One Health education in Kakuma refugee camp (Kenya): From a MOOC to projects on real world challenges

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ABSTRACT

Today, the world counts millions of refugees but only a fraction of them have access to higher education. Despite the multiple public health problems in refugee camps and the need to build local capacities to prevent and combat them, University level courses in public health are largely unavailable for refugees. This paper describes the development, implementation and evaluation of an innovative two-module blended-learning programme on One Health in Kakuma refugee camp (Kenya). This programme combines: (I) Interdisciplinary and multi-expert MOOC on "Global Health at the Human-Animal-Ecosystem interface"; (II) peer-to-peer learning involving students from University of Geneva Master of science in Global Health and research collaborations around specific and locally-relevant problems; (III) onlinementoring and lecturing by experts from the Institute of Global Health in Kakuma. A total of 87 refugees applied to Module 1; 15 started the Module 1 in October 2017, of these 14 completed it and 6 passed the exams, finally five students started the Module 2 in October 2018 which they all passed in February 2019. Five student-led collaborative projects were developed focusing on the conception of a community-based monitoring system for prevalent diseases in the camp. With such a pedagogic approach, the programme provides an overview on Global Health challenges at the human-animal-ecosystem interface and the importance of the One Health approach, and introduces students to scientific research through interdisciplinary and international collaborations and innovation. The high number of applicants and positive feedback from students in Kakuma show the interest in One Health education in the camp. This learning experience ultimately aims at building local knowledge and capacity fostering “One Health” champions to reinforce local and national health system. This framework for One Health education could be potentially scaled up to other camps in Africa and the world.
1. Introduction

Today, 70.8 million people have been displaced globally because of persecution, conflicts, environmental and other disasters, and, among them, 25.9 million are refugees [1]. On average, refugees spend 20 years in exile [2] and only 3% have access to higher education [3]. The potential of this often young, skilled and motivated population remains largely neglected, yet mobile technologies and internet penetration have brought important opportunities [4,5].

MOOCs (Massive Open Online Courses) provide free and high-quality education to the millions of individuals across the world not able to attend a traditional campus course. Although MOOCs have mostly attracted people who live in developed countries [6], they also offer learning opportunities to underserved regions of the world [7]. MOOCs are currently used in refugee camps in Jordan, Kenya, Lebanon, and Turkey (e.g., Edraak, Jamiya Project, Kiron Open Higher Education, and InZone) [8-11] covering domains such as business, engineering, computer science, and social science. Yet, limitations in internet connectivity, learning infrastructure and equipment (e.g., computers), and digital literacy, together with a permanent social insecurity for learners, challenge the scale-up, sustainability and impact of many of these MOOC-based educational programmes [8]. Few studies have quantified the impact of these types of higher education online programmes [9]. For instance, the MOOCs for Inclusion study funded by the European Commission assessed how MOOCs can empower migrants and refugees for better inclusion, re-engagement in education and employment, and found that educational approaches that combine online and on-site teaching are more effective than ‘online only’ in fragile contexts [9]. Students with little digital literacy or formal education background need contact to real people in order to raise questions on difficult to understand concepts and for social networking [9]. In addition, students in refugee camps need context-specific learning support and academic guidance to gain relevant knowledge and skills that could improve their quality of life and career prospects [8,10,12,13].

Despite the multiple public health challenges in refugee camps and the need to raise awareness, educate and build local capacity to prevent and control them, university level on-line courses in public health are currently unavailable, to our knowledge. Between 2009 and 2017, 364 outbreaks of often deadly infectious diseases (e.g., cholera, influenza) affected 108 refugee camps worldwide [14]. Cholera outbreaks struck Kakuma refugee camp (Kenya) in 2005, 2009, 2015, and 2017 [15-18]. Malaria remains a major health concern in camps in tropical Africa and South-East Asia [19-21]. Overcrowding, inadequate sanitation, and poor access to basic health services create optimal conditions for pathogens to spread across camps [14,22]. This raises important concerns about the impact the ongoing COVID-19 pandemic is going to have in such settings [23]. Moreover, many camps, especially those in tropical Asia and Africa, host diverse venomous animals such as spiders, scorpions and snakes, which put refugees at risk of potentially life-threatening stings or bites [24-28].

