
EXTENDING THE REACH OF LOCAL HEALTHCARE INITIATIVES WITH MASSIVE OPEN ONLINE COURSES

Louise M. Blakemore [l.blakemore@imperial.ac.uk], Imperial College London, National Heart and Lung Institute [<https://www.imperial.ac.uk/nhli/>], United Kingdom

Abstract

Recent studies indicate that massive open online courses have had limited success in reducing inequalities in access to education. Interestingly, there are exceptions to these findings in the field of healthcare education. This may be due in part to this sector's established expertise in developing short courses for continuing professional development (CPD) and the requirements for healthcare professionals to complete CPD training.

This paper highlights examples where pre-existing healthcare education initiatives have succeeded in increasing access to their programmes by developing massive open online courses and argues that the success of these courses relies on well-established local educational practices. By tailoring courses to address local and national healthcare priorities such as raising the awareness of antibiotic resistant nosocomial infections, or breast cancer prevention strategies, these courses address healthcare challenges that are of direct relevance to prospective students in the region.

These massive open online courses have piloted innovative content developed using local expertise in established learning practices such as inter-professional education, games-based learning and clinical simulations. The examples in this paper have been largely unaccounted for in the current debate surrounding the potential for massive open online courses to remove improve access to education. A unifying theme across the MOOCs discussed in this paper is that they were developed in partnership with pre-existing local healthcare educational initiatives.

Abstract in French

De récentes études indiquent que les cours libres et massivement en ligne n'ont réduit les inégalités d'accès à l'éducation qu'avec un succès limité. De manière intéressante, il existe des exceptions dans le domaine de l'éducation à la santé. Cela pourrait être dû en partie à l'expertise reconnue de ce secteur dans l'élaboration de cours résumés destinés aux professionnels dans le cadre de leur développement professionnel continu et aux exigences imposées aux professionnels de la santé de suivre une formation professionnelle continue.

Cet article met en évidence des exemples d'initiatives d'éducation à la santé préexistantes qui ont permis d'accroître l'accès à leurs programmes en développant des cours libres et massivement en ligne. Le succès de ces cours repose sur des pratiques éducatives locales bien rodées. En adaptant les cours aux priorités de santé locales et nationales, telles que la sensibilisation aux infections nosocomiales résistantes aux antibiotiques ou aux stratégies de prévention du cancer du sein, ces cours traitent de problèmes de santé qui intéressent directement les futurs étudiants de la région.

Ces cours libres et massivement en ligne ont permis de tester du contenu innovant et développé en utilisant une expertise locale dans des pratiques d'apprentissage établies telles que la formation interprofessionnelle, l'apprentissage basé sur les jeux, et la simulation clinique. Les exemples décrits dans cet article ont été largement ignorés dans le débat actuel sur le potentiel des cours libres et massivement en ligne de sorte à améliorer l'accès à l'éducation. Un thème fédérateur parmi les MOOC abordés dans ce document est qu'ils ont été développés en partenariat avec des initiatives éducationnelles préexistantes en matière de soins de santé.

Keywords: MOOCs; healthcare education; continuing professional development; inter-professional education; Latin America; Africa

Introduction

The Global Health Workforce Network (GHWN) has recently recommended reforming healthcare curricula to prioritise the needs of the local community being served (Global Health Workforce Network, 2017). This reform in healthcare curricula is of great importance to low- to middle-income countries (LMICs) where education and training of healthcare professionals is underfunded and gaps in health inequalities are widening (World Health Organization, 2016). The “Global strategy on human resources for health: Workforce 2030” document sets one of the key objectives for 2030 as increasing the training of the health workforce to meet the future needs of the population and health systems (World Health Organization, 2016). In addition to reform of pre-licensure undergraduate degrees and post-licensure postgraduate degrees, one method of delivering this community-tailored education is through continuing professional development (World Federation for Medical Education, 2015).

Healthcare professionals are often required by governing councils to provide evidence of profession- or specialism-specific lifelong learning. This continuing professional development (CPD) may take the form of educational conferences, workshops, formal training, and may be delivered in a face-to-face or online setting. This lifelong learning is generally self-directed and practice-based, and allows healthcare professionals to respond to the changing needs of patients and healthcare systems of their local community (World Federation for Medical Education, 2003). This continuing professional development is also essential for healthcare professionals to stay up to date in advances in science, medicine and relevant technologies. As a result of this requirement for healthcare professionals to complete CPD training throughout their career, many healthcare professionals have been early adopters of massive open online courses.

The massive open online course (MOOC) format has been proposed to act as a method of increasing access to education, particularly in low- and middle-income countries (LMICs) (Carver & Harrison, 2013; Parr, 2013b). Recent studies indicate that this has not borne out. The majority of MOOC students appear to be highly educated, residing in high-income countries (Christensen et al., 2013; Dillahunt, Wang, & Teasley, 2014; Shah & Pickard, 2017). One area in which there have arguably been small successes in increasing access to education is in the healthcare setting, particularly by MOOCs tailored to local healthcare needs (Magaña-Valladares et al., 2016; Medina-Presentado et al., 2016; Stokes, Towers, Jinks, & Symington, 2015). This paper reviews several healthcare MOOC case studies from LMICs and HICs, examining the factors that contribute to the success of these programmes. A unifying theme across the MOOCs discussed in this paper is that they were developed in partnership with pre-existing local healthcare educational initiatives. Particularly in the context of community-tailored healthcare education, it is vital that those developing MOOCs in this area work in partnership with local and national healthcare education initiatives to more effectively meet the educational needs of their students.

This paper also reviews the barriers that healthcare professionals may face in accessing the educational content of MOOCs. It has been noted that the *open* aspect of the term *massive open online course* is often a misnomer (Sandeem, 2013). For example, the Coursera and FutureLearn MOOC platforms do not make course materials and software freely available and adaptable for use by others in line with traditional definitions of the term *open* in the context of open knowledge and education (Open Knowledge International, 2018; Sandeem, 2013). While the Open edX course platform does make course materials and software freely available and adaptable for use by others, it restricts student access to courses on the edX platform based on students’ country of residence (edX, 2018a). The restriction of access to courses based on students’ geographical location also precludes the edX course platform from meeting the definition of *open* in this setting (Open Knowledge International, 2018). These distinctions are important if MOOCs are to be effective in reducing inequalities in access to healthcare

education particularly in low- and middle-income countries where healthcare education is underfunded. Making course materials and software available for adaptation, can facilitate offline continuing professional development training for healthcare professionals in settings with limited internet access.

