Technology-enhanced learning for healthcare professionals: an essential response to infectious disease pandemics

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In the past 10 years, the world has experienced wave after wave of serious infectious disease outbreaks, including Ebola, influenza, severe acute respiratory syndrome (SARS) and most recently Zika.[1] These infections cause considerable morbidity and mortality, and it is just a matter of time before there is another outbreak. The population affected by these pandemics is not only the general public but also healthcare professionals, including doctors. At best, there might be temporary incapacity to work among healthcare professionals and, at worst, considerable numbers of professionals can die, such as during the recent Ebola outbreak in Sierra Leone.[2] The country's clinical and public health workforce is still recovering from this shock.

There is a major impact across the continuum of health professional education during any pandemic—from training students to providing continuing education for the overstretched and reduced healthcare workforce. The consequence is that clinical care is compromised not only during the pandemic but also in the recovery phase.

The education of medical students can be seriously hampered, with reduced opportunities for clinical teaching. Healthcare is best learnt at the bedside, but this may be impossible during a pandemic. How do we help students and doctors to learn about these infections in the midst of a pandemic? How do we keep them safe from infection and prevent them from further spreading the disease?

During past influenza pandemics, young people have been disproportionately affected—probably because they had no exposure to and so no immunity from previous similar pandemics. Yet, these same young people make up most of our undergraduate and postgraduate learners in healthcare. So what should we do?

Some have suggested that medical schools should be closed or that students should be prohibited from being in contact with patients during a pandemic.[3] An argument for this approach is that students do not have the same duty of care to patients as do qualified healthcare professionals.[4] Also the presence of students is not essential to the care of patients—in the way that the presence of healthcare professionals is. Also, the presence of students can overburden their teachers who are also providing care. Healthcare professionals face numerous educational challenges during pandemics, from keeping updated about the characteristics of the infection and its spread to caring for patients and reducing the outbreak in the population.

While the approach of closing schools might be merited in the most extreme circumstances, it can be difficult to justify when serious infections occur all the time and so it is impossible to eliminate all risks to students in all circumstances. It is also hardly in keeping with attempts to ensure that learners become part of the healthcare team.

An alternative approach is to think about new technologies in healthcare professional education and about how we could leverage these technologies to deliver effective education in a safe environment. It is also worthwhile considering how we could deconstruct exactly what we would like students to learn. Learners certainly must have a good knowledge of pandemic infections and ideally should be able to access knowledge that they will be able to apply in actual practice. In this regard, e-learning could have a real role to play. It puts the learner at no risk and, when it is delivered as it should be, it can deliver evidence-based, interactive and multimedia content. It can deliver case-based and practical knowledge and be followed by assessment leading to certification. All of these features would be helpful both in preparation for and in the midst of a pandemic.

Technology-enhanced learning can also be continually updated—which is critical in a pandemic setting. During the influenza pandemic of 2009, the guidance on prevention and management changed continually as the authorities learnt more about the particular strain of influenza that was causing the outbreak. As a result, providers of learning had to continually check and update their content so that it was still compatible with the latest recommendations. Sometimes recommendations change on a day-by-day basis. It is important to think about updating from the start of the creation of content. Text can be quickly and easily updated. However, video can be more expensive. But short sections of video can be more easily updated—so it is worthwhile thinking in these terms at the beginning of the creation of content. 'Live' or synchronous e-learning resources are one way of ensuring that the content is current at the time of its publication (or broadcast). Twitter or other social media platforms might be a means of disseminating advice;, however, we should exercise caution as myths or misinformation about disease can also be spread by this modality.[5 6] It is important to think about the differentiation between the challenge of ongoing educational activity and the challenge of a dynamic changing knowledge base during the pandemics themselves—these may have different technology-enhanced learning implications and potential solutions. As a general principle, social media, texts and email may be best to deliver the immediacy needed during the actual outbreaks.