Most of these diseases result from close socio-ecological connections between humans, animals and their environment (e.g., [29-31]) and can be better understood, prevented and controlled by using scientific knowledge from ecology, veterinary and human medicine and by applying a One Health approach [32]. The One Health approach, based on an ecological approach to public health and the interdependence of human and animal health and their surrounding environment, promotes systemic thinking and transdisciplinary collaborations including multiple sectors (e.g., human and animal health) and local communities. Although there is increasing national and international political recognition of this approach in the fight against antimicrobial resistance and emerging and endemic zoonoses (e.g., Tripartite Collaboration between WHO-FAO-OIE) [33], many initiatives struggle to get implemented at the national and local levels [34-36]. This is partly due to a lack of awareness on the active role that local communities can play to alert about problems and tackle them in collaboration with research institutions and public health authorities [37,38].

Our objective was to develop, implement and evaluate the first blended educational programme on One Health for refugees in Kakuma refugee camp in Kenya. This programme builds on a MOOC on One Health developed by the University of Geneva (UNIGE) and uses a project-based learning model bringing together students from the camp with students at UNIGE and University of Nairobi (UnN).

2. Material and methods

2.1. Kakuma refugee camp and InZone

Kakuma refugee camp (Kakuma hereafter) is located 600 km from Nairobi in the Turkana County, an arid area of northwest Kenya. It is one of the world’s largest refugee camps hosting 193,429 refugees and asylum-seekers from over 19 countries of origin (as of November 2019; [39]).

Considering the numerous public health problems at the human-animal-ecosystem interface and the importance to raise awareness about these problems and to ultimately build local capacity to prevent and control them in Kakuma, the Institute of Global Health of the Faculty of Medicine at the UNIGE together with InZone, decided to develop a One Health educational programme in 2017. InZone is a centre for higher education in refugee contexts at the UNIGE [40]. Since 2010, InZone has offered context-specific credit-bearing courses on human rights, children’s rights, ethics, and basic medical education to refugees in Kakuma [12]. These courses are built on MOOCs and delivered with continuous support to participating students by (I) other students and experts in Geneva via WhatsApp, (II) on-site refugee facilitators, and (III) experts that teach face-to-face in the camp at the end of the MOOC. All InZone activities are conducted with the assistance of the Education and Protection sector of the United Nations High Commissioner for Refugees (UNHCR), which operates the camp in collaboration with RAS, the Refugee Affairs Secretariat of Kenya. InZone has built a solar-powered learning hub in the camp and supports learners with on-site facilitation and the requisite IT infrastructure.

2.2. One Health programme: content and implementation

The eight-week long MOOC “Global Health at the Human-Animal-Ecosystem Interface” (MOOC hereafter) is at the core of the One Health programme. This MOOC was launched in March 2017 on Coursera with the contributions of 44 experts from 20 institutions. It provides an overview of how One Health is interpreted and applied to different health issues (e.g., antimicrobial resistance, rabies) and contexts of the world (see detailed syllabus in Appendix A).

The One Health programme is organised into two sequential and complementary modules. The first, introductory module prepared students for the second, more advanced module. Module 1 also served as selection for highly motivated students prior to their admission to Module 2. Both modules are blended, combining distance learning and face-to-face interactions with experts in Kakuma. Table 1 presents the sequence and content of Modules 1 and 2.

Students in Kakuma had online and on-site support throughout the programme. When following the adapted version of the MOOC (Module 1) or the full MOOC (Module 2), they interacted continuously via WhatsApp with a group of international and interdisciplinary students from the UNIGE’s Master of science in Global Health (MGH hereafter) (peer-to-peer learning approach). MGH students were based in Geneva and followed in parallel the full MOOC on Coursera. Online exchanges between students in Kakuma and Geneva were guided and supervised by two experts at the UNIGE’s Institute of Global Health (IB, RRdC). These experts supported students in Geneva through regular class meetings. They mentored students in Kakuma during the week of on-site lecturing in the camp. In Kakuma, three on-site facilitators
Table 1
Sequence and content of Modules 1 and 2 of the One Health programme implemented in Kakuma.

