Johns Hopkins Biocontainment Unit
Annual Report
FY 2020
EXECUTIVE SUMMARY

The Johns Hopkins Biocontainment Unit (BCU) is dedicated to patient care, safety, training, research and innovation in the context of highly infectious diseases. Established in the Spring of 2015 in response to the Ebola outbreak in West Africa, the JH BCU has quickly grown to be one of the premiere highly infectious diseases units in the world. Shortly after its opening, the JH BCU was selected by the Office of the Assistant Secretary of Preparedness and Response (ASPR) to be the U.S. Region 3 Ebola and Other Special Pathogens Treatment Center (RESPTC). During its first 5 years of operation, the BCU team trained over 400 Johns Hopkins staff in the safe care of patients with serious communicable diseases and participated in regional and national discussions on how to prepare the U.S. healthcare system for the next infectious disease outbreak. The BCU was instrumental in preparing the Johns Hopkins Health System for COVID-19. The BCU was the first unit to care for persons under investigation (PUIs) as well as confirmed cases of COVID-19 at The Johns Hopkins Hospital. Once the number of cases exceeded BCU capacity, the BCU team helped to set up additional “biomode” units by creating a just-in-time training program for staff and helping set up the infrastructure for the new units. The BCU also played an important role in COVID-19 research by establishing a large retrospective cohort of COVID-19 patients (the JH-CROWN registry), a prospective biorepository, and leading the Hopkins arm of the NIH trial that showed remdesivir is clinically useful in treating COVID-19. In the coming year, the BCU will continue to grow its education and research agenda to meet the needs of the Johns Hopkins Health System, the local community, the state of Maryland, and our national and international partners as we continue our fight against COVID-19 and prepare for future infectious disease outbreaks.

The Johns Hopkins Biocontainment Unit

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The BCU Team

Lisa Maragakis  
*Executive Director*

Brian Garibaldi  
*Medical Director*

Lauren Sauer  
*Research Director*

Noreen Hynes  
*Associate Medical Director*

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Jade Flinn  
*Nurse Educator*

Chad Bowman  
*Special Operations Response Team Coordinator (SORT): Lifeline Critical Care Transport*

Mary Brown  
*Chair of BCU Drill Committee*

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*Nurse Super User: Operations and Drills*
1. COVID-19

1.1 Introduction*

In response to the 2014 Ebola outbreak in West Africa, the Office of the Assistant Secretary for Preparedness and Response (ASPR) created a regional network of ten high-level isolation units (HLIUs), also known as biocontainment units (BCUs), to enhance readiness in the United States to respond to high consequence pathogens. While most of these units were initially formed to care for patients with suspected or confirmed infection with communicable viral hemorrhagic fever viruses, they were also designed to care for patients with other high-consequence pathogens such as Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS) and extensively drug-resistant tuberculosis (XDR TB). Notably, these U.S. HLIUs and their clinical teams were among the first in the nation to provide care for patients infected with the SARS coronavirus-2 (SARS-CoV-2), the etiologic agent of coronavirus disease 2019 (COVID-19).

The Johns Hopkins Biocontainment Unit (JH BCU) is the U.S. Department of Health and Human Services (HHS) Region 3-designated HLIU treatment center, serving Delaware, Maryland, Pennsylvania, Virginia, Washington D.C. and West Virginia. The JH BCU team is a multidisciplinary and highly-trained group of clinicians, frontline healthcare providers, researchers, infection prevention and emergency management personnel who have been working together since 2014 to enhance preparedness to respond and provide care for persons infected with high consequence pathogens (HCP) with high transmissibility and high mortality in the setting of few, if any, Food and Drug Administration (FDA) approved medical countermeasures (MCM). The JH

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BCU has a tripartite mission that reflects the major pillars of high consequence pathogen preparedness and response: 1) Preparedness Planning, Education and Training, 2) Patient Care and Clinical Operations, and 3) Research and Innovation. In its response to the COVID-19 pandemic, the JH BCU participated in readiness activities leading up to the admission of the first patient with COVID-19, provided care for the first persons-under-investigation (PUIs) and the first confirmed COVID-19 cases, helped to establish and educate additional units and teams to safely provide care for patients suspected or confirmed to have COVID-19, and currently leads clinical and translational COVID-19 research studies. The role of the JH BCU in the COVID-19 response highlights the importance of regional treatment centers in local, regional, and national efforts to combat novel infectious diseases and provides a roadmap for increasing U.S. capacity to respond to future infectious disease outbreaks.