The Early Adoption of Online CPD Courses by Healthcare Professionals

One of the key reasons for the success of MOOCs in the healthcare sector is the requirement for healthcare professionals to complete continuing professional development (CPD) training to maintain the currency of their professional knowledge. To better understand the factors underlying the success of healthcare MOOCs, it is important to first review the lifelong learning requirements for healthcare professionals. Evidence of continuing professional development is required for a wide range of healthcare professionals undergoing revalidation or recertification processes (Peck, McCall, McLaren, & Rotem, 2000). This continuing professional education may be job role specific, specialty specific, or may relate to wider professional development such as management skills. Professional bodies maintain a register of licensed healthcare professionals at a national level. Within the UK for example, the General Medical Council maintain registers of doctors licensed to practice medicine within the UK (General Medical Council, 2019). Regulations surrounding CPD training are also governed at a national level. CPD for healthcare professionals may be mandatory or voluntary and the requirements regulated by a national professional body or the government (Peck et al., 2000). A recent European study on CPD practice across five professions (dentistry, medicine, nursing, midwifery and pharmacy) within the 28 countries of the EU/EFTA found that mandatory requirements for CPD training were in place in around a third of these countries for all five professions (European Commission, 2013). The remaining countries generally either had voluntary CPD training requirements in place, or a mix of mandatory and regulated voluntary requirements depending on the profession (European Commission, 2013). There is also a lack of international consensus on the regulation of CPD training. Reviews on this topic have noted a shift towards mandatory regulation of CPD training in countries such as Australia, Bhutan, China, India, Malaysia, Pakistan, South Africa and Singapore (Das et al., 2018; Murgatroyd, 2011). However, resolutions at a national level can take time to be translated into practice at a national level. For example, in India medical licensure is regulated at a state-level, and only around a third of State Medical Councils have made evidence of CPD training mandatory for re-registration to date (Das et al., 2018). There are also challenges in ensuring that there are no financial and geographical barriers to CPD training, particularly for healthcare professionals in low- and middle-income countries (Das et al., 2018).

There are elaborate quality assurance process in place in order to ensure that CPD training undertaken by healthcare professionals will meet the requirements of the professional body that regulates their license to practice (Academy of Royal Medical Colleges, 2012). Within the UK for example, a number of professional bodies including medical royal colleges, will review educational materials for the purposes of continuing professional development. If the materials meet a professional body's accreditation requirements, then the educational training event or e-learning can be advertised with the agreed amount of credits and the professional body's logo to convey their stamp of approval (Academy of Royal Medical Colleges, 2012; Royal College of Nursing, 2018; Royal Pharmaceutical Society, 2018; The Royal College of Midwives, 2018). Within Europe, the European Accreditation Council for Continuing Medical Education (EACCME) was established in 1999 by the European Union of Medical Specialists (UEMS) (Union Européenne Des Médecins Spécialistes, 2017). While this Council has a focus towards training for medical professionals, where relevant, approved CPD can be used by other healthcare professionals. Umbrella accreditation of CPD activities by UEMS-EACCME affords accreditation at a European level, circumventing the need for educational providers to apply for accreditation from professional bodies in a number of countries. UEMS-EACCME began accreditation of *live events* such as conferences, seminars and training days in 2000 (Union Européenne Des Médecins Spécialistes, 2017).

Around this time the potential for healthcare professionals to use technology to enhance their CPD, including searching websites to identify educational content relevant to their own practice-based requirements was beginning to be recognised (Barnes, 1998; Davis, 1998). Five years later in 2003, the World Federation for Medical Education (WFME) published the first global standards framework for quality improvement in the continuing professional development of medical doctors (World Federation for Medical Education, 2003). This framework shows that in 2003, distance and *net-based* learning were becoming an increasingly popular method of completing CPD (World Federation for Medical Education, 2003). The framework also recommends that doctors should take responsibility for developing competencies in the use of information and communication technologies for their own self-directed learning, to find resources, and to manage electronic patient records (World Federation for Medical Education, 2003).

As a sign of the increasing number of online CPD courses in Europe, the EACCME began accrediting e-learning materials for CPD purposes in 2009 (UEMS-EACCME®, 2016). While what is widely recognised as the “first” MOOC (massive open online course) was taught in 2008 by Stephen Downes and George Siemens in association with the University of Manitoba, it was not until 2012 that the first larger MOOC platforms were established (Downes, 2012; Parr, 2013a). By the time that the edX, Coursera, Udacity and FutureLearn platforms launched in 2012, many healthcare professionals had been completing continuing education in an online mode of study for over a decade (Barnes, 1998; Davis, 1998). The early adoption of online learning for CPD purposes by healthcare professionals may have contributed to the popularity of healthcare MOOCs.

The Rise in Popularity of Healthcare MOOCs

In 2013 there were around 10 million students enrolled on 1,200 massive open online courses (Shah, 2013). In 2017, this number grew to around 81 million students enrolled on approximately 94,000 courses (Shah, 2018). Of these, approximately 7% of the courses, over 6,000 are on the topic of health and medicine (Shah, 2018). In 2017, the five largest massive open online course platforms were Coursera, edX, XuetangX, Udacity and FutureLearn (Shah, 2018). XuetangX is a Chinese massive open online course platform that uses edX platform software code to deliver MOOC courses (XuetangX, 2018).

The potential for massive open online courses to contribute to healthcare education, particularly continuing professional development (CPD) was quickly recognised (Harder, 2013). Professor Catherine Lucey, the Executive Vice Dean of the School of Medicine at University of California San Francisco led one of the first MOOCs to offer CPD credits to students on the “Clinical Problem Solving Skills” course (Harder, 2013). In 2013, this course had over 28,000 students enrolled, including 200 academics teaching at a range of medical schools in the USA (Harder, 2013). At the time, the ability of MOOCs to transform practice in healthcare education were viewed as twofold, to showcase methods of online learning that could be incorporated into university degrees, and to offer academics insight into the way that topics such as clinical problem solving were taught at other universities (Harder, 2013). There are now numerous MOOCs that offer students from a range of healthcare professions CPD credits following successful completion of the course.

