

RESEARCH NOTE

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Rapid implementation of open-access pandemic education for global frontline healthcare workers

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Abstract

Background The recent global pandemic posed extraordinary challenges for healthcare systems. Frontline healthcare workers required focused, immediate, practical, evidence-based instruction on optimal patient care modalities as knowledge evolved around disease management.

Objective This course was designed to provide knowledge to protect healthcare workers; combat disease spread; and improve patient outcomes.

Methods A team of global healthcare workers responded by rapidly creating a competency-based online course. To promote transcultural applicability, the course was developed by an international team of more than 45 educators from over 20 countries. Course delivery included a built-in language translation tool, routine updates, and several innovative course design elements. User feedback was collected to determine efficacy of course content, structure, unique delivery elements, and delivery options.

Results An initial population of online learners ($n = 147$) living in 23 different countries and representing 22 languages completed the course and participated in post-course surveys. An additional population of learners ($n = 505$) attended an in-person offering of course materials. Course participants gave positive feedback and several requested additional courses in similar formats.

Conclusion Global open access education courses may provide needed resources to empower healthcare professionals during health crises. Responsive course design can accommodate diverse learner resources and transcultural applicability.

Keywords Open access, Pandemic response, Frontline healthcare worker, Transcultural, Healthcare

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Introduction

Frontline healthcare workers faced rapidly changing guidelines for Coronavirus Disease 2019 (COVID-19) management as the pandemic emerged. Patient care delivery was complicated by lack of information concerning infective agents, preventative actions, and optimal treatment modalities. The COVID-19 course evolved in response to healthcare workers urgent needs for knowledge and the World Health Organization's (WHO) call to support each country's capacity to respond [1]. The purpose of this open-access course was to rapidly fill the need for a reliable source of up-to-date information for frontline healthcare workers managing COVID-19 patients in acute care during the first year of the pandemic. Course participant feedback guided specific course updates to ensure optimal efficacy of instructional strategies.

Methods

The course, *Covid-19 Orientation for Frontline Healthcare Providers* (COVID course), was rapidly developed and made freely available as an open-access online course in early April 2020. The purpose of the COVID course was to provide essential knowledge for safe, competent, evidence-based clinical practice; protect healthcare workers; combat the spread of COVID-19; and improve patient outcomes. Initial course development took place over two weeks in late March through early April of 2020 with the assistance of volunteer educators from two global non-profit organizations. One course author was active in both course development and in care delivery as a Nurse Practitioner in New York City throughout 2020. They provided the COVID course team with up-to-date information on best-practice guidelines for COVID care as they were developed in the field. Other lead faculty consolidated information on scholarly literature on COVID-19 (peer-reviewed and publications on preprint servers), PPE guidelines, and care adaptations required within multiple locations including remote or resource-limited settings. To ensure quality and promote trans-cultural applicability [2, 3], course development engaged an international team of over 45 volunteer educators from over 20 different countries. Input was obtained and integrated from volunteer educators through regularly scheduled video conferencing, a shared spreadsheet that outlined course objectives and content that had been completed, that a volunteer was in the process of creating, or that needed a volunteer to complete. Volunteers were solicited from a pre-existing database of volunteer educators who were vetted through the nonprofit organizations Nurses International and NextGenU.org].

The 14-hour course addressed 24 mini-modules on six primary topics: introduction to COVID-19, prevention and control, screening and evaluation, caring for

the COVID-19 patient, consideration of effort cessation, and understanding scientific evidence to improve the care of COVID-19 patients. Topics were identified by both volunteer educators and clinicians working in regions affected by the pandemic. The development team implemented best practices in online andragogy including self-assessments, clinical case studies, videos from field experts, and text-based learning options to accommodate low-bandwidth environments [4–6]. The course was hosted via NextGenU.org using the Moodle learning management system. The course went live in the second week of April 2020 and was updated weekly for over a year (including additions of topics such as vaccination information and different treatment modalities) to reflect changes in the science of COVID-19 prevention and treatment modalities.

The course was designed non-linearly, thus all course materials were available without prerequisites and sequential completion of materials was optional. This design choice promoted student self-selection of what materials they needed rather than presupposing that all learners needed all modules in a prescribed order [3, 4]. The course platform supported mobile device use, with mobile phone-friendly options for learners without internet-ready computers [7]. Low-bandwidth learning options were provided, including text-based resources and learning modules. The course was designed in English; however, a built-in Google Translate-based language translation tool was included to improve access to materials for participants who spoke a primary language other than English. The course included an optional final examination based on course competencies for participants who completed all course modules. Participants who completed the examination obtained a certificate of completion upon achieving a final exam score of $\geq 70\%$.