1.2 Impact of the JH BCU on Health System Infectious Disease Preparedness

1.2.1 Preparedness Planning, Education and Training Prior to COVID-19

Preparedness and training are critical to the success of a high-level isolation unit. Staff must be familiar with infection prevention practices, personal protective equipment (PPE), and clinical care protocols for high consequence pathogens, and must maintain continuous readiness. Since 2014, the JH BCU has employed a full-time nurse educator to coordinate the training and competency assessment of over 150 rostered staff members from multidisciplinary backgrounds. BCU team members represent over 15 functional units in the hospital and include nurses, physicians, physician assistants, nurse practitioners, laboratory technicians, respiratory therapists, radiology technicians and infection control preventionists. The hospital infection prevention team is integral to BCU preparedness planning, protocol development, training, and assessments to ensure that evidence-based practices for infection prevention are incorporated and optimized for all BCU activities. Quarterly training and assessment sessions for all staff include updates on high
consequence pathogens, PPE donning and doffing practice and skills training for critical protocols such as spill cleanup, PPE breaches, phlebotomy and lab specimen management, waste handling, and clinical procedures.

In addition to these unit-based activities, the JH BCU conducts quarterly training exercises in coordination with the Johns Hopkins Office of Emergency Management (OEM) and the Maryland State Department of Health. In the five years prior to COVID-19, the JH BCU successfully completed 22 preparedness exercises including twelve full functional drills, six table top exercises, and four no-notice drills. Lessons learned from these exercises informed operational, logistic, and clinical aspects of BCU activation and helped to refine the state and regional response plans for highly infectious diseases. The BCU also activated three times for PUIs suspected to have viral hemorrhagic fever which further informed care protocols.

In the 18 months prior to its activation for COVID-19, the JH BCU designed and implemented a pilot education program supported by the Maryland Department of Health that aimed to address Ebola and other emerging infectious disease preparedness gaps for frontline and special pathogen assessment hospitals throughout the state. The primary goal of the program was to improve Maryland frontline healthcare worker knowledge and skills for the identification and isolation of PUIs suspected to be infected with high-consequence pathogens. The program also sought to foster relationships between healthcare facilities and state public health agencies for effective notification and care transitions of patients infected with high consequence pathogens.

During the pilot program, the BCU team delivered in-person training sessions at 16 hospitals for a diverse audience of over 160 clinicians, local public health representatives, emergency management personnel, and hospital staff. These sessions covered the basics of infection control and prevention, and emphasized the “identify, isolate and inform” strategy for responding to infectious diseases.
In addition to its role in local and regional preparedness, the BCU collaborates within a national network of treatment centers coordinated by the National Emerging Special Pathogen Training and Education Center (NETEC). This network addresses training and preparedness beyond the state and region, shares best practices for high-level infectious disease containment, and contributes to the growing science of containment care. The JH BCU has co-hosted regional symposia and training events with NETEC with a particular focus on protocol development and practical, hands-on training of frontline staff and administrators.

These education and training activities prepared the BCU team to care for the first patients with COVID-19 at JHH. They also led to improved infection control practices across the health system as BCU team members shared their training and expertise with their home units and provided infection prevention and preparedness training to colleagues across the hospital and health system.

1.2.2 Preparedness, Education and Training During the COVID-19 Response

As the COVID-19 pandemic emerged at the end of 2019, the JH BCU team pivoted frontline training sessions to specifically address the need for area hospitals to operationalize surge capacity, implement robust screening for respiratory symptoms and recent travel history, and develop personal protective equipment (PPE) airborne and droplet precaution ensembles and use plans. The program culminated in a statewide symposium on high-consequences pathogens on February 20, 2020, with representation from every county in the state of Maryland, just 9 days before the BCU activated for its first COVID-19 PUI. This adaptive educational experience established the BCU team as a valuable preparedness and training asset that could design and deliver expedited high consequence pathogen training focused on infection prevention and PPE best practices.
Even as the JH BCU team actively cared for the first COVID-19 PUIs and patients confirmed to have COVID-19 at JHH in February-March 2020, the team helped to plan a sustainable and safe model for healthcare workers to care for PUIs and patients with COVID-19 in other non-BCU clinical units. The air handling systems on these clinical units were modified by the Facilities Department to have the negative air pressure, filtration, and ventilation needed to safely provide care for patients with COVID-19. These units were termed “biomode” units. In collaboration with Healthcare Epidemiology and Infection Control (HEIC), the BCU team developed and implemented a just-in-time PPE training program which blended video content with hands-on skills sessions led by BCU staff. Over the course of four days in March 2020, the BCU and HEIC teams trained 150 healthcare workers including clinical educators, clinical support staff, providers, and nurses in proper PPE donning and doffing techniques. These staff became ambassadors and a resource to reinforce PPE best practices throughout the hospital. The role of “Safety Officer”, a team member who assists with the safe donning and doffing of personnel working on COVID-19-dedicated biomode units, emerged from this initiative. Once the number of patients with COVID-19 exceeded BCU capacity, BCU team members were deployed to the biomode units to address PPE safety and training, augment existing bedside staffing models, and provide operational and technical consultative services.