In addition to offering MOOCs as short courses, there are a growing number of online undergraduate and postgraduate degrees hosted on MOOC platforms. In contrast to subjects such as computer science, healthcare science MOOCs tend to supplement rather than replace on-campus undergraduate education (Davies, 2013). This is partially due to the levels of interaction and practical training required to develop clinical skills in undergraduate or pre-licensure programmes in healthcare subjects such as nursing, physiotherapy, pharmacy, medicine and dentistry (Harder, 2013). At the postgraduate level, online Masters healthcare courses with an emphasis on theory, management and data analysis, such as Public Health and Nutritional Sciences are increasingly available on MOOC platforms on a *paid for* basis (Coursera, 2018; edX, 2018b; XuetangX, 2017).

A study of healthcare professionals' learning on MOOCs found that the majority of students demonstrated high levels of self-efficacy and confidence in learning in a MOOC environment (Milligan & Littlejohn, 2016). This may be a result of healthcare professionals developing skills in identifying and successfully completing relevant training as part of their mandatory professional CPD requirements. In addition, it may be linked to these healthcare professionals being confident in completing CPD in an online setting (Barnes, 1998; Davis, 1998). The study by Milligan and Littlejohn also found that a smaller but significant number would benefit from scaffolding activities surrounding digital literacies such as guidance on how to effectively use search engines (Milligan & Littlejohn, 2016). Other research has also indicated that there may be a deficit of this aspect of digital health literacy in certain sectors of the workforce (Atique et al., 2016). It is possible that MOOCs may be able to play a role in educating healthcare professionals in digital literacy skills. Of the students that enrolled in the "Social Media for Healthcare" MOOC on the FutureLearn platform, most students stated that they found it relatively easy to find healthcare information online (Atique et al., 2016). However, over half of the students stated that when they had found this data, they were unsure how to evaluate whether this could be used in making healthcare decisions (Atique et al., 2016). It's worth noting that only 50% of the students enrolled on the course were healthcare professionals, so the findings may not be fully representative of the healthcare workforce. To remedy this gap in digital health literacy authors of this study recommend educating students in basic ICT skills and digital literacy such as being able to confidently search for information and then evaluate it effectively (Atique et al., 2016). These studies indicate that MOOCs developed for healthcare professionals may benefit from incorporating digital literacy guidance in their curriculum (Atique et al., 2016; Milligan & Littlejohn, 2016).

One of the criticisms levelled at healthcare MOOCs has been the prevalence of courses that are only offered in English, and a lack of representation of courses developed by or in partnership with educational institutions in LMICs (Casas, Lazzari, Insausti, Launois, & Fouque, 2016; Liyanagunawardena & Williams, 2014). A study in 2014 reviewed the MOOC courses in the field of health and medicine and found that over 90% of courses were taught in English, and only two of the courses at the time were offered by universities outside of North America, Western Europe and Australia (Liyanagunawardena & Williams, 2014). Additionally, the authors of this study called for greater collaborations with subject experts with expertise in taught content who are based in LMICs, highlighting an example of the "African Health OER Network" (Liyanagunawardena & Williams, 2014). The African Health OER Network was established in 2009 to develop open educational resources on specific conditions and diseases tailored to the requirements of the local communities (Hoosen & Ludewig Omollo, 2010). The African Health OER Network was initially comprised of OER Africa, an organisation with expertise in open educational resources and distance education, and the Kwame Nkrumah University of Science and Technology, the University of Michigan, the University of Ghana, the University of Cape Town and the University of the Western Cape (Hoosen & Ludewig Omollo, 2010). Resources added to the African Health OER Network were all peer reviewed prior to being made available to learners as a quality assurance measure (Saide, 2012). The importance of ensuring that learners in LMICs have equity of access to high quality learning materials in MOOCs has been raised again in a recent study (Laurillard & Kennedy, 2017). This study suggests a third factor, *efficiency* is equally important to ensure that there is a beneficial relationship between the course developer's financial investment, and the return of investment in terms of a course that is of value to the student in terms of local learning needs and recognition of their learning in the form of credit or certification (Laurillard & Kennedy, 2017). The next section describes MOOCs that have been developed in partnership with local educational institutions or healthcare workers in LMICs to address healthcare educational needs that are of a priority to the local community. By meeting these requirements these case studies illustrate how MOOCs may be used effectively to reduce inequalities in healthcare education. This may be of particular relevance for those developing MOOCs for students in low- and middle-income countries where healthcare education is underfunded.

Supporting the Response to Local and National Healthcare Priorities

MOOCs have arguably been the most successful in healthcare education when they have been harnessed by local educational initiatives to target certain sectors of the workforce in response to what are deemed to be national or regional healthcare priorities (Annear et al., 2016; Magaña-Valladares et al., 2016; Medina-Presentado et al., 2016). The following section reviews a range of MOOCs that were considered to be a success from the perspective of course developers as they addressed a learning need of direct relevance to the local community. Learners valued the resources and training, and in certain examples, their accreditation as continuing professional development. The success of these courses can be attributed to their careful instructional design, and that these MOOCs usually represent only one facet of a wider educational programme that involves face-to-face teaching.

Targeting Nosocomial or “Hospital-Acquired” Infections

In Latin America, a MOOC with over one thousand students was successful in increasing knowledge and a commitment to change in practice regarding hospital-acquired infections (Medina-Presentado et al., 2016). The course developers attribute its success in 19 Latin American countries to the instructional languages of Spanish and Portuguese, its use of clinical simulations and electronic rounds on clinical cases, and trained professionals to monitor discussion boards (Medina-Presentado et al., 2016). Hospital-acquired infections are a growing problem in this region and are reportedly underdiagnosed (Aguayo et al., 2015; Labarca, Costa Salles, Seas, & Guzmán-Blanco, 2016; Quesada-Gómez et al., 2015; Salgado Yopez et al., 2017). The developers of this MOOC were keen to raise an awareness of the most common nosocomial infections in Latin America, and to educate healthcare professionals on measures to improve patient safety such as contact isolation policies and hospital hygiene policies (Medina-Presentado et al., 2016).

