

**EVALUATION OF THE WORLD HEALTH ORGANIZATION'S BASIC  
EMERGENCY CARE COURSE AND ONLINE CASES IN UGANDA**

by

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## **ABSTRACT**

### **Background**

Uganda lacks formal emergency care training programs to address its high burden of acute illness and injury. The Ugandan Ministry of Health (MoH) rolled out the World Health Organization's (WHO) Basic Emergency Care (BEC) course, the first open-access short course to provide comprehensive basic emergency training for health workers in low-resource settings. The BEC and its new online cases both require further evaluation.

### **Aim and Objectives**

The study aimed to assess the BEC course and online cases' impact with the following objectives:

1. Determine participants' knowledge acquisition and self-efficacy in emergency care.
2. Evaluate BEC participants' perceptions of the course and online cases.
3. Assess the online cases' impact on participants' knowledge and self-efficacy in emergency care.

### **Methods**

Mixed methods design explored the BEC's impact. MCQs and Likert scales assessed knowledge and self-efficacy, respectively, among 137 participants pre-BEC, post-BEC and six-months post-BEC using mixed model analysis of variance (ANOVA). FGDs assessed perceptions of the course and online cases post-BEC and six-months post-BEC among 74 participants using thematic content analysis.

### **Results**

Participants gained and maintained significant increases in MCQ averages and Likert scores. The pre-course cases group scored significantly higher on the pre-test MCQ than controls ( $p=0.004$ ) and found cases most useful pre-BEC. Nurses experienced more significant initial gains and long-term decays in MCQ and self-rated knowledge than doctors ( $p=0.009$ ,  $p<0.05$ ). Providers valued the ABCDE approach and reported improved emergency care management post-BEC. Resource constraints, untrained colleagues and knowledge decay limited the course's utility.

### **Conclusions**

Basic emergency care courses for low-resource settings can increase frontline providers' long-term knowledge and self-efficacy in emergency care. Nurses experience greater initial gains and long-term losses in knowledge than doctors. Online adjuncts can enhance health professional education in LMICs. Future efforts should focus on increasing trainings and determining the need for re-training.

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## **ACRONYMS AND ABBREVIATIONS**

<b>AFEM</b>	The African Federation for Emergency Medicine
<b>ALS</b>	Advanced Life Support
<b>ACLS</b>	Advanced Cardiac Life Support
<b>ANOVA</b>	Analysis of variance
<b>ATLS</b>	Advanced Trauma Life Support
<b>A&amp;E</b>	Accident & Emergency
<b>BEC</b>	Basic Emergency Care
<b>CME</b>	Continued Medical Education
<b>CPR</b>	Cardiopulmonary Resuscitation
<b>EMS</b>	Emergency Medical Services
<b>FGD</b>	Focus Group Discussion
<b>LMIC</b>	Low-and-Middle-Income Country
<b>MCQ</b>	Multiple Choice Questionnaire
<b>MMR</b>	Mixed Methods Research
<b>MoH</b>	Ministry of Health
<b>MOOC</b>	Massive Open Online Course
<b>NCD</b>	Non-Communicable Disease
<b>O&amp;G</b>	Obstetrics and Gynaecology
<b>OER</b>	Open Educational Resources
<b>OPD</b>	Outpatient Department
<b>PNFP</b>	Private-non-for-profit
<b>RTI</b>	Road Traffic Incident
<b>SSA</b>	Sub-Saharan Africa
<b>ToT</b>	Training of the Trainers
<b>UNAS</b>	Uganda National Ambulance Service
<b>WHO</b>	World Health Organization

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## CHAPTER 1: INTRODUCTION

### 1.1. Background

Prioritisation of emergency care and its integration into health systems is essential to building momentum around global health priorities and eliminating health disparities. Defined as “the subset of emergency services focused on delivery of curative interventions targeting severe clinical cases”, emergency care addresses life and/or limb-threatening conditions with time-sensitive clinical services.<sup>1</sup> The term “emergency services” refers to a broad range of interventions at the population and individual levels, including emergency care, that function to provide prompt action in high-risk situations.<sup>1</sup>

Low-and-middle-income countries (LMICs) suffer the highest rates of mortality from acute complications and illness, accounting for >90% of injury-related deaths worldwide.<sup>2</sup> Road traffic incidents (RTIs) in particular are now the leading cause of death among children ages 5-14 and young adults ages 15-29.<sup>3</sup> Emergency care, which prioritises early resuscitation and stabilisation, may directly impact over half of all deaths in LMICs.<sup>4</sup>

Global health agendas and LMIC national health strategies have neglected emergency care in favour of vertical programs despite increasing calls to action. In 2007, the World Health Organization (WHO) urged the establishment of “formal and integrated trauma and emergency care systems”, and formed the Emergency, Trauma and Acute Care programme to prompt action.<sup>5, 6</sup> In 2019, the World Health Assembly passed resolution 72.16 “to strengthen the provision of emergency care as a part of universal health coverage” and urged “emergency care training for all relevant health provider cadres”, including “training frontline providers in basic emergency care”.<sup>7, 8</sup>

Governments and global health organisations continue to support vertical programs that address specific conditions over the development of well-integrated prehospital and facility-based emergency care.<sup>5, 9, 10</sup> The resultant lack of dedicated resources, infrastructure, and formally-trained healthcare providers creates substantial gaps in emergency care systems.<sup>11-13</sup> Sub-Saharan Africa (SSA) in particular accounts for 24% of the global disease burden and yet is served by only 3% of the world’s health workers, very few of whom are emergency care specialists.<sup>13</sup> Given the severe health worker shortage, basic training programs for all cadres of providers are necessary to fill critical gaps in emergency care in LMICs.

Educational modalities such as short courses and online learning, or e-learning, have emerged as strategies to strengthen healthcare providers’ skills in LMICs.<sup>14, 15</sup> Short-course educational programs have demonstrated success as an effective, high-impact solution to strengthening healthcare provider skills and knowledge in low-resource environments where resource-intensive, extensive on-the-job training and long-term programs remain limited.<sup>16-18</sup> E-learning through free and open digital publications of educational materials known as open educational resources (OERs) enhances information dissemination and clinical education, reaching and at times exceeding the

efficacy of lecture-only courses in high-income countries.<sup>19</sup> Blended learning, or mixing online OER adjuncts with face-to-face class time, could mitigate short course limitations such as declining knowledge and the need for frequent refresher courses in LMICs. Though less accessible in LMICs, online OERs and courses may benefit providers in low-resource settings most, and require a broader evidence base to understand their applications.<sup>20-24</sup>

The WHO has responded to the unmet need for formal emergency care training in LMICs with the Basic Emergency Care (BEC) Course, the first open-access short course providing comprehensive basic emergency training for low-resource settings. The BEC uses lectures, discussions and skills practicums to teach high-yield modules to frontline providers across cadres. To date, the BEC is the first open-access short course encompassing the breadth of emergency care in low-resource settings.<sup>25-27</sup> Since its pilot, BEC has expanded to include OERs, including online slide sets, cases and quick cards, to promote e-learning and blended learning.

In an attempt to augment knowledge acquisition and retention, the UCSF WHO Collaborating Centre for Emergency and Trauma Care was tasked with developing mobile adjuncts to the BEC. As a component of this work, a set of pre-course clinical cases were developed that include all of the learning points from the BEC in an attempt to provide a flipped classroom experience to enhance the in-person course. These cases were piloted at 2 small sites in Tanzania with another adjunct, but have not been evaluated separately nor have they been evaluated with a larger group of participants.

## **1.2 Uganda**

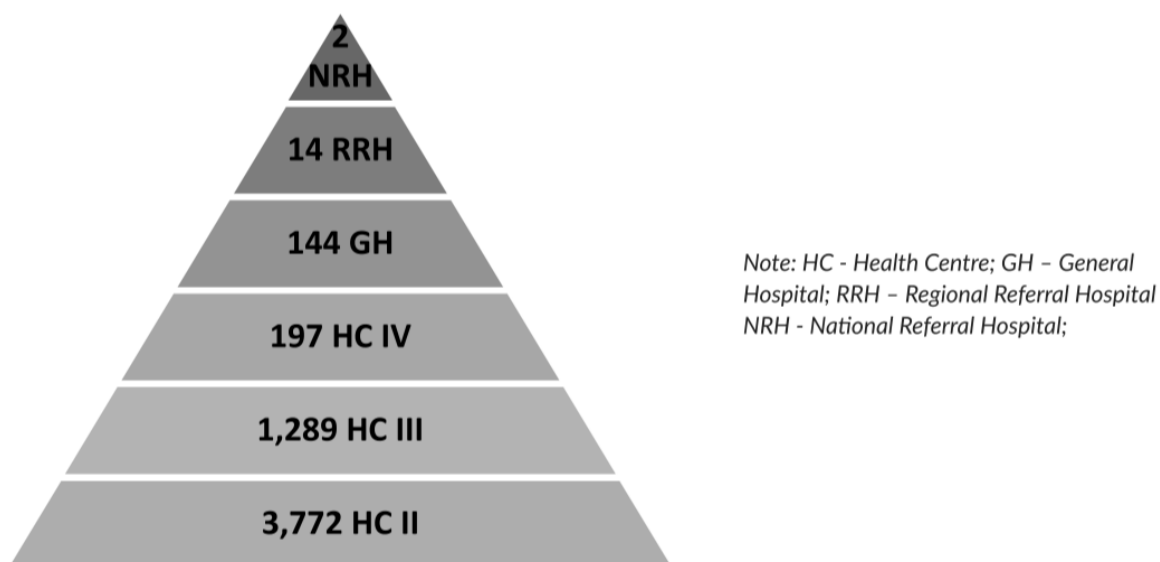
Uganda is a low-income, land-locked nation in East Central Africa with a population of 40.8 million inhabitants.<sup>28</sup> With a median age of 15.9 years and total fertility rate of 5.8 children per woman, Uganda has one of the youngest and fastest growing populations in the world.<sup>28</sup> Decades of regional instability and resultant waves of migration from neighbouring nations continue to expand the country's growing population. Though 70% of Ugandans live in rural areas, the country has undergone rapid urbanisation with the capital Kampala claiming almost 3 million inhabitants and a 5.6% growth rate as one of Africa's fastest growing cities.<sup>28, 29</sup> Kampala has experienced massive growth as an economic hub with resultant increase in road traffic and vehicle ownership, particularly boda-bodas.

While communicable diseases account for over 50% of morbidity and mortality, non-communicable diseases (NCDs) and maternal and perinatal conditions significantly contribute to Uganda's disease burden.<sup>30</sup> Uganda reports one of the highest rates of RTIs in the world (28.9/100,000) and a heavy infectious disease burden including malaria, tuberculosis, respiratory, diarrhoeal and vaccine-preventable diseases with a 5.9% HIV prevalence.<sup>28, 31</sup> The MoH has made notable progress in improving health markers such as HIV prevalence, life expectancy from birth, under-five mortality, stunting and maternal mortality in the last decade. Life expectancy from birth increased from 45.7 to 62.2 years for males and 50.5 to 64.2 years from females from 1991 to

2014, and under-five mortality decreased from 187 to 55 deaths per 1,000 live births from 1990 to 2015.<sup>30</sup> With these improvements, the MoH has begun to prioritise NCD prevention and control, including mental illness and substance abuse disorders.

Uganda’s decentralised healthcare system suffers from overburdening and underfinancing, resulting in human and material resource shortages. The National Health Policy relies on local governments for budgeting, resource allocation and service delivery at the district level, and on the MoH for policy-making, health strategy, surveillance, and resource mobilisation at the national level.<sup>32, 33</sup> The public sector consists of multiple tiers within each health-subdistrict that together provide 44% of all health services.<sup>33</sup> The tiered health system begins with preventative services provided by village health teams and escalates to tertiary care provided by national referral hospitals, though lack of ambulances and fuel hinders patient transfers between tiers (Figure 1).<sup>33, 34</sup> As of 2011, the government reported 3584 distinct health facilities, including private facilities run by faith-based organisations, traditional healers and private providers (Table 1).<sup>34</sup> The government spends USD12 per capita on basic healthcare, falling below the WHO and Health Sector Strategic and Investment Plan recommended per capita spending goals of USD34 and USD17, respectively.<sup>32</sup> Limited spending results in poor facilities and stock, low staffing, lack of emergency services, and untimely care that disproportionately affects impoverished Ugandans.<sup>32, 33</sup> The severe health worker shortage limits the quality and availability of care as Uganda’s density of 0.09 physicians and 0.63 nurses per 1,000 people falls below WHO recommended standards.<sup>35</sup>

**Figure 1: Organisation of Health Services in Uganda**



Source: WHO Cooperation Strategy: Uganda 2016-2020

**Table 1: Number of Health Units in 2011**

Level of Health Unit	Government	Private-non-for-profit	Total
Hospital	65	62	127
Health Centre IV	166	14	180
Health Centre III	868	251	1119
Health Centre II	1662	496	2158
<b>Totals</b>	<b>2761</b>	<b>823</b>	<b>3584</b>

Source: Health facilities inventories 2011

### 1.3 Status of Emergency Care in Uganda

Uganda's emergency care system primarily consists of facility-based care constrained by the absence of well-defined prehospital emergency services, human and material resources and formal emergency care training.<sup>36</sup> The MoH recently established the Department of Emergency Medical Services and the Kampala National Ambulance Service in recognition of the poor state of emergency care. Though the Department plans to develop essential prehospital training programs, call centres, and toll-free hotlines, most public and private ambulance services serve urban patients as transport vehicles and do not provide care unless an in-hospital provider accompanies the patient on interfacility transfers. Facility-based emergency care includes dedicated accident & emergency (A&E), casualty and outpatient departments (OPDs) during working hours and inpatient wards during non-working hours to care for emergency patients.<sup>37</sup> The 2008 MoH Demographic and Health Survey reported that 70% of hospitals and 90% of health centres lacked the basic physical infrastructure to provide emergency care and surgical services, including water and electricity.<sup>38</sup> Most hospitals lack a 24-hour dedicated emergency department and 75% of hospitals fail to deliver even the most basic health services.<sup>36, 37, 39</sup>

Kampala's emergency care system suffers from a high, likely underestimated trauma burden and consists of specialised hospitals that delegate emergency care to all cadres of providers. Emergency patients typically self-present and receive treatment from nurses, clinical officers, and on-call physicians at the local, regional and national referral levels. Specialists such as trauma surgeons and orthopaedists will attend to patients requiring acute surgical intervention, though neurosurgical services remain less accessible.<sup>40</sup> Mulago National Referral Hospital is a tertiary care centre and teaching hospital that treats most trauma patients in the greater Kampala metropolitan area. As a National Referral Hospital, "Mulago National Referral Hospital" includes three distinct sites that each attend to special patient populations, including obstetric, gynaecologic and perinatal patients at Kawempe National Referral Hospital, burns patients at Kiruddu National Referral Hospital and trauma patients at the main hospital, i.e. "Mulago Hospital." Recent studies and trauma registries from Mulago and other hospitals show that RTIs cause significant morbidity, mortality and loss of economic productivity in Uganda, disproportionately impacting young males.<sup>41</sup> Though urban and rural populations endure high all-cause injury mortality, the disabling injury rate is four times greater in urban than rural Uganda.<sup>42</sup> Given the lack of formal out-of-hospital

emergency medical services (EMS), patients who die from trauma most often do so in the field without reaching a facility in Uganda, resulting in incomplete, inaccurate RTI registries and underestimations of the trauma burden.<sup>43, 44</sup>

Prehospital care in Uganda remains undefined outside of private ambulance services and the nascent Uganda National Ambulance Service (UNAS) in Kampala, though recent advocacy has sparked increased planning for national policies and training programs. Key-stakeholders have collaborated to construct a national EMS and prehospital services policy to minimise reliance on untrained community members, police, boda-boda drivers and taxi drivers as first responders. Multiple studies have identified key weaknesses in Ugandan prehospital care for RTI victims as the lack of a national EMS, poor quality first aid treatment and skills, the lack of health insurance, and avoidable delays in treatment and transportation.<sup>36, 45</sup> Despite increasing emphasis on ambulances and EMTs, less than 5% of patients arrive at health facilities by ambulance across the country with non-trauma complaints accounting for most UNAS calls.<sup>41, 46</sup> Recently, UNAS has consolidated with private ambulance providers to develop a larger, government-controlled fleet and a 24-hour call centre that will eventually be staffed by volunteers.

Uganda's medical community only recognised emergency medicine as a distinct specialty in 2018, and most frontline providers have never received formal emergency training. This trend may change with the recent development of physician specialist training programs and national training curricula for EMTs and emergency nurses that will soon enrol students. Mbarara and Makerere Universities established Master of Emergency Medicine Programs in 2016 and 2018, respectively, and will soon graduate their first classes of residents.

In response to the lack of formal training, the Department of Emergency Services rolled out the BEC course in 2018 to hundreds of providers across the country with the fiscal support of the MoH, Korean Foundation for International Health, WHO and African Federation for Emergency Medicine (AFEM). An inconsistent funding source has limited course availability, though international donors have pledged future funding and expressed interest in programs to train more BEC trainers.

## **1.4 Adult Education in Healthcare**

### *1.4.1 Short Courses in Health Professional Education in LMICs*

Short courses have become a standardised and popular educational format for health professional education in high-income countries and LMICs. Despite limitations on knowledge retention and acquisition in comparison to on-the-job training and long-term education, short courses are an important modality in many LMICs with inadequate workforce populations and training options. The most recognisable courses include Advanced Life Support (ALS) courses like the Advanced Trauma Life Support (ATLS), Advanced Cardiac Life Support (ACLS), Advanced Paediatric Life Support Courses and others that require significant funding and re-certification every few years. Though frequently mandatory, these courses have unclear impact on

patient outcomes and current evidence shows a general decline in participants' gained knowledge and skills within one-year post training.<sup>47, 48</sup> The prevalence of such courses and certification in Africa is unknown, though various African societies and hospitals require these international courses.

Short courses in procedural skills and clinical knowledge have been piloted within a narrow definition of success in various LMICs. Abbreviated, adapted ALS courses such as the Trauma Evaluation and Management and Rural Trauma Team Development Courses, and emergency ultrasound and nursing courses in LMICs have demonstrated improved performance on written and skill-based exams immediately post-course though participants were not assessed beyond immediately post-course.<sup>17, 18, 27, 49</sup> With a successful pilot in Tanzania, Uganda and Zambia, the BEC is the first open-access course on basic comprehensive emergency care. Given that long-term knowledge retention may limit short course's utility, the BEC's impact on long-term knowledge retention should be evaluated. Though published data on patient outcomes post-BEC intervention are unavailable, a recent WHO bulletin reported a one-half reduction in mortality related to emergency conditions in two Ugandan district hospitals post-BEC training.<sup>50</sup>

#### *1.4.2 Open Electronic Resources in Health Professional Education in LMICs*

The use of online OERs for continued medical education (CME) has potentially far-reaching effects in low resource settings though has mainly been studied in high-income countries. Due to cost-efficiency and accessibility, OERs and massive open online courses (MOOC) can reach larger numbers of healthcare workers in resource-limited settings with promising results, especially when free.<sup>51, 52</sup> Data suggests that health care professionals in LMICs benefit more from MOOCs in their clinical practice and professional network than their counterparts in HICs; however, a 2013 review revealed that only two of 98 MOOCs were offered in LMICs, demonstrating a serious educational gap.<sup>52, 53</sup> OERs have implications beyond basic clinical knowledge to procedural skills, and have successfully trained LMIC physicians in obstetric, neurosurgical, and paediatric surgical skills.<sup>54-56</sup> A recent systematic review of e-learning in surgery showed that e-learning is at least as effective as other methods of training.<sup>19</sup>

The impact of online OERs in SSA is unknown despite increasing access to the Internet. Mobile technology has enabled Internet accessibility with 44% unique mobile subscriber penetration in 2017 and a quadrupling of mobile internet subscribers since 2010.<sup>57</sup> Smartphone use now accounts for a third of total connections.<sup>57</sup> Mobile technology usage in SSA has expanded digital and financial inclusion to rural populations where half of the population lives. By 2025, almost 300 million people will connect to the Internet in SSA with the majority connecting through mobile broadband networks and one billion people will have SIM connections.<sup>57</sup> Increasing, improving access to the internet could enable broader use of online OERs for health professional education in LMICs as recommended by the World Health Assembly.

### 1.4.3 Blended Learning in LMICs

Blended learning, or combining online and in-class learning, has gained popularity among governments and academic institutions in LMICs. This educational style may minimise course costs, material constraints and faculty burden, and yield better outcomes than traditional-lecture style classes in health professional education.<sup>58, 59</sup> Collaborative efforts have demonstrated the feasibility and efficacy of blended learning courses in LMICs across the globe with great potential in Africa where Internet accessibility continues to experience rapid growth.<sup>57, 60</sup> In contrast to MOOCs, blended learning maintains lower attrition rates by providing local accreditation and has the capacity for local adaptation, though technological difficulties and minimal technological support can impede initial implementation.<sup>58, 61</sup> Though blended learning has become standard in high-income countries, technology enhanced learning remain under-utilised in LMICs.<sup>20, 61</sup>

## 1.5 Motivation

Increased formal training on emergency care provision through short courses like the BEC could greatly impact the state of emergency care in Uganda. The MoH's national rollout of the WHO BEC course is the first of its kind with other East African nations, including Tanzania and Ethiopia, following suit. Though BEC pilot data showed positive results, the BEC requires a broader evaluation to determine its efficacy given limited MoH spending to address the healthcare worker shortage and absence of emergency care training in Uganda. The motivation for this study came from the Ugandan MoH and the advocacy body Emergency Medicine Uganda responsible for coordinating and teaching the nationwide rollout of the BEC. Supported by the WHO, the Ugandan government and Ugandan emergency medicine pioneers recognised the need for improved emergency care training for healthcare professionals. This study's results will aid other national governments in determining the BEC's utility as an interventional package for emergency services.

The rapid global expansion of accessible Internet has garnered interest in online OER usage in LMICs. A secondary motivation for this study is to describe online OERs' acceptability and impact in LMICs such as Uganda. OER usage in the BEC course could improve provider knowledge retention and confidence in emergency care provision and serve as a tool for CMEs post-course. This study would contribute to the growing body of literature on OER usage and blended learning recommended by the WHO-commissioned report on eLearning. Together, this study's outcomes would enable further OER development for continued medical education in LMICs to increase access to emergency care knowledge and OER development for health care professional education.

This study's goal was to describe providers' perceptions of the BEC and to measure the BEC's impact on provider confidence and knowledge through basic training evaluation. A secondary goal of this study was to compare participants' outcomes with the traditional BEC versus BEC with pre-course cases.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Emergency Care in LMICs and Sub-Saharan Africa

Emergency care is “an essential part of integrated health-care delivery” that has the potential to avert half of all deaths and a third of all injury in LMICs.<sup>5, 43</sup> Though LMICs comprise 80% of the global population, they account for 19% of global healthcare spending.<sup>62</sup> Despite nominal investment in emergency care, emergency settings remain the primary access point to healthcare for patients in LMICs, and the site of death for more patients in SSA than their global counterparts.<sup>6, 63</sup>

Most hospitals in SSA lack dedicated 24-hour emergency departments in addition to basic infrastructure, adequate equipment and trained personnel, leading to increased mortality from acute illness and injury compared to global rates.<sup>38, 63</sup> A recent geospatial analysis showed that one-third of African nations meet the WHO’s standard of accessible emergency care, defined as 80% of the population living within two hours of a hospital, without commentary on the quality of care at said facilities.<sup>64</sup> Given these barriers, acutely ill patients with surgical and medical disease often present later in their disease course and cannot receive timely care, contributing to high morbidity and mortality in the emergency setting in SSA.<sup>63</sup>

Both prehospital and facility-based emergency care demand focus for future mortality reduction efforts in LMICs. Prehospital EMS cover less than 9% of Africa’s population, limiting access to surgical intervention for RTIs.<sup>44,65</sup> Consequently, investment in integrated EMS and emergency facilities could save more lives than investment in primary care clinics.<sup>63</sup> This need in SSA in particular has mobilised healthcare providers, policy-makers and international partners to advocate for emergency system development and universal health coverage.<sup>5,8</sup>

### 2.2 Uganda’s Disease Burden

NCDs, malaria, pneumonia and trauma rank among the leading causes of in-patient death in Ugandan hospitals, though provide a limited perspective given most deaths occur in the pre-hospital settings.<sup>66-68,43</sup> Traffic-related injuries number among the top causes of mortality in Uganda due to inadequate roads, minimal vehicle and traffic regulations, *boda boda* dependency, and rapid population growth with minimal investment in trauma reduction and treatment.<sup>69-72</sup> Crash fatalities increased by 5% from 2017 to 2018 in the Kampala Metropolitan Area with Kampala accounting for 41% of all reported RTIs in Uganda.<sup>73</sup> As a result, Kampala’s various Regional and National Referral hospitals receive high volumes of trauma patients without adequate resources for acute care provision.