1.2.3 **Patient Care and Unit Operations Prior to COVID-19**

The BCU was prepared to activate to care for patients with COVID-19 in part because of the development and implementation of a novel tool called the “BCU Readiness Scale and Checklist.” This tool was created in 2018 to identify barriers to successful unit activation, and to allow the BCU team to proactively update unit protocols and infrastructure to mitigate those barriers. Readiness is measured not only in terms of functional clinical space (e.g. a working negative pressure air-handling system) but also safe staffing ratios based on clinical acuity and
adequate PPE supplies. Regular use of this checklist meant that the BCU was ready to activate for the first COVID-19 PUIs and confirmed cases.

In addition to preparing for a unit activation, the BCU team partnered with the Johns Hopkins Lifeline transport team to establish the Johns Hopkins Special Operations Transport Team (SORT). SORT consists of emergency medical technicians (EMTs), paramedics, and critical care nurses who have undergone special training in infection control precautions. SORT established protocols for both intra- and inter-hospital transport of patients with suspected or confirmed high consequence pathogens and participated in full functional exercises and the transport of PUIs to the BCU. They have worked with the US military to provide ground transport operations during large federal drills. SORT has also become an operational and educational resource for other transportation services in Maryland and Region 3 looking to establish their own high consequence pathogens transport protocols.

The BCU also worked closely with OEM from 2017-2019 to establish a unit-specific incident command structure (ICS). The ICS model was used in BCU full functional exercises with great success and became a model for the health system in terms of the utilization of incident command principles in the response to preparedness emergencies including mass casualty events and infectious disease outbreaks.13

1.2.4 Patient Care and Unit Operations During COVID-19

From February 29 through March 20, 2020, the BCU team managed the first three persons under investigation (PUI’s) and the first eleven confirmed cases of COVID-19 at JHH. The BCU team activated and decommissioned a total of 3 times, caring for 10 patients in the BCU’s physical space with the remaining 4 patients located on a sister medical unit in airborne infection isolation rooms staffed by BCU team members. Several of these patients required hemodialysis and/or critical care services requiring the addition of new staff members such as dialysis technicians to
the BCU team. All new staff underwent comprehensive just-in-time training by existing BCU staff members prior to caring for patients. Previous full-functional exercises demonstrated that this type of training was effective in limiting the likelihood of healthcare worker exposure to highly infectious diseases.8

For each activation of the BCU for COVID-19, the time interval between the decision for unit activation and unit readiness, defined as the physical and functional ability to safely admit patients to the BCU, was measured to be less than 90 minutes. As a regional treatment center, the BCU also met its eight-hour goal between unit activation notice and patient admission to JHH for each of the COVID-19 activations. Safe, organized, and expedited transport of patients for admission to the JHH BCU from the JH Emergency Department and outside hospitals was provided by Lifeline SORT. Transportation strategies were updated using a multidisciplinary after-action “hot wash” after each admission. The BCU partnered with SORT to expand the Safety Officer role during patient admission transports, which was later expanded to all inter- and intra-hospital COVID-19 patient transports. BCU team members also served as these “Transport Safety Officers (TSOs)” as demand increased which provided time for Lifeline and JHH to implement a TSO education program to increasing overall transport capacity.

Upon activation, the implementation of an incident command structure was necessary to maintain situational awareness and to facilitate planning for the COVID-19 patient surge throughout the health system. The BCU command directly communicated relevant clinical information, safety issues, and frontline experiences to the hospital and health system incident command centers. Through this incident command structure, the hospital was able to stand up 14 biomode units to provide care for patients with COVID-19, and this model was later expanded to other health system hospitals in order to respond to the surge of COVID-19 patients throughout the Johns Hopkins Health System. The first three weeks of COVID-19 care lead by the BCU team
provided the health system with the necessary time to create the physical infrastructure to have negative pressure on these biomode units, and for the BCU and HEIC teams to properly train additional staff in the safe care of patients with COVID-19.

Once the number of patients exceeded the capacity of the BCU team at the end of March 2020, the BCU team merged with other units to continue providing frontline care. At this point, the BCU donated its 7-day par supply of viral hemorrhagic fever PPE to the health system response including 1,000 complete PPE ensembles and 25 powered air purifying respirators (PAPRs). BCU and HEIC team members continued to serve as a vital resource for training and support of the biomode units’ infection prevention and clinical care protocols.