This course was designed to foster inter-professional education to improve patient safety outcomes. Target healthcare professionals included clinicians working in the specialty of infectious diseases, intensive care clinicians, and biomedical and clinical scientists specialising in microbiology (Medina-Presentado et al., 2016). Students were divided into discussion groups based on their language preference, either Portuguese or Spanish, with shared discussion forums at the beginning and the end of the course. During the clinical simulations on the MOOC, they presented students with a problem and gave them multiple options regarding their course of action (Medina-Presentado et al., 2016). What was interesting about the design of the clinical simulations was that these were profession-specific simulations with physicians taking one set and nurses another (Medina-Presentado et al., 2016). The discussion forums were multi-professional, and the course leads thought that the interdisciplinary nature of the students enhanced the discussion forums and encouraged interprofessional learning (Medina-Presentado et al., 2016). These lessons learned could be applied to future inter-professional MOOCs.

This course is an example of a MOOC developed by a partnership between local, regional and international experts in infectious disease. This MOOC was developed following an invitation from the Society for Worldwide Medical change to a Uruguayan company specialising in developing CPD for healthcare professionals, EviMed, the American Society for Microbiology (ASM) and the University of the Republic Uruguay (Medina-Presentado et al., 2016). Four universities in Brazil and Uruguay contributed to the development of teaching resources and supported the online learning and two-day workshop that accompanied the course (Medina-Presentado et al., 2016). Various organisations advised on the content of the resources to ensure that it met training requirements including the Pan American Health Organisation, the Pan American Organisation of Infectious Diseases, the ASM, and the US Centers for Disease Control and Prevention (Medina-Presentado et al., 2016). One of the limitations of this course is that participants were charged a fee for joining (\$100 for doctors, \$75 for other healthcare professionals). However, scholarships were available for attendees and were often made available for prospective students by national scientific societies. All participants on the course

either received a certificate of completion or a certificate of participation for CPD purposes (Medina-Presentado et al., 2016). It is thought that the lack of a mandatory requirement for healthcare professionals to provide evidence of CPD in some Latin American countries may have influenced the decision taken by approximately half of the students to opt for a certificate of participation (Medina-Presentado et al., 2016).

Raising Awareness of Breast Cancer Prevention Strategies

In Mexico, between the period of 2010-2014 a MOOC was part of a highly effective Government-backed educational strategy to increase awareness of breast cancer prevention strategies amongst healthcare professionals including community healthcare promoters (Keating et al., 2014; Magaña-Valladares et al., 2016). Breast cancer prevention was identified as an educational priority for primary healthcare professionals in Mexico, and the National Institute of Public Health, a local cancer prevention NGO *Tómatelo a Pecho*, and the Global Task Force on Expanded Access to Cancer Care and Control in Developing Countries collaborated to develop a range of training programmes and resources (Magaña-Valladares et al., 2016). This collaboration received additional funding from the National Commission for Social Health Protection of Mexico (Magaña-Valladares et al., 2016).

This initiative featured three strands of training for distinct groups of professionals, a one-day face-to-face session with medical students, a blended learning programme for community health promoters and a blended learning programme featuring a MOOC for physicians and nurses (Magaña-Valladares et al., 2016). The physicians and nurses first completed a one-day face-to-face course that primarily focussed on the practical elements of clinical examinations and the diagnosis of breast cancer. Following this, students progressed to the MOOC course, which was taught in Spanish and hosted on a Moodle virtual learning environment. The organisers chose to deliver the training to the doctors and nurses via a MOOC as they were geographically dispersed across the country. This MOOC had one of the highest completion rates reported with approximately 88% of 11,569 students *graduating* from the course (Magaña-Valladares et al., 2016). The course organisers attributed this success to a game-based learning strategy whereby students were rewarded for progress and the highest scoring students would be posted on a nationwide “leader board” (Magaña-Valladares et al., 2016). Weekly progress reports were circulated to all participants that included a comparison of the relative progress of each of Mexico’s states (Magaña-Valladares et al., 2016). This was thought to foster a competitive spirit amongst the healthcare teams in each state and contributed to the high completion rates. The organisers acknowledged that the innovative method of gamification of the MOOC would not have been possible without the support of the Mexican health authorities (Magaña-Valladares et al., 2016). This course demonstrates that MOOCs can be used to provide CPD training on topics that address the needs of the local community to geographically dispersed students.

Increasing the Availability of Public Health Eye Care Educational Resources

The International Centre for Eye Health (ICEH) at the London School of Hygiene and Tropical Medicine has developed a suite of MOOC courses aimed at improving access to CPD education for healthcare workers in LMICs (Parsley, Patel, Leck, & Stroud, 2016). The ICEH and The International Agency for the Prevention of Blindness (IAPB) have recorded a gap in the number of eye health healthcare workers in Africa and have developed training resources for both generalist and specialist eye health workers (IABP, 2015; Palmer et al., 2014). Of note, the shortage of eye health professionals is particularly profound in French- and Portuguese-speaking African countries (IABP, 2015). One of the first MOOC courses developed by the ICEH, “Global blindness: Planning and managing eye care services” is available in four languages, French, English, Spanish and Portuguese, ensuring that there are no language barriers for the target audience of the course (ICEH, 2018). The course features over 60 individual learning items, and students are advised that the course will require around 4 hours of study per week for 6 weeks (Parsley, Patel, et al., 2016). Many of the courses developed by the Open Education for Eye Health programme at ICEH are available on both the FutureLearn

platform and as “Open Study” courses on the LSHTM’s virtual learning environment (ICEH, 2018). The resources for the course were made available as open education resources (OERs) on the “Open Study” platform and many students, including ophthalmic educators reported using these for teaching and learning in the year after completing the course (Parsley, Patel, et al., 2016). Local eye care educators in Kenya, Botswana and Ghana promoted the first “run” of the MOOC course to eye health care workers (Parsley, Debrah, et al., 2016). In an evaluation of the impact of the course the Open Education for Eye Health programme found that while OERs from the MOOC were being adapted and re-used, one of the ways that the content could be improved is if it were even more tailored to the local context. To resolve this, the team had planned to facilitate partnerships with a range of African educational institutions to enable them to adapt the learning materials to more effectively meet the healthcare requirements of the local community (Parsley, Debrah, et al., 2016).