### 2.3 Emergency Care in Uganda

Emergency care in Uganda, while still in its infancy, remains unintegrated, unavailable and under-resourced. Even highway general hospitals receiving mass casualties have reported a universal absence of dedicated emergency departments and less than 50% of necessary materials and equipment to provide acute care, including gloves, oxygen,

blood and surgical tools.<sup>74</sup> Outside of UNAS in Kampala, no formal public ambulance system exists.

Uganda faces massive healthcare worker shortages of both physicians and nurses due to insufficient training programs, brain drain and poor working conditions. The mass exodus or “brain drain” of physicians out of the country resulted in part from political instability in the 1970s and 80s, and continues today with no raise in government salaries in the past ten years.<sup>75</sup> In-country, many health workers opt for administrative or research roles or moonlight at private hospitals with up to 37% of public-sector providers skipping work per day, contributing to the “internal brain drain” and diminishing the availability of clinical services.<sup>76, 77</sup> Nurses, the backbone of healthcare in much of SSA, may attend to forty patients on average at urban hospitals like Mulago Hospital.<sup>35, 77</sup>

Most emergency patients receive care from nurses and mid-level providers known as clinical officers without any formal emergency training. These providers take on higher-level tasks out of necessity, especially in rural areas. Absent a national triage system, these providers face limitations in facilitating timely care. A recent study in Northern Uganda revealed that emergency care providers self-report reliance on the “eyeball” method i.e. using overall visual appearance to triage patients instead of a standard triage tool that incorporates vitals.<sup>37</sup>

## **2.4 Emergency Education and Training in Uganda**

Formal emergency care training is limited in Uganda with ongoing efforts to fill the gaps. Emergency training programs for non-physician providers have shown promising results in rural SSA settings, including in Kawolo Hospital’s emergency department where BEC-trained nurses oversee all emergency care.<sup>35, 78, 79</sup> Two master’s programs for physician specialists began in 2016 at Mbarara University and 2018 at Makerere University with a national EMT and emergency nursing curriculum underway. Standard medical curricula exclude emergency care education or siloe it under anaesthesia and surgery with the exception of pilot emergency medicine courses and student groups focused on first-aid trainings at Makerere University.<sup>80</sup>

In 2015, the Department of Emergency Medical Services within Uganda’s MOH launched the first national rollout of the WHO BEC in partnership with AFEM. The BEC is part of the Emergency Care Outcomes Project (ECOP), an intervention that standardises triage, trauma and medical checklists and mortality surveillance. Ugandan medical officers and nurses trained as instructors taught the BEC to 276 healthcare providers, including nurses, clinical officers, doctors and medical students in thirteen districts. Unpublished data showed an average increase of 26% points across cadres with no follow-up data collected. Following ECOP implementation, unpublished data from implementation sites Mubende and Kawolo Hospitals suggests a 50% reduction of in-hospital patient mortality related to emergency conditions.<sup>35</sup>

## **2.5 Emergency Care Short Courses**

Short courses in emergency care may require adjuncts to impact long-term knowledge retention. A recent systematic review showed no association between ATLS and trauma death reduction, and studies of ALS-trained providers showed significant decay in CPR skills within one to twelve months post-course.<sup>48, 81, 82</sup> As short courses persist as the only option for emergency care education in many LMICs, they require strategies to improve long-term knowledge retention.

Existent emergency care short courses adapted to LMICs have specific focuses, including ultrasound, general trauma, trauma surgery and obstetrics, with positive impacts at reasonable cost (in comparison to the 27,000USD cost per ATLS course in countries lacking local instructors according to a recent Mongolian study).<sup>17, 26, 83-87</sup> Cunningham et al. recently described the success of a pilot of comprehensive basic emergency course for nurses in Tanzania.<sup>17</sup> Other short-term, emergency ultrasound trainings with registrar physicians in Tanzania and non-physicians in Uganda have showed significant improvement in both written tests and confidence levels.<sup>18, 87</sup> Such pilot programs demonstrate potential for emergency care short courses created for SSA, and require more evidence regarding long-term knowledge retention.

## **2.6 Blended Learning in LMICs**

Blended learning has gained traction in LMICs given equal to superior efficacy to in-person teaching in LMICs, and minimisation of faculty shortages and institutional burden.<sup>88</sup> Online resources such as video lectures and modules can play an important role in pre-class learning and cut down required course time while improving students' outcomes, engagement and critical-thinking.<sup>89, 90</sup> Most blended learning courses in LMICs have focused on physician training and utilised computer-assisted learning, with few specific post-graduate applications.<sup>91</sup>

Blended learning has its drawbacks in LMICs, including significant implementation challenges with technology, government collaboration, financial support and contextualisation of courses based on a recent meta-analysis.<sup>58</sup> Models like the flipped classroom may also require significantly more design and implementation time for educators—over a two-fold increase in time to flip a basic pharmaceutical course in one study—and increase students' stress to perform in class in comparison to traditional models.<sup>92, 93</sup> A recent collaborative study including Makerere University reported that blended learning courses cost more than double the equivalent traditional style course, though utilised video-conferencing in the classroom.<sup>94</sup> Finally, blended learning models like the flipped classroom depend on student preparation and autonomy as a unpreparedness can render in-class activities meaningless.

Few examples of OER usage in emergency care education exist in SSA. The only example to date in Uganda is an online, comprehensive emergency care module developed for medical students at Makerere University that demonstrated equal

performance to traditional classroom-based lectures delivered by visiting faculty.<sup>80</sup> Aside from equal efficacy to traditional educational models, blended learning could mitigate shortages of healthcare educators to broaden educational access in Uganda given that district local governments must provide educational strategies but lack expertise in emergency care and other specialties.

## 2.7 Training Program Evaluation

Kirkpatrick's model is a common framework for professional training program evaluation that assesses four levels: participants' reactions (i.e. how much participants liked the program), learning (i.e. what principles, facts and techniques were learned), behaviour (i.e. what changes in behaviour resulted from the program), and results (i.e. what were the changes in quality resultant from the program).<sup>95</sup> These levels are based in Miller's pyramid of clinical assessment that evaluates learners at the lowest level in the classroom and at the highest level in the workplace, progressing from knowledge ("knows") to competence ("knows how") to performance ("shows how") and culminating in action ("does") (Figure 2).<sup>96, 97</sup> Kirkpatrick's model emphasises that each incremental level holds more information than its preceding level, valuing results rather than action above all. Despite its popularity, the model has certain limitations including oversimplification, assumption of causality between program and "results", weak linkages between the four levels, and failure to consider contextual variables' impact on the training's outcomes.<sup>98</sup>

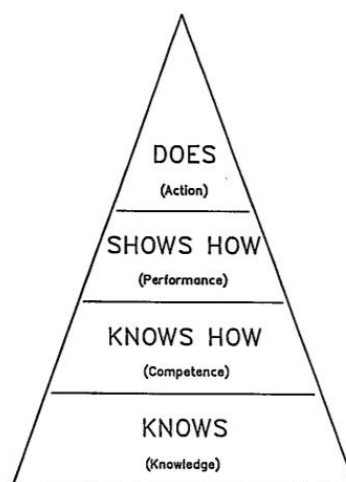


Figure 1. Framework for clinical assessment.

## Figure 2: Miller's Pyramid of Clinical Assessment

Source: Miller GE. The assessment of clinical skills/competence/performance. Acad Med. 1990;65(9 Supl):S63-7.

## 2.8 Mixed Methods in Program Evaluation

Mixed methods research (MMR) has become widespread in training program evaluation through its incorporation of quantitative, meaning numerical, and qualitative, meaning non-numerical or verbal, data.<sup>99</sup> The continuous evolution of

MMR prompts regular, new definitions with no singular predominating definition. Of the many definitions, Greene's description encompasses the dynamism and variety of MMR inquiry:

"A mixed methods way of thinking is an orientation toward social inquiry that actively invites us to participate in dialogue about multiple ways of seeing and hearing, multiple ways of making sense of the social world, and multiple standpoints on what is important and to be valued and cherished."<sup>100</sup>

Using both quantitative and qualitative methods enables researchers to combine and interpret a vaster evidence body to answer both specific and overall research questions that together explore "multiple standpoints on what is important". Mixed methodologies may enable a more comprehensive answer to research questions than a single methodology alone to combine complementary, "rich, subjective insights on complex realities from qualitative inquiry with the standardized [*sic*], generalizable [*sic*] data generated through quantitative research."<sup>101</sup>

Though rooted in the social sciences, MMR has gained acceptance in healthcare research, including in health services and training program evaluation.<sup>102-105</sup> Such "mixing" of methods may enable understanding of complex aspects of emergency systems, resource availability, environment, psychosocial factors and human interactions to improve patient care and aid future investigation and hypothesis generation.<sup>106</sup>

MMR does not always produce synergistic results, and its popular and at times unselective use in healthcare research may counteract its open, integrative design. MMR's critics call attention to researchers' unthoughtful application of mixed methods, citing constrained design and streamlined templates chosen to meet guidelines set by funding frameworks.<sup>107</sup> Medical education researchers interested in MMR can avoid these pitfalls by designing integrative rather than additive studies, understanding mixed methods theory, collaborating with qualitative researchers, and identifying a mixed question set.<sup>105</sup> Training program evaluation studies should embed qualitative portions within larger quantitative portions to integrate outcome and process data into local context.<sup>103</sup> This type of integrative, embedded approach permits a broader commentary on the impact and reception of non-traditional training programs.

## **2.9 Focus Group Discussions**

FGDs generate dynamic data to allow participants' ideas and opinions to develop through group interactions while maintaining flexibility to explore new emergent ideas and opinions.<sup>108, 109</sup> Unlike individual or group interviews, FGDs enable thought evolution through the interplay of participants' stated ideas and group interactions.<sup>110</sup> Crucial to the success of FGDs, group dynamics may embolden expression of opinions or discussion of taboo topics, and empower less talkative participants to play an active role in data generation.<sup>110</sup> Though transcriptions make up the bulk of FGD data, facilitators can observe body language and facial expressions to inform

interpretations of participants' statements that may otherwise be lost in other forms of data collection. FGD use in medical and health-related research began as a means of adding an explanatory layer to mixed methods studies with recent acceptance as a stand-alone method.<sup>104</sup> Its use in medical education enables exploratory research to generate hypotheses and unique commentary on social, cultural and medical aspects of curricular design and clinical practice.<sup>104</sup>

The rising use of focus groups in healthcare research has drawbacks. FGDs can fail to generate representative or rich data when individual voices are silenced due to power imbalances, discomfort or poor moderation.<sup>110</sup> Qualitative researchers debate whether to recruit existent groups instead of groups of strangers to mitigate strained or uncomfortable group interactions as a result. Like MMR, funding organisations may require FGDs in research methodologies, leading to shoddy design and sampling that neglect group interaction and better approximate group interviews.<sup>111</sup> With attention to group composition, synergy and privacy, FGDs can “facilitate the expression of ideas and experiences that might be left underdeveloped in an interview and... illuminate the research participant’s perspectives through the debate within the group.”<sup>110</sup>

## CHAPTER 3: METHODOLOGY

### 3.1 Setting

As one of Africa's fastest growing cities, Uganda's capital Kampala is divided into five urban divisions with a population trending towards 3 million.<sup>28</sup> Kampala drives 80% of Ugandan industry and commerce, and generates 65% of the national GDP.<sup>112</sup> Given Kampala's high concentration RTIs, the MoH has targeted the BEC intervention towards Kampala's hospitals. The MoH provided the investigators with letters of support and invitations for hospitals to participate in the study that a public official and co-investigator delivered in-person to each study site. Hospital administrators in turn provided material support and a list of providers who they believed would benefit from the course.

### 3.2 Population

The study population included all mid-level, non-physician providers and physicians eligible to enrol in the BEC course, including nurses, midwives, clinical officers and doctors. Given the lack of dedicated emergency facilities in Uganda, providers worked in a variety of departments.

### 3.3 Sample

The MoH EMS Department recommended six public and private-non-for-profit (PNFP) hospitals with high-volume emergency departments as BEC training sites. This included national referral hospitals, regional hospitals and PNFPs, including Naguru, Mulago, Nsambya, Mengo, Masaka, Kiruddu and Kawempe Hospitals, to capture the diversity of clinical settings and providers in Kampala. Hospital administrators provided a list of 20-30 hospital-based nurses, midwives, clinical officers and physicians who they believed would benefit from the BEC course. If a hospital could not provide 20 participants, the investigators invited healthcare providers from the other study sites based on past BEC participants' recommendation of colleagues to attend the course. In a minority of cases, providers who had not been invited by the administration contacted the investigators asking to participate. A few participants not on the administrators' lists were recruited by colleagues enrolled in the BEC who contacted the investigator on their peer's behalf.

The investigators ensured that most participants in each BEC course worked at the training site where the course took place. This study used convenience sampling to recruit participants for the general course. Given that the sample size for the study was fixed at approximately 140 participants divided between each modality subgroup, sample size calculations were not necessary. We based this assumption on the wide range of sample sizes in existing educational studies and understanding that the six hospital sites and their providers were both large enough and representative enough for the normality assumptions required for statistical analysis.

The investigators changed the intervention strategy half-way through the study due to incomplete data collection from the earlier national rollout, assigning participants in

earlier BEC trainings to the pre-course cases group and participants in the later BEC trainings to the control group. Given the unforeseen change in design, the control and pre-course cases arms were not perfectly matched. Mengo Hospital, a PNFP, and Kawempe Hospital, a government hospital, were placed in the control group such that only these two groups did not receive the pre-course cases. Overall, the cadre representation at these sites matched the other sites and the sites' assignment to the control group was determined only by timeline. Clinical officers were scarce at all sites except Naguru.

Convenience sampling was used to invite all BEC participants to participate in the quantitative portion of the study and random sampling to invite six to nine providers from each course to participate in the qualitative portion, i.e. the post-course focus group discussion (FGD). If a provider declined to participate in the immediate post-BEC FGD, another randomly selected participant was invited to attend such that every focus group had six to nine providers. In the six months post-BEC FGDs, the investigator re-invited the same participants from the initial round of FGDs, and additional participants via convenience sampling to account for attrition given scheduling conflicts. The selection did not account for difference in cadre representation such that the proportional representation of nurses, clinical officers and physicians varied between groups. Hospital leadership was excluded from the focus groups to avoid any discomfort or hesitancy to provide criticism of the providers' clinical settings.

### **3.4 Inclusion Criteria**

The study included all participants aged 18 and above from the 2018 BEC courses in Kampala at Mulago, Mengo, Naguru, Nsambya, Kawempe and Kiruddu Hospitals. Only midlevel non-physician providers, including nurses, midwives and clinical officers, and physicians may enrol in the BEC course. Participants had to be fluent in English as the BEC course is delivered in English.

### **3.5 Exclusion Criteria**

All participants who were below the age of 18 years old, not fluent in English, or not healthcare professionals were excluded from the study.

### **3.6 Data Collection**

#### *3.6.1 Quantitative Data Collection*

The quantitative portion of this study measured knowledge and self-efficacy in basic emergency care provision through multiple choice questionnaires (MCQs) and Likert scales, respectively. The MCQs were a standardised, mandatory 25-item exam with four answer choices per question that tested integration of new knowledge into standard clinical situations. The BEC course creators designed the exam to assess procedural knowledge and recall of the most important aspects of basic emergency care. All BEC participants take the MCQ as a pre-test and post-test and must score  $\geq 75\%$  on the post-test to pass the course and receive BEC certification. The same

MCQ was re-administered six-months post-BEC to assess provider knowledge retention.

A ten-item Likert was designed to assess BEC participants' perceived self-efficacy, or competency, in emergency care provision and administered at the same three time points as the MCQ (Appendix 1).<sup>113</sup> The scale's ten questions assessed five domains: comfort, perceptions of colleagues' skills, knowledge, preparedness, and confidence in the provision of basic emergency care. A four-point scale without a mid-point or neutral option was used to limit social desirability bias and compel responders to express an opinion.<sup>114, 115</sup>

Providers were recruited from the six sites based on hospital administrators' compiled lists of providers and colleagues' recommendations in a few cases. 142 participants completed pre-course MCQs and Likert scales. 137 participants completed post-course MCQs and 135 participants completed post-course Likert scales. Five providers did not complete the BEC course due to unforeseen scheduling conflicts and were excluded from the study.

80% of providers (110/137) completed the six-month follow up MCQ and Likert scale. The remaining 27 providers, including 18 nurses, 8 doctors and 1 clinical officer, were uncontactable or geographically inaccessible due to extended leave or change in post. The investigators contacted the participants by phone, email and WhatsApp to convene follow up sessions at each hospital site, investigators convened as many participants as could attend the session to take the follow up MCQs and Likert scales in a quiet, classroom setting at their work site with the same hour-long time constraint. If a participant was unable to attend the follow-up session, the investigator made all attempts to meet with the participant to administer the written MCQ or Likert scales in a quiet uninterrupted setting.

### *3.6.2 Qualitative Data Collection*

The qualitative portion of this study consisted of FGDs that assessed BEC participants' perceptions of the course with and without online cases. The investigators aimed to explore participants' experiences with emergency care and general perceptions of the BEC in terms of its efficacy, applicability and utility in the providers' clinical settings.

The focus groups were designed to assess provider perceptions of the BEC immediately post-BEC and 6-months post BEC and conducted in English. As an official national language, English unites Kampala's multilingual population, and healthcare workers must have proficient to fluent mastery for training and interpersonal communication. Two semi-structured scripts (Appendix 2) were designed to explore prior healthcare experience, prior emergency experiences, general perceptions of the BEC and of the online cases and finally perceptions of the course's impact over six months. They were modelled off scripts used to discuss emergencies with community members in Zambia and Kenya.<sup>116</sup> The FGD script immediately post-BEC was designed to explore providers' experiences with emergency care provision and their immediate perceptions of the course. The six-

month post-BEC script included modifications that assessed changes in participants' perceptions of the BEC and pre-course cases in their clinical contexts regarding applicability and value. Each FGD script was adapted to the intervention arm to assess providers' perceptions of the pre-course cases and their utility, and included an additional section for participants who received the pre-course cases to probe their perceptions of the online resources that they accessed prior to the course. Only the second script probed providers' perceptions of changes in their clinical actions and performance resultant from participation in the BEC course.

An American co-investigator with experience in qualitative research and semi-structured interviews conducted the first FGD round from October to November 2018 and the second round from March to April 2019 in English. All FGDs took place in a private room at each of the six sites. The facilitator asked participants about personal experiences with emergency care and training, and perceptions, limitations and recommendations for the BEC course in the first round of FGDs. Though the facilitator coordinated the course, she did not teach outside of the event that an instructor was absent in order to reduce bias and create a neutral environment for the FGDs. The second round of FGDs focused on new emergency care experiences, and changes in perceptions, limitations, and future directions for the BEC course and pre-course cases. A Ugandan study staff member attended the first round of FGDs to take notes, provide feedback and debrief with the facilitator, afterwards transcribing all focus groups using the audio recordings with all identifiers removed. As a native to Kampala, the staff member included and provided interpretations of Ugandan expressions and phrases. One investigator reviewed the transcripts and gave feedback to the EMU transcriber for corrections or clarifications to standardise the transcriptions. For the follow-up round of FGDs, the facilitator transcribed audio recordings. The facilitator and another co-investigator reviewed and cleaned transcriptions for accuracy. All names were removed and recordings were deleted once transcribed.

From October to November 2018, six FGDs with 47 total participants were conducted in English immediately post-BEC. The FGDs ranged from 45 to 65 minutes with most lasting about 60 minutes. Focus groups were recorded using VoiceRecorder™ on an iPhone 8. Focus group participants were asked to avoid using identifiers such as names, and were able to leave at any time throughout the discussion.

From March to April 2019, the same facilitator repeated the above procedure to conduct seven FGDs in the same hospitals, conducting one additional FGD at Naguru China-AID Friendship Hospital to extract more data given fewer participants than in the first round of FGDs. The follow-up FGDs included 38 total participants, ranging from 21-45 minutes and averaging 31 minutes in duration.

### **3.7 Data Analysis**

#### *3.7.1 Focus Groups Discussions*

Two investigators independently reviewed the transcript from the first round of FGDs using thematic content analysis to code data into broad themes and sub-themes. The

investigators compared their codes, categories and themes for discussion and refinement. They repeated this process until thematic saturation was reached for the first round of FGDs, and then again for the second round of FGDs with the coders applying old codes and analysing for new codes, themes and sub-themes. The investigators conducted a comparative analysis between the first and second round of FGDs, discussing key similarities and differences. One author used the qualitative analysis software Atlas.ti 8™ for Windows whereas the other preferred manual, handwritten analysis.

### *3.7.2 Data Analysis – MCQs and Likert Scales*

The MCQs consisted of 25 questions and were graded on a percentage scale. The MCQs were analysed at three different points in time: immediately pre-BEC, immediately post-BEC and at six months post-BEC. Providers were grouped by cadre and exposure to the pre-course cases in the analysis. A mixed model ANOVA analysis was used to analyse knowledge acquisition and retention, excluding clinical officers given small sample size (n=9). Modality and time effects were fixed while participant effects were treated as random. Mixed model ANOVA was chosen to compare MCQ and Likert survey means between groups while identifying main effects of and interactions between independent participant variables (e.g. pre-course case exposure, cadre, case completion, number of cases completed) in a longitudinal manner.

Likert scales were graded on a four-point scale correlating to positive confidence and self-efficacy in emergency care provision such that the highest possible score was 40 and the lowest possible score was four. A liability analysis was used to establish intercorrelation between the various categories tested by the Likert scale using Cronbach alpha coefficients for each category. As a commonly accepted method in medical education literature, Cronbach alpha was chosen to establish reliability of the Likert scale and internal consistency given that each item was designed to measure the same trait of self-efficacy in accordance with the tau equivalent model.<sup>117</sup> A mixed model ANOVA analysis was used to analyse self-efficacy in emergency care provision based on each Likert category to compare means between groups and identify main effects of and interactions between independent participant variables as with the MCQs. Providers were again grouped by cadre and exposure to the pre-course cases.

## **3.8 Ethical Considerations**

Ethical approval for this study was obtained from the University of Cape Town's Human Research Ethics Committee, Makerere University's Human Research Ethics Committee and University of California San Francisco's Institutional Review Board. The Ugandan (MoH) does not have an internal review process, but provided support and approval for the study.

## **3.9 Risk to Participants**

The risk to participants in this study was minimal and limited to retrospective identification of participants and the elicitation of negative emotions in the focus groups. Retrospective identification was limited by ensuring that all participants used an assigned number generated randomly in lieu of name to remain anonymous in the MCQs and Likert scales. A master spreadsheet was created correlating participant name and number for future analysis, meaning there was still a risk of retrospective identification of participants and their scores. To minimise provocation of negative emotions, trauma and stress in the focus groups, all participants were informed that they could leave at any point in time and did not have to answer any questions or contribute to the discussion if they felt uncomfortable. Though the investigators attempted to provide local counselling services' contact information to participants, Makerere University and the surrounding hospitals do not provide on-site counselling. Focus group participants were instructed to not use names or identifiers in the focus groups and maintain confidentiality at the termination of the discussion. The transcripts and audio recordings were maintained securely and all identifiers were removed from the transcripts by a member of EMU.

### **3.10 Benefit to Participants**

The participants in this study did not directly benefit materially from the study, though they contributed to evaluating the impact of the BEC on emergency care practitioners in Uganda. As participants in the BEC course, they helped determine whether the course has been effective in Uganda and may be applicable on a broader global scale to emergency care education in LMICs. All participants received a soft copy of the BEC manual and access to the online slideshows and some received pre-course cases that will be disseminated globally for all BEC participants. These resources became available to participants in the control arm at the conclusion of the study. All study participants may reference these resources in their practice for the rest of their lives. Focus group participants also had the opportunity to weigh in on the state of emergency care education in Uganda and provide suggestions and recommendations regarding the BEC. Ultimately, these practitioners' contributions will provide the Ugandan MoH with a better understanding of the impact of this course and enable advocacy for further emergency care education and systems development.