1.2.5 Research and Innovation Prior to COVID-19

Since its creation in 2015, the BCU has sought to advance the field of containment care through innovative research projects that relate to medical countermeasures development, infection prevention, human factors engineering, environmental engineering, personal protective equipment, and bioethics. Shortly after opening the unit, the BCU team created and validated a process to ensure that autoclaves effectively decontaminate waste from patients infected with category A pathogens such as Ebola. In partnership with Jhpiego (a non-profit affiliate of Johns Hopkins) and the Johns Hopkins Center for Bioengineering Innovation and Design (CBID), the BCU team helped to design and test a novel self-doffing personal protective equipment coverall. Of particular relevance to the current COVID-19 pandemic, the BCU team, in collaboration with the Johns Hopkins Applied Physics Lab, used a novel fluorescent microbead system to simulate the movement of infectious particles through a biocontainment environment and to assess the impact of environmental control systems and patient care protocols on the movement of these infectious simulants. In partnership with HEIC, the BCU team combined these infectious simulants with more traditional methods to enhance the detection of self-contamination during the
doffing process, and to validate the use of a trained observer in the doffing process for viral hemorrhagic fevers.\textsuperscript{18,19} The BCU team partnered with the Johns Hopkins Berman Bioethics Institute to explore the ethical, legal and social implications of genomic research on containment care.\textsuperscript{20} In 2016, the BCU team also partnered with the other regional treatment centers to form the Special Pathogens Research Network (SPRN) to improve the capacity for research to be conducted during an infectious disease outbreak.\textsuperscript{21}

1.2.6 \textit{Research and Innovation During COVID-19}

During COVID-19, the BCU continued to play an active role in research on highly infectious diseases. Using the central IRB established through the SPRN, the BCU team led the Johns Hopkins arm of the Adaptive COVID-19 Treatment Trial (ACTT-1) which showed that remdesivir compared to placebo reduced the time to recovery in hospitalized COVID-19 patients.\textsuperscript{22} The BCU team helped to establish the JH-CROWN registry which includes all COVID-19 patients seen at The Johns Hopkins Health System. This registry will be used to better understand the pathobiology of COVID-19 and to inform the clinical care of COVID-19 patients.\textsuperscript{23} In tandem with the JH-CROWN registry, the BCU team efficiently stood up multiple protocols that allowed for the collection of residual clinical and prospectively collected research specimens. The BCU team also established a longitudinal COVID-19 cohort that aligns with the global ISARIC research protocol.\textsuperscript{24} This cohort will allow more in-depth exploration into the pathophysiology of COVID-19 by correlating patient phenotype with physiologic samples such as blood, urine and bronchoalveolar lavage fluid in addition to serving all the downstream sample needs of the basic and translational researchers across Johns Hopkins.
1.3 Notable BCU COVID-19 Research Projects

1.3.1 *JH-CROWN and the Johns Hopkins COVID-19 Precision Medicine Center of Excellence (PMCOE)*

The Johns Hopkins COVID-19 Precision Medicine Center of Excellence (PMCOE) is dedicated to exploring the pathobiology of COVID-19 and to understanding the clinical trajectories of patients to better inform bedside care. The cornerstone of the Center is JH-CROWN, the COVID-19 PMAP Registry. JH-CROWN is a data registry of all of the COVID-19 patients cared for in the Johns Hopkins Health System. Housed on the Hopkins Precision Medicine Analytics Platform (PMAP), CROWN includes demographics, medical history, comorbid conditions, symptoms, vital signs, respiratory events, medications and laboratory results. There are currently over 20 research groups using JH-CROWN to advance our understanding of COVID-19. JH-CROWN is funded in part by the BCU, with a specific goal of providing the Maryland State Department of Health with prediction tools to inform patient care and operations during a potential second surge. The COVID-19 Inpatient Risk Calculator (CIRC) is the first prediction model and was recently featured in *Annals of Internal Medicine*.

1.3.2 *ACTT*

The Adaptive COVID-19 Treatment Trial (ACTT) was the first clinical trial operationalized and launched within 28 days of protocol receipt from the National Institute of Health (NIH). This multi-center, adaptive, randomized control trial was the first investigational therapeutic trial launched in the United States, ACTT-1, which resulted in important evidence to support the anti-viral medication Remdesivir as an effective treatment for patients infected with COVID-19. The BCU’s collaboration with the National Emerging Special Pathogens Training and Education Center (NETEC) Special Pathogens Research Network (SPRN) was leveraged to expedite research implementation in the midst of the COVID-19 bioemergency response, using
their central IRB, housed at the University of Nebraska Medical Center. The BCU Research Director serves as the SPRN director and the SPRN sites have been responsible for 29% of the enrollments in all of the ACTT arms. As an adaptive clinical trial, additional investigational products are incorporated in a double-blinded framework including baricitinib during ACTT-2 and interferon beta-1a in ACTT-3.

1.3.3 **Clinical Characterization Protocol for Severe Emerging Infections (CCPSEI)**

CCPSEI is a prospective, observational cohort study that enrolls suspected and confirmed cases of high consequence pathogens, such as pandemic-threat disease, those listed on the U.S. Select Agent list, and other emerging and re-emerging threats that are particularly problematic for patients and communities. The protocol was adapted from the harmonized clinical trial efforts of the [International Severe Acute Respiratory and emerging Infection Consortium](https://www.isaric.org) (ISARIC). The CCPSEI protocol has enrolled over 338 adult and pediatric patients and serves as the central source for prospective enrollments and biospecimens for the Johns Hopkins COVID19 Biorepository.