Knowledge for Managing Public Health Emergencies

The World Health Organisation established its own MOOC platform “OpenWHO” in 2017 to host courses for healthcare professionals to learn about epidemics, pandemics and health emergencies (World Health Organization, 2018c). At present there are over 30 courses hosted on the platform, with a small number offering a certificate of participation to learners following completion of the course (World Health Organization, 2018a; 2018c). OpenWHO have developed a partnership with the NGO Translators Without Borders to translate course materials into the local languages and dialects of the target audience of healthcare workers (World Health Organization, 2018c). For example, following the outbreaks of Ebola in the Democratic Republic of Congo in 2017 and 2018 the WHO Health Emergencies Programme’s Knowledge Transfer team ensured that Ebola resources on the OpenWHO platform were translated into Lingala and Congolese Swahili, the two most common languages spoken in the provinces in which the outbreak occurred (World Health Organization, 2018b). Another example of OpenWHO tailoring their MOOCs to support a recent infectious disease outbreak, is the “Plague: Knowledge for Responders” course that is available in English, French and Malagasy (World Health Organization, 2017b). During the outbreak of plague in Madagascar in 2017 that affected almost 2,000 people, around 71 healthcare workers contracted an illness consistent with the symptoms of the plague, underlining the importance of this educational resource (World Health Organization, 2017a).

One of the key benefits of the MOOCs on the OpenWHO platform is the rapid translation of resources into languages required by healthcare professionals based in the region of healthcare emergencies including infectious disease outbreaks. Another advantage of this platform is the lack of restrictions to learner enrolment to the free courses, and the possibility for learners to download all educational resources including videos, transcripts and audio versions of the videos and presentations for use offline or in their own educational programmes. The simplicity of the OpenWHO platform has been designed for the technical requirements of students who may have limited or intermittent internet access if they are in remote settings (World Health Organization, 2018c). However, from a pedagogical perspective one of the limitations of this platform is the lack of complexity of course design, which does not permit more advanced learning activities such as clinical simulations. Many of the OpenWHO courses have fewer than five learning “steps” and on average students are expected to complete these MOOCs within 1-2 hours (World Health Organization, 2017a). In order for students to be awarded a certificate of participation they are often required to complete a group of MOOCs on one particular topic (World Health Organization, 2018a).

Overcoming Barriers to the Development, Access and Completion of Healthcare MOOCs

Despite the successes of the MOOCs discussed in this paper, barriers to the development, access and completion of healthcare MOOCs remain. Firstly, while an aspiration for many faculties that run MOOCs is to provide access to education to students who may not be able to attend similar classes in person due to financial barriers, for many prospective students,

obstacles to online learning such as access to a reliable internet connection remain (Aboshady et al., 2015; Carver & Harrison, 2013; Marcial, Caballero, Rendal, & Patrimonio, 2015; Parr, 2013b). A recent report estimates that almost 60% of the world's population do not have access to the internet (World Bank, 2016). A study on the use of MOOCs by undergraduate medical students in Egypt found that many final year medical students had taken MOOCs to try and boost their employment prospects by learning more about specialist areas (Aboshady et al., 2015). They found that one of the biggest barriers to participation cited by students was access to an internet connection or slow internet speed (Aboshady et al., 2015). These findings were echoed in a study in another low- and middle- income country (LMIC) that investigated barriers to online learning in the Philippines (Marcial et al., 2015). This study cited the issue of cost and access to the internet as the strongest barrier to participation in open online courses (Marcial et al., 2015).

Secondly, two of the largest global MOOC providers, edX and Coursera restrict enrolment of prospective students based on their country of residence (Shah, 2017). The Open Knowledge Network define openness in relation to knowledge as "Knowledge is open if anyone is free to access, use, modify, and share it – subject, at most, to measures that preserve provenance and openness" (Open Knowledge International, 2018). At present the EdX platform does not permit students living in Cuba, Iran and the Crimea region to enrol on their courses as a result of US sanctions (edX, 2018a). Coursera does not currently permit students from Iran, Sudan, the Crimea region, Cuba, Syria or North Korea to access all or certain parts of their platform (Coursera Help Center, 2018). As a result, healthcare professionals resident in these countries are unable to freely enrol on courses on these platforms. Thirdly, the availability of courses that are available free of charge on the edX platform is likely to be reduced in the future as support fees are introduced (Agarwal, 2018). While it seems as though these changes are being introduced to ensure the sustainability of edX the platform, it is another reason to question which students these courses will remain *open* for.

While edX is restricting access to certain courses, their platform software code, Open edX has also been made *open* and is available online to allow other institutions to set up their own online courses (edX, 2017). This could be a potential avenue for MOOC developers to consider, to ensure equity of access to their courses. Additionally, MOOC developers such as the International Centre for Eye Health (ICEH) at the LSHTM offer students the choice of enrolling on the FutureLearn platform or enrolling for a "Open Study" course on their institutional Moodle virtual learning environment (ICEH, 2018). All of the course contents on the Moodle VLE are OERs that can be downloaded and edited by participants for use in their own online or face-to-face courses (ICEH, 2018). This approach facilitates a wider use of course materials, and the opportunity for students to adapt the course materials for their own teaching in a face-to-face setting.

Barriers to MOOC development should also be taken into consideration. A study investigating academics' views of developing a MOOC from a LMIC found that there were concerns regarding how students would perceive the quality of course content that was developed by a LMIC (Pasha, Abidi, & Ali, 2016). These concerns about whether students may be less likely to perceive the content of the MOOC as *cutting edge* as it was developed in a LMIC appear to be exacerbated by wider issues surrounding the representation of LMICs in academia and academic ranking systems based on citations (Graham, Hale, & Stephens, 2011; Pasha et al., 2016). Despite these initial concerns, the academics at Aga Khan University in Pakistan successfully developed a MOOC on the bioinformatics of drug design, a topic that was identified as one that would benefit healthcare students in the region (Pasha et al., 2016). Taking the technical requirements of their students into consideration, the course developers ensured that all course videos could be downloaded to watch offline at a later date, and that no students would be penalised for failing to complete the online tests within a certain time frame (Pasha et al., 2016). This indicates that despite their initial concerns, it is likely that educators in LMICs are more likely to be attuned to their students educational and technical requirements in relation to MOOC development.