## CHAPTER 4: QUANTITATIVE RESULTS

### 4.1 Introduction

MCQs and Likert scales were administered and collected pre-BEC, post-BEC and at six-months post-BEC with the aim of assessing changes in knowledge and self-efficacy in emergency care provision. 137 study participants completed the BEC course and were included in the following analysis.

### 4.2 Participant Demographics

The 137 providers consisted of 87 nurses (63%) (including registered, diploma, midwives and nurse assistants), 41 doctors (30%) (including medical officers and specialists), and 9 clinical officers (7%) (Table 2). Of the 137 participants, 86 participants (from four courses) received instructions to complete at least 16/32 of the pre-course cases whereas the remaining 51 (from the remaining two courses) did not receive the pre-course cases or any pre-course work (Table 3).

Aside from Naguru Hospital, where eight clinical officers attended the course, the composition of the pre-course cases and control groups were similar in cadre distribution and number. Participants were assigned to the pre-course cases group or control group based on timing of the course, with those enrolled in later courses assigned to the control arm. Of the 86 participants assigned to complete the pre-course cases, 65/86 (76%) self-reported case completion of at least one online case, including 78% of nurses, 74% of doctors and 63% of clinical officers. The six-month follow up MCQ and Likert scale were completed by 80% of providers (110/137). The remaining 27 providers, including 18 nurses, 8 doctors and 1 clinical officer, were uncontactable or geographically inaccessible due to extended leave or change in post.

**Table 2: BEC Participants by Site and Cadre**

	<b>Nurse</b>	<b>Clinical Officer</b>	<b>Doctor</b>
<b>Nsambya</b>	11	0	9
<b>Naguru</b>	12	8	4
<b>Mulago</b>	12	0	7
<b>Mengo</b>	22	1	5
<b>Kiruddu</b>	16	0	7
<b>Kawempe</b>	14	0	9
<b>TOTAL (n, (%))</b>	87, (63%)	9, (7%)	41, (30%)

**Table 3: BEC Participants in Pre-Course Cases and Control Groups by Cadre**

	<b>Pre-Course Cases Group</b>	<b>Control Group</b>
<b>Nurses</b>	51	36
<b>Clinical Officers</b>	8	2
<b>Doctors</b>	27	13
<b>TOTAL (n, (%))</b>	86, (63%)	51, (37%)

### 4.3 Knowledge Acquisition and Retention

#### 4.3.1 Descriptive Analysis of MCQ Scores

Emergency care knowledge was estimated by the participant's score on the MCQ as a percentage at each time point. This analysis refers to the three time points as: 1) pre-test, 2) post-test, meaning immediately post-BEC, and 3) six months post-BEC test, meaning at the six months follow-up point.

There was a significant increase in the mean MCQ scores of all 137 providers from 66% pre-test to 86% post-test, though the mean score decreased to 80.3% at six months post-BEC (Table 4). There was an average score increase of 20%, or five correct answers, between the pre-test and post-test, and 15%, approximately four correct answers, between pre-test and six months post-BEC tests (Table 5). Participants experienced an average overall reduction in score of 5%, approximately one incorrect answer, from post-test to six-months post-BEC tests. The pre-course cases group had greater mean MCQ score than the control group at all time points (not statistically significant).

**Table 4: Average MCQ Score and Standard Deviation Over Time in Control, Pre-Course Cases, and Composite Groups**

	<b>Pre-BEC</b>	<b>Post-BEC</b>	<b>6 months post-BEC</b>
<b>MCQ Average Score (%)*</b>	63.3, 68.8 <b>(65.7)</b>	85.0, 86.1 <b>(85.1)</b>	79.2, 81.1 <b>(80.39)</b>
<b>Composite Standard Deviation</b>	14.7	11.0	12.8

\*Values reported as: control group, pre-course cases group (**composite**)

**Table 5: Average Change in MCQ Exam Score Over Time**

<b>MCQ Δ in Score</b>	<b>Δ Pre to Post*</b>	<b>Δ Pre to 6 months*</b>	<b>Δ post to 6 months*</b>
<b>Average Δ in Total Score (%)</b>	24.3, 17.3 <b>(19.9)</b>	18.4, 12.0 <b>(14.5)</b>	-6.8, -4.9 <b>(-5.5)</b>

\*Values reported as: control group, pre-course cases group (**composite**)

#### 4.3.2 ANOVA Analysis of MCQ Scores

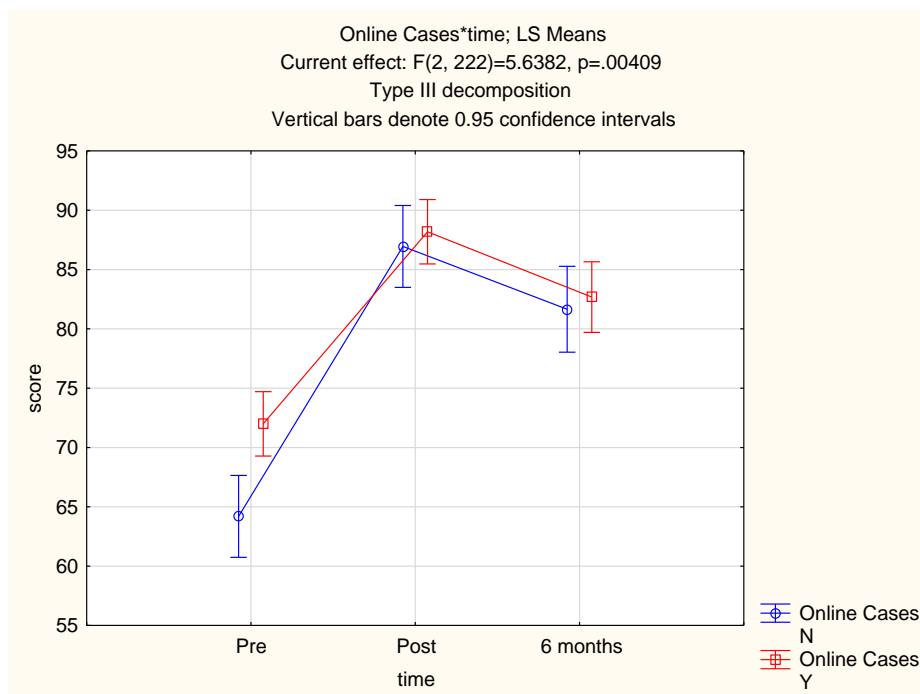
Mixed model analysis of variance (ANOVA) was used to analyse interactions between the dependent variable of MCQ score and independent variables of pre-course cases exposure, time and cadre. Clinical officers were excluded from ANOVA analysis due to limited numbers (n=10), leaving only nurses and doctors for a total of 127 participants. The analysis maintained an intention to treat framework for the 137 participants who completed the course and did not separate participants in the pre-

course cases group by self-reported case completion, though a post-hoc analysis examined the effect of self-reported case completion.

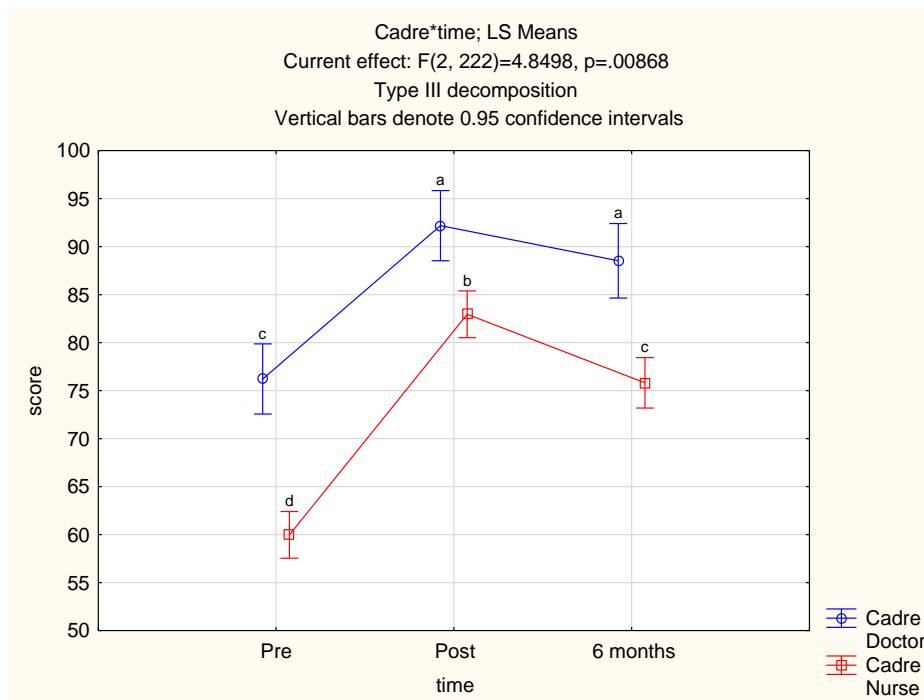
ANOVA revealed a significant group time effect ( $p=0.004$ ), or interaction between assignment to the pre-course cases versus control groups and time. The pre-course cases group scored significantly higher on average than the control group on the pre-test (70.0% versus 60.0%); however, this interaction was not significant on the post-test or six-month post-BEC MCQs despite higher averages among the online group than the control group overall (Figure 3, Table 4). These results indicate that exposure to the pre-course cases increased participant knowledge prior to the course but did not impact participants' performance later in the course, a finding that will be further discussed in the Online Cases section of the Qualitative Findings in Section 5. Section 4.3.3 presents the findings of a post hoc, sub-group analysis of the online group based on self-reported case completion.

ANOVA analysis also showed a significant relationship between the independent variables of cadre and time and the dependent variable of MCQ score ( $p = 0.009$ ) (Figure 4). This finding highlights the impact of cadre on knowledge retention over time as demonstrated in the mean difference in nurses and doctors' six-month post-BEC MCQ scores. The relationships between cadre, group and time ( $p=0.52$ ), and cadre and group ( $p=0.21$ ) as related to MCQ score were insignificant. Section 4.3.4 explores the relationship between cadre and time on MCQ scores in greater detail.

**Figure 3: Online Case Assignment and Time Interaction in ANOVA Analysis**



**Figure 4: Cadre and Time Interaction in ANOVA Analysis**



\*letters denote significant differences i.e. no overlapping of confidence intervals between comparison points

#### 4.3.3 Cadre Sub-Group Analysis

ANOVA analysis revealed significant differences between nurses and doctors at all time points in the composite group ( $p < 0.001$ ) (Figure 4). Nurses averaged a lower pre-BEC baseline score of 61% compared to doctors' pre-test baseline 77% (Table 6). Both groups demonstrated significant knowledge gain from the pre-test to post-test with nurses scoring a mean difference of 23%, or five to six correct answers, and doctors scoring a mean difference of 16%, or three to four correct answers (Table 7). Nurses demonstrated a significant loss of knowledge from post-test to six months post-BEC test with a mean difference of -7.1% ( $p < 0.001$ ) whereas doctors had a comparatively insignificant loss of knowledge with a mean difference of -3.7% ( $p = 0.07$ ) (Table 7).

Compared to doctors, nurses had lower baseline scores and gained significantly more initial knowledge from the pre-test to post-test. Nurses retained significantly less knowledge from post-test to six-months post-BEC test whereas doctors comparatively lost an insignificant amount of knowledge (Figure 4, Table 7). Though mean MCQ scores decreased for both nurses and doctors from post-test to six-months post-BEC, both cadres maintained a significant increase in their six-month scores from their pre-test scores with a mean difference of 12% for doctors and 16% for nurses, demonstrating knowledge retention over time.

**Table 6: Mean MCQ Score by Cadre Excluding Clinical Officers (n=127)**

<b>Cadre</b>	<b>Mean Test Score % (Pre, Post, 6 months*)</b>	<b>Standard Deviation (Pre, Post, 6 months*)</b>
<b>Nurse</b>	61, 83, 76	13.1, 11.4, 12.5
<b>Doctor</b>	77, 92, 88	12.9, 6.4, 9.2
<b>Composite</b>	66, 86, 80	14.9, 10.9, 12.9

**Table 7: Mean MCQ Score Differences by Cadre and Time Excluding Clinical Officers (n=127)**

<b>1st Mean</b>	<b>2nd Mean</b>	<b>Mean Difference</b>	<b>Standard Error</b>	<b>p-value</b>
Doctor pre-test	Doctor post-test	-16.0	1.9	0
Doctor pre-test	Doctor 6 months post-test	-12.3	2.0	0
Doctor post-test	Doctor 6 months post-test	3.7	2.0	.07
Nurse pre-test	Nurse post-test	-23.0	1.3	0
Nurse pre-test	Nurse 6 months post-test	-15.8	1.3	0
Nurse post-test	Nurse 6 months post-test	7.1	1.3	0
Doctor pre-test	Nurse pre-test	16.2	2.2	0
Doctor post-test	Nurse post-test	9.2	2.2	0
Doctor 6 months post-test	Nurse 6 months post-test	12.7	2.4	0

#### *4.3.4 Self-Reported Case Completion Sub-Group Analysis*

The pre-course cases group scored higher than the control group on the MCQ at all time points, though only significantly higher on the pre-BEC test, prompting a post-hoc ANOVA analysis that divided the online group participants based on self-reported case completion. This analysis included three groups: 1) participants in the control group (i.e. “controls”), 2) participants in the pre-course cases group who self-reported case completion (i.e. “completion” group), and 3) participants in the pre-course cases group who did not self-report case completion (i.e. “no completion” group). Participants who self-reported case completion, defined as completing at least one case, completed an average of 11 cases in total with a range from 1 to 32 cases total. Participants who

self-reported completion of at least one case were considered in the “completion” group given that one attempt could translate to future case completion in the post-course phase. Though the assignment was to complete at least sixteen cases, the feasibility of case completion and usage was considered more important in defining the completion sub-group than completion of the overall assignment.

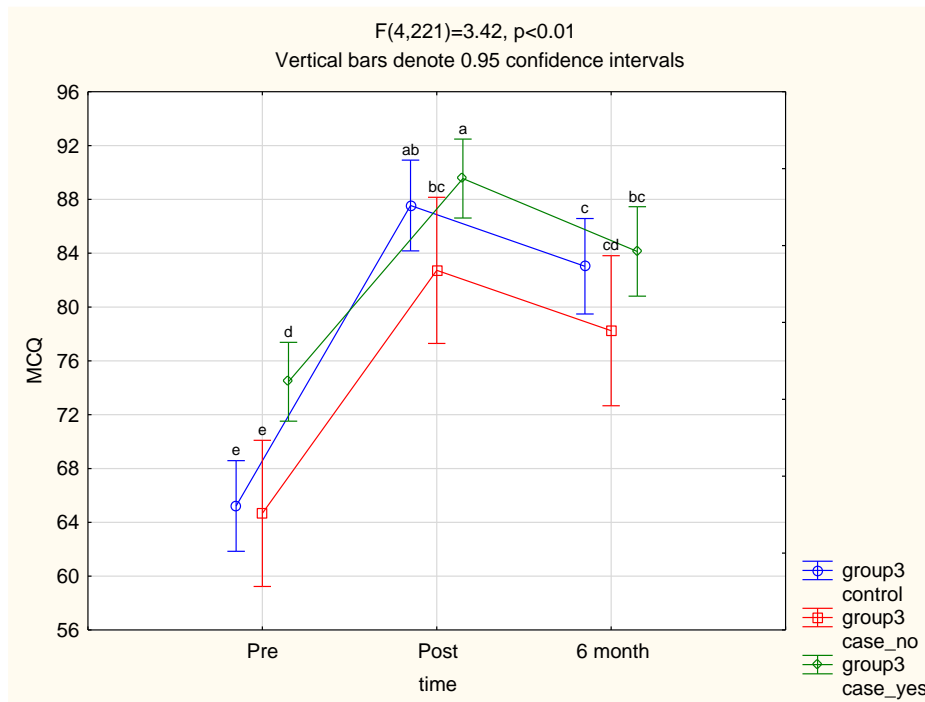
The completion group had higher average MCQ scores at all three time points than the no completion group and the controls (Table 8). The controls scored higher on the post-test and six-month post-BEC test than the no completion group. The difference between mean scores was greatest between the completion and the no completion groups. There was no significant dose-response relationship between the number of cases completed and MCQ scores at any time point in the post-hoc sub-analysis.

**Table 8: Comparison of Mean MCQ Scores Based on Self-Reported Case Completion**

	<b>Pre-test mean MCQ score</b>	<b>Post-test mean MCQ score</b>	<b>6-months mean MCQ score</b>
<b>Self-reported case completion</b>	72.0%	88.5%	82.1%
<b>No self-reported case completion</b>	63.3%	81.2%	77.6%
<b>Controls</b>	60.7%	85.0%	79.6%

ANOVA analysis revealed a significant interaction between group and time ( $p < 0.01$ ), showing that the completion group scored significantly higher when compared to the no completion *and* control groups on the pre-test. These same participants in the completion group also scored significantly higher on the post-test when compared to no completion group, though the difference was not significant between the completion group and controls. Participants who did not self-report case completion scored similarly to the control group at all three time points, though their scores were insignificantly lower on the post-test and six-month post-BEC test. Though the primary analysis in Section 4.3.2 showed similar differences in the pre-test between the pre-course cases versus control groups, this post-hoc analysis revealed differences between the completion and no completion groups. Cadre and time had an almost significant interaction ( $p = 0.1$ ), though cadre and time were individually significant in the post-hoc analysis ( $p < 0.001$ ). This contrasted with the results of the primary ANOVA analysis in Section 4.2.2 wherein cadre and time had a significant interaction. Interactions between cadre, group and time and between cadre and group were insignificant.

**Figure 5: Group-Time Effect in Post-Hoc ANOVA of Self-Reported Case\***



\*group3control = control group, group3case\_no = participants who did not self-report case completion in pre-course cases (“no completion”) group, group3case\_yes = participants who reported case completion in pre-course cases (“completion”) group

#### 4.4 Liability Analysis of Likert Scale

A liability analysis measured Cronbach’s alpha coefficient to test intercorrelation between groupings of items measuring comfort, knowledge, confidence and preparedness. Given the low number of two to three questions per category, a Cronbach’s alpha coefficient of >0.60 was considered as definitive of intercorrelation as the coefficient increases with increasing number of items. One item (“colleagues”) measuring confidence in colleagues was grouped alone and therefore no coefficient was calculated for this category. Table 9 shows the Cronbach alpha coefficient for each Likert-item category. Three items measuring “comfort” in patient care and ability to follow protocol yielded a coefficient of 0.42, demonstrating low intercorrelation. Though the two items measuring comfort in patient care were correlated, the third item measuring comfort in protocol was not, illustrating that “comfort” best approximated comfort in patient care rather than comfort in following protocol.

The items for “confidence” had a Cronbach alpha coefficient of 0.48, which while <0.60 demonstrated inter-correlation as the item-total correlation was equivalent at 0.32 for the two confidence questions. “Prepared” and “knowledge” were intercorrelated with alpha coefficients of 0.74 and 0.62, respectively. Given these findings, the items measuring “knowledge”, “confidence” and “prepared” were inter-correlated and valid summative measures of respondents’ self-perceived knowledge, confidence and preparedness.

**Table 9: Likert Liability Analysis Results by Category**

Category	Cronbach alpha coefficient	Average inter-item correlation
Comfort	0.42	0.2
Confidence in colleagues	N/A	N/A
Knowledge	0.62	0.4
Preparedness	0.74	0.5
Confidence	0.48	0.3

## 4.5 Likert Scale Response Analysis

### 4.5.1 Descriptive Analysis of Likert Responses

Descriptive analysis showed significant increases in Likert scale scores measuring provider confidence in emergency care provision in the composite group post-BEC with significant retention after six months. The composite group self-reported a mean +16% increase in score from pre to post-BEC and +12% change in score from pre-BEC to six months. The cases cohort reported slightly higher average total scores at all three points in time than the control cohort, though this was not significantly different. Clinical officers self-reported the highest average score pre-BEC, including 10% and 14% higher than doctors' and nurses' average scores, respectively. Nurses and clinical officers' Likert scale scores declined from post-BEC to six months post-BEC whereas doctors' self-confidence slightly increased from post-BEC to six months post-BEC.

**Table 10: Mean Difference in Likert Scores Over Time**

Likert $\Delta$ in Score	$\Delta$ Pre to Post	$\Delta$ Pre to 6 months	$\Delta$ post to 6 months
<b>Average <math>\Delta</math> in total score</b>	7, 6.8 <b>(6.5)</b>	5.1, 4.3 <b>(4.8)</b>	-1.2, -1.4 <b>(-1.2)</b>
<b>Median <math>\Delta</math> in total score</b>	6.0, 7.0 <b>(7.0)</b>	4.0, 4.0 <b>(4.0)</b>	-1.0, -1.0 <b>(-1.0)</b>

\*Values reported as: control group, pre-course cases group (**composite**)

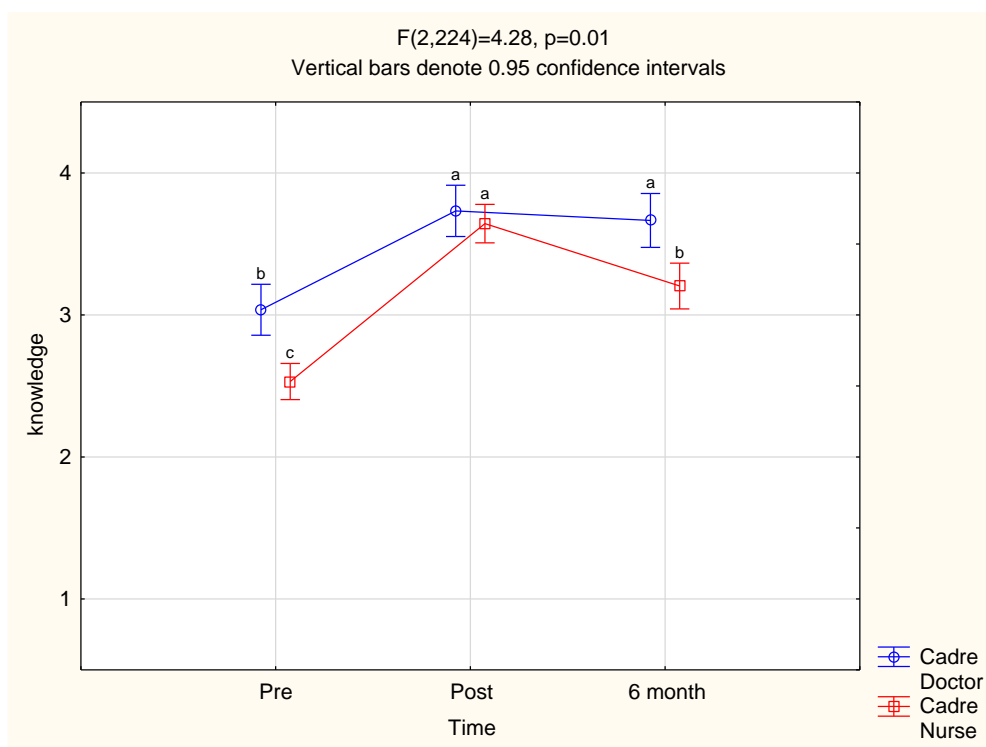
### 4.5.2 ANOVA of Likert Responses

ANOVA was used to analyse each Likert-item grouping's score with time, group and cadre, again excluding clinical officers from the analysis. "Confidence in colleagues" was included in the analysis despite its exclusion from the liability analysis, though ANOVA yielded no significant interactions over time as participants' scoring remained relatively stable at all time points. Given that providers were culled from different departments and that most of their colleagues did not receive BEC training, this finding was not surprising. Analysis of "knowledge" and "prepared" items revealed a significant interaction between cadre and time (Figures 6, 7). Though nurses started

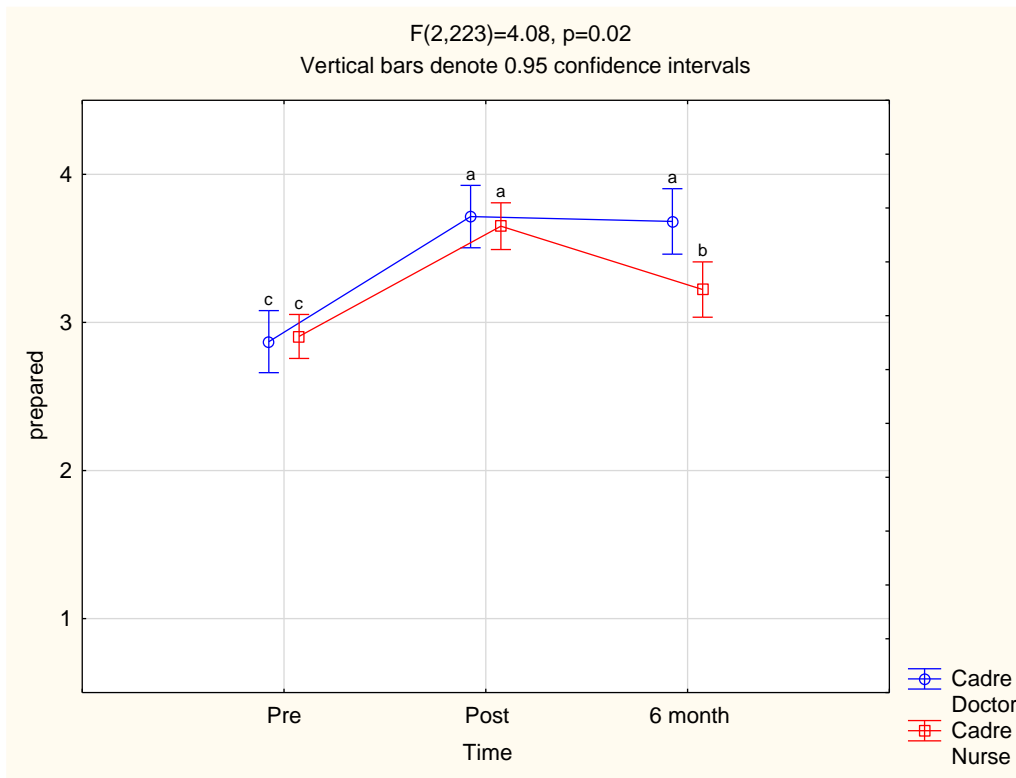
at a lower baseline, they tended to self-rate their knowledge and preparedness at the same level as doctors post-BEC, but significantly reduced these ratings at six months. This finding reflected the same significant interaction between cadre, time and MCQ scores as in the ANOVA in Section 4.2.2, indicating that nurses' self-perception of their knowledge correlated to their actual measured knowledge. In comparison, doctors tended to maintain elevated self-ratings of knowledge with insignificant reductions in score, also reflecting the findings of the ANOVA analysis in Section 4.2.2. Though the liability analysis did not group "prepared" with "knowledge", the ANOVA results for "prepared" resembled that of the "knowledge" grouping, indicating that preparedness may approximate knowledge in the emergency care setting. "Confidence" was correlated with time and cadre individually, though the interaction between cadre and time was insignificant in contrast to "knowledge" and "preparedness".

