designated Ebola assessment

hospitals have developed many of the same capabilities as ETCs and may have played significant roles in their respective hospitals' readiness and response to the pandemic which are not represented in this study. Lastly, the study lacked a control group to make direct comparisons of measurable impacts or differential outcomes of these specialized programs compared to non-ETCs. Future studies could determine whether ETCs had better outcomes among patients, higher staff morale, or fewer infections among healthcare staff to provide strong comparative evidence of the value of ETC programs during the pandemic.

In conclusion, in the early weeks of the COVID-19 pandemic, ETCs leveraged their high-level isolation capabilities to support hospital, local, and regional COVID-19 readiness and response. Our findings highlight the roles their programs played, their lessons learned, and the capabilities and expertise shared within their respective hospitals and beyond, as well as the continued challenges they face in sustaining those capabilities for the next HCID threat. Responding operational ETCs have significantly invested in advancing and sustaining capabilities to respond to HCID events over the past 6–7 years. These investments are core components of the US domestic health security infrastructure. The recent presentations of travelers with monkeypox to hospitals in Texas and Maryland, the potential of a patient with Lassa Fever a plane ride away from the United States, in tandem with ongoing cases of Middle East Respiratory Syndrome (MERS), recent independent outbreaks of EVD, and the COVID-19 pandemic, underscore the value of the ETC network and highlight the importance of funding to support continued operations.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/ice.2022.43>

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