**1.4 Patient Care**

1.4.1 **Patient Care in the BCU**

The BCU activated and decommissioned three times for the admission and care for the first COVID-19 persons under investigation and confirmed cases.

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<th>Activation #1: 5 days</th>
<th>2 patients; ruled out</th>
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<tr>
<td>Activation #2: 3 days</td>
<td>1 patient; ruled out</td>
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| Activation #3: 8 days | BCU: 4 patients; COVID-19+  
Meyer 9: 7 patients COVID-19+ |

Over these critical initial 3 weeks, the BCU team activated its staffing plans of 16 nurses, 10 providers, 6 respiratory therapists, 4 radiology technicians, 5 infection control preventionists, and
5 administrative/operations, both on Osler 8 and upon Meyer 9’s Bio-Mode activation. This core team navigated the clinical and unit operations involved in the specialty care of patients infected with the novel coronavirus for 21 days, serving as a pilot for many of the protocols and procedures that are now utilized throughout the hospital in the care of patients with COVID-19.

1.4.2 **POCUS**

Point of care ultrasound (POCUS) is a valuable tool in bedside care and has taken on a more prominent role during the pandemic. POCUS provides real time information about cardiac and pulmonary physiology and is a great way to engage patients in their clinical care. All BCU providers are trained in POCUS, particularly in the setting of critically ill patients. In response to the care that he received by the BCU team in March 2020, a grateful patient donated $50,000 to purchase handheld ultrasound devices for COVID providers. The hospital decided to match that gift and purchased a portable US device for each of the COVID wards. This has greatly expanded our POCUS capacity and leaves us well-positioned in terms of both devices and trained personnel for a possible second surge of COVID-19, as well as for non-COVID clinical care.

1.5 **Incident Command Structure**

In advance of the BCU’s first patient, the BCU team integrated into HEIC’s departmental incident command that activated on January 27, 2020 to begin planning efforts for COVID-19 at JHH and across JHHS. The BCU team was integral in discussion on PPE, patient transport, and clinical care. The BCU incident command structure (ICS) was then activated close to a month later on February 29, 2020 with support from the Johns Hopkins Medicine Office of Emergency Management in response to the admission of the first PUI to the BCU. The BCU ICS integrated into the Unified Health System Command, which activated a couple days later on March 3, 2020.

The BCU’s ICS activation allowed the structure to be tested for the first time in a real-world emergency. For previous drills/exercises, all ICS positions except for the safety officer and
logistics chief stayed off the unit in a nearby conference room that was converted into a command center with audio/visual enhancements. However, during the COVID-19 activation, the command center was set up in the nurses’ station on the BCU to be able to react more quickly to needs as they arose. This was an excellent learning experience which has informed how the BCU ICS will operate in future activations.

1.6 Interdisciplinary Collaboration during COVID-19

1.6.1 Special Operations Response Team (SORT)

LIFELINE’s Special Operations Response Team (SORT) has continued to set the standard for highly infectious disease transports. Established in response to the 2014 Ebola outbreak and partially funded through the BCU, SORT is nationally recognized as a critical care transport team specializing in highly infectious disease transports. From January 2020 to June 2020 Lifeline has completed 864 COVID-19 related interhospital and intrahospital transports. Of those 864 transports, 7 were air medical transports. Lifeline and the SORTeam have continued to participate and train with the BCU and HEIC to further develop their protocols and procedures in the packaging, transport, and admission of a patient needing biocontainment care.

1.7 Conclusion

The Johns Hopkins Biocontainment Unit played a critical role in the Johns Hopkins Health System response to COVID-19. Through its preparedness planning, frequent training activities, robust educational programs, research activities, and integration into a broader hospital and health system incident command structure, the JH BCU demonstrated the value of having a dedicated highly infectious disease unit and team during a pandemic surge. The creation of similar units and trained teams beyond the existing regional treatment centers could enhance health system preparedness and resilience for the continued fight against COVID-19 and for future infectious disease outbreaks.
1.8 Funding

This work was supported by the Office of the Assistant Secretary of Preparedness and Response (US), Hospital Preparedness Program [grant numbers U3REP150540, U3R2015002863] as well as the Maryland Department of Health.

1.9 Acknowledgements

The JH BCU team would like to acknowledge the hard work and dedication of the Johns Hopkins Health System community whose members continue to work around the clock to provide safe care for patients with COVID-19. The JH BCU team would also like to thank the Maryland State Health Department, NETEC and ASPR for their continued support and collaboration in infectious disease preparedness and response.

