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Experience of using simulation technology and analytics during the Ebola crisis to empower frontline health workers and improve the integrity of public health systems

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Abstract

The Ebola outbreak highlighted the challenge of health security and particularly of how best to give frontline workers the knowledge, confidence and competence to respond effectively. The goal was to develop a tool to improve infection prevention and control through local capacity building within the context of an emergency response. The research showed that digital technology could be a powerful 'force multiplier' allowing much greater access to high fidelity training during an outbreak and keeping it current as protocols evolved or new safety critical steps were identified. Tailoring training to the local context was crucial to its relevance and accessibility. This initiative used a novel approach to the development of the training tool – ebuddi. It used agile development to co-create the tool with active participation of local communities. A further pilot showed how it could be extended to meet the longer term needs of triage training and ensure better quality assurance. In the longer term it may have the potential to improve compliance with International Health Regulations, be adapted for future emergencies, and contribute to global health security.

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1. Introduction

The recent Ebola outbreak highlighted four key areas of concern in health security. Firstly, it focused attention on the importance of infection prevention and control (IPC) competence and compliance amongst frontline workers in a region as large and remote as West Africa. Secondly, training needed to be accessible to a wide range of people be they working in healthcare and the laboratory sectors or burial teams and maintenance staff - all with large variations in skills, knowledge and education levels [1]. These workers, whether they were professionals or volunteers, needed access to training to keep themselves, their patients, colleagues and families safe. Thirdly, community engagement was vital in controlling the outbreak. Finally, the need to be prepared for novel and new pathogens such as Middle East Respiratory Syndrome Coronavirus (MERS-CoV), Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and other strains showing resistance to anti-microbials. Ebola was not a one off - there will be constant challenges of this nature, requiring healthcare systems to be more resilient, watchful and responsive than

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ever before.

There are important messages to learn about health security from the Ebola response, both in the West African region and globally. Even highly trained international health workers lacked skills in the use of Personal Protective Equipment (PPE) which lead to high profile cases of infection. These observations imply a problem with how such epidemics are handled and without a change in attitude and approach; similar issues could resurface in the next outbreak, as illustrated by the challenge of dealing with the endemic Lassa Fever in the same region [2].

In his article, 'The Next Epidemic - Lessons from Ebola', Bill Gates emphasised the need for better and faster training for health personnel to confront and contain an epidemic quickly [3]. He is not the only figure to draw attention to training on a global stage. Multiple reviews reflect lessons learnt from community empowerment and giving the frontline the tools, knowledge and competences to contain the outbreak [4,5]. This a lesson for all countries as highlighted by the EFN report on EU Health Professionals' Perceptions of Preparedness for Ebola and Infectious Diseases of High Consequence (IDHC) 'We are not prepared unless we are all prepared' [6]. In addition there was the recognition of the importance of innovation and finding smarter ways of responding, but most initiatives struggled to realise their full potential [7, 8,9].

Simulated training can 'bring learning alive' and increase engagement levels [10]. It encourages teamwork, in particular the role of the buddy, which is vital in situations where PPE is required. The digital nature facilitates a network-based approach to distribution allowing tight version control and replication across communities, districts, countries and potentially continents [11,12]. It helps shift training from a classroom based, didactic style delivered by an international expert to a more peer based, personalised approach that overcomes some of the constraints inherent with a centralised, cascade based approach to rolling out new training.

This article presents a model that could transform IPC training. It blends traditional training with tablets to create a technology-enhanced approach that aims to improve patient and health worker safety. The system, known as ebuddi, has been prototyped in West Africa and has the potential to improve quality, accessibility, scalability and legacy of training [10, 13]. This novel approach has attracted international attention and it could be used to improve health systems resilience and outbreak response worldwide.

2. Background

2.1. Masanga Mentor Ebola Initiative

Creating the ebuddi prototype was a collaborative approach between organisations with frontline operational capacity and specialists in medical education, training and agile software development. The Masanga Mentor Ebola Initiative (MMEI) comprised the Masanga Hospital in Sierra Leone, The MENTOR Initiative and experts from Merlin's Lassa Fever Programme. Plymouth University Peninsula Schools of Medicine and Dentistry (PUPSMD) were involved throughout providing input based on pedagogical principles and best practice in virtual learning and distributed simulation.

2.2. Our approach

The core concepts were based on national guidelines and IPC curriculum developed by the Liberian Ministry of Health in association with the WHO and CDC. These were applied to pedagogical mechanics from game based learning and used agile development to interpret them with Graphical User Interface (GUI), animation and language [13]. Initial prototypes were built from videos with WHO expert trainers and photos of the healthcare settings, and evolved through co-creation and agile development. Co-creation by experts and frontline trainers produced an authentic module that engaged the audience more than passive illustrations portrayed in textbooks or demonstrations by international experts alone. Agile development meant that frontline trainers and healthcare workers could feedback to the international development team and see their involvement included in subsequent builds.

Initially the development involved input from diaspora groups able to meet directly with the development team in London. However as communications links were put in place with operational training teams on the ground, input to the development team could be provided directly from those in the frontline - ensuring even greater authenticity and relevance of the training material to the safety critical steps. Fig.1 illustrates this continuous loop of communications between the in-field metrics and international development teams exchanging module iterations with data to improve technical performance and learning impact. The quicker this feedback was incorporated, the more impact it had on subsequent suggestions as trainers were encouraged to see the value of their ideas, encouraging bottom up innovation.

Open innovation and collaboration make digital approaches to learning more accessible and affordable. For such technology-based initiatives, insights such as the Principles for Digital Development act as 'living guidelines that can help development practitioners integrate established best practices into technology-enabled programs' [13]. Considering an open approach to technology-enabled international development would encourage a free flow of ideas that permeate organizational boundaries, not waste public resources unlocking code and duplicating work. The Principles guide strategies for leveraging and contributing to broader resources and knowledge to give greater impact. With these guidelines, we can make a more concerted effort to institutionalise the many hard lessons learned in the use of information and communication technologies in development projects [14].

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