Post-hoc analysis with groupings based on self-reported case completion showed no group time effects for any Likert-item category, indicating that case completion did not interact with time to impact participants' Likert-item scores as it did on the MCQ scores described in Section 4.2.4.

**Figure 6: Cadre-Time Effect on Likert Grouping "Knowledge"**



**Figure 7: Cadre-Time Effect on Likert Grouping “Prepared”**



## CHAPTER 5: QUALITATIVE FINDINGS

### 5.1 Introduction

Two rounds of FGDs were conducted with 46 providers post-BEC and 38 providers six-months post-BEC at all training sites in Kampala, with the objective of exploring participants' personal experiences with emergency care and perceptions of the BEC course with and without online cases. As some providers participated in both post-BEC and six-months post-BEC FGDs, the total number of participating providers was 74 given overlap between the two rounds of FGDs.

Six FGDs with 46 total participants were conducted immediately post-BEC at each training site (Table 11). Two of the six groups did not receive the pre-course cases prior to the course. Most participants were nurses (73%), followed by doctors (15%) and clinical officers (11%) (Table 11). Thematic content analysis was applied until saturation was reached.

Seven FGDs with 38 total participants were conducted six-months post-BEC at each of the six BEC training sites with an additional FGD conducted at Naguru Hospital given lower participation. Participants in five out of seven FGDs had received the pre-course cases prior to the BEC. Ten participants in the six-month post-BEC FGDs had also participated in the first round of FGDs. The second round of FGDs aimed to explore changes in participants' perceptions of the applicability, acceptability, and utility of the BEC course in their clinical practice as compared to the first round of FGDs. Thematic content analysis was applied until saturation was reached followed by a comparative analysis of the two rounds of FGDs. The participant demographics in the second round of FGDs were like those of participants in the first FGDs and included 30 (79%) nurses, 5 (13%) doctors and 3 (8%) clinical officers (Table 12).

This chapter summarises and compares the results of thematic content analyses of post-BEC and six-month post-BEC rounds of FGDs, describing changes in perceptions of the course, emergency care provision, and pre-course cases over time.

**Table 11: Participant demographics in FGDs Post-BEC**

Hospital	Number of Nurses	Number of Clinical Officers	Number of Doctors	Total participants
Kawempe	6	0	1	7
Kiruddu	6	0	1	7
Naguru	3	5	0	8
Nsambya	4	0	4	8
Mengo	9	0	0	9
Mulago	6	0	1	7
<b>TOTAL</b>	<b>34 (74%)</b>	<b>5 (11%)</b>	<b>7 (15%)</b>	<b>46</b>

**Table 12: Participant Demographics in FGDs Six-Months Post-BEC**

Hospital	Number of Nurses	Number of Clinical Officers	Number of Doctors	Total participants
Kawempe	6	0	1	7
Kiruddu	3	0	1	4
Naguru	5	3	1	9
Nsambya	3	0	1	4
Mengo	8	0	0	8
Mulago	5	0	1	6
<b>TOTAL</b>	<b>30 (79%)</b>	<b>3 (8%)</b>	<b>5 (13%)</b>	<b>38</b>

## 5.2 Previous Emergency Care Training

Each provider shared his or her background in emergency care prior to the course. 71% of participants in the first round of FGDs reported having no formal emergency care training whereas 100% of participants in the second round of FGDs had formal emergency care training given their BEC certification (Table 13). Of the 30 providers with no pre-BEC emergency training, many reported several years to decades of experience providing care in emergency settings such as A&E, casualty, burns and obstetric units. Most doctors (n=4/7) reported receiving modular emergency care trainings on specific topics such as paediatrics, surgery and obstetrics, though formalised emergency care had not been a part of their medical school training. In comparison, 23% of nurses and clinical officers reported receiving formal emergency care training mostly through short courses on triage, trauma, and basic and ALS and less commonly as modules within their formal training curricula. One provider had previously attended a BEC course during the initial government rollout and another provider had attended a similar emergency course designed for providers in LMICs.

**Table 13: Self-Reported Emergency Training in FGDs Post-BEC**

Hospital	Formal emergency training	No formal emergency training
Kawempe	2	5
Kiruddu	1	6
Naguru	3	5
Nsambya	3	5
Mengo	4	5
Mulago	1	6
<b>TOTAL</b>	<b>14 (33%)</b>	<b>30 (71%)</b>

## 5.3 Perceived Educational Value of the BEC

### 5.3.1 Most Valuable Learning Points

Participants were asked about the most salient learning points from the BEC in both FGD rounds.

Participants' most common responses in order were:

- ABCDE approach
- Difficulty in breathing/routes of oxygen administration (masks, nonrebreathers)
- Airway management
- Choking manoeuvres
- Altered mental status
- Shock
- Logroll
- Primary/secondary surveys
- SAMPLE History
- Adrenaline use in anaphylaxis
- Personal safety/Personal protective equipment
- Call for help

These points emerged as valuable concepts in the first round of FGDs and again as applied concepts or skills in the second round of FGDs, indicating that consistency in the concepts perceived as useful post-BEC over the six months between FGDs. Overall, providers tended to value the simplified organisation of general approaches (i.e. ABCDE approach, SAMPLE history, primary/secondary surveys as discussed in Section 5.3) over discrete course topics such as altered mental status, shock and drugs.

### 5.3.2 Correcting Technique

Many providers provided examples of correcting personal skills and techniques in the course of attending the BEC. In ten instances, providers reported realising they were using “wrong” techniques during the skill practicums and demonstrations. The most commonly cited incorrect techniques and skills included bag-valve-mask ventilation (“bagging”), airway suction, oxygen administration and manual airway manoeuvres like head tilt and chin lift. Though providers expected to learn new skills like log roll and Heimlich manoeuvres, they did not anticipate this benefit. One provider explained immediately post-BEC,

*“Before doing this course, maybe before we thought we knew, [but] we were doing some things wrongly. Yeah, but after the course we have improved... What we were doing wrongly, we are going to do them rightly*

*especially when we are resuscitating, putting on the masks, such things.”*  
[Doctor, FGD1]

The practicum on difficulty in breathing, including oxygen administration and bagging, revealed incorrect practices to many providers. One nurse stated, *“I have learned from here that our patients almost all have not been getting oxygen. Even the way we put on the nasal prongs, in a wrong way and even non-re-breather masks.”* [Nurse, FGD5] Another nurse described learning that the standard practice of applying plaster to exhalation ports on simple face masks was incorrect. Such realisations were not limited to nurses – doctors also described moments of realising improper suctioning, bagging, jaw thrust and general emergency airway management technique.

### 5.3.3 Adrenaline Misconceptions

Adrenaline use in anaphylaxis emerged as a major, unexpected teaching point. Regardless of cadre and setting, many providers did not consider adrenaline the first line treatment for anaphylaxis despite its availability before attending the BEC. Various providers described instances of how their emergency department had transitioned to treating anaphylaxis with adrenaline instead of hydrocortisone, *“the old practice”*. [Doctor, FGD12]

## 5.4 The ABCDE Approach

### 5.4.1 The ABCDE Mindset

Providers cited the course’s organised, systematic approach to emergency care as the most useful and applicable learning point in both rounds of FGDs. Across cadres, participants perceived the theoretical and practical value of the ABCDE approach (a sequential approach to patient assessment with “A” for airway, “B” for breathing, “C” for circulation, “D” for disability and “E” for exposure) at both time points. The realisation of the ABCDE approach in the first FGDs shifted to a focus on the approach’s impact on participants’ confidence and comfort in emergency care provision in the second round of FGDs.

In the first round of FGDs, participants perceived the ABCDE approach as a “mindset change” and contemplated its impact. Many viewed the approach as a vital starting point and counteraction to *“disorganisation”* and the tendency to *“begin with IV fluids”* and *“injections”*. One midwife noted,

*“with this [BEC course] knowledge, I think my mother would be around by this time. But the doctor and the nursing team did not know the ABCDE approach, SAMPLE method, and I lost my mother. So, emergency care, any slight area, if you do not go back to A, you lose somebody.”* [Midwife, FGD6]

After six months, almost every provider who chose to share a scenario described how applying the approach had empowered them to manage multiple emergency patients. Sensitisation to the general emergency approach, one provider insisted, was,

*“the beauty of the course. I think it’s like vaccination, you know? You are primed and when this comes your body is ready to act. So for me I credit the course because of that. Because now when an emergency comes I feel like, I feel I am ready to tackle it.”* [Doctor, FGD9]

A nurse explained, *“it makes work easy and it helps to know that first thing’s first”* [Nurse, FGD12], a notion echoed by other providers with similar phrases. The primary and secondary surveys were frequently mentioned as useful for junior doctors and clinical officers managing casualties alone on night shifts.

#### 5.4.2 Nurses and ABCDE: *“It’s not for the doctors only”*

The approach emboldened nurses to act, including assessing patients and providing care, in the absence of a supervisor. A nurse reflected that before the course,

*“I didn’t have that confidence. I would fear and quake when I see a patient. But this time [since the course] I’m sure what I’m doing is the right thing. It’s not for the doctors only. So right away, I quickly... give them a bed, ask what happened.... And then I start with my ABC.”* [Nurse, FGD10]

This nurse and others described how the approach expanded their perceived purview, eroding the mentality of *“what can I do, sit there and wait for the doctor.”* [Nurse, FGD6] Many nurses voiced the same sentiment of *“It’s not for the doctors only”* [Nurse, FGD10], describing instructing other nurses, leading teams and providing treatment when doctors were unavailable. Beyond organisational, the approach empowered all cadres to act, lead and instruct.

#### 5.4.3 Limitations to the ABCDE Approach

Several providers expressed that the ABCDE approach had no value in their resource-limited clinical settings. As one ATLS-certificatied clinical officer explained immediately after the course,

*“It is a bit of disappointment how many times we have got these trainings...you manage a patient and then you know you would have taken the patient through the ABCDE procedures but your hands are tied and always to me, my patients end up dying.”* [Clinical Officer, FGD2]

Others agreed that general approaches could not overcome material shortages. Another doctor echoed the sentiment that, *“In real practice it doesn’t happen for me—ABCDE”* [Doctor, FGD8] due to overcrowding and the continuous stream of acute patients. In contrast, a provider explained six-months post-BEC,

*“after the course we realised a bit of changes that immediately if we received an emergency patient we followed the protocol, which is ABCDE... it gives confidence. Now I have more confidence.” [Doctor, FGD12]*

While many perceived the BEC’s value to lie in its simple frameworks and approaches, a few participants expressed contrary opinions due to limited resources.

## **5.5 Personal Experiences Managing Emergencies**

### *5.5.1 Spectrum of Emergency Management*

Providers in both rounds of FGDs were asked to share both positive and negative experiences with emergency management, and comment on the presumed diagnosis and the quality of their management (i.e. “what went well or what did not go well in your management?”). Participants had a wide spectrum of experience with emergency management as administrators culled providers from numerous departments including A&E, casualty, obstetrics/gynaecology, orthopaedics, OPD, inpatient wards, intensive care unit, surgical and others. Collectively, participants shared 32 different personal experiences with emergency care management in the first round of FGDs and 27 experiences in the second round.

### *5.5.2 Common Emergency Settings and Diagnoses*

The described emergencies took place in various hospital units, including OPDs, casualty units, A&E units, inpatient wards and surgical theatres. A minority of cases described occurred outside of the hospital, including along the roadside and in rural or home settings.

The most commonly described emergencies included trauma, obstetric conditions and airway obstruction. Providers did not know or could not guess the diagnosis in several cases. Most scenarios described adult patient care though a minority included paediatric and neonatal care. The most common emergencies in order were:

- Trauma (including traumatic internal and external bleeding and fractures)
- Obstetric conditions (ectopic pregnancy, post-partum haemorrhage, eclampsia, obstructed labour, etc.)
- Airway obstruction
- Shock
- Seizures
- Heart failure exacerbations

Less commonly described emergencies included difficulty in breathing, subdural haematoma, burns, empyema, liver failure, hypoglycaemia and hyperglycaemia.

### *5.5.3 Self-Perceived Quality of Emergency Care Management*

Most participants shared self-perceived negative experiences managing emergencies pre-BEC and positive experiences managing emergencies post-BEC (Table 14). Providers’ descriptions of managing pre-BEC emergencies highlighted human error,

including lack of knowledge, confidence, and skills, and systems error, including lack of personnel, materials and finances. In contrast, providers reported significant improvements and focused on barriers to using BEC skills and knowledge in the second round of FGDs.

#### 5.5.4 Negative Experiences Managing Emergencies

Providers most commonly shared negative experiences pre-BEC, describing low confidence and poor management in 69% of shared scenarios pre-BEC as compared to 11% of shared scenarios post-BEC.

**Table 14: Self-Reported Perception of Previous Emergency Management in FGDs**

Quality of Emergency Management	Pre-BEC Emergencies (N=32)	Post-BEC Emergencies (N=27)
Management went well (n,%)	10 (31%)	24 (89%)
Management did not go well (n,%)	22 (69%)	3 (11%)

Providers descriptions centred on the absence of supervisors and the burden of task-shifting. This theme emerged in the first FGDs through eight unique experiences described by nurses and junior doctors.

Nurses described scenarios of waiting for the doctor to manage actionable conditions like bleeding, suggesting that they felt too disempowered to address the underlying emergency. One nurse voiced that, *“We [nurses] always do our part but some doctors disappoint us, you call them they are maybe busy on phone or other things, so by the time they appear, the health of the patient will have deteriorated.”* [Nurse, FGD1] Another nurse explained in caring for a bleeding patient, *“the lady died because... the doctor delayed to come...”*[Nurse, FGD3]. Nurses often could not name or guess the most likely diagnosis or condition, stating that the doctors did not know or never discussed the case with them. In one such case, a nurse expressed deep remorse and concern for a patient’s care, asking:

*“But all of us, were there like what went wrong? Didn’t we assess? What did we give that went wrong? Because after diazepam, he said be putting [the] IV [intravenous line], but after it did not go well because even the ICU doctor was like what went wrong? Is it PE [pulmonary embolism]? So we were like... it is like we did not assess the patient because we lost the patient just in an hour? So, that is why I tell people that I fear diazepam. Because doctors were like what went wrong, and I was also like what went wrong?”* [Nurse, FGD4]

Junior doctors also voiced a lack of confidence in acting without a supervisor, but in contrast to nurses felt obligated to provide care. In describing management of a patient with a penetrating abdominal wound, one junior doctor said, *“...the Senior Doctor had gone to sleep, so I was alone with the nurses...what I remember was were not*

*confident...*” [Doctor, FGD1]. Another blamed a senior medical officer for advising her, “*so wrongly*” [Doctor, FGD1] regarding draining a pleural effusion. Senior specialist doctors described situations where they felt unprepared to manage an emergency, though they constituted a minority of participants.

#### 5.5.5 Positive Experiences Managing Emergencies

Providers shared ten positive experiences in the first round of FGDs. In most cases, the provider did not provide a diagnosis, though expressed satisfaction with the patient’s improvement and clinical decision-making based on routinisation of care. Reflecting upon the course, one nurse self-critiqued, “*You find that most of the time [before the course], you begin [managing emergencies] with IV fluids, you do not really follow the ABCDE and even do not know them or how to do them.*” [Nurse, FGD3] Review by a qualified PhD advanced paramedic/nurse and final year medical student revealed mismanagement of most patients in the seven “*management went well*” scenarios based on presumed diagnosis as either expressed by the participant or inferred from the description. Through these explanations, the “*fluids first*” approach of immediately administering normal saline regardless of the scenario emerged, and revealed that some providers did not recognise mismanagement of a patient due to route action.

In the second round of FGDs, more participants shared positive experiences (n=25) than negative (n=3) (Table 14). This finding reflects the quantitative increases in participants self-rated knowledge and preparedness as well as the MCQ’s objective measures of emergency care knowledge described in Chapter 4. All cadres recognised elucidated a similar shift in mindset and organisational approach to managing emergencies. Immediately post-course one nurse stated, “*I feel we have never been prepared like this. I feel like I am now confident and competent to encounter emergencies...*” [Nurse, FGD3] In the second FGDs, nurses tended to act while calling for help whereas clinical officers and doctors took leadership roles instead of waiting for the senior doctor.

Several providers described scenarios of uncertainty, sub-optimal outcomes and inability to apply BEC principles due to overcrowding and resource limitations. Some providers with previous emergency training did not perceive any change in their management.

## 5.6 Outcomes

Providers tended to believe that the course improved patient outcomes and survival, though challenges arose post-BEC that prevented timely management and favourable outcomes. One A&E nurse estimated that due to his team’s BEC training, “*At least 70% of them [patients] who would have died are making it.*” [Nurse, FGD9] In one high-volume trauma A&E, a doctor described that introducing a “*morbidity and mortality audit*” [Doctor, FGD12] using the BEC’s framework to review cases and

evaluate management with significant reduction to zero mortalities at their latest review that she felt *“means people have improved in the way they are handling patients.”* [Doctor, FGD12]

Nurses in high dependency units attributed shorter hospitalisations and faster recoveries to the course, and described applying life-saving interventions. One doctor attributed these changes to uniformity in approach, stating,

*“...after the training now people have a common understanding. The very first thing they check: is the airway patent? ...And they are confident. However much they call them “emergency, emergency” they are going. Because they go with confidence.”* [Doctor, FGD12]

Despite perceived improvements, challenges to providing care, including colleagues without training and material shortages, limited the results providers expected from the course.

## **5.7 Challenges: Materials and Colleagues**

### *5.7.1 Material Challenges: “Our hands are tied”*

Participants often mentioned resource limitations’ role in determining patient outcomes, though they perceived greater control from the first to second round of FGDs. The theme of tied hands, signifying providers’ inability to provide emergency care due to uncontrollable elements, emerged in three different FGDs. Material constraints prompted more discussion for providers working in public hospitals. One clinical officer described that,

*“It [A&E] is just chaos, you are lost, you are alone, understaffed, you find you have a ward full of twenty patients... Even if you know what to do, you are scared, if I try this and something goes wrong, [I] am going to be accountable.”* [Clinical Officer, FGD2]

Many providers voiced *“pain”* [Nurse, FGD2], *“disappointment”* [Nurse, FGD2] and *“torment”* [Nurse, FGD2] regarding scenarios when they knew the appropriate management for a patient’s condition but could not intervene due to material constraints. Another provider stated,

*“By the time I was thinking still of what to do, this baby died and from that time, it was tormenting me because you do not have what to use, and sometimes you know what do to prolong the life, but your hands are tied and it hurts every time you are working. Ah, and you are just there. There is nothing to use and you say this is Uganda, and just keep quiet and the person dies in your hands, and you find the mother saying*

*Musawo [medical personnel] you have neglected me, and yet you do not have what to use and you take the blame you cry out and it hurts.”*  
[Nurse, FGD2]

Healthcare finances resurfaced as the ultimate constraint to patient care even when a provider knew the appropriate management for a patient’s condition. Especially in public hospitals, the patient or the patient’s attendant’s (i.e. relative or friend’s) ability to pay for care determined access to vital interventions. Others reported a general lack of materials in their units that they believed the government should supply.

### 5.7.2 Improvisation

The theme of improvisation to address material shortages emerged in the second round of FGDs . Various providers felt that knowledge learned in the BEC enabled them to improvise for materials they lacked and gave examples of improvising to control bleeding, stabilise cervical spines or manage adult and paediatric airways. A nurse described her shift in mindset,

*“Some people think that when you don’t have resources you don’t need to improvise. So, but then the resources are there, you have them ready, usually...we try [to get them]. So, you have them ready, you have the resources, you can’t forget. We learned last time.”* [Nurse, FGD8]

Even with increased improvisation, providers focused on material shortages as a major limitation to practicing and maintaining new skills and knowledge. Frustrated with limited oxygen administration on her unit, one nurse explained,

*“We don’t have face masks, we don’t have nonrebreathers... We are just there. We know what to do but we don’t know what to use. So you are there you look at somebody [thinking] I wish I would do this but [claps] my hands are tied.”* [Nurse, FGD11]

Others reflected that improvisation and knowledge could not conquer the overburdening and understaffing of Kampala’s emergency care system.

### 5.7.3 Colleagues and Managing Emergencies Alone

The definition of managing emergencies alone shifted between FGDs from being the only provider to the only BEC-trained provider, regardless of untrained colleagues’ presence. In the first FGDs, providers reported feeling overwhelmed by overcrowded, understaffed settings as the sole provider. Participants expanded this theme of “*loneliness*” in the second round of FGDs to include working with untrained colleagues perceived as impediments to timely, team-based care. On shift, various providers

charged that they spent too much time instructing colleagues, arguing with “*resistant*” [Nurse, FGD7] colleagues, and calling for colleagues who “*disappear to go do other things*” [Nurse, FGD9] in emergencies. Providers worried about patient outcomes while off-duty when untrained colleagues managed new patients, and griped that untrained colleagues did not “*know the importance of managing an emergency as a team*” [Nurse, FGD9]. Though providers expressed more criticisms of their colleagues in the second FGDs, the quantitative data showed a more positive opinion as participants’ confidence in their colleagues remained stably moderate in the Likert ratings over the three time points (see Chapter 4).

Providers had mixed emotions about teaching and instructing untrained colleagues depending on their teams’ receptivity and dynamics, though many had positive experiences. One such nurse felt empowered to manage emergencies “*plus or minus a doctor...alone as a skilled health worker*” knowing that “*now you can even call anybody who doesn’t know anything provided you know how to instruct. When you do like this, something can happen.*” [Nurse, FGD6] In contrast, providers across cadres mentioned how incomplete assessments of acute patients in intra-hospital transfers worsened care and diminished their confidence in colleagues. Some participants working without trained teams reported exhaustion and omission of the approaches and skills learned in the course though a few providers felt comfortable teaching and leading their teams. Participants perceived that discrepancies in training of facility-based providers compromised patients’ care and diminished the utility of the BEC training.