From left to right: Brian Garibaldi, Andrew Michalek, Samuel Gutner, Brandy Loveless, Jade Flinn, Amber Thomas, Mary Brown, Christopher Sulmonte, Carrie Billman (crouching)
2. STAFF READINESS AND EDUCATION

2.1 Highly Infectious Disease Training Activities

2.1.1 Drills

Over the last year, the BCU Exercise Committee has continued its mission to organize, implement, and analyze the results from table top exercises to full-scale exercises. Through FY2020, the committee was co-chaired by Mary Brown, Planning Specialist and Interim Director of the Office of Emergency Management, Brian Garibaldi, the Medical Director of the BCU, and Jade Flinn, the Nurse Educator of the BCU. Three exercises were completed and a large-scale exercise testing both state and regional capabilities for high consequence pathogens was planned for April of 2020. The completed exercises tested communications, logistics, and patient care for patients on the BCU and prepared the team for its subsequent activation in response to COVID-19.

2.1.2 No Notice—July 2019

On July 13, 2019, the BCU participated in a no-notice drill conducted by the Maryland State Department of Health (MDH) to exercise the communication and coordination of the 3 tier special pathogen system of treatment centers, special pathogen assessment hospitals, and frontline facilities. The BCU was notified by MDH mid-day to request transfer of a person under investigation for Ebola. Functional readiness assessments were conducted of the physical space, amount of personal protective equipment and supplies, and availability of staff for one adult critical care patient within an 8-hour
window. Additionally, the Lifeline Special Operations Response Team (SORT) availability was assessed for expedited deployment for patient transfer. Through its consistent preparedness activities and routine assessment of activation barriers, the BCU found that the necessary components for safe and successful unit activation were functional and available.

2.1.3 Mr. Clean

On October 24, 2019, the BCU conducted a full-scale exercise that tested the workflow of unit decommission following the hospitalization of a patient infected with a viral hemorrhagic fever. The drill measured the effectiveness of a proposed terminal disinfection workflow, the efficiency of multiple disinfection passes, and the volume of waste generated during decommission. Additionally, staffing models and communication systems were tested for functionality and effectiveness. Lessons informed changes in decommission procedures and strengthened collaboration with Hospital Epidemiology and Infection Control (HEIC) for future protocol development.

2.1.4 Santa’s Sleigh

On Saturday, December 14, 2019, Lifeline’s SORT co-led a transport exercise with 2 partner emergency medical services (EMS) transport agencies, St. Francis Healthcare Special Operations Unit of Delaware and Cecil County EMS Department of Maryland. The drill tested each EMS agencies’ high consequence pathogen PPE ensemble during transport and handoff to Lifeline SORT. Both agencies utilized a portable isolation unit to package and transport a simulated
patient from Delaware and Cecil County. Upon arrival to JHH, patient handoff to Lifeline SORT, doffing procedures, and ambulance unit decontamination procedures were exercised. Additionally, BCU activation procedures focusing on effective communication through the notification system (Assurance) were tested to gauge weekend availability and identify gaps in contact points. The exercise prompted robust discussions regarding PPE modifications in relation to endurance and comfort for the prolonged dressed period during transport, safe disinfection procedures during doffing, and alternative transport routes. Overall, the collaboration amongst EMS agencies and SORT was strengthened and the BCU validated activation notification procedures.

2.1.5 The Behemoth

As both a state and regional treatment center for high consequence pathogens, the BCU must exercise coordination with surrounding healthcare facilities and public health departments to ensure efficient transfer of care. Prior to the COVID-19 outbreak, the BCU team, the Office of Emergency Management (OEM), and Lifeline SORT planned for a 4 day drill on April 14-17 in which the BCU would coordinate and activate for multiple patient admissions both within the state and region. The goal of this ambitious exercise, “The Behemoth Drill”, was to locally exercise real-time activation procedures, continuous clinical care of specialty patient populations, and
sustainable unit operations while meeting coordination objectives between JHH, Maryland Department of Health, Maryland state assessment and frontline hospitals, and regional stakeholders including Delaware, Virginia, Washington D.C., and West Virginia. An overview of the planned drill activities is depicted below. During its 3 activations and decommissions for COVID-19 related patient care, the BCU met all the proposed Behemoth objectives so the actual drill was cancelled.
3. RESEARCH AND INNOVATION

3.1 Notable Research Collaborations

3.1.1 **Special Pathogens Research Network (SPRN)**

Lauren Sauer serves as the interim director of the Special Pathogens Research Network, the operational research arm of NETEC. The network is responsible for operationalizing research protocols and collecting specimens in bioemergencies and SPRN sites have been responsible for 29% of the global enrollments into the ACTT Trial. The network has four main working groups – Biorepository and Protocols, State of the Science/Network Engagement, Emergency Central IRB, and, Training and Education. These groups support the operational research infrastructure for NETEC and serve as the research advisory arm of the network and for the federal government.

3.2 Research Dissemination

3.2.1 **Publications**


3.2.2 Presentations, Workshops, and Seminars

2020 The JHM COVID-19 Clinical Experience. Johns Hopkins Medicine Grand Rounds, Baltimore, MD (delivered via Zoom)

2020 The JHM COVID-19 Clinical Experience. Johns Hopkins Pediatric Grand Rounds, Baltimore, MD (delivered via Zoom)

2020 At the bedside during COVID-19. Medical Grand Rounds, St. Peter’s University, New Brunswick, NY (delivered via Zoom)

2020 Novel Methodologies to Enhance Staff Safety in a Biocontainment Unit. American Society of Microbiology Biothreats Conference, Arlington, VA.