Technology-enhanced learning can also be used to deliver specific educational messages to learners during a pandemic—in a timely and reliable way. These messages may relate to more than just clinical medicine. They might relate to advice about caring for the healthcare professionals' family members who are ill or about ethical concerns on how healthcare professionals can fulfil their duty of care to patients while at the same time ensuring that they do not put themselves unnecessarily at risk.[7] Resilience training can improve the preparedness of individuals within an organisation for a pandemic.[7] Technology-enhanced learning can also be used to help healthcare professionals learn about infection control, the isolation of suspected patients and when and how

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to use personal protective equipment. The care of learners and healthcare professionals during pandemics must be paramount—learning resources that can help in this regard will be valued.[8] Finally, in countries with limited clinical and educational budgets, technology-enhanced learning can deliver low-cost and high-value education to high numbers of learners. It can also reach out to generalists and first responders in primary and secondary care. These professionals have a vital role to play in recognising, referring and reporting suspected patients in the early days of a pandemic.[9]

Simulation is also likely to have a role to play. Simulation will allow learners to interact with realistic scenarios and will also enable professionals to learn both clinical and communication skills and to integrate these skills—both of which are critical to medical management in pandemic settings. Simulation also allows learners to get things wrong without harming patients—which is especially important during pandemics when a wrong decision could result in misdiagnosis or mismanagement. This in turn can have adverse consequences for the patient but as importantly can result in spread of infections and so adverse consequences for other patients and public health. Simulation also offers a safe environment for the learner. When mentioning simulation in the context of safety, we usually mean psychological safety, whereby the learner will not feel bad that they have made a mistake or harmed a patient. But in the context of simulation to help learn about pandemics, then the learners' physical as well as psychological safety is at stake. Simulation can help healthcare professionals learn about pandemics without any risk of spread of the condition and this capacity of simulation must be leveraged to its maximum capacity. Even if practicing on patients were of low infective risk, many patients affected by a pandemic are seriously ill or exhausted and so not suitable to be seen by learners in any case. However, in contrast, the simulator will not get tired. Finally, a cornerstone of simulation is team-based learning—and once again this is a good fit with the competencies required during a pandemic—patients need integrated multidisciplinary care delivered by teams who have been trained to work together.

Many of these tenets are true of simulation in almost any context but there may

be some features of simulation exercises that are particular to pandemics. One study emphasised that learners should be 'prepared for the planned chaos of the exercise, uncertainty as part of decision making, and a perceived time pressure to make complex decisions'.[10] This study also emphasised the importance of involving the correct faculty members with the right expertise in developing scenarios that will be credible and that will help learning. This will be a challenge as the correct faculty members will be busy providing clinical care during the pandemic. However, it is important that these faculty members are creating the scenarios as they will have the real-life experience of providing a dynamic response in the midst of a pandemic.

However, it is important to remember that neither e-learning nor simulation represent a panacea. Technology-enhanced learning has an important role to play in education but we should not be seduced by overhyped technology.[11]

The technology should always be secondary to the achievement of learning outcomes and quality improvement. Technology-enhanced learning also depends on learners having the requisite technology and skills to use this technology so that they will be able to access the learning. This is less likely to be a problem in the Western world but it can be a problem in developing countries and it is these countries where many pandemics start. Pandemics are also more likely to spread in poorer countries as such countries often lack the public health infrastructure to bring these infections under rapid control. So, it would be unwise to rely too much on technology-enhanced learning without ensuring first that the technology is fit for purpose in the relevant territories. Different formats of technology-enhanced learning may also be more suitable for different territories—for example, simple and short text-based resources or even text or Short Message Services may be best where equipment is variable or where there is reliance on narrow band internet connections. Resources that are compatible with mobile devices are likely to be useful everywhere. Lastly e-learning resources on infectious diseases cannot be simply parachuted in—consideration needs to be given as to how they can be integrated with existing resources in curricula.[12]

The limitations of simulation in the pandemic context are twofold. First, simulation can never completely reproduce the circumstances of a pandemic—in particular, the level of uncertainty when dealing with patients. And, second, simulation can be prohibitively

expensive—especially in poor countries where pandemics are most likely to start and then get out of control. In simulation, there is the cost of hardware, software, trainers, learners and also patients or actors.[13] These costs can be controlled as long as we are not too drawn in by high technology and that we use the right simulation for the task in hand—this will not always be the most expensive one.[14]

It is likely that simulation and e-learning will play an important role in the pandemics of the future—but we need to think about this area in much greater detail and before the pandemic is on us. We also need to continuously evaluate our efforts so that we can improve what we are doing and so better meet the needs of patients and staff.

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