## 5.8 Pre-Course Cases

### 5.8.1 Pre-Course Case Completion

30 of the 46 focus group participants in the first FGDs were required to complete at least half of the 32 pre-course cases before beginning the BEC. Of the 30 participants required to complete pre-course cases, 70% self-reported or filled out an online Google form reporting completing at least one case and 43% self-reported completing at least 16 cases (Table 15). Case completion ranged from 50-88% between the various hospital sites, illustrating differences between the potential acceptability and accessibility of the cases to providers from different hospitals.

**Table 15: Self-Reported Case Completion in Post-BEC FGDs**

	<b>Participants who completed cases (n, %)</b>	<b>Participants who completed requirement (n)</b>
<b>Nsambya</b>	7 (88%)	5
<b>Naguru</b>	4 (50%)	1
<b>Mulago</b>	5 (71%)	3
<b>Kiruddu</b>	5 (71%)	4

<b>TOTAL</b>	21 (70%)	13 (43%)
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For the 70% of participants in pre-course cases group who self-reported case completion, the cases piqued interest, set expectations, and provided a preview of the BEC's content and scope. One participant explained, *"Personally, as I went through the courses, I really got interested in coming for the training."* [Nurse, FGD1] Participants found cases' real-time explanations of wrong and right answers helpful, and expressed general satisfaction with the cases' applicability, quality and convenience. Participants reported liking how the cases gave explanations for wrong and right answers, though one participant found this *"confusing"*. [Nurse, FGD3] Participants described the cases using positive words like *"convenient"* [Nurse, FGD1], *"very useful"* (x4) [Nurses, Doctor FGD1, FGD2, FGD4] and *"really good"* [Nurse, FGD1] with no complaints about the quality of the cases themselves.

Explicit barriers to case completion included time constraints (n=6), technological difficulties (n=3), lack of smart phone or computer (n=1), and poor and/or no network connectivity (n=2). Discussion revealed implicit barriers to case completion including money for cellular data and lack of motivation and time for independent, unprogrammed study. Nurses reported more technological difficulties and overall had less access to smart phones, computers and Internet than doctors – several even printed and shared hard copies of cases for the pre-course assignment. Given one week to complete the cases, many participants mentioned wanting more time for completion (n=6) and did not like the individual case completion Google form (n=3).

Participants in the first FGDs anticipated future uses of the pre-course cases as teaching tools (n=2), personal reference tools (n=2) and study materials for returning to school (n=2) though some stated they probably would not return to the materials after the course.

### 5.8.2 Motivated Adult Learning

Motivated adult learning emerged as a challenge to pre-course work and post-course review in both FGDs. As one nurse summarised,

*"Because there are people who left school long ago and they are not abreast with the current things, so there is that challenge and because of other things to be done, time is short. Another thing is that with adult learning, what motivates them? It is until you turn to class [for motivation] but right now as we still have them [the cases], we shall use them as training materials."* [Clinical Officer, FGD2]

Though participants accurately anticipated uses of the cases, their actual reported use in the second round of FGDs was minimal. One provider explained that, *"...if you've just finished the course you feel you know everything and you're like eh why should I go back [to the pre-course cases]?"* [Nurse, FGD9] Others expressed general disinterest in repeating the same case, using data and devoting unpaid time to

studying. Other explanations included lack of time and integration as accepted CME credit. Participants' perceptions of the cases' utility as pre-course work, but not as review materials, aligned with the ANOVA results in Chapter 4, demonstrating that their only significant impact on MCQ scores was on the pre-test marginal benefit thereafter.

The several providers who reported using the cases tended to be younger with recent completion of their qualifying studies. Discussion often transitioned from the cases to independent adult learning, revealing a generational divide between those with the motivation and technological literacy for studying with OERs versus those without either. The topic caused tension between younger providers who encouraged their peers to *"keep on learning, not just wait for the training"* [Nurse, FGD8] and older providers who could not *"see the time...to go back to those resources"*. [Nurse, FGD8] Providers within both camps emphasised the importance of training students and providers in their early careers. Even though providers realised had forgotten material, most felt unmotivated to return to the pre-course cases and other course resources.

## **5.9 Mixed Cadres**

### *5.9.1 Classroom and FGD Group Dynamics*

The mixed cadre nature of the BEC impacted classroom dynamic and the resultant FGD dynamic depending on the group's composition. The presence of a single doctor in the focus group could silence other cadres' voices so that a physician-centric point of view dominated the conversation with senior doctors impacting group dynamics more so than junior doctors. The absence of doctors centred the discussion on nurses' roles and views, providing a space for more open conversation.

The FGD dynamic mimicked that of the BEC classroom, according to nurses and midwives who felt more challenged by the content but less confident to ask questions. Nurses and midwives expressed difficulty keeping up with content due to limited knowledge of physiology and pharmacology, explaining that certain topics in decision-making fell outside of their purview. One midwife expressed that her least favourite part of the course was, *"The theory part of it, sometimes you could not understand and you are left behind, and at times I would feel like ah this thing is boring, until when we reached the practical bit, there you would pick [learn] something."* [Midwife, FGD1] These divisions manifested in the significant interaction between time and cadre ANOVA results in Chapter 4 whereby nurses gained more knowledge but also experienced a more precipitous decline in knowledge than doctors in their MCQ scores. ANOVA results assessing the Likert groupings of "knowledge" and "prepared" also reflected this pattern, illustrating that while nurses may have more to initially gain from the BEC course, they experience a phenomenon of diminishing returns on knowledge and preparedness at a greater rate than in doctors.

### *5.9.2 Dividing the BEC Classroom*

Two schools of thought emerged as some providers suggested splitting cadres up while others emphasised the importance of training as a team. In one post-BEC FGD, a surgeon met resistance from her colleagues when she suggested splitting cadres up to learn theory and re-grouping them for two days of drills. Her non-physician colleague replied,

*“it’s good to be mixed, because sometimes when emergencies come, you will be mixed and also having a group of different people, nurses, doctors, help to bridge the gap, therefore it’s better to mix. In addition to that, when the facilitators are teaching, they have to breakdown things for everyone to understand.”* [Nurse, FGD1]

Most FGD participants sided with the latter opinion, placing the burden on the facilitators to cater to a mixed classroom. Yet in the second FGDs, providers tended to side with the surgeon’s opinion that certain topics divided cadres and required different paces and depths of learning.

In the second FGDs, more providers reported feeling *“lost”* and *“behind”* in follow-up FGDs while others expressed frustration of the reinforcement of the division. One nurse ruminated, *“And in our setting I don’t know why people [nurses] still have the fear. For the doctors, they are confident. But for the nurses, they even still have the fear in that when you call for help.”* [Nurse, FGD9]

Despite conflicting opinions on the mixed nature of the course, providers emphasised the importance of training non-physician providers across the country. Doctors and nurses agreed that *“it is even more important for them [lower cadres] to be having the knowledge”* [Doctor, FGD8] and that *“all cadres should be equipped with skills irrespective of who you are.”* [Doctor, FGD1] Providers of all cadres contextualised that the scarcity of consultants and doctors, most without emergency training, obligated clinical officers and nurses to assume the responsibilities of stabilisation and assessment regardless of their training.

## **5.10 Feedback and Future Recommendations**

### *5.10.1 Course Content and Programming*

Providers provided concrete feedback on course programming and content. The most common recommendations in order were:

- More time
- More simulations
- More obstetrics/gynaecology content

- Addition of basic cardiopulmonary resuscitation (CPR) education and demonstration
- More paediatric content
- More trauma content
- Payment for transport and/or per diem

Most providers felt that the course packed too much content into too little time. Participants voiced concern that they retained less information due to the pace and breadth of the course. Time constraints limited questions and mastery of new skills for some. One such nurse reflected, *“I wish next time if it happens they could get more time for the practical side....Even though you had maybe questions to ask you wouldn’t ask because you knew this is the time for us to be done.”* [Nurse, FGD11]

Providers suggested increasing paediatric and obstetrics/gynaecology content and including CPR protocol, a deliberate omission by the BEC architects. Though most found theory and content valuable, many requested more demonstrations in addition to simulations, either in the classroom or on the wards with assigned roles. Most providers expressed satisfaction with the course’s basic content *“as a start...when people don’t even know that you can do a chin lift”* but hoped that *“It should escalate and it should go into deeper level things”* [Doctor, FGD9] with the continued development of emergency care in Uganda. In addition to ALS courses, some participants suggested that course facilitators and instructors create a formal follow-up mechanism to reassess providers’ performance on an annual basis.

### 5.10.2 Retraining

Feedback on the course returned to the topic of adult learning and retraining in both rounds of FGDs. Most participants agreed that the course was applicable to their clinical setting and should continue in the future, requesting training of their colleagues and re-training for themselves to ensure uniformity and best practices. Almost every follow-up FGD mentioned dividing the course into CME accredited internal trainings to reach more providers and provide refreshers for trained providers.

In comparison to doctors, nurses reported wanting more time in the course and more frequent retraining. A senior nurse explained, *“As you know we are adults and we forget so we need to be getting more of the CMEs.”* [Nurse, FGD8] Nurses’ self-awareness of a greater need for retraining is in line with the significant difference in knowledge decay between nurses and doctors in their MCQs and Likert scores at the six-month post-BEC point. Those in settings like ICUs and A&Es felt they could better maintain and practice their skills, though high turnover at public facilities often leads to new assignments in non-emergency settings.

### 5.10.3 Training Expansion

All cadres agreed on the necessity of whole-hospital and even nationwide training, suggesting the BEC's incorporation into healthcare students' and interns' education. One doctor recommended, *"if it is available across the country that everyone will be trained well with the BEC."* [Doctor, FGD8] Providers also felt that the course should expand to lower tier clinical settings like Health Centre IV, Referral hospitals and remote districts with *"deep centres"* to *"improve ourselves countrywide."* [Doctor, FGD5] Within their own hospitals, participants focused on future whole-hospital trainings and training of the trainers (ToT) courses with some providers inquiring about opportunities to become BEC trainers. Most expressed the necessity of expanding the training to reap the full benefits of the course within their clinical setting. A nurse explained,

*"And even according to the clinical settings some people will be trained and others will not be trained. So it will be very hard for them to plug this with people who did what who did not attend. We need to train unit per unit to ensure uniformity of what you get."* [Nurse, FGD7]

### **5.11 Emergency Care Capacity in Uganda**

Many framed the course's value in the broader context of Ugandan emergency care capacity in both rounds of FGDs. They emphasised the importance of training more providers, establishing dedicated emergency units and response teams in all hospitals, and ensuring adequate emergency equipment on every ward. BEC participants called upon the government, policy makers and stakeholders to increase investment in healthcare resources for emergency care. Some providers rallied their colleagues, urging that, *"We should push harder for what we are doing for the country. Policy makers, stakeholders take this serious, who is going to let others know. Advocacy should be on higher level."* [Doctor, FGD1] Various providers voiced the need for the Ministry to create *"branches, fully fledged emergency branches"* [Nurse, FGD3] for every hospital, a design that has not been adopted to date. Considered together, these exchanges revealed an implicit understanding that the BEC, while a valuable intervention, could not alleviate the burden of providing care in Uganda's inadequate emergency care system without concurrent investment in human and material resources.

## CHAPTER 6: DISCUSSION

### 6.1 Introduction

Prioritisation of integrated emergency care systems could have a profound impact on clinical outcomes in LMICs.<sup>5, 117</sup> Integral to strengthening health care systems and achieving Sustainable Development Goal 3 to ensure healthy lives and promote well-being for all at all ages is a trained, motivated workforce.<sup>118</sup> In recognition of emergency care as a key part of universal health coverage, the World Health Assembly passed Resolution 72.16 in May 2019, urging the provision of dedicated emergency care training for all relevant types of health providers.<sup>119</sup> Future educational interventions targeting health workers in LMICs require evidence to support their deployment within the limited spending of national health strategies.

Though several studies have demonstrated the success of adapted short-courses in emergency-related fields in SSA, none have assessed open-access courses and few have evaluated medium term knowledge retention among health care professionals.<sup>17, 27, 120</sup> This study is the first evaluation of an open-access, basic emergency care course for frontline providers in low-resource settings, and additionally assesses OER usage. It describes the BEC's impact by assessing the first three levels of Kirkpatrick's framework for training evaluation, including trainees' reactions, learning and behaviour.<sup>95</sup>

The study's mixed methods design enabled holistic commentary on the BEC's utility given the qualitative findings on providers' perceptions of the course and the quantitative findings on long-term knowledge retention and self-efficacy. The FGDs assessed Kirkpatrick's levels one and three, i.e. trainees' reactions and self-reported behavioural changes resulting from BEC course completion. The MCQs and Likert scales assessed level two, or learning, in terms of knowledge and attitudinal changes due to BEC participation. Though unable to assess Kirkpatrick's level four through patient outcomes, this analysis and currently unpublished data suggest that the BEC may impact patient outcomes and highlights the need for ongoing investigation of patient outcomes following the BEC's implementation in Uganda.<sup>121</sup>

Given the scarcity of fully operationalised emergency units in the Ugandan setting, BEC participants in this study represented a diversity of health workers and clinical settings, though all providers reported managing emergencies in their units. The participants' opinions, ideas and commentaries described in Chapter 4 represent a range of emergency care experiences, providing a broad description of the state of emergency care in Kampala and attitudes towards the BEC course.

The results reveal the value of the first open-access, basic emergency care short-course for a low-resource setting, and provide new commentary on blended learning in health professional education in LMICs. Providers demonstrated long-term knowledge retention and increased self-efficacy in emergency care provision. They identified the course's strengths and weaknesses, including modifiable and structural

challenges to the BEC and general emergency care education in Uganda. The quantitative and qualitative findings together offer new perspectives on blended learning and create an opening for future investigation.

## **6.2 The State of Emergency Care in Kampala**

Focus group participants painted a challenging picture of emergency care in Kampala, describing educational, human and material constraints to caring for acutely ill and injured patients. They described austere clinical settings with high patient volumes, low salaries, stunted career development and limited postgraduate emergency training programs. Recent studies of LMIC health workers have shown that such frustrations result in migration, dual practice, informal task shifting and absenteeism.<sup>122, 123</sup>

The most commonly described scenarios were trauma, obstetric emergencies, airway obstruction, shock and seizures. In the first round of FGDs, providers' descriptions of managing basic, common emergencies focused on low self-confidence and competency in the context of absent supervision and material and resource shortages. Scenarios described in the second FGDs centred on improved emergency care provision and improvisation with an increased focus on untrained colleagues over material constraints. Regardless of cadre, providers' descriptions of managing emergencies identified various levels of error, including human and structural.

### *6.2.1 Educational Gaps*

70% of participants in the first FGDs had never received any formal emergency training in their primary training or career as health professionals though many had worked in emergency settings. The rest reported learning through short courses and modules in their respective curricula and CME programming, though none had specialised in emergency care or completed a long-term course. This finding aligns with the reported dearth of emergency care education in SSA where formal, long-term emergency care training programs exist in only ten countries and include only two non-physician clinician training programs.<sup>124</sup> The pre-BEC MCQ scores aligned with the low level of emergency care education described in the FGDs, and the average participant failed the pre-test. Though the ongoing development of postgraduate emergency programs in Uganda will increase training opportunities for non-physician providers, the current emergency programs in Kampala, limited to two emergency medicine residencies for physicians, cannot address the overwhelming shortage of formal emergency care training.

Providers' self-reported and objective competencies in managing common emergencies revealed educational gaps that transformed with BEC exposure. From the first to second FGDs, the number of negative scenarios declined from 79% to 11% of all shared scenarios and MCQ scores transitioned from failing pre-BEC to passing at both post-BEC time points with relative knowledge retention. Providers' confidence and overall self-efficacy increased over time as shown by the "confidence" Likert categorisation and overall increase in Likert scale scores, an indication of Kirkpatrick's level two. Nurses experienced greater initial gains from pre-BEC to post-BEC and then

subsequent greater losses from post-BEC to six-months post-BEC than doctors. Given providers' low level of formal emergency training pre-BEC, the pre-BEC MCQs and thematic analysis revealed deep gaps in emergency care training that influenced providers' self-perceived performance and objective knowledge of emergency management. These results highlight the BEC's ability to overcome significant educational gaps in emergency care in LMICs to impact providers' learning and perceived behavioural changes, or Kirkpatrick's second and third levels of training evaluation.

### *6.2.2 Human Error*

From a human error perspective, most participants admitted lacking the training, confidence and clinical decision-making skills to care for emergency patients. Junior doctors, nurses and clinical officers felt constrained in their abilities to act without a supervisor, yet the absence of authority figures mandated their reluctant assumption of patient care from simple to complex cases. Thematic content analysis revealed underlying currents of fear, uncertainty and distrust in one's skills and training, again reflecting the severe educational gap in emergency care training in Uganda. Such lack of confidence delayed assessment, decision-making and intervention, resulting in untimely care and thereby poor patient outcomes in the described scenarios. Untimely care plagues many LMIC emergency settings where patients often suffer delays in assessment and treatment due to overcrowding and understaffing,<sup>4</sup> though improved communication could minimise delays and adverse events.<sup>125, 126</sup> Providers reported significant emotional trauma from observing untimely and inadequate care for acutely ill and injured patients in their units. Though providers expressed low self-efficacy in the focus groups, their Likert responses reflected a more positive interpretation of their self-perceived competency based on the average single-item score. This indicates that the qualitative portion may have identified subtleties missed in the quantitative Likert assessment as suggested by the low Cronbach alpha coefficient or lack of correlation between items intended to measure "confidence".

### *6.2.3 Systems Barriers to Emergency Care*

From a systems perspective, providers focused on poor organisation, material and human resource constraints and overwhelming patient volumes as major barriers to care. Poor organisational structure, including absent management and supervision, frustrated providers who felt ill-equipped to manage emergencies, a finding reflected in other studies of health workers in LMICs.<sup>123</sup> In both rounds of FGDs, providers focused on absolute scarcity of essential materials and medications for their patients, including gloves, oxygen and blood as reported by other studies.<sup>127, 128</sup> The theme of hand-tying, signifying the entrapment of providers by material shortages, re-emerged as providers recounted cases of knowing the correct course of action thwarted by absent manpower or resources that stripped them of their capacity to provide care. The subsequent disappointment, shame and emotional trauma of witnessing preventable death and disability impacted many providers who felt constrained by their clinical settings.

Providers from public settings tended to focus on material constraints and the patient's ability to pay more than providers from the two PNFP hospitals. PNFP providers tended to have more material resources and serve a wealthier patient population willing to pay out-of-pocket fees for private care. Given that the government spends \$12 per capita on healthcare,<sup>32</sup> the underlying lack of healthcare financing undercuts public providers' abilities to provide meaningful, timely interventions for impoverished patients as illustrated in the scenarios described in Chapter 5, including instances of delayed intervention for a mother with obstructed labour, and an infant with status epilepticus that resulted in death. Ugandan PNFP workers have reported better infrastructure and materials with subsequent improved interpersonal relationships, communication and organisation in comparison to their public counterparts.<sup>122</sup> Regardless of setting, the significance of the patient's ability to pay highlights health inequities in Uganda, with poor patients suffering the recognised health consequences of poorly stocked and staffed public hospitals.<sup>33, 129</sup>

### **6.3 The Value of the BEC**

Providers identified the "*beauty of the course*" in the ABCDE approach, highlighting how simple, organisational approaches impacted their self-perceived and measured abilities to provide emergency care. Uniformity in approach made work easier, more enjoyable and more efficient with a perceived improvement in patient outcomes, especially when working with a team of BEC-trained providers. The study's quantitative findings confirmed a significant increase in objective and self-perceived knowledge and self-efficacy with retention over time. The qualitative findings expounded upon these increases, describing their perceived impact on providers' practice in their clinical settings where teams of trained providers reaped more benefits than individual providers with untrained teams. To repurpose one participant's analogy, the BEC "*primes*" frontline providers to recognise and tackle emergencies in the same way that a vaccine primes the human body to recognise and tackle foreign invaders. These findings illustrate Kirkpatrick levels one and three as participants had overwhelmingly positive reactions to the course and its ABCDE approach and identified behavioural changes secondary to the course.

#### *6.3.1 Most Valuable Learning Points*

The most valuable learning points of the course in descending order included the ABCDE approach, the skills practicums (including in breathing and airway management), altered mental status, shock, logroll, primary/secondary surveys, SAMPLE history, adrenaline use, safety protocol and calling for help. Across time points, providers in both rounds of FGDs emphasised the ABCDE approach, a streamlined framework for how to approach any emergency. The approach emboldened health workers across cadres to assess and manage patients with confidence. This shift in mindset may have impacted nurses most as evident in their initial dramatic gains in quantifiable knowledge on the MCQ and "knowledge" and "preparedness" Likert categories when compared to doctors.

### 6.3.2 Simple Frameworks

Providers reported that simple organisational tools like the ABCDE approach and SAMPLE history increased their confidence and responsiveness in assessing acutely ill and injured patients. All cadres emphasised the approach's utility in establishing baseline comfort in their patient management and as a safe point of reference and return throughout their evaluations. Nurses gave powerful examples of managing patients whose care they would have deferred to doctors pre-BEC, including management of hypotension, cardiac arrest, seizures and altered mental status. The approach's effectiveness in patient care increased when uniformly accepted and understood among the care team; however, providers reported less efficacy when applying the approach alone. Specifically, providers managing trauma reported that they often abandoned the ABCDE approach due to limited team member presence and the need to focus on immediately apparent injuries. Such an approach is problematic in the evaluation of the acutely injured patient as distracting injuries may compromise patient outcomes. Providers referenced the primary and secondary survey as useful frameworks, though their commentary suggested that they needed more education on these more complex algorithms, and often did not have time to conduct a secondary survey. Given that road traffic injury is the primary killer among people ages 5-29,<sup>3</sup> increasing acceptance and knowledge of the trauma patient evaluation through simple frameworks like the ABCDE approach and primary survey is crucial to strengthening Uganda's emergency care system. These findings suggest that the ABCDE approach is high yield with optimal effects when applied by a team rather than a singular provider.

### 6.3.3 Correction of Vital Techniques and Skills

The course's introduction and correction of vital techniques and skills proved invaluable to some providers who admitted previous improper use or understanding of basic techniques. The most common misunderstandings included selection of oxygen administration routes, manual non-invasive ventilation technique, manual airway manoeuvres and the "*fluids first*" approach. Participants described many clinical scenarios that required oxygenation and ventilation, but only after learning about the different routes of oxygen administration realised that their therapies often did not meet patients' requirements. They expressed surprise upon learning the correct method for bag-valve-mask ventilation, including how to obtain a proper seal and manoeuvre patients' airways (i.e. head tilt, chin lift and jaw thrust) to maximise ventilation. The "*fluids first*" theme emerged in participants' descriptions of emergency management in the first FGDs though less so in the second FGDs, illustrating a pre-BEC reliance on large volume boluses regardless of a patient's condition. This knee-jerk approach revealed detrimental routinisation of emergency care when considering volume-overloaded patients and paediatric shock patients as demonstrated by the FEAST trial.<sup>130</sup>

BEC participants' increased knowledge around oxygen administration and fluid management could significantly impact patient outcomes based on current evidence.

A systematic review of oxygen therapy projects in LMICs reported low oxygen therapy knowledge and skills among health workers with subsequent improvement after training and retraining, though turnover and shortages presented challenges to maintaining skills and improving outcomes.<sup>131</sup> SSA's high burden of severe acute respiratory illness leads to high morbidity and mortality among paediatric and elderly populations, worsened by a general lack of oxygen with only 43.8% of African hospitals reporting access to a cylinder or concentrator.<sup>128, 132, 133</sup> In this context, educating health professionals in emergency respiratory management could improve mortality from manageable conditions like pneumonia, asthma, chronic obstructive pulmonary disease (COPD) and tuberculosis. The WHO Emergency Triage Assessment and Treatment (ETAT) course is one such example that prioritises oxygen therapy for paediatric shock patients.<sup>134</sup> Still, many hospitals lack oxygen delivery equipment and monitoring devices despite the cost-effectiveness of such interventions. A study in Papua New Guinea determined that the introduction of oxygen concentrators and pulse oximeters decreased paediatric pneumonia mortality risk by 35% with a cost of US \$50 per DALY averted.<sup>135</sup> Educational interventions like the BEC and ETAT with cost-effective infrastructural investment in oxygen delivery and monitoring devices could significantly reduce morbidity and mortality from sentinel conditions like childhood pneumonia.