2020 The first 2 weeks of COVID-19 at The Johns Hopkins Hospital. Royal College of Physicians of Edinburgh Weekly COVID Conference. Online live talk to 4500 members of the RCPE and other guests from around the world.

2020 The JHM COVID-19 Experience. World Molecular Imaging Society Imaging of Infection Webinar Series (delivered via Zoom)

2020  How should youth sports return to play during COVID19? Aspen Institute Sports & Society Program. Washington, DC


2019  Evaluating New Technologies, Drugs, and Diagnostics in Emerging Pathogen Outbreaks. University of Nebraska Medical Center. Omaha, NE

4. MARKETING AND NATIONAL PRESENCE

4.1 BCU in the news

10/9/2020 - Medicine Matters - Garibaldi treats President Trump

10/5/2020 - YouTube - POTUS Care Press Conference #3

10/4/2020 - YouTube - POTUS Care Press Conference #2

10/3/2020 - YouTube - POTUS Care Press Conference #1

10/3/2020 - Baltimore Sun - Johns Hopkins Doctor Among Those Assisting With COVID-19 Treatment Plan For President Trump

9/28/2020 - Medscape - Model Predicts Severe Disease in Those With COVID-19

9/19/2020 - Providence Journal - Many unanswered questions as New England nears flu season amid coronavirus pandemic

9/17/2020 - Yahoo Finance - COVID-19 vaccine is unlikely 'to eliminate all disease:' Johns Hopkins Doctor


9/1/2020 - Fox 10 Phoenix - People ‘in their 20s, 30s and 40s’ becoming key spreaders of COVID-19, experts say

8/30/2020 - Fox 45 Baltimore - Will some COVID-19 survivors require a lung transplant to fully recover?

8/26/2020 - Yahoo Finance ‘CDC alters coronavirus testing rules for those with no symptoms’

7/24/2020 - Medpage Today ‘Family Audio Recordings Help Humanize COVID-19 ICU Patients for Medical Staff’
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6/24/2020 - Science News ‘The steroid dexamethasone is the first drug shown to reduce COVID-19 deaths’

6/23/2020 - WJZ – ‘Howard County Couple Treated Together For Coronavirus Now Back Home Recovering’

6/12/2020 - WJZ – “I Was Scared When I Saw Myself” | Marathon Runner In Peak Physical Condition Hospitalized By COVID-19; Now On The Road To Recovery’

5/6/2020 - Center Maryland “The Conference Call” Podcast with Damien O’Dougherty – ‘Dr. Brian Garibaldi on the view of COVID-19 from the Johns Hopkins Biocontainment Unit’

5/3/2020 - Baltimore Sun – ‘Baltimore-area hospital workers battle emotions as well as the virus’


4/7/2020 - ACRRC Podcast – ‘Lessons from 40 COVID Patients in the ICU with Brian Garibaldi’

3/28/2020 - Public Health on Call Podcast with Josh Sharfstein – ‘What it’s Like to Treat Patients with COVID-19 – A Doctor’s Perspective’

3/27/2020 - WSJ – ‘How the Coronavirus Attacks Your Body’


3/4/2020 - 60 minutes – ‘Coronavirus: How U.S. hospitals are preparing for COVID-19, and what leading health officials say about the virus’

2/26/2020 - Yahoo Finance news live interview - ‘Biocontainment expert on coronavirus: There's no need for average people to panic yet’

1/29/2020 - The World News –‘Coronavirus? Johns Hopkins doctor says you’re more likely to get the flu’

1/29/2020 Baltimore Sun –‘What is coronavirus and what precautions should people be taking?’

1/29/2020 WAMU-FM/D.C. – ‘Combating The Coronavirus In The Capital’

1/29/2020 Baltimore Sun – ‘Coronavirus preparation underway at Maryland hospitals and schools as state awaits results of first test’

1/27/2020 CBS DC – ‘With Coronavirus Cases Growing, Johns Hopkins Specialized Unit Prepared To Take Patients’

1/24/2020 AP News – ‘Too soon to tell if new virus as dangerous as SARS cousin’
4.2 Tours

In FY20, the BCU hosted tour groups from local, regional, national and international partners. Audiences included students, nurses, physicians, hospital executives, federal agencies, and county health departments. Below is a partial illustration of tours from the past year.