| Learning objectives | Module 1a Introduction to Global Health at the Human-Animal-Ecosystem Interface | Module 2 Global Health at the Human-Animal-Ecosystem Interface |
|---------------------|---------------------------------|---------------------------------------------------------------|
| Distance learning   |                                 |                                                               |
| Duration            | 6 weeks                         | 8 weeks                                                       |
| Dates               | 16 October - 24 November 2017   | 5 November - 28 December 2018                                 |
| Content             | An adapted version of the MOOC: 11 video-lectures, readings (key definitions and concepts, short scientific articles, etc), online practice quiz | Full MOOC on Coursera: 53 video-lectures, readings (short scientific articles, reports, etc), online practice quiz |
| Learning materials  | A USB stick with video-lectures, readings and a 60 page course guide with detailed instructions for each week | MOOC content online on Coursera and offline via a USB stick provided in advance |
| Mentoring           | Continuous interaction with a group of international and interdisciplinary students from the UNIGE's Master in Global Health (peer to peer learning approach) | Access to the InZone learning hub computers twice a week |
| Activities          | - Discussion and debate on the topic of the week with MGH students via WhatsApp | - Work in interdisciplinary teams on projects aiming at designing a surveillance system for health risks at the human-animal-ecosystem interface in Kakuma refugee camp (Kenya) (project-based learning). Each team included students from Kakuma, MGH and University of Nairobi |
| Face-to-face learning in Kakuma |                                 |                                                               |
| Duration            | 5 days                          | 5 days                                                       |
| Date                | 5–9 February 2018               | 18–22 February 2019                                          |
| Content             | - On-site lecturing involving experts (IB, RRdC) | - On-site lecturing involving experts (IB, RRdC) |
|                     | - Interactive activities: discussions and group work on specific local health problems to further prepare students for a final exam. | - Interactive activities: discussions on theory and practice with a focus on projects |
|                     | - Exam: an oral assessment of the knowledge on the content of the video-lectures and the presentation and assessment of the group work. | - Field work related to the selected project led by a MGH student |
|                     |                                 | - Exam: final MOOC quiz on Coursera, oral exam assessing knowledge and critical thinking, project presentation and assessment |
| Total Duration      | 7 weeks                         | 9 weeks                                                       |
| UNIGE credits       | 3 ECTS                          | 6 ECTS                                                        |

Abbreviations: MGH: UNIGE Master in Global Health, MOOC: MOOC “Global Health at the Human-Animal-Ecosystem interface”.

Supported students and ensured the smooth development of programme activities, while reporting progress to the team in Geneva (e.g., completion of quiz and field work).

2.3. Programme evaluation

At the end of Module 1, experts from the Institute of Global Health used an online anonymous survey to solicit feedback of students in Kakuma on their learning experience and future career perspectives. On-site course facilitators were also surveyed to assess their view on student motivation and practical challenges during the course. Survey questions are included in Appendix B.

At the end of Module 2, the MGH student who visited Kakuma (JM) conducted a focus group discussion in Kakuma with the five students who passed the 2-Module programme to assess, 1) their experience while following this programme; 2) their experience while interacting with the students in Geneva; 3) their experience with project-based learning, and 4) how they will move forward as One Health students.

3. Results

3.1. Students’ engagement and completion of the programme

A total of 67 students in Kakuma applied to the One Health programme. Their motivations for enrolment are reported in Appendix C. To ensure close interaction with the students in Kakuma, a group of 15 was selected to start the Module 1 in October 2017. One student dropped out of the programme for unknown reasons. Six students out of the 14 who completed the Module 1 successfully passed it in February 2018 and accessed Module 2 in October 2018. Two students left the camp and one on-site facilitator joined this Module. The final number of students was five, who passed Module 2 in February 2019. The profile (i.e. gender, age) of applicants and of the students who were selected and passed the Module 1 are shown in Appendix C.

3.2. Programme activity

A total of 26 MGH students (cohort 2017) were involved in Module 1 and 32 MGH students (cohort 2018) in Module 2. MGH students played an important mentoring role. They animated WhatsApp discussions by posting weekly questions and raising topics for debate, and
by providing concept clarifications and responses to spontaneous questions posed by the students in Kakuma (Fig. 1). These questions often referred to general concepts and definitions (e.g., the difference between an emerging and an endemic zoonosis; the difference between an anthroponosis and a zoonosis), but also raised more challenging issues that required MGH students to do additional research to provide their more detailed responses (e.g., whether dog culling would be an effective strategy to tackle rabies in Kakuma, or how citizen science could be applied to tackling public health problems in Kakuma).

3.3. Projects

A total of five student-led projects were developed during Module 2 focusing on the conception of a community-based monitoring system for prevalent diseases in the camp: malaria, cholera, zoonotic food-borne diseases, rabies and snakebite envenoming (Table 2). Each group included one representative from Kakuma, 5–6 MGH students and one student from the UoN. Students in Kakuma were the project focal points in the field providing key information on the camp and the project feasibility, while students from the UoN provided specific technical expertise on the disease based on their own research experience in Kenya. MGH students coordinated the project and supported the research, tapping into the scientific literature and the network of international experts and organisations based in Geneva (e.g., WHO, MSF, UNHCR).