#### *6.3.4 Anaphylaxis Management*

Providers lacked knowledge on guidelines for anaphylaxis treatment with intramuscular adrenaline, an accepted global practice. Few studies on anaphylaxis treatment in LMICs exist, though a study in Pakistan revealed that providers treated only 22.5% of in-hospital patients with diagnosable anaphylaxis with adrenaline, leading to 3.1% mortality—above global averages of 0.002-0.65%.<sup>136</sup> Similar studies have demonstrated poor provider awareness around anaphylaxis treatment with only 15% of patients with anaphylaxis receive adrenaline in emergency units in Italy, and over two-thirds of Turkish and Ibero-American providers failing to select adrenaline as the first-line treatment for anaphylaxis.<sup>137-139</sup> With the documented rise of allergic disorders in Uganda, especially in urban settings with twice the prevalence of such conditions, providers' knowledge of first-line treatment for anaphylaxis could have profound implications on outcomes.<sup>140</sup> Two participants in the six-month FGDs gave examples of treating anaphylaxis with IM adrenaline due to knowledge gained in the BEC, demonstrating a concrete application and outcome from their participation. Though less frequently mentioned than the ABCDE approach and technical skills learned in the course, increased knowledge of anaphylaxis treatment has the potential to save many lives and is a critical finding of this study.

#### *6.3.5 Improving Patient Outcomes*

Participants believed that patient outcomes improved after participating in the BEC course. Though unsubstantiated, providers' claims that more patients—70% in one participant's estimate—were surviving due to correction of basic techniques learned in the BEC could have significant impacts on patient outcomes. A senior surgeon

emphasised that such priming of her emergency unit's staff had reduced mortality to zero at their last review, citing uniformity of approach and implementation of a morbidity and mortality review based on the BEC as the sources of the reduction. Self-reported confidence in the quality of providers' emergency management shifted from 31% to 89% of shared scenarios after six months of applying BEC knowledge and skills. While the contrived FGD setting may have increased providers' tendency to report positive cases, providers shared more scenarios with positive outcomes and feasible diagnoses based on clinical context. When reporting poor outcomes six months after the BEC, providers reported feeling more confident in the appropriateness of their care plan despite suboptimal outcomes. The relationship between provider confidence and patient care quality remains unclear, though most agree that confidence is not a proxy for clinical mastery. A recent study of the U.S. Patient-Centred Excellence Survey showed that hospitals with higher confidence i.e. perception of overall patient experience performance outperformed hospitals with lower degrees of confidence.<sup>141</sup> Increased post-BEC provider confidence, while not indicative of clinical mastery, could at the least suggest improved patient experience if not outcomes.

Providers' changing perceptions and confidence in their management suggest that the BEC may impact patient outcomes; however, evidence from well-established short courses challenges this claim. A recent systematic review on the educational impact of ATLS courses and their effects on trauma mortality did not find any associated reduction in trauma death in contrast to other studies that have in the past.<sup>47, 142</sup> Nevertheless, unpublished data on the national BEC rollout in Uganda showed a one-half reduction of in-hospital mortality in Masaka Hospital, a highway-based facility with high volumes of trauma whose providers received the BEC training in the national rollout.<sup>121</sup> For an ultimate assessment of the BEC's value, the MoH should collect and analyse patient outcomes in the facilities that received the BEC intervention for the five sentinel conditions i.e. road traffic injury, paediatric diarrhoea, pneumonia, post-partum haemorrhage and asthma.

## **6.4 Interprofessionalism**

### *6.4.1 Interprofessional Differences*

There were significant differences in the course's impact on nurses and midwives compared to doctors over time. Nurses and midwives tended to gain more objective and perceived knowledge from the course immediately, with diminishing retention at six-months, though they did retain significant knowledge from their pre-test to six-month scores. The quantitative findings confirmed an overt shift in nurses and midwives' mindset, knowledge, preparation and overall self-efficacy that significantly diminished at the six-month point. Nurses and midwives' descriptions of managing post-BEC emergencies added depth to this finding as they reported a radical departure from their pre-BEC "wait for the doctor" mentality to assumption of team leadership roles, assessment of patients and provision of interventions. Nurses and midwives' self-rating of their "confidence" did not appreciably decline at six-months post-BEC,

indicating a distinction between confidence and knowledge as two separate entities. Though doctors tended to retain their knowledge and self-efficacy in comparison to nurses, all cadres experienced boosts in both categories.

#### *6.4.2 Interprofessional Education*

Among the documented benefits of interprofessional education, little data exists regarding differences in knowledge acquisition based on cadre. The pilot study of the interprofessional “Helping Mothers Survive Bleeding After Birth” short course in Tanzania described similar findings to this study in knowledge and confidence trends over time in comparing doctors to nurses and midwives.<sup>85</sup> Like participating doctors in the BEC, senior Kenyan medical students in a two-day trauma course maintained knowledge and confidence from their post-course results to their nine-months follow-up assessments.<sup>86</sup> When considered with the limited data, differing retention of knowledge and confidence between cadres may derive from discrepancies in baseline knowledge, signifying that because nurses may begin with a lower baseline they must retain more new material than doctors. Outside of previous exposure to BEC content, FGD findings suggested interprofessional differences in education levels, comfort learning new material, and opportunities to apply learned skills and knowledge in their clinical settings given the medical hierarchy’s divergent demands and constraints based on cadre. Nurses had fewer opportunities to apply new skills and concepts given their decreased autonomy in their clinical settings, whereas doctors had more liberty to apply new concepts and skills in their patient management.

The BEC’s interprofessional design evoked conflicting opinions in the FGDs. Interprofessional training has gained recognition as a means to improving patient safety and outcomes.<sup>143</sup> Though various participants, including doctors, nurses and midwives, suggested splitting the BEC course up by cadres, such divisions’ benefits on perceived knowledge retention could outweigh the benefits of interprofessional training as a team. Recent studies show that interprofessional simulation and team training improve team-based attitudes, behaviours, communication, and confidence in providing collaborative care both among students and practicing health professionals in emergency and other scenarios.<sup>144-146</sup> The delays in care described in the participants’ personal emergency care experiences often resulted from a lack of communication and organisation between emergency care team members, and resulted in blame and negative emotions, resulting in tension between lower cadres and supervising doctors. Compounded by the scarcity of health workers in Uganda, poor communication and collaboration illustrate the need for more interprofessional training to overcome medical hierarchies and silo mentalities that preclude lower cadre officers from taking active roles in patient care.

### **6.5 Participant Recommendations**

#### *6.5.1 Leadership and Untrained Colleagues*

Trained providers focused on untrained colleagues’ impact on their ability to provide high quality emergency care, highlighting how the BEC had compelled them to assume

leadership roles due to lack of uniformity and teamwork in emergency management in their units. Untrained and often resistant colleagues consumed BEC-trained providers time and created conflict, limiting participants' ability to implement new skills and knowledge. In contrast, other BEC participants felt confident and empowered to teach untrained colleagues, though most agreed that universal training would avoid delays in patient care and team conflict. Though the BEC teaches leadership and communication skills, its focus on clinical skills and knowledge leaves providers to determine their leadership style as oftentimes the only provider with emergency care training on his or her team. Various studies have explored the leadership gap in medical education in SSA, and emergency medicine specialists have voiced discomfort with assuming leadership roles, especially in management.<sup>147</sup> Future efforts could focus on leadership and teacher training programs for emergency care providers similar to a recent CME pilot course on leadership and teaching for non-physician clinicians in Uganda.<sup>124</sup>

### *6.5.2 Retraining and Knowledge Decay*

The significant drop-off between nurses and midwives long-term knowledge retention illustrates that some cadres may require different strategies to maintain new skills and knowledge. The topic of retraining emerged in both rounds of FGDs with a greater emphasis at the six-month mark when providers, especially nurses and midwives, perceived and experienced a decline in their knowledge and skills. Though all cadres experienced declines in self-reported confidence over time, there was no incremental relationship between quantifiable knowledge and confidence lost over time. Given over-confidence with decaying knowledge, establishment of retraining frequency could ensure patient safety and maintain providers' knowledge base and skill set.

Studies have confirmed a significant decay in resuscitation knowledge and skills six months to one year after ALS short courses, though providers may retain organisation and prioritisation skills for up to eight years.<sup>48, 142, 148</sup> Studies of Rwandese medical students trained in emergency triage and emergency obstetric short courses demonstrated a similar decay in learned clinical knowledge and skills in the months following the course.<sup>84, 149</sup> The established relationship between short courses and knowledge decay has prompted retraining requirements for many basic and ALS support courses, though at the expense of the self-funding provider. Evidence has yet to identify optimal retraining frequencies for such courses. For these reasons, the American College of Emergency Physicians emphasises the value of such courses as educational tools rather than as privileging tools for employment.<sup>150</sup> The BEC should not become a privileging tool for employment, but rather another indicator of a provider's skill set and knowledge base.

Most BEC participants desired retraining, though nurses and midwives may have a greater need for retraining based on their significant knowledge decay. The combination of decaying knowledge with increased confidence could compromise patient safety if a provider overestimates her capabilities. More so than doctors, nurses and midwives may require retraining to mitigate this combination and maintain

knowledge and skills as shown in other studies of short courses in LMICs. The qualitative findings clarified that nurses have fewer opportunities to practice learned knowledge and skills in their clinical settings yet remain confident in their practice. By providing more retraining opportunities in the form of CMEs with internal trainers, all cadres of providers can increase their knowledge and skill retention while changing interprofessional culture to encourage all cadres to utilise BEC learning points in their daily practice. BEC-trained nurses in Mubende and Kawolo Regional Referral Hospitals have initiated BEC-based CME modules in their settings with success, teaching daily in-service education settings to maintain trained providers' skills and educate untrained providers.<sup>121</sup>

### *6.5.3 Course Content*

Providers requested that course include more obstetric, gynaecologic and paediatrics content. SSA has the highest regional maternal and child mortality in the world though simple, low-cost interventions, including investment in emergency systems infrastructure and training, could prevent most deaths.<sup>151-154</sup> Almost 1 million of the 5.8 million yearly trauma deaths in LMICs are children, indicating a need for paediatric trauma training.<sup>155</sup> BEC participants working in obstetrics and gynaecology (O&G) and paediatrics, including neonatal intensive care units, expressed that the course fell short of their expectations regarding O&G and paediatric emergencies. Nurses and midwives working in women and children's hospitals, including Mulago Women and Children's Hospital and Kawempe National Referral Hospital, voiced these needs more so than other providers. As a comprehensive course, the BEC teaches ample content with limited time; however, future courses could tailor content to sites given advance notice, including in women and children's hospitals and in designated trauma, stroke or cardiac centres. Providers working in O&G and paediatrics may require more tailored emergency care courses in comparison to their peers with many examples of successful courses implemented in O&G.<sup>156</sup> BEC course coordinators should not exclude providers in these fields given the inadequate number of trained emergency care professionals and constant turnover of health workers between departments that requires familiarity with all types of emergencies. Additional triage interventions such as the WHO ETAT Course and South African Triage Scale could improve paediatric outcomes when implemented alongside the BEC, whereas less consensus exists on O&G triage scales, and requires further research.<sup>157, 158</sup>

Though participants requested basic CPR's inclusion in the course, the BEC course creators omitted CPR and suggested following local protocol based on the limited chain of survival in most of SSA. Cardiac arrest management is resource intensive—the U.S. alone spends \$33 billion USD per year on out-of-hospital cardiac arrest (OHCA), with poor outcomes.<sup>159</sup> The chain of survival, a concept that refers to the integrated levels of care required for successful management of OHCA, achieves <10% survival rate in countries with the most advanced and well-resourced medical systems.<sup>160-162</sup> In countries with incomplete chains of survival, CPR may be a futile and unethical intervention that prolongs unnecessary suffering with 100% mortality

rates in the few studies of OHCA survival in LMICs to date.<sup>163, 164</sup> While in-hospital cardiac arrest patients have better outcomes than OHCA patients, limited access to intensive care units, ventilators, essential medications and percutaneous coronary intervention lead to high morbidity and mortality with neurological devastation for the few survivors of cardiac arrest in SSA.<sup>162, 165</sup> With this picture in mind, the BEC focuses on manageable and common emergency conditions, making suggestions like more O&G and paediatric content more feasible and effective for future redesigns of the course rather than increased focus on CPR and cardiac arrest.

#### *6.5.4 Simulation*

Providers recommended adding simulations to mimic realistic settings and integrate BEC content with actual practice. Simulation, meaning learning in safe environments that replicate patient care scenarios, provides learners with the opportunity to practice new skills and knowledges while receiving real-time feedback without harming patients. While simulation can teach clinical skills, it also facilitates interprofessional communication, teamwork and task management for all levels of medical learners with resultant improvements in patient safety and performance as most clinical errors result from communication, teamwork and coordination deficiencies.<sup>166</sup> Though often costly and time-intensive, simulation may be more effective than traditional clinical education given participant buy-in and could augment teamwork and knowledge retention post-BEC.<sup>167, 168</sup> Simulation exercises have high efficacy as an educational tool among interprofessional and interdisciplinary teams in various emergency settings, including obstetric, surgical, neonatal and paediatric patients in scenarios replicating post-partum haemorrhage, trauma, shock, difficult airway and general resuscitation.<sup>167, 169-172</sup> Less evidence on simulation exists in LMICs with most focused on its benefits in surgical education, though a recent study of short-term disaster preparedness in India found case-based learning to be superior to simulation exercises for nurses.<sup>173, 174</sup>

BEC students recommended more simulation both during and post-course in situ and in the classroom. They believed that simulations during and post-BEC would enhance teamwork and solidify and refresh BEC skills and knowledge, though additional benefits could include improving processes and workflow for in situ simulations. Throughout the course, many providers realised they had incorrect technique or understanding of integral concepts—simulation could enable self-correction and practice of emergency care skills in a realistic setting with an instructor to provide feedback. Providers tended to prefer hands-on activities such as the skills practicums and case-based group learning to lectures with lower cadre providers reporting feeling lost during lectures on less familiar content. Simulation-based exercises may improve provider self-comfort in emergency care provision and enable lower cadres to experiment with new content and ask questions with translation to improvement in patient care practices and outcomes.<sup>168, 172</sup> While higher-fidelity simulations exceed the BEC's budget, lower fidelity simulations such as acting out designed scenarios with assigned team roles could promote deliberate practice and increase skill

development during the course and post-BEC alongside case-based learning through the BEC pre-course cases.

#### *6.5.5 Per Diems*

Providers had more negative reactions to course programming in comparison to their reactions to the course content and its intrinsic value, advocating for per diems, transport refunds and lunch allowances during both rounds of FGDs. Per diems refer to the daily allowances paid to health workers for workshop intended to cover expenses such as food, transportation and sometimes lost wages. In SSA, per diems may consume 50-70% of governmental and non-profit budgets, and some countries have even passed legislature mandating them while many research ethics committees require them.<sup>175</sup> Though higher level officials receive higher per diems, per diems significantly exceed daily wages and are an important income source for all levels of health workers according to a recent study (Figure 1).<sup>176</sup> Late payment and underpayment may compel health workers to develop alternative coping strategies to meet short and long-term financial requirements with per diems as the most effective mode to earn quick cash.<sup>177</sup> While per diems offer health workers incentives and may comprise a more significant source of income than wages, they create excessive cost and conflict in running health workshops like the BEC and may encourage fraudulent practices such as workshop jumping and attendance fraud.<sup>176</sup> The optimal solution to Uganda's per diem culture is beyond this dissertation. Future BEC courses in Uganda may require per diems for workers, though the involvement and attendance of enthusiastic, moralistic leaders from administration, management and government in the course could mitigate such funding's necessity or undercut associated abuses. Regardless, BEC coordinators must navigate Uganda's per diem culture and work with collaborators to ensure transparency and fairness if compensating for course attendance.

#### *6.5.6 Programming*

During both rounds of FGDs, providers requested increased shift coverage and course duration. Despite reassurances from hospital administrators, providers' participation in the BEC course often led to coverage shortages in participants' units and occasionally led to conflict or dual obligations that caused students to miss class. Securing formal letters excusing staff from shifts and ensuring adequate coverage will be crucial to the success of future BEC courses and buy-in from staff and hospital administrators. Participants also felt that having off-site trainings would reduce colleagues from calling them back to the wards, though the cost for running the course would increase. Finally, participants requested longer course durations from two to four weeks as they felt the course covered a broad range of material with minimal time for integration and simulation. The BEC represents an interim solution to the absence of formal long-term emergency care training programs in Uganda. Its length and low budget make it an attractive option to MoHs and collaborators with minimal disturbances to patient care. Retraining and CMEs could be future solutions to

requests for longer courses fuelled by concerns about knowledge retention or integration during the four-day course.

## **6.6 Online Electronic Resources and Blended Learning**

Our findings add new evidence on the efficacy of OERs in LMICs while identifying barriers to their usage. The pre-course cases cohort scored higher at all time points than the control group on the MCQs, though only the pre-test difference was significant. The difference in MCQ mean scores was greatest between the case completion and no completion groups in the subgroup analysis, suggesting that those who had the work ethic to complete the cases may have had a higher baseline knowledge than those who lacked the motivation to complete the assignment. With this in mind, the completion group may represent a motivated group, the no completion group an unmotivated group and the control a mix of both motivated and unmotivated groups. Based on these differences and the qualitative findings, the cases were most useful for preparation and exposure to the material pre-course rather than study and review post-course. This pattern mimics the “flipped classroom model” wherein OER usage exposes students to pre-course material for improved knowledge assimilation and integration in the classroom. Providers who completed the pre-course cases viewed them as pre-course work required to prepare for the BEC. Though participants recognised future uses for the cases, including as study and teaching materials, they tended not to refer to these resources during or after the BEC.

24% of providers did not attempt a single case despite receiving the assignment. Barriers to completion included lack of access to smart phones, cost, time and energy. Nurses and clinical officers reported more technological barriers to accessing the pre-course cases than doctors, but we did not show a significant interaction between cadre and online case benefit. Technological barriers included poor network connectivity, difficulty navigating the BEC website, and inability to open the compressed files sent to all participants. The cost associated with the pre-course cases, including purchasing data or internet and accessing a smart phone or computer, limited or prohibited some providers’ usage of the online resources. Doctors reported greater access to internet, smart phones and computers with fewer issues accessing the cases, a finding consistent with surveys of doctors’ self-reported internet access and OER awareness and emergency medicine specialists’ demand for online educational materials in SSA.<sup>147, 178</sup>

Participants who failed to complete the assignment and those who did not use the pre-course cases post-BEC emphasised self-directed learning as a significant barrier to case utilisation. Identified as an effective method to enhance healthcare professionals’ knowledge acquisition and clinical skills, self-directed learning requires the learner to take the initiative to diagnose her learning needs, goals, strategies and outcomes to direct her learning.<sup>179, 180</sup> Outside of uncompensated time and effort, this type of learning demands self-regulation, or strategic learning tailored by the provider to her goals and needs.<sup>179, 181</sup> Participants who failed to complete the cases pre-BEC or did not refer to them post-BEC, highlighted time, effort and self-regulation as major

barriers to case usage. For those who completed the cases, online case usage significantly declined from pre- to post-course. The recency of a provider's education appeared to increase the likelihood of return to the cases post-course likely due to proximity to the self-directed and self-regulated learning required of students. As a result, younger more recently qualified providers tended to use cases for teaching and studying more than their older peers.

Gauging self-directed learning readiness (SDLR) may aid identification of providers who would benefit from independent forms of learning as in OER usage.<sup>180, 182</sup> A recent systematic analysis of nurse and midwives' SDLR found that positive interest in online learning increased SDLR and knowledge acquisition whereas age, work experience and educational qualification had no influence on SDLR.<sup>181</sup> In contrast, a scoping review of SDLR among nursing, medicine, physiotherapy, pharmacy, occupational therapy and dentistry students found that age, year level and previous education levels increased SDLR.<sup>183</sup> These findings suggest that positive attitudes to online learning increase SDLR and could predict providers who would benefit most from the pre-course cases, whereas age has an unknown effect. Identifying providers with higher SDLR could predict who would benefit most from future online educational interventions incorporated into the BEC and future online courses.

Even though providers recognised declining knowledge retention and requested retraining, many felt challenged by the notion of SDLR inherent in the online case utilisation. Given erratic compensation, overburdening and understaffing, health professionals in Uganda have myriad reasons for negative feelings towards clocking uncompensated, extra time for their jobs as in the BEC pre-course work. Such feelings may limit the efficacy of OERs in low-resource settings like Uganda where OER access demands money, time and SDLR with little incentive for stressed providers, many of whom engage in dual practice for financial sustenance.<sup>184</sup> With medical education's transition to flipped classroom formats, such barriers to OER access could limit the success of alternative styles of education mandating pre-class online preparation in LMICs. Though various studies have demonstrated successful deployment of OER usage, a recent systematic analysis reported that most designs require significant implementation efforts that may not be sustainable in the long-term.<sup>58</sup> This study required considerable pre-course interaction with the providers to implement online case usage that may not be possible in the future, including pre-course meetings and trouble-shooting sessions whether in person or over the phone. In contrast, OER usage in the controlled classroom setting could remove structural and technological barriers to further participant engagement with online resources in the classroom given an instructor's presence and access to electronic devices. In addition, administrative acceptance of online case completion as a CME activity could increase engagement with BEC content and encourage providers to practice and maintain emergency care knowledge.

The rapid expansion of mobile technology and internet connectivity in Africa, including 300 million people accessing the Internet and a billion SIM connections by 2025, could

render limitations such as cost, poor connectivity and unaffordable devices obsolete such that OERs become standard fare rather than an alternative educational method.<sup>57</sup> OER introduction during health worker education in LMICs could standardise such usage, and serve as a conduit to expose students to material otherwise inaccessible due to lack of trained faculty or resources. Despite encouraging 2025 estimates, internet and OERs will remain inaccessible to 800 million Africans, mandating intensive efforts and more traditional educational structures to reach frontline providers without internet access.<sup>57</sup> Future research should explore if OER usage within the classroom enhances knowledge retention and promotes post-course reference to the OERs thereby extending the course's impact.

## **6.7 Future Training**

Our findings revealed the perceived need for more trainings of BEC participants' peers and re-trainings of all cadres of BEC participants, especially nurses, aligning with the quantitative findings that nurses retained significantly less knowledge than doctors. Many Basic Life Support Courses have a two-year retraining requirement, though participants suggested retraining as frequently as every few months. Participants recommended breaking the BEC into discrete, internal CMEs, a strategy that BEC-trained nurses from Kawolo District Hospital have implemented with success.<sup>121</sup> Nurses may require more frequent retraining as they have fewer chances to practice their knowledge and skills, due to hierarchical limitations and frequent staff rotations.

All providers advocated for the local and national expansion of the BEC, emphasising the significance of training lower cadres. With increased task-shifting and limited physician presence, lower cadre providers are integral to the future of emergency care provision in SSA. Providers emphasised uniform training of colleagues both within and outside of their departments as well as on a national level. They recommended that future trainings focus on providers in rural areas and on public institutions receiving high volumes of trauma. Though both private and public facilities require emergency care training, a recent World Bank review of 22 LMICs found that most poor patients receive their care in public institutions when limiting the scope of care to licensed health care providers, indicating that BEC efforts targeting public institutions could reach the patients suffering most.<sup>185</sup> Based on a recent systematic comparative analysis between public and private healthcare systems in LMICs, the public sector may also be more efficient and deliver higher quality care than the private sector, though both systems suffer from poor accountability and transparency.<sup>185</sup> As most acutely ill and injured patients in Kampala likely receive emergency care in public hospitals like Mulago National Referral Hospital, future BEC trainings should focus on public hospitals with high emergency care volumes for far reaching effects in a healthcare system with undue burden on the poor.