**FY20 Number of Tours: 15**

**Visitors Included:**

![Logos of different organizations participating in tours]
5. **FINANCIAL SUSTAINABILITY**

FY20 saw the conclusion of our original BCU five year, four million dollar grant from the Assistant Secretary for Preparedness and Response. For the fifth and final year of the grant, the BCU was awarded $652,500. Additionally, this year saw the conclusion of the two year pilot Maryland Education and Special Pathogen Training Program, in partnership with the Maryland Department of Health. This second and final year of funding provided the BCU with an additional $400,000. This led to a total FY20 budget of $1,052,500.

In preparation for the conclusion of both of these grants, one of the priorities in FY19, that continued into FY20, was the development of a long-term funding strategy. Through these efforts, the BCU acquired sustainable funding for FY21 in the amount of $1,260,000, with legislative line items already in place to support the BCU in FY22.

### 5.1 Long Term Federal Funding

This year saw continued and strengthened collaboration with the Government Affairs team to develop a strategy of education and exposure to critical congressional offices on the importance and relevance of the BCU. Over the past year, we hosted congressional staff and members during training and exercises in an effort to keep hospital preparedness on the forefront of prioritized funding. In addition, the BCU and government affairs team, along with members of NETEC, visited congressional offices on multiple occasions in DC to advocate for continued funding. This led to a discussion not only with Maryland delegates, but other states within the region with funding appropriation roles in Delaware, West Virginia, and Pennsylvania. As of October 2020, the LHHS subcommittee in the House of Representatives included a line item for continued support of all Biocontainment Units both for FY21 as well as FY22. The Senate appropriations committee approved the FY21 line item and will have confirmation of FY22 funding this fall.
During this time, we will continue to educate and advocate for the importance of high level isolation units such as the BCU. As such the BCU received $600,000 from the HHS budget in FY21 to support continued preparedness and maintenance of the BCU.

5.2 COVID Supplemental Fund and HHS Budget

In response to the current COVID Pandemic and in recognition of continued efforts in patient care and education, Congress provided two single-year, lump sum, supplemental appropriations to the BCU. In total, Congress provided $585,000 to expand the BCU’s COVID-19 education and response operations in partnership with institution, local, state, and national partners. In addition to this one year of lump sum support, there are legislative developments to create long term additional funding for the BCU specifically aimed at improving COVID-19 and overall pandemic response.

5.3 Maryland Education and Special Pathogen Training Program

Initially started in FY18 in partnership with the Maryland Department of Health, the Maryland Education and Special Pathogen Training Program began in earnest in FY19. The grant, which was a two year/ $800,000 program, supported the development of a statewide education and preparedness program. The program was split into three parts, each with its own goals and objectives. The first arm focused on the state’s assessment hospitals, facilities that are required to isolate and stabilize a patient with a high consequence pathogen for 96 hours. Specially, the BCU team provided site assessment, subject matter expertise, and technical support in strengthening and development of preparedness programs within each of the five facilities. Much of the work over the past year was focused on creating relationships with each of these facilities and positioning our own team members to best support the preparedness activities of each of the partner facilities.

The second arm focused on providing education and resources to frontline facilities. These hospitals are the largest designation in the state, and are required to identify, isolate, and inform
state stakeholders of potential patients with high consequence pathogens. They are also required
to provide care for such patients in their facility for up to 24 hours. In order to best provide this
information and training, the BCU team in partnership with the Bloomberg School of Public Health,
created a one day frontline training course that could be performed at any facility. The course
includes an overview of high consequence pathogen terminology and case studies, an overview of
personal protective equipment, and simulation of basic clinical skills that frontline staff will use in
most encounters. The training course started its full rollout in May and, as of October 2020, trained
over 160 frontline staff at almost 20 locations around the state.

The third and final arm of the program was to provide a statewide symposium focused on the
topics of emerging infectious diseases and high consequence pathogen preparedness. The
symposium was a one day event, which took place February 20th, 2020 in Turner Auditorium. This
event included invited talks from experts within the fields of emergency preparedness and high
consequence pathogens, breakout sessions for discipline specific discussions, and opportunities to
network with partners throughout the state. The event was sold out and was represented by every
county in the state of Maryland.
6. FUTURE ACTIVITIES

The BCU is excited to continue to build its capabilities as we enter our 6th year as the Region III Ebola and Other Special Pathogen Treatment Center. In addition to continuing our work as part of the Hopkins COVID-19 clinical, education and research response we will continue to work with the Maryland Department of Health to deliver a highly infectious diseases training program for the state as well as partner with the Robert Wood Johnson Foundation to launch the BCU Project ECHO initiative *Covid-19: From Challenges to Solutions* to deliver regional education to our partner institutions. Moreover, we look forward to continuing our work with NETEC through participation in working groups and standing committees. We will continue to develop our research portfolio to improve the safety of the biocontainment environment and to more intelligently design protocols and equipment to keep our providers, patients, and community safe. Lastly, we will pursue exciting new funding and development opportunities to build a sustainable highly infectious diseases program that will position Johns Hopkins to be a world leader in COVID-19 and pandemic response.
References


5. Public Health On Call [Internet]; 2020. Podcast