Summary and Recommendations

This paper highlights examples of where MOOCs have been successful in meeting the requirements for community-tailored continuing professional development for healthcare professionals. These examples show that MOOCs can be used to support reform in the national healthcare curricula to ensure that the needs of the local community are prioritised. These courses can be used to supplement the lifelong learning of healthcare professionals and support capacity building in areas of national and regional healthcare priorities. The success of these courses has hinged on collaborative partnerships with local educational initiatives and expertise. While high income countries still make up a large proportion of the global distribution of educational institutions that develop MOOCs, the number of MOOCs developed by LMICs to cater for local educational needs is rising. These courses are taught in languages spoken by students in the local community and can provide evidence of continuing professional development valued by students.

To summarise, MOOCs should be considered as a method to improve healthcare workforce capabilities in areas of key local, national and regional health priorities and may help countries to meet the objectives of the “Global strategy on human resources for health: Workforce 2030” (World Health Organization, 2016). Following a review of the key features of these courses, the following recommendations can be made to massive open online course developers considering creating CPD courses for healthcare professionals:

1. Engage local universities, NGOs and local health authorities in identifying the educational needs of the local community prior to the development of the course and enlist experts from these organisations to contribute to the course design and teaching.
2. Ensure that the language of instruction meets the requirements of the local community and where possible, make the course available in multiple languages to enable enrolment of students from a wider region.
3. Consider whether the MOOC platform will exclude prospective students due to paywalls or students’ country of residence. If it is not possible to change the MOOC platform, ensure that the course materials are freely available to all students on an institutionally-hosted website or virtual learning environment as OERs.

References

1. Aboshady, O. A., Radwan, A. E., Eltaweel, A. R., Azzam, A., Aboelnaga, A. A., Hashem, H. A., Darwish, S. Y., Salah, R., Kotb, O. N., Affi, A. M., Noaman, A. M., Salem, D. S., & Hassouna, A. (2015). Perception and use of massive open online courses among medical students in a developing country: multicentre cross-sectional study. *BMJ Open*, 5(1). doi:10.1136/bmjopen-2014-006804
2. Academy of Royal Medical Colleges (2012). *Standards and Criteria for CPD Activities: A Framework for Accreditation*. Retrieved http://www.aomrc.org.uk/wp-content/uploads/2016/04/Standards_criteria_CPD_activities_0112.pdf
3. Agarwal, A. (2018, May 3). Furthering the edX Mission, Forging a Future Path. EdX [Blog post]. Retrieved from <https://blog.edx.org/furthering-the-edx-mission>
4. Aguayo, C., Flores, R., Levesque, S., Araya, P., Ulloa, S., Lagos, J., Hormazabal, J. C., Tognarelli, J., Ibanez, D., Pidal, P., Duery, O., Olivares, B., & Fernandez, J. (2015). Rapid spread of *Clostridium difficile* NAP1/027/ST1 in Chile confirms the emergence of the epidemic strain in Latin America. *Epidemiology and Infection*, 143(14), 3069-3073. doi:10.1017/S0950268815000023
5. Annear, M. J., Eccleston, C. E., McInerney, F. J., Elliott, K.-E. J., Toye, C. M., Tranter, B. K., & Robinson, A. L. (2016). A New Standard in Dementia Knowledge Measurement: Comparative Validation of the Dementia Knowledge Assessment Scale and the Alzheimer’s Disease Knowledge Scale. *Journal of the American Geriatrics Society*, 64(6), 1329-1334. doi:10.1111/jgs.14142

6. Atique, S., Hosueh, M., Fernandez-Luque, L., Gabarron, E., Wan, M., Singh, O., Salcedo, V. T., Li, Y.-C. J., Shabbir, S.-A. (2016). Lessons learnt from a MOOC about social media for digital health literacy. *Conference Proceedings: Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 5636-5639. doi:10.1109/EMBC.2016.7592005
7. Barnes, B. E. (1998). Creating the practice-learning environment: using information technology to support a new model of continuing medical education. *Academic Medicine*, 73(3), 278-281.
8. Carver, L., & Harrison, L. M. (2013). MOOCs and Democratic Education. *Liberal Education*, 99(4), 20-25.
9. Casas, J., Lazzari, C., Insausti, T., Launois, P., & Fouque, F. (2016). Mapping of courses on vector biology and vector-borne diseases systems: time for a worldwide effort. *Memorias Do Instituto Oswaldo Cruz*, 111(11), 717-719. doi:10.1590/0074-02760160295
10. Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. (2013). *The MOOC phenomenon: who takes massive open online courses and why?* Philadelphia: University of Pennsylvania.
11. Coursera (2018). Global Master of Public Health – Imperial College London. Degrees. Retrieved from <https://www.coursera.org/degrees/global-mph-imperial>
12. Coursera Help Center (2018). International restrictions. Retrieved from <https://learner.coursera.help/hc/en-us/articles/208280116-International-restrictions>
13. Das, S., Shah, M., Mane, A., Goyal, V., Singh, V., & Lele, J. (2018). Accreditation in India: Pathways and Mechanisms. *Journal of European CME*, 7(1), a1454251. doi:10.1080/21614083.2018.1454251
14. Davies, E. (2013). Will MOOCs transform medicine? *BMJ*, 346.
15. Davis, D. (1998). Continuing medical education. Global health, global learning. *BMJ (Clinical research ed.)*, 316(7128), 385-389.
16. Dillahunt, T. R., Wang, B. Z., & Teasley, S. (2014). Democratizing higher education: Exploring MOOC use among those who cannot afford a formal education. *The International Review of Research in Open and Distributed Learning*, 15(5). doi:10.19173/irrodl.v15i5.1841
17. Downes, S. (2012). *Connectivism and Connective Knowledge. Essays on meaning and learning networks*. Retrieved from <http://online.upaep.mx/campusvirtual/ebooks/CONNECTIVEKNOWLEDGE.pdf>
18. edX (2017). Open edX Architecture. Retrieved from <https://edx.readthedocs.io/projects/edx-developer-guide/en/latest/architecture.html>
19. edX (2018a). Fundamentals of Advocacy in Health Policy. Retrieved from <https://www.edx.org/course/fundamentals-of-advocacy-in-health-policy>
20. edX (2018b). Online Master's in Nutritional Sciences. Online Master's Degree. Retrieved from <https://www.edx.org/masters/nutritional-sciences>
21. European Commission (2013). *EAHC/2013/Health/07: Study concerning the review and mapping of continuous professional development and lifelong learning for health professionals in the EU*. Retrieved from https://ec.europa.eu/health/sites/health/files/workforce/docs/cpd_mapping_report_en.pdf
22. General Medical Council (2019). *The medical register*. Retrieved from <https://www.gmc-uk.org/registration-and-licensing/the-medical-register/a-guide-to-the-medical-register>
23. Global Health Workforce Network (2017). *Education Hub*.
24. Graham, M., Hale, S. A., & Stephens, M. (2011). *Geographies of the World's Knowledge*. London: Convocol! Edition.
25. Harder, B. (2013). Are MOOCs the future of medical education? *BMJ*, 346.