To improve emergency care for the 76% of Ugandans living in rural areas,<sup>28</sup> the BEC must include rural providers in future courses with subsequent investigation of provider reactions and patient outcomes. This study focused on the education of urban providers, who may differ from rural providers in their practice and exposure to

emergency care. Notably, rural areas have lower physician density than urban areas, mandating increased task-shifting of acute care tasks to clinical officers and nurses. These providers require a broad range of clinical knowledge and skills in the context of limited access to labs, imaging and medications as shown in a large, longitudinal evaluation of patients presenting to a six-bed EU in Karoli Lwanga Hospital, a rural district hospital staffed by midlevel providers with two years of training through Global Emergency Care.<sup>186</sup> Focused training efforts on non-physician clinicians will be central to improving rural emergency care as evidenced by mortality reductions following Global Emergency Care's long-term training program.<sup>68</sup>

## **6.8 Future Directions**

The BEC is one component of a WHO emergency care package in Uganda that includes two clinical checklists, a triage protocol, and resuscitation area guidance implemented in a further 17 regional hospitals.<sup>121</sup> The WHO and its partners will collect patient outcomes to monitor the bundle's implementation, thereby providing the fourth level in Kirkpatrick's model used to evaluate the BEC in this study. Though analysis of the WHO bundle may not isolate the singular impact of the BEC, its inclusion of patient outcomes as a primary metric of the bundle's efficacy would provide new commentary on this novel multi-pronged approach to emergency systems strengthening, including education, infrastructure, organisation and protocolisation. In this study each BEC course cost 1,072USD to run; in contrast, a recent study in Mongolia that calculated the minimum cost for a single ATLS course with foreign instructors to be 27,000USD, excluding salaries for instructors who donated their time.<sup>83</sup> Though exclusive of patient outcomes, this study's Kirkpatrick-based evaluation of the BEC could enable increased advocacy around frontline provider education as a viable, cost-effective tool for emergency systems development in LMICs in SSA and other regions lacking formal emergency care training. In the future, investigation of patient outcomes, retraining frequency, including CME-*isation* of the BEC, in-class use of the pre-course cases, and rural extension of the course could further enhance the BEC's impact.

## **6.9 Limitations**

Several significant limitations to this study deserve consideration despite best intentions to ensure methodological soundness.

This small-scale study focused only on BEC-trained providers in Kampala, though the MoH rolled the course out to hundreds of providers across Uganda. Study staff recruited providers using convenience sampling based on hospital administrators' and BEC participants' recommendations, meaning that not all providers were employed full time in a department dedicated to emergency care. Participants were recruited from Kampala only, and therefore do not represent the geographic diversity of practice within Uganda. Selection bias may have occurred given that participants were not compensated and chosen by the administration for the course. As participants thereby volunteered their time to take the course, they could have been more motivated than

a standard participant. Though participants had to speak English to enrol in the course, most providers in Kampala speak English as a unifying language given Uganda's linguistic diversity, and likely did not contribute to selection bias.

The pre-course cases arm received the cases prior to taking the pre-test, meaning that there was no true comparison between the pre-course cases and control arm prior to the intervention. Given similar baseline demographics and clinical settings, it is unlikely that the pre-test differences between the control and pre-course cases' arms reflected differences in the providers, but rather resulted from exposure to the intervention. The change in the MoH's funding mechanism changed the study design midway through the timeline, leading the investigators to assign later courses to the control group arm. This meant that the control and pre-course cases arms were not perfectly matched, though timing, rather than the hospital or providers' characteristics, led to this otherwise random assignment.

In assessing knowledge through MCQs and self-confidence through self-reported Likert scales, this study did not directly assess performance, behavioural change or patient outcomes. The MCQs reflect a representative but not all-encompassing portion of the BEC's content. Participants answered the same MCQs at all three time points, though they never learned which questions they missed or the correct answers until the study's conclusion. In retaking the same exam, participants could have remembered questions and looked up the answer in the interim or implicitly chosen the same answer as on previous exams without the thought process that new questions may have encouraged.

Some participants from the first round of FGDs could not participate in the second round, leading to different group dynamics between the two rounds of discussions. The presence of the U.S. facilitator who coordinated the course may have biased FDG participants' responses as they viewed the FGDs as an opportunity to benefit their clinical setting. FGDs were conducted in English as it unites the linguistically diverse population of Uganda, though may have limited providers' comfort or ability to express themselves given that English was not their primary language. Though audio-recordings were transcribed word-for-word by study staff present at the FGDs, ambient noise limited transcription on a few occasions and the second round was transcribed by a non-Ugandan study staff member. The interplay between cadres in the FGDs may have limited lower cadre providers from expressing themselves and biased the conversation towards doctors.

## CHAPTER 7: Recommendations

### 7.1 Recommendations

The focus group participants and the investigators contributed recommendations for this study.

1. All Ugandan health professionals in all cadres should receive basic emergency care training as early as possible.
  - Provide training in basic emergency care management, including trauma, paediatrics, obstetrics/gynaecology, teamwork and communication
  - Integrate emergency care education into health professional students' curricula
  - Offer health professional trainings in emergency care through BEC and similar courses
  - Develop diploma and master's programs for emergency care
  - Prioritise emergency care training within the MoH's agenda
2. The MoH and its partners should provide more opportunities for BEC training and retraining in addition to advanced courses.
  - Disseminate BEC as broadly as possible through MoH prioritisation, identifying hospitals with greatest need
  - Determine frequency for retraining and recertification
  - Offer BEC and other emergency care educational opportunities for CME credit
  - Offer advanced emergency care courses for LMICs or develop advanced course for LMICs
3. Online electronic resources for health professional education should be easy to access and navigate with professional benefit outside of independent, self-motivated learning.
  - Ensure reliable, affordable Internet connections or give stipend to participants to connect to the Internet
  - Train providers on how to use online resources
  - Create professional incentive to use online resources post-course
4. Beyond emergency care training, Ugandan health professionals need the materials and equipment to provide timely, quality emergency care.
  - Basic materials and equipment like oxygen, blood, airway adjuncts, essential medications, etc.
  - Basic personal protective equipment like gloves, masks, gowns, etc.
  - Basic hospital infrastructure like dedicated emergency department, staff and operations

## *7.2 Next Steps*

This study's findings will be presented to the Ugandan MoH and WHO. This study contributes a new body of evidence supporting the MoH and its partners' efforts to disseminate the BEC course across the country. The findings provide a new perspective on the utility of pre-course electronic resources in countries with limited Internet accessibility and affordability that could guide future e-Learning interventions.

## CHAPTER 8: CONCLUSION

The aim of this study was to assess the BEC pre-course cases' impact on participants' knowledge and self-efficacy in emergency care provision.

Mixed methods analysis revealed that participants in the online group entered the course with greater knowledge than the control group. Nurses experienced more significant initial gains and long-term decay in knowledge than doctors. Qualitative analysis revealed that the pre-course cases set expectations and prepared participants to engage with new material, though barriers such as technological difficulties, cost and time limited case use pre- and post-course. After course completion, participants reported limited motivation to revisit the cases and pursue independent learning outside the classroom. The ABC approach and skills practicums were identified as the most useful and applicable course concepts both post-course and six months post-course.

Pre-course online adjuncts can set expectations and prepare health professionals in LMICs to enter short courses with more knowledge. BEC participants reported successful applications of their new skills and knowledge, though felt limited by systemic constraints, untrained colleagues and knowledge decay. Future efforts should focus on optimising OER usage in short courses in LMICs and determining BEC retraining frequency for past participants.

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## APPENDIX 1: LIKERT SCALE

Please indicate how strongly you disagree or agree with the following statements by crossing the response that best describes you now. Check a box by crossing it.

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I feel comfortable handling any patient requiring emergency care.				
2. I feel nervous about seeing patients with emergencies.				
3. I feel that others in my clinical unit have the knowledge and skills to handle emergency care patients.				
4. I feel that I lack the skills to provide care in most emergencies.				
5. I feel prepared to see emergency care patients in my clinical setting.				
6. I feel confident seeing very ill patients.				
7. I feel uncomfortable using standard emergency care protocol.				
8. I feel that I understand the ABCDE's of basic emergency care.				
9. I feel my organized approach allows me to be prepared for all emergency care patients.				
10. I do not feel confident in my knowledge of emergency care.				

## APPENDIX 2: FOCUS GROUP SCRIPT

### BEC PARTICIPANT FOCUS GROUP FACILITATION GUIDE

**Interview Guide:** This is solely a guide. The interviewer will aim to get appropriate information from each participant in the WHO Basic Emergency Care training programme. Not all questions may be necessary and additional follow-up questions may be asked of each trainee to clarify or expand answers given.

***Sections A, B and C will be asked in the focus group immediately post-BEC. Sections B and D will be asked in the focus group three to six months post-BEC.***

#### A. Prior experience and building interview rapport:

*Thank you for your participation in this focus group. I would like to begin by learning more about your different experiences and trainings as healthcare providers.*

- 1) How many years have you been a healthcare provider?
- 2) What has been your training prior to this position?
- 3) Prior to this training, had you ever participated in any emergency care training during your training as a healthcare worker?

#### B. Experience with emergencies:

*Thank you for your comments. I would now like to learn about your experiences addressing medical emergencies.*

- 4) Would someone like to start by describing a medical emergency they have treated?
  - Probing Questions:
    - What type of medical emergency was it? What was wrong with the patient?
    - What did you do to treat the patient?
    - Did you feel confident in your initial assessment and management of the patient?
    - What went well in the assessment, diagnosis and management? What did not go well?

*Allow as many people as volunteer to describe their medical emergency, and probe only with the above points if they do not otherwise cover them. After each person shares, make sure to thank them and acknowledge that their contribution is very valuable though it may be tragic or emotional.*
- 5) Thank you all for sharing your experiences so far. The types of emergencies you have mentioned include .... *(list a summary of what they have shared burns, motor vehicle accidents.....)* Are there any other types of medical emergencies that you see in your community?

#### C. BEC training course -- general perceptions:

*Thank you for your comments. I would now like to learn about your experiences with the BEC training course.*

- 6) What did you think of the BEC training course?
  - Probing Questions:
    - What was as expected and what was not expected in the course?
    - What were your favourite and least favourite parts of the course?
    - What skills did you learn and what skills did you hope to learn that you did not?
    - Did you feel this course will be useful to you in caring for patients in the future? Why or why not?
- 7) What did you think of the online coursework that accompanied the course?
  - Did you find the online resources easy to use and accessible?
  - Were the online resources useful in preparing for the course?
  - (If applicable): did you use the online resources after the conclusion of the course? If yes, when and why?
  - Would you recommend the online resources to a colleague?
- 8) How could the training be improved?

D. BEC training course -- impact:

*Thank you for your comments. I would now like to learn how you feel the BEC training course has impacted you, your healthcare system and your community.*

- 9) What parts of the course have been most useful for you in your practice as a healthcare provider?
  - Have you referred to the online course material in your practice?
- 10) Was the course useful and appropriate in your clinical setting?
- 11) Has the training changed how you care for patients or practice emergency care? If yes, how? If no, why not?
- 12) Do you feel this training has impacted health in your community? If yes, how? If no, why not?
- 13) Do you think the training should continue for future years? Why? Or Why not?
- 14) Were there skills you would have liked to learn during the course?
- 15) Do you have any additional comments or feedback about the training?

Thank you so much for coming and sharing your experiences, thoughts, and opinions with us. Some of the experiences you have described involved death and tragedy. You have provided us with valuable information that will be used to improve the emergency care services in Uganda. As mentioned before, if you feel you would like to speak to me after the session, I will be available. That concludes our focus group session.

## APPENDIX 3: BEC STUDY PROPOSAL

### EVALUATION OF THE WHO BASIC EMERGENCY CARE COURSE NATIONWIDE ROLLOUT IN UGANDA

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## ABSTRACT

**Introduction:** Uganda, like many low- and middle-income countries (LMICs), has a high burden of acute illness and injury, but lacks an emergency care system capable of meeting resultant needs. Manageable conditions, such as paediatric diarrhoea, pneumonia, road traffic injury, asthma, and postpartum haemorrhage, result in high levels of morbidity and mortality. The Ministry of Health (MoH) has prioritised developing and strengthening its emergency care system, and a recent WHO assessment identified action priorities including developing context-relevant emergency care courses, and widespread training of providers. The WHO's Basic Emergency Care (BEC) course is clinical training aimed at frontline providers (doctors, nurses, and clinical officers) who provide emergency care at their facilities but have received little or no formal training in the field.

BEC has recently been taught in two facilities in Uganda and is scheduled for a national rollout to approximately 500 providers in 2018. Pre-BEC online cases have recently been created to augment the normal BEC through a “flipped classroom” model that may increase provider knowledge retention and confidence, and later serve as a resource.. This study aims to assess the impact of the WHO BEC course on clinicians’ knowledge and confidence in emergency care, compare course delivery modalities, and evaluate perceptions of the BEC course, including cultural acceptability and barriers to implementation.

**Methods:** This prospective study aims to assess provider confidence and emergency care knowledge prior to, immediately following, and three to six months after completion of the BEC course. It additionally assesses the potential efficacy of a new electronic-based BEC delivery platform. We aim to enroll 360 adult medical providers across 10 health care facilities without prior emergency care training but who have a post in an emergency receiving area. These cohorts will include clinical officers, nurses, and doctors of varying experience. Assessments of provider knowledge will be performed prior to the course and after the course as well as through focus groups. Quantitative data from the pre and post-course assessments will be analysed to evaluate for improvement in knowledge and skill acquisition, including data already collected by the Ugandan MoH prior to July 2018.

An additional post-course assessment will be performed three to six months after the course to assess for knowledge retention. Focus groups will be used to evaluate the participants’ perceptions of the BEC course after its completion and then again during the three to six-month follow-up to explore themes related to knowledge retention.

**Discussion:** Quantitative results from the MCQ and Likert scale surveys will measure provider confidence and knowledge retention in the provision of emergency care pre and post-BEC, and allow a comparison between course modalities. Qualitative results from the focus groups will enable an analysis of provider perceptions of the BEC course, its utility, and the cultural acceptability and barriers to pre-course online work and short courses in Uganda and LMICs. Together these results will enable assessment of the use of short-courses for clinical education in emergency care in Uganda, and more broadly in other LMICs.

## 1. INTRODUCTION

### 1.1. Background

Prioritization of emergency care and its integration into health systems is essential to building momentum around global health priorities and eliminating health disparities. LMICs suffer the highest rates of mortality from acute complications and illness, accounting for >90% of injury-related deaths worldwide (1). Emergency care, which prioritises early resuscitation and stabilization, may directly impact over half of all deaths in LMICs (2).

Despite this, both global health agendas and LMIC national health strategies continue to neglect emergency care. They typically address vertical programs, focusing on the management of specific conditions rather than developing robust, well-integrated prehospital and facility-based emergency care (3-5). The resultant lack of resources, infrastructure, and formally-trained healthcare providers leads to serious gaps in access to emergency care (6-8). This is especially true in sub-Saharan Africa, which accounts for 24% of the global burden disease yet claims only 3% of the world's healthcare providers – very few of whom have specialized in emergency care (8). The WHO has increasingly prioritized the emergency care agenda. In 2007, it urged the establishment of “formal and integrated trauma and emergency care systems”, and recently established the Emergency, Trauma and Acute Care Program to address these gaps (5,9).

High-income countries with sufficient human resources rely on long-term, formal training programs for their health workforce (2). Given the human resource shortages, this approach of specialist training will not fill critical gaps in emergency care in LMICs within the next decade (2,10,11). Short-course educational programs are an effective, high-impact intervention for strengthening healthcare provider skills, and have been found to be particularly effective in low-resource environments (12). Open educational resources (OER), which include free and open digital publications of educational materials, have been shown to enhance information dissemination and clinical education, but a broader evidence base is needed to understand their application in LMICs (13-18).

In 2015, the WHO created the Basic Emergency Care (BEC) course. Similar to the American Heart Association's Advanced Cardiac Life Support, the BEC aims to educate a range of providers about basic emergency care in a standardized format. The modular course uses lectures, group discussions, and practical sessions to cover the approach to the critically ill and injured, over 5 full-contact days. Successfully piloted in Uganda, Tanzania and Zambia, BEC is now freely available for nationwide rollouts and has been supported by online slide sets, quick cards for provider reference, and open-source manuals. BEC is, to our knowledge, the first open-access short course encompassing the breadth of emergency care in a LMIC relevant context (19-21). It is also currently a key component of a larger effort through the African Federation for Emergency Medicine (AFEM), national MoHs, and the WHO to improve emergency care across the continent.

Short-courses often provide limited long-term knowledge retention and require frequent refresher courses; however, a growing body of evidence has positioned the “flipped classroom” model (wherein students are first exposed to new material outside of class and assimilate knowledge through problem-based learning and discussion in class) as an effective alternative to traditional lecture-style

courses (22-26). Using pre-class OER, the flipped classroom has notably been successful among a range of healthcare providers, including medical students, nurses, residents, and in-house emergency medical staff (24-26). Though this strategy could increase healthcare provider confidence and knowledge acquisition and retention to improve patient outcomes, its effect has not been robustly studied in LMIC health settings. A comparison of the traditional and flipped classroom course delivery modalities is warranted, particularly in LMICs, where the positive impacts of OER courses are likely to be felt most.

## **1.2. Motivation**

Uganda is a rapidly growing low-income sub-Saharan African country with 39.6 million inhabitants (27). A recent WHO and MoH national assessment found significant gaps in the health care system, leaving most of the population uncovered (28). The only formal prehospital service – the Ugandan National Ambulance Service, established in 2014 – is based in the nation’s capital, and does not extend to most of the country (29). Formal emergency care within hospitals is also sparse. Some hospitals have emergency receiving areas staffed with healthcare providers, but these nurses, clinical officers and doctors almost entirely lack formal emergency care training (30). Consequently, 75% of hospitals fail to deliver even the most basic emergency care services (28).

The BEC represents the first open-access emergency educational tool that is tailored specifically for the low resource setting, such as in Uganda. A nationwide BEC course rollout, targeting multiple cadres of frontline healthcare providers across the country, is likely to improve the current situation, affording timely and accessible care to an increasing number of Ugandans. The goal of this study is to understand the impact that short-courses have on healthcare provider knowledge and confidence in the provision of basic emergency care, and also to understand the perceptions and cultural acceptability of the BEC Course in Uganda. This information will then be used both to understand the usefulness the BEC and online resources to emergency care training in Uganda and to help move towards improved emergency care delivery in Uganda.

## **1.3. Research question**

Primary research question:

Does the WHO BEC course significantly improve healthcare provider confidence, knowledge acquisition and retention, and how do these metrics compare across course delivery modalities?

Secondary research question:

Is the BEC culturally appropriate, acceptable and practical for the target audience?

## **1.4. Aim**

The aim of this study is to determine how the BEC course impacts confidence, knowledge acquisition and retention among a diverse group of healthcare providers and across course delivery modalities.

This study also aims to evaluate perceptions of the BEC Course including its cultural acceptability, barriers to implementation, and findings regarding retention.

## 1.5. Objectives

This study has the following objectives:

1. To assess the impact of the BEC course on healthcare provider knowledge and confidence in emergency care
2. To compare healthcare provider knowledge and confidence within different course delivery modalities
3. To evaluate perceptions of the BEC Course including its cultural acceptability, barriers to implementation, and findings regarding retention.

## 2. METHODS

### 2.1. Study design

This prospective study uses quantitative and qualitative methods to assess healthcare providers confidence and emergency care knowledge prior to, immediately following, and three to six months after completion of the BEC course. It additionally assesses the potential efficacy of a new electronic-based BEC delivery platform in the form of online cases and the cultural acceptability of the BEC course. As the MoH has already initiated the BEC course rollout and collected pre- and post-course data from the surveys outlined in this study, contact information will be requested from the MoH to retroactively consent BEC graduates from courses prior to July 2018 to analyse pre- and post-course surveys, and invite participation in the three to six month follow up data collection.

#### *Surveys*

Provider data on emergency care knowledge and confidence will be collected from healthcare providers in both cohorts at three re-specified time points: immediately before the course, immediately after course completion, and at three to six months post-completion.

A standardised multiple-choice question (MCQ) exam is used before and after every BEC course; it will be used to evaluate each participant's knowledge on emergency care topics and practice. A Likert scale survey (Appendix A) is employed simultaneously to quantify participants' confidence and comfort surrounding the provision of emergency care. All exams and surveys will be de-identified and anonymously coded with a random number generator, so that individual changes in confidence and knowledge retention can be evaluated. Participants in courses after July 2018 will complete the pre-course surveys before gaining access to online cases, which they will be asked to complete prior to the course.

**We are seeking ethical approval to analyse data from the routinely collected MCQ and Likert surveys, and to return after three to six months to administer the MCQ and survey again. We are also seeking approval to contact past BEC graduates to retroactively consent them for use of their pre and post course surveys collected by the Ugandan MoH for data analysis, and invite them to participate in the three to six-month follow up.**

#### *Focus groups*

In addition, BEC participants from courses after July 2018 onwards will be randomised using a random number generator to form subsets of approximately 25% of each BEC course's participants) for participation in focus group discussions of one to two hours, where a non-biased facilitator will use a structured guide to gather deeper qualitative information regarding the course's influence on participants' confidence in providing emergency care (Appendix B). Open-ended questions will be used to collect facilitator and participant perceptions of course strengths and weaknesses and other qualitative aspects of the study. These focus groups will be conducted post-BEC and at the three to six months follow-up.

Prior to participation in any of these data collection means (surveys, exams, and focus groups), participants will be formally consented through both written and verbal means (Appendix C).

**We are seeking ethical approval to hold focus groups immediately after and three to six months post-BEC.**

## **2.2 Study population**

The study population will include all participants from the 2018 Uganda BEC courses, which will run in public sector hospitals. Two cohorts of healthcare providers (including physicians, nurses, and clinical officers) without prior emergency care training, but with roles in emergency receiving areas of public hospitals, will be enrolled. Due to BEC prerequisites, all participants will be fluent in English (as the course is delivered in English). Targeted hospitals will include: Mulago Hospital, Mengo Hospital, Naguru Hospital, Nsambya Hospital, Kibuli Hospital and Kiwoko Hospital in Luwero.

## **2.3 Data collection and management**

### *Surveys*

Each participant will randomly be assigned a number to use for the MCQ exam and Likert scale survey in lieu of their name, including data from previous participants who retroactively verbally consent to participation in this study. A master spreadsheet will be created correlating participant name and number for future analysis and stored securely in an encrypted Excel (© Microsoft, Richmond, WA) document that will be destroyed shortly after the three to six-month post-BEC round of data collection. Pre- and post-course surveys will be administered by the BEC training team, in line with normal practice. All quantitative data will be entered into encrypted Excel spreadsheets and shared with the study team for analysis purposes. All Word and Excel documents will be stored on a password-protected computer accessible only by the research team. Paper copies will be stored in a locked office cupboard at Makerere University. The MCQ and Likert scale survey will be administered pre-BEC, post-BEC and at three months follow-up.

The three to six-month survey will be administered to all consenting participants by AF in late 2018. All data will be entered and stored in an encrypted Excel spreadsheet.

Data compilation and data handling will only be done by the researchers. The data will not contain any personal identifying information of the survey participants. The data will not be sold or used for any commercial purpose. Only the UCSF, UCT and Makerere researchers will compile and handle data.

The data will not contain any personal identifying information of the survey participants. The de-identified database will be kept in a Dropbox cloud file that is created in Uganda and shared with UCSF and UCT researchers for analysis. Paper copies of the database will be stored in a locked cupboard at Makerere University.

### *Focus groups*

Focus groups will be conducted with all consenting participants by AF and other trained research members at in 2018. These focus groups will be conducted post-BEC and at the three to six months follow-up. Focus group discussions will be recorded with an audio recording device and transcribed into encrypted Word documents. Once transcribed and back checked, audio files will be deleted. During transcription of the audio files, any identifying information will be removed. Participants who find the focus groups traumatic will be offered a debriefing session with peers.

## **2.4 Statistical analysis**

To ensure robust, high-quality analysis, ongoing support a Cape Town-based biostatistician, from whom analytic planning has already been sought for this study, will be enlisted.

Given that the sample size for this study is fixed at 360 participants, 180 of which will be in each course delivery modality subgroup, sample size calculations are not necessary. The current size of the study is large enough and representative enough for the normality assumptions that our statistical analyses will require. As the rollout is nationwide, the distribution of rural and urban sites is also representative of the population. Based on a standard deviation of 12.5 from previous BEC tests, a 95% confidence interval, and a sample size of 180 in each study arm, this study is powered to 97% to detect a difference as low as 5% in test scores across groups.

Provider knowledge acquisition will be assessed through comparison of pre- and immediate post-course exams; retention will be assessed through later comparison with 3-month post-course exams. Provider confidence will be assessed both quantitatively (Likert scale surveys) and qualitatively (focus group discussions).

Based on data from previous BEC courses, 90% participation in the pre- and immediately post-course evaluations, and 75% participation in the six-month follow-up are anticipated. Given that there will not be data points from all participants at all time points, a mixed model ANOVA is best used to analyse for the acquisition and retention of knowledge, as well as confidence, both within and across cohorts. Modality and time effects will be fixed, while participant effects while be treated as random. Focus group data will be coded and thematically analysed using Atlas.ti software to provide additional data regarding the impact of the BEC course on providers' confidence levels over time.