Project proposals were evaluated by experts at the Institute of Global Health in December 2018 and the project on malaria (Table 2) was selected by consensus based on its relevance and feasibility. An MGH student (JM) received a grant from InZone to follow up on this project in Kakuma in February 2019. As we could support only one project, the other student project ideas were not further supported in the field in Kakuma.

3.4. Field validation of the project “Community Based Surveillance System for Malaria in Kakuma Refugee Camp”

First, the MGH student received basic training on mosquito larvae collection and morphological identification at the Vector Control Group at the Swiss Tropical and Public Health Institute in Basel. Once in Kakuma, she trained students in these techniques during larval collection in the field and analysis in the lab using two stereomicroscopes that were brought to the camp (Fig. 2). The project was selected to be presented at the Global Compact on Refugees Academic Network Workshop convened by UNHCR in Geneva on November 13, 2019 and will be further developed by the MGH student during her 5-month internship at the Institute of Global Health.

3.5. Programme evaluation

At the end of Module 1, students in Kakuma and on-site facilitators were invited to complete an online anonymous satisfaction survey. A total of eight out of the 14 students in Kakuma who completed Module 1 and all three on-site facilitators completed the survey. When asked about their motivations to take Module 1: 4/8 students wanted to learn more about One Health and Global Health; 2/8 students were motivated by previous experiences in the field of infectious diseases (e.g., “My motivation was instigated by the Anthrax outbreak in our location a decade ago”, “When I wanted to apply for this course I saw Ebola as one of the main topics at the Human-Animal-Ecosystem so I wanted to learn more about it”); 2/8 students saw Module 1 as an opportunity to engage into community work (e.g., “The need to feel the gaps in our community. These gaps include fighting malaria and snake bites among others”). Concerning the course topics that were most interesting for the students: 5/8 students pointed to health problems associated with animals in the camp and in the world, as well as how these problems can be prevented (e.g., “Zoonotic Tuberculosis due to consumption of unpasteurised dairy products won my heart …. I will use this knowledge to inform locals & families around Kakuma and beyond to stay afloat of the Zoonotic Tuberculosis by taking properly prepared dairy products, especially in the Camp and its
## Table 2

| Title of the project | Objectives | Data to be collected | Community involvement | Tools to be used |
|----------------------|------------|----------------------|-----------------------|------------------|
| InZone in Kakuma Refugee Camp | Establish household level incident-based reporting of dog bite incidents by secondary school children as an integrated surveillance system for One Health. | New cases of diarrhoea among children under 5; type of stool; contact with animals/animal-source food; annual dog census; dog-keeping knowledge, attitudes, and practices; dog bite incidence in community members. | Community members who will be trained to become trainers of One Health education in the camp. With our programme students in Kakuma and the feedback from its participants highlight the interest in practical challenges during the course including limited computer skills and internet access, and lack of smartphones in some cases, or limited access to InZone learning hub due to heavy rain and flooding. | KoBoToolbox, SNIS Call, using an App. 
Three-way data collection system: descriptive data on the snake or call
in Zone comes with certain requirements (having a secondary school diploma, proficiency in English, basic computer skills) that are only met by a minority of refugees. |
and the many ethical considerations around what refugees can and cannot do [45].

Our One Health programme also opens potential educational opportunities for students in Kakuma outside the camp, especially because this programme is part of UNIGE’s continuing education and therefore students obtain 3 ECTS credits for Module 1 and 6 ECTS for Module 2. ECTS credits are recognised in all European Universities and in a growing number of African ones [46]. Yet continuing education and career development remain extremely challenging and uncertain for most refugees, who struggle to obtain requisite funding, equivalence for their foreign credentials, or visas to study in countries outside of their hosting country.

This programme was enriching for MGH students too, particularly because they were confronted with real world problems and with the multiple difficulties related to researching in a refugee camp [47]. Refugee camps are often “black boxes” and access to public health scientific literature is limited, which challenged our students and pushed them to think innovatively (e.g., using social media data and grey literature as sources of information). This also encouraged MGH students to collaborate with students in the camp and those at the UoN in an effort to gain a better understanding of the camp and related public health problems. They also developed their own network of experts from academic and humanitarian institutions in Geneva, which has the potential of generating future professional opportunities.

The programme proposed here provides a framework for One Health education in a refugee camp. This framework could benefit from other training programmes in One Health (e.g., [48]) or include other important topics like climate change [49] to keep evolving. It could be potentially scaled up to other refugee camps in Africa and the world.

Declaration of Competing Interest

The authors have declared that no competing interests exist.

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Appendix. Supplementary data
Supplementary data to this article can be found online at https://doi.org/10.1016/j.oonhlt.2020.100158.