26. Hoosen, S., & Ludewig Omollo, K. (2010). The African Health OER Network: Advancing Health Education in Africa through Open Educational Resources. *African Journal of Health Professions Education*, 2(2), 21-22.
27. IABP (2015). *IABP Africa Human Resources for Eye Health Strategic Plan 2014-2023*. Retrieved from https://www.iapb.org/wp-content/uploads/IAPB-Africa_HREH-Strategic-Plan_2014-2023_0.pdf
28. ICEH (2018). Open Education / Free Online Courses / Webinars. Retrieved from London School of Hygiene and Tropical Medicine – International Centre for Eye Health.
29. Keating, N. L., Kouri, E. M., Ornelas, H. A., Méndez, O., Valladares, L. M., & Knaul, F. M. (2014). Evaluation of Breast Cancer Knowledge Among Health Promoters in Mexico Before and After Focused Training. *The Oncologist*, 19(10), 1091-1099. doi:10.1634/theoncologist.2014-0104
30. Labarca, J. A., Costa Salles, M. J., Seas, C., & Guzmán-Blanco, M. (2016). Carbapenem resistance in *Pseudomonas aeruginosa* and *Acinetobacter baumannii* in the nosocomial setting in Latin America. *Critical Reviews in Microbiology*, 42(2), 276-292. doi:10.3109/1040841X.2014.940494
31. Laurillard, D., & Kennedy, E. (2017). *The potential of MOOCs for learning at scale in the Global South*. UCL Institute of Education, London WC1H 0AL: Centre for Global Higher Education.
32. Liyanagunawardena, T. R., & Williams, S. A. (2014). Massive open online courses on health and medicine: review. *Journal of Medical Internet Research*, 16(8), e191-e191. doi:10.2196/jmir.3439
33. Magaña-Valladares, L., González-Robledo, M. C., Rosas-Magallanes, C., Mejía-Arias, M. Á., Arreola-Ornelas, H., & Knaul, F. M. (2016). Training Primary Health Professionals in Breast Cancer Prevention: Evidence and Experience from Mexico. *Journal of Cancer Education: The Official Journal of the American Association for Cancer Education*, 33(1), 160-166. Retrieved from <https://link.springer.com/article/10.1007%2Fs13187-016-1065-7>
34. Marcial, D. E., Caballero, R. D. B., Rendal, J. B., & Patrimonio, G. A. (2015). "I am offline": measuring barriers to open online learning in the Philippines. *Information Technologies and Learning Tools: Theory, Methods and Practice of Using ICT in Education*, 45(1), 14.
35. Medina-Presentado, J. C., Margolis, A., Teixeira, L., Lorier, L., Gales, A. C., Pérez-Sartori, G., Oliveira, M. S., Seija, V., Paciel, D., Vignoli, R., Guerra, S., Albornoz, H., Arteta, Z., Lopez-Arredondo, A., & García, S. (2016). Online continuing interprofessional education on hospital-acquired infections for Latin America. *The Brazilian Journal of Infectious Diseases: An Official Publication of the Brazilian Society of Infectious Diseases*, 21(2), 140-147. doi:10.1016/j.bjid.2016.11.003
36. Milligan, C., & Littlejohn, A. (2016). How health professionals regulate their learning in massive open online courses. *The Internet and Higher Education*, 31, 113-121.
37. Murgatroyd, G. B. (2011). *Continuing professional development: the international perspective*. Retrieved from https://www.gmc-uk.org/-/media/documents/cpd---the-international-perspective-jul-11_pdf-44810902.pdf
38. Open Knowledge International (2018). *Open Definition 2.1*. Retrieved from <http://opendefinition.org/od/2.1/en/>
39. Palmer, J. J., Chinanayi, F., Gilbert, A., Pillay, D., Fox, S., Jaggernath, J., Naidoo, K., Graham, R., Patel, D., & Blanchet, K. (2014). Mapping human resources for eye health in 21 countries of sub-Saharan Africa: current progress towards VISION 2020. *Human resources for health*, 12, 44-44. doi:10.1186/1478-4491-12-44
40. Parr, C. (2013a). MOOC creators criticise courses' lack of creativity. Times Higher Education. Retrieved from <https://www.timeshighereducation.com/news/mooc-creators-criticise-courses-lack-of-creativity/2008180.article#survey-answer>