## **3 TIMELINE**

	2018											2019					
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
<b>Ethics Applications</b>	X	X	X														

Statistics input	X	X	X														
BEC rollout planning & coordination	X	X	X	X	X	X	X	X	X	X	X						
BEC rollout & data collection	X	X	X	X	X	X	X										
3-month follow-up							X	X	X								
Data analysis											X	X	X	X	X	X	
Manuscript writing												X	X	X	X	X	
Final presentation																	X

#### 4 ETHICAL AND LEGAL CONSIDERATIONS

Ethics approval for this project has been submitted to UCSF and will be sought from the Ugandan Ministry of Health, Makerere University, and the University of Cape Town. Makerere University will only consider the study's IRB proposal with University of Cape Town's HREC approval as per protocol. Participants will be protected in numerous ways: participation will be voluntary and consented, no identifying information will be collected, and participants will remain anonymous in all analyses. Participation in this study is not anticipated to negatively affect participants.

All participants will remain anonymous in the surveys, questionnaires and focus groups by using an assigned number generated randomly in lieu of name. A master spreadsheet will be created correlating participant name and number for future analysis, meaning there is still a risk of retrospective identification of participants and their scores. Given that there is no formal emergency care training in Uganda and no expectation of provider knowledge of emergency care, there is no risk to employment from identification of provider name with scores. The purpose of the BEC national rollout is to address this gap in provider knowledge.

Risk will be minimized by storing the master spreadsheet securely in an encrypted Excel (© Microsoft, Richmond, WA) document that will be destroyed shortly after the three to six-month post-BEC round of data collection. All quantitative data will be entered into encrypted Excel spreadsheets. Paper copies will be stored in a locked office cupboard at Makerere University. Focus group discussions will be recorded with an audio recording device and transcribed into encrypted Word documents. Once transcribed and back checked, audio files will be deleted. Study personnel will explain all aspects transcription of the audio files, any identifying information will be removed. In the consent process, study personnel will emphasize that participation is voluntary, and request a signed consent form from each participant. In the case of BEC graduates from courses prior to July 2018, verbal consent will be collected and documented. These measures will greatly minimize any risk of participant identification.

#### 5 LIMITATIONS

There are several limitations to this study:

Though the BEC is a national rollout across ten districts and different types of hospital, the results of this study will not be generalizable to every emergency care setting in Uganda.

Language barriers might also limit this study as only fluent English-speakers may participate. This mean some emergency care providers will be excluded from the study and thus not represented.

Both the qualitative and quantitative methods used in this study have inherent limitations. Likert scales are used to quantitatively measure perceptions, attitudes, or opinions. Using a quantitative method to capture inherently qualitative information restricts participants' abilities to describe their true, individual perceptions. Focus group discussions may be biased by group dynamics that may distract or influence participants' stated opinions. Together, Likert scales allow participants to privately share their perceptions whereas focus groups enable sharing of perceptions that is not confined by Likert scale structure.

The MoH began the BEC course prior to this study. Retroactive verbal consent will not be possible for all BEC graduates from courses prior to July 2018. This may limit the sample size of the study.

## 6. BUDGET PER COURSE

Item	Quantity	Unit price UGX	Units	Total Cost UGX
Stationery and course materials for participants	10	15,000		150,000.00
Printing of certificates	10	2,000		20,000.00
Materials for training	1	166,667		166,666.67
MEALS (tea, lunch) 8 participants, 3 trainers, 1 administrator and 1 investigator	13	15,000	4	780,000.00
Professional Trainer Fee	3	200,000	4	2,400,000.00
Administrator Fee	<u>1</u>	<u>180,000</u>	<u>4</u>	720,000.00
<b>TOTAL PER COURSE</b>				<b>4,236,66.67</b>
<b>VALUE PER PARTICIPANT</b>				<b>423,666.67</b>
<b>GRAND TOTAL</b>				<b>25,420,000.00</b>

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**APPENDIX A: BEC PRE- AND POST-COURSE LIKERT SCALE SURVEY**

**Example:**

Please indicate how strongly you disagree or agree with the following statements by crossing the response that best describes you now.

Ms. Lute Citizen has answered these questions in the following way:

**Check a box by crossing it:**

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I like to eat chicken			X	
2. I am cooking chicken.		X		

Question 1, Lute’s answer shows that right now she agrees that she likes to eat chicken.

Question 2, Lute disagrees with the statement that right now she is cooking chicken.

Please indicate how strongly you disagree or agree with the following statements by crossing the response that best describes you now. Check a box by crossing it.

Question	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I feel comfortable handling any patient requiring emergency care.				
2. I feel nervous about seeing patients with emergencies.				
3. I feel that others in my clinical unit have the knowledge and skills to handle emergency care patients.				
4. I feel that I lack the skills to provide care in most emergencies.				
5. I feel prepared to see emergency care patients in my clinical setting.				
6. I feel confident seeing very ill patients.				
7. I feel uncomfortable using standard emergency care protocol.				

8. I feel that I understand the ABCDE's of basic emergency care.

9. I feel my organized approach allows me to be prepared for all emergency care patients.

10. I do not feel confident in my knowledge of emergency care.

## APPENDIX B: BEC PARTICIPANT FOCUS GROUP FACILITATION GUIDE

### How did you feel and why (compliment concepts of the Likert scale)

**Interview Guide:** This is solely a guide. The interviewer will aim to get appropriate information from each participant in the WHO Basic Emergency Care training programme. Not all questions may be necessary and additional follow-up questions may be asked of each trainee to clarify or expand answers given.

**Sections A, B and C will be asked in the focus group immediately post-BEC. Sections B and D will be asked in the focus group three to six months post-BEC.**

#### A. Prior experience and building interview rapport:

*Thank you for your participation in this focus group. I would like to begin by learning more about your different experiences and trainings as healthcare providers.*

- 16) How many years have you been a healthcare provider?
- 17) What has been your training prior to this position?
- 18) Prior to this training, had you ever participated in any emergency care training during your training as a healthcare worker?

#### B. Experience with emergencies:

*Thank you for your comments. I would now like to learn about your experiences addressing medical emergencies.*

- 19) Would someone like to start by describing a medical emergency they have treated?
  - Probing Questions:
    - What type of medical emergency was it? What was wrong with the patient?
    - What did you do to treat the patient?
    - Did you feel confident in your initial assessment and management of the patient?
    - What went well in the assessment, diagnosis and management? What did not go well?

*Allow as many people as volunteer to describe their medical emergency, and probe only with the above points if they do not otherwise cover them. After each person shares, make sure to thank them and acknowledge that their contribution is very valuable though it may be tragic or emotional.*

- 20) Thank you all for sharing your experiences so far. The types of emergencies you have mentioned include .... *(list a summary of what they have shared burns, motor vehicle accidents.....)* Are there any other types of medical emergencies that you see in your community?

#### C. BEC training course -- general perceptions:

*Thank you for your comments. I would now like to learn about your experiences with the BEC training course.*

21) What did you think of the BEC training course?

- Probing Questions:
  - What was as expected and what was not expected in the course?
  - What were your favourite and least favourite parts of the course?
  - What skills did you learn and what skills did you hope to learn that you did not?
  - Did you feel this course will be useful to you in caring for patients in the future? Why or why not?

22) *(For online course participants)* What did you think of the online coursework that accompanied the course?

- Did you find the online resources easy to use and accessible?
- Were the online resources useful in preparing for the course?
- (If applicable): did you use the online resources after the conclusion of the course? If yes, when and why?
- Would you recommend the online resources to a colleague?

23) How could the training be improved?

#### D. BEC training course -- impact:

*Thank you for your comments. I would now like to learn how you feel the BEC training course has impacted you, your healthcare system and your community.*

24) What parts of the course have been most useful for you in your practice as a healthcare provider?

- Have you referred to the online course material in your practice?

25) Was the course useful and appropriate in your clinical setting?

26) Has the training changed how you care for patients or practice emergency care? If yes, how? If no, why not?

27) Do you feel this training has impacted health in your community? If yes, how? If no, why not?

28) Do you think the training should continue for future years? Why? Or Why not?

29) Were there skills you would have liked to learn during the course?

30) Do you have any additional comments or feedback about the training?

Thank you so much for coming and sharing your experiences, thoughts, and opinions with us. Some of the experiences you have described involved death and tragedy. You have provided us with valuable information that will be used to improve the emergency care services in Uganda. As mentioned before, if you feel you would like to speak to me after the session, I will be available. That concludes our focus group session.

## APPENDIX C: BEC SURVEY STUDY PARTICIPANT CONSENT FORM

### CONSENT TO PARTICIPATE IN A RESEARCH STUDY

#### Evaluation of the WHO Basic Emergency Care Course Nationwide Rollout in Uganda

**Investigators:** Dr. Joseph Kalanzi, Makerere University. E-mail: [kajubi.josef@gmail.com](mailto:kajubi.josef@gmail.com) (+256 782 430 333) or Alexandra Friedman, University of California San Francisco and University of Cape Town. E-mail: [alexandr.friedman@gmail.com](mailto:alexandr.friedman@gmail.com) (+256 787 632 574).

**Sponsor:** University of California San Francisco Research Allocation Program for Trainees

**Background and rationale for the study:** The Ugandan Ministry of Health (MoH) has begun a national rollout of the World Health Organization's Basic Emergency Care (BEC) course to strengthen its emergency care system. This course is a clinical training for frontline providers who provide emergency care but have received little or no formal training in the field.

**Research sponsors and organizational affiliation:** Makerere University, Uganda Ministry of Health, University of California San Francisco, University of Cape Town

**Purpose:** We are doing a study on the BEC course's effect on clinicians' knowledge and confidence in providing emergency care and on clinicians' perceptions of the BEC course.

**Procedures:** We invite you to take the BEC multiple choice exam (40 minutes) and provider confidence survey (20 minutes) immediately before and after the course as you normally would, and then again at six months after the course.

**Participants:** About 200 English-speaking medical providers 18 years of age and older already enrolled in the BEC course. Involvement begins prior to the course and extends to six months after the course.

**Risks/Discomforts:** There is minimal risk to your participation in this study. Information provided by you will remain anonymous and confidential. There will be no disclosure of information that may result into administrative consequences. You are free to not answer any interview question in this survey and you can stop the survey at any time.

**Benefits:** There are no material benefits to you from the study.

**Confidentiality:** We will do our best to make sure that the personal information gathered for this study is kept private. However, we cannot guarantee total privacy. Your personal information may be given out if required by law. If information from this study is published or presented at scientific meetings, your name and other personal information will not be used.

**Alternatives:** Study participation is not mandatory, and does not affect your participation in the BEC course.

**Cost:** Participants will bear no costs in this study.

**Compensation for study participation:** There is no compensation for participation in this study.

**Reimbursement:** Participants' cost in time and opportunity will be compensated through meals.

**Questions about the study:** You may contact Dr. Kalanzi at (+256) 782 430 333 or Ms. Friedman at (+256) [787 632 574](tel:787632574) at any time to ask questions about the study.

**Questions about participants' rights:** You may contact the Chairperson of the Makerere School of Medicine Research and Ethics Committee Assoc. Prof. Ponsiano Ocama (+256) 0772421190 or any of the Review Boards below at any time to ask questions about your rights as a research participant. If you wish to ask someone other than the researchers or to voice any problems or concerns you may have about the study, please call the Makerere University Research and Ethics Committee at (+256) 0414-533541; the University of California San Francisco Institutional Review Board at (+1) 415-476-1814; or the University of Cape Town Human Research Ethics Committee at (+27) 21 406 6492.

**Statement of voluntariness:** Participation in this study is completely voluntary and you may refuse to participate at any time. No matter what decision you make, there will be no penalty to you in any way.

**Dissemination of results:** Results of the study will be disseminated through a peer-reviewed publication and the MoH. If published, you will not be identified in any way.

**Ethical approval:** This study has been approved by the Makerere University SOM-REC, University of California San Francisco IRB and University of Cape Town HREC.

**STATEMENT OF CONSENT/ASSENT**

..... has described to me what is going to be done, the risks, the benefits involved and my rights regarding this study. In the use of this information, my identity will be concealed. I am aware that I may withdraw at anytime. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name .....Signature/thumb print of participant ..... Date .....

Name .....Signature of person obtaining informed consent ..... Date

.....

## APPENDIX D: CONSENT TO PARTICIPATE IN A RESEARCH STUDY

**Study Title:** Evaluation of the WHO Basic Emergency Care Course Nationwide Rollout in Uganda

**Investigators:** Dr. Joseph Kalanzi, Makerere University. E-mail: [kajubi.josef@gmail.com](mailto:kajubi.josef@gmail.com) (+256 782 430 333) or Alexandra Friedman, University of California San Francisco and University of Cape Town. E-mail: [alexandr.friedman@gmail.com](mailto:alexandr.friedman@gmail.com) (+256 787 632 574).

**Sponsor:** University of California San Francisco Research Allocation Program for Trainees

**Purpose:** We are doing a study on the BEC course's effect on clinicians' knowledge and confidence in providing emergency care and on clinicians' perceptions of the BEC course.

**Procedures:** We invite you to participate in a focus group about your thoughts on the BEC course for 1-2 hours immediately after the course and then again six months after the course. These focus groups will take place in a private room at your BEC training site and then in a private room at the hospital where you work for a total time spent of 2-4 hours. You will be contacted by Alexandra Friedman close to six-months after the BEC course to schedule the follow up focus group.

**Participants:** About 50 English-speaking medical providers 18 years of age and older already enrolled in the BEC course will take part in the study.

**Risks/Discomforts:** There is minimal risk to your participation in this study. Information provided by you will remain anonymous and confidential. There will be no disclosure of information that may result into administrative consequences. You may choose not to answer any questions that make you uncomfortable, and are free to leave if you feel uncomfortable.

**Benefits:** There are no material benefits to you from the study.

**Confidentiality:** We will do our best to make sure that the personal information gathered for this study is kept private. However, we cannot guarantee total privacy. Your personal information may be given out if required by law. If information from this study is published or presented at scientific meetings, your name and other personal information will not be used.

We will ask you and the other people in the group to use only first names during the focus group. Please do not to tell anyone outside the group what any particular person said. However, we cannot guarantee that each participant will keep the discussions private. Only the investigators will have access to the focus group recordings. These recordings will be transcribed, de-identified, and then deleted.

**Alternatives:** Study participation is not mandatory, and does not affect your participation in the BEC course.

**Cost:** Participants will bear no costs in this study.

**Compensation for study participation:** There is no compensation for participation in this study.  
**Questions about the study:** You may contact Dr. Kalanzi at +256 782 430 333 or Ms. Friedman at +256 787 632 574 at any time to ask questions about the study.

**Questions about participants' rights:** You may contact the Chairperson of the Makerere School of Medicine Research and Ethics Committee Assoc. Prof. Ponsiano Ocama (+256) 0772421190 or any of the Review Boards below at any time to ask questions about your rights as a research participant. If you wish to ask someone other than the researchers or to voice any problems or concerns you may have about the study, please call the Makerere University Research and Ethics Committee at (+256) 0414-533541; the University of California San Francisco Institutional Review Board at (+1) 415-476-1814; or the University of Cape Town Human Research Ethics Committee at (+27) 21 406 6492.

**Statement of voluntariness:** Participation in this study is completely voluntary and you may refuse to participate at any time. No matter what decision you make, there will be no penalty to you in any way.

**Dissemination of results:** Results of the study will be disseminated through a peer-reviewed publication and the MoH. If published, you will not be identified in any way.

**Ethical approval:** This study has been approved by the Makerere University SOM-REC, University of California San Francisco IRB and University of Cape Town HREC.

## CONSENT

You have been given a copy of this consent form to keep.

..... has described to me what is going to be done, the risks, the benefits involved and my rights regarding this study. In the use of this information, my identity will be concealed. I am aware that I may withdraw at anytime. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Name .....Signature/thumb print of participant .....

Date .....

Name .....Signature of person obtaining informed consent ..... Date

.....

## APPENDIX 4: UNIVERSITY OF CAPE TOWN HREC APPROVAL



UNIVERSITY OF CAPE TOWN  
Faculty of Health Sciences  
Human Research Ethics Committee



Room E53-46 Old Main Building  
Grootte Schuur Hospital  
Observatory 7925  
Telephone [021] 406 6492  
Email: [sumayah.ardedien@uct.ac.za](mailto:sumayah.ardedien@uct.ac.za)  
Website: [www.health.uct.ac.za/fhs/research/humanethics/forms](http://www.health.uct.ac.za/fhs/research/humanethics/forms)

23 July 2018

**HREC REF: 330/2018**

**Prof L Wallis**  
Division of Emergency Medicine  
F-51  
OMB

Dear Prof Wallis

**PROJECT TITLE: EVALUATION OF THE WHO BASIC EMERGENCY CARE COURSE NATIONWIDE ROLLOUT IN UGANDA (MSc-candidate-A Friedman)**

Thank you for your response letter dated 18 July 2018, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

**Approval is granted for one year until the 30 July 2019.**

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: [www.health.uct.ac.za/fhs/research/humanethics/forms](http://www.health.uct.ac.za/fhs/research/humanethics/forms))

***We acknowledge that the student: Alexandra Friedman will also be involved in this study.***

**Please quote the HREC REF in all your correspondence.**

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

Signature Removed

**PROFESSOR M BLOCKMAN**  
**CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE**

Federal Wide Assurance Number: FWA00001637.  
Institutional Review Board (IRB) number: IRB00001938

## APPENDIX 5: UGANDAN MINISTRY OF HEALTH LETTER OF SUPPORT

Telephone: General Lines: 256 – 417 – 712260  
Permanent Secretary's Office: 256 – 417 – 712221  
Toll Free: 0800100066

E-mail: [ps@health.go.ug](mailto:ps@health.go.ug)  
Website: [www.health.go.ug](http://www.health.go.ug)  
ADM. 130/313/05



Ministry of Health  
P. O. Box 7272  
Plot 6, Lourdel Road,  
Wandegeya  
KAMPALA  
UGANDA

18<sup>th</sup> July, 2018

To Whom It May Concern,

Dear Sir/Madam;

### **LETTER OF SUPPORT FOR THE STUDY "EVALUATION OF THE WHO BASIC EMERGENCY CARE COURSE NATIONWIDE ROLLOUT IN UGANDA"**

I write this letter of reference to demonstrate the Ministry of Health's support of the joint BEC Course study conducted by Makerere University College of Health sciences, University of California San Francisco, and University of Cape Town. The training is for health workers (doctors, nurses and clinical officers) working in public hospitals across Uganda. Ministry of Health believe that this study is integral to assessing the impact of the BEC training on health workers' knowledge and confidence in the provision of emergency care to patients. Ministry of Health has rolled out WHO Basic Emergency Care training under MKCCAP.

This study has the support of WHO and Ministry of Health, which already collect the BEC pre- and post-course exams mentioned in the study proposal as a standard part of the BEC course. The study has already been submitted for approval to the Institutional Review Boards of UCSF, UCT and Makerere University College of Health sciences. Its submission and execution have our full support with the hope of continuing to improve Uganda's emergency care system through emergency care education.

Thank you for your consideration of this study.

Sincerely,

Signature Removed

Dr. Olaro Charles  
**DIRECTOR CLINICAL SERVICES**

Cc: Permanent Secretary  
Cc: Ag Director General Health Services  
Cc: Commissioner Emergency Medical Services

**APPENDIX 6: MAKERERE UNIVERSITY SCHOOL OF MEDICINE ETHICS  
APPROVAL**



**COLLEGE OF HEALTH SCIENCES  
SCHOOL OF MEDICINE**

**RESEARCH ETHICS COMMITTEE**

September 06, 2018

**Dr. Alexandra Friedman  
University of California  
C/o Dr Joseph Kalanzi  
Makerere University**

Category of Review

- Initial review
- Full board review
- Expedited review
- Continuing review
- Amendment
- Termination of study
- SAEs

Dear Dr. Alexandra,

**Re: Approval of proposal #REC REF 2018-117**

**“Evaluation of the WHO basic emergency Care Course Nationwide Rollout in Uganda”**

Thank you for submitting an application for approval of the above – referenced **proposal**. The committee reviewed it and granted approval for one year, effective September 06<sup>th</sup>, 2018. Approval will expire on September 05<sup>th</sup>, 2019.

**Continuing Review**

In order to continue work on this study (including data analysis) beyond the expiration date, the School of Medicine Research and Ethics Committee must reapprove the protocol after conducting a substantive, meaningful, continuing review. This means that you must submit a continuing report form as a request for continuing review. To best avoid a lapse, you should submit the request six (6) weeks before the lapse date. Please use the forms supplied by our office.

**Amendments**

During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek School of Medicine Research and Ethics Committee approval before implementing it.

Page 1 of 2

# APPENDIX 7: UCSF INSTITUTIONAL REVIEW BOARD APPROVAL



University of California  
San Francisco

## Human Research Protection Program Institutional Review Board (IRB)

### Expedited Review Approval

Principal Investigator

Andrea Tenner MD

**Type of Submission:** Modification Form  
**Study Title:** Evaluation of the WHO Basic Emergency (BEC) Course Nationwide Rollout in Uganda

**IRB #:** 18-24418  
**Reference #:** 231650  
**Committee of Record:** San Francisco General Hospital Panel  
**Study Risk Assignment:** Minimal

**Approval Date:** 09/17/2018 **Expiration Date:** 09/11/2019

**IRB Comments:**

**All changes to a study must receive UCSF IRB approval before they are implemented.** Follow the [modification request](#) instructions. The only exception to the requirement for prior UCSF IRB review and approval is when the changes are necessary to eliminate apparent immediate hazards to the subject (45 CFR 46.103.b.4, 21 CFR 56.108.a). In such cases, report the actions taken by following these [instructions](#).

**Expiration Notice:** The iRIS system will generate an email notification eight weeks prior to the expiration of this study's approval. However, it is your responsibility to ensure that an application for [continuing review](#) approval has been submitted by the required time. In addition, you are required to submit a [study closeout report](#) at the completion of the project.

**Documents Reviewed and Approved with this Submission:**

**Consent Documents**

Study Consent Form	Title	Version #	Version Date	Outcome
Informed Consent Focus Group		Version 1.0	09/14/2018	Approved

For a list of [all currently approved documents](#), follow these steps: Go to My Studies and open the study – Click on Informed Consent to obtain a list of approved consent documents and Other Study Documents for a list of other approved documents.

**San Francisco Veterans Affairs Medical Center (SFVAMC):** If the SFVAMC is engaged in this research, you must secure approval of the VA Research & Development Committee in addition to UCSF IRB approval and follow all applicable VA and other federal requirements. The UCSF IRB [website](#) has



University of California  
San Francisco

**Human Research Protection Program  
Institutional Review Board (IRB)**

**Expedited Review Approval**

*Principal Investigator*

Dr. Andrea Tenner MD

**Type of Submission:** Continuing Review Submission Form  
**Study Title:** Evaluation of the WHO Basic Emergency (BEC) Course Nationwide Rollout in Uganda

**IRB #:** 18-24418  
**Reference #:** 257886  
**Committee of Record:** San Francisco General Hospital Panel  
**Study Risk Assignment:** Minimal

**Approval Date:** 08/07/2019 **Expiration Date:** 08/06/2020

**Regulatory Determinations Pertaining to this Approval:**

**Data analysis phase:**

This study is in data analysis and involves no greater than minimal risk for the population being studied.

**All changes to a study must receive UCSF IRB approval before they are implemented.** Follow the [modification request](#) instructions. The only exception to the requirement for prior UCSF IRB review and approval is when the changes are necessary to eliminate apparent immediate hazards to the subject (45 CFR 46.103.b.4, 21 CFR 56.108.a). In such cases, report the actions taken by following these [instructions](#).

**Expiration Notice:** The iRIS system will generate an email notification eight weeks prior to the expiration of this study's approval. However, it is your responsibility to ensure that an application for [continuing review](#) approval has been submitted by the required time. In addition, you are required to submit a [study closeout report](#) at the completion of the project.

For a list of [all currently approved documents](#), follow these steps: Go to My Studies and open the study – Click on Informed Consent to obtain a list of approved consent documents and Other Study Documents for a list of other approved documents.

**San Francisco Veterans Affairs Medical Center (SFVAMC):** If the SFVAMC is engaged in this research, you must secure approval of the VA Research & Development Committee in addition to UCSF IRB approval and follow all applicable VA and other federal requirements. The UCSF IRB [website](#) has more information.