41. Parr, C. (2013b). MOOCs: another weapon in the outreach armoury. *Times Higher Education* (2109), 11-11.
42. Parsley, S., Debrah, O., Gichangi, M., Leck, A., Molao, C., Ntodie, M., & Patel, D. (2016). *Using open education to strengthen global eye care: Strategic action and international collaboration*. Paper presented at the OER16: Open Culture, Edinburgh, UK.
43. Parsley, S., Patel, D., Leck, A., & Stroud, J. (2016). *Can we use Open Education to bridge the gaps in global eye care training?* Paper presented at the 10th General Assembly – IAPB, Cape Town, South Africa.
44. Pasha, A., Abidi, S. H., & Ali, S. (2016). Challenges of offering a MOOC from an LMIC. *International Review of Research in Open & Distance Learning*, 17(6), 221-228.
45. Peck, C., McCall, M., McLaren, B., & Rotem, T. (2000). Continuing medical education and continuing professional development: international comparisons. *BMJ (Clinical research ed.)*, 320(7232), 432-435.
46. Quesada-Gómez, C., López-Ureña, D., Acuña-Amador, L., Villalobos-Zúñiga, M., Du, T., Freire, R., Guzmán-Verri, C., Gamboa-Coronado, M. d. M., Lawley, T. D., Moreno, E., Mulvey, M. R., Brito, G. A. d. C., Rodríguez-Cavallini, E., Rodríguez, C., & Chaves-Olarte, E. (2015). Emergence of an Outbreak-Associated Clostridium difficile Variant with Increased Virulence. *Journal of Clinical Microbiology*, 53(4), 1216-1226. doi:10.1128/jcm.03058-14
47. Royal College of Nursing (2018). *RCN Accreditation*. Retrieved from <https://www.rcn.org.uk/professional-development/professional-services/accreditation>
48. Royal Pharmaceutical Society (2018). *Accreditation and Endorsement*. Retrieved from <https://www.rpharms.com/about-us/our-services/accreditation-and-endorsement>
49. Saide (2012). African Health OER Network – Impact Study. Retrieved from https://open.umich.edu/sites/default/files/downloads/2012.07._african_health_oer_network_impact_study_final_report_july_2012.pdf
50. Salgado Yopez, E., Bovera, M. M., Rosenthal, V. D., González Flores, H. A., Pazmiño, L., Valencia, F., Alquinga, N., Ramirez, V., Jara, E., Lascano, M., Delgado, V., Cevallos, C., Santacruz, G., Pelaéz, C., Zaruma, C., & Barahona Pinto, D. (2017). Device-associated infection rates, mortality, length of stay and bacterial resistance in intensive care units in Ecuador: International Nosocomial Infection Control Consortium's findings. *World Journal of Biological Chemistry*, 8(1), 95-101. doi:10.4331/wjbc.v8.i1.95
51. Sandeen, C. (2013). Assessment's Place in the New MOOC World. *Research & Practice in Assessment*, 8, 5-12.
52. Shah, D. (2013, October 9). 2013: A Year in Review. Class Central [Blog post]. Retrieved from <https://www.class-central.com/moocs-year-in-review-2013>
53. Shah, D. (2018, January 18). By The Numbers: MOOCs in 2017. Class Central [Blog post]. Retrieved from <https://www.class-central.com/report/mooc-stats-2017/>
54. Shah, D., & Pickard, L. (2017, November 27). Class Central Learner Survey (2017): MOOC Users Highly Educated, Have Experienced Career Benefits. ClassCentral MOOCReport [blog post]. Retrieved from <https://www.class-central.com/report/class-central-learner-survey-2017/>
55. Stokes, C. W., Towers, A. C., Jinks, P. V., & Symington, A. (2015). Discover Dentistry: encouraging wider participation in dentistry using a massive open online course (MOOC). *British Dental Journal*, 219(2), 81-85. doi:10.1038/sj.bdj.2015.559
56. The Royal College of Midwives (2018). *RCM accreditation scheme*. Retrieved from <https://www.rcm.org.uk/promoting/learning-careers/rcm-accreditation-scheme/>
57. UEMS-EACCME® (2016). *EACCME Criteria for the Accreditation of E-Learning Materials (ELM)*. Retrieved from https://www.uems.eu/__data/assets/pdf_file/0017/40157/EACCME-2.0-CRITERIA-FOR-THE-ACCREDITATION-OF-ELM-Version-6-07-09-16.pdf

58. Union Européenne Des Médecins Spécialistes (2017). *The European Accreditation Council for CME (EACCME®)*. Retrieved from <https://www.uems.eu/areas-of-expertise/cme-cpd/eaccme>
59. World Bank (2016). *World Development Report 2016: Digital Dividends*.
60. World Federation for Medical Education (2003). Continuing Professional Development of Medical Doctors. In *WFME Global Standards for Quality Improvement* (pp. 32). WFME Office: University of Copenhagen, Denmark: WFME.
61. World Federation for Medical Education (2015). Continuing Professional Development of Medical Doctors. In *WFME Global Standards for Quality Improvement: The 2015 Revision* (pp. 56). WFME Office, University of Copenhagen, Denmark: WFME.
62. World Health Organization (2016). *Global strategy on human resources for health: workforce 2030*. Geneva, Switzerland.
63. World Health Organization (2017a, 2 November 2017). Plague – Madagascar. Disease outbreak news. Retrieved from <https://www.who.int/csr/don/02-november-2017-plague-madagascar/en/>
64. World Health Organization (2017b). Plague: Knowledge resources for responders (English/Malagasy). Retrieved from <https://openwho.org/courses/knowledge-resources-plague>
65. World Health Organization (2018a, 14 August 2017). Frequently Asked Questions (FAQ). Retrieved from <https://openwho.org/pages/faq>
66. World Health Organization (2018b, 20 August 2018). Online Learning Resources for Ebola virus disease. Retrieved from https://openwho.org/news?locale=en#post_f35a2baf-f74e-4965-9dc1-d2ebe0a54478
67. World Health Organization (2018c). Saving lives by sharing knowledge online. Retrieved from <http://www.who.int/features/2018/sharing-knowledge-online/en/>
68. XuetangX. (2017, September 15). xuetangX and Zhengzhou University launched the first Medical online Master's Degree in Mainland China [Press release]. Retrieved from <https://www.prnewswire.com/news-releases/xuetangx-and-zhengzhou-university-launched-the-first-medical-online-masters-degree-in-mainland-china-300520279.html>
69. XuetangX (2018). About Us. Retrieved from https://www.xuetangx.com/global_detail

Acknowledgement

An earlier version of this paper was submitted as part of the requirement for the Post-Graduate Diploma degree in University Learning and Teaching at Imperial College London. The author would like to thank Dr Kevin Lam from the University of Greenwich for his assistance in translating the paper abstract into French.