Research design and implementation

This multi-method descriptive study includes feedback from both global online course users and from participants in ten in-person course offerings based upon the online material that were taught by the Network for Human and Social Development in greater Islamabad, Pakistan [7]. Both cohorts received the same course materials, and each of the ten in-person offerings were provided the same content; the in-person course data was included in this study to describe a unique use of online open-access course materials.

Online participants were asked to take an optional pre- and post-course survey with Likert-style questions and free-text opportunities to provide feedback. The online surveys used evaluative questions such as: "I feel confident that I; [1] gained substantial knowledge about the subject matter; [2] learned new skills; [3] felt comfortable learning independently online; [4] the course help

Table 1 Online course Post-survey Likert Mean responses (n = 96)

Question	Mean Response (SD)	Median Response
There were enough learning materials (e.g. text, recorded audio/video lecture, PDF, etc.) to study each competency in appropriate depth	1.51 (0.70)	1
The learning objectives (the goals) for the learning materials were clearly identified	1.53 (0.68)	1
The learning materials were at the right level of difficulty (Likert Scale: 1 - too easy, 3 - correct level, 5 - too hard)	2.95 (0.73)	3
The quizzes contributed to my learning	1.75 (0.92)	2
The multiple choice questions for the quizzes and final exam were understandable	1.83 (1.09)	2
There was enough time to complete the final multiple choice exam	1.45 (0.61)	1
I had sufficiently good internet connectivity to complete this course	1.53 (0.66)	1
What type of device did you primarily use to take this course?	Laptop: 86% Desktop: 6% Mobile Phone: 6% Tablet: 2%	
In the future, I would prefer to take another [organization name redacted] course vs. traditional (classroom) course	2.37 (1.27)	2
I believe the education I received from [organization name redacted] is of equal or better quality than the education available from a traditional university in my home region.	2.37 (1.24)	2
I would recommend this course to a peer	1.95 (0.98)	2

Note: Data represented in this table is composed of data from learners who completed the online post-course survey. All questions are 1–5 Likert scores: 1 - Strongly agree, 3 - Neither agree nor disagree, 5 - Strongly disagree, unless stated otherwise in the question

me achieve my goals”. Items were ranked on a five-point Likert-scales with an additional option of “Not applicable or unable to evaluate.” Survey questions are presented in Tables 1 and 2; face validity for the online survey was established through review by the international panel of educators involved in course development. Demographic data such as age, education level, and location of online course participants was collected to describe the sample and sort participant background information. The online survey was conducted in English, but the automated language translation tool was available for non-English speaking participants.

Participants in the in-person course offerings from the community health organization in greater Islamabad did not participate in the online pre- or post-course surveys. Instead, their comments and feedback were collected anonymously by in-person course instructors at the end of their course. Specific feedback queries were provided to course/project directors digitally. In-person participants were asked evaluative questions similar to the

Table 2 Free text Course Feedback

What did you like best about this course?	How up to date it was
	it was informative and enabled people go give their personal experiences. this helps us learnwhat is actually happening on groubd in different countries
	I really liked the quizzes at the end of most of the modules. It helped me to check my understanding of the material.
	The consideration of mental health was incredibly important and I really appreciated that. I also appreciated the inclusion of the global response section, as I think it is important to understand how different countries have had different outcomes due to different responses to the pandemic.
	It was well-organized and provided timely quizzes to test my understanding of the material
What would you change about this course?	I thought that the length of some of the webinars could be condensed for efficiency
	Less lengthy and more interactive.
	better grammar
	the amount of reading material

Note: A reflective sample of responses from the post-course survey, n = 96. All responses are represented as direct quotes, unedited for grammar/spelling

Likert-style items asked of the online course participants, consisting of agreement with statements such as: “Objectives of training were defined,” “Content was organized and easy to understand,” and “Topics were relevant.” Qualitative data were analyzed using content analysis, a method in which data is coded for meaning and then abstracted to better understand overarching themes contained within the data [8].

No personally identifiable data were collected during this study in either the online or in-person course surveys. Consent was implied by voluntary participation in the optional pre- and post-course surveys. The study was reviewed and approved by the University of British Columbia Institutional Review Board for research ethics.

Results

Online participants

Online survey results included n = 147 participants (response rate of approximately 7.4%) with 99 pre-course surveys and 96 post-course surveys completed (49 participants completed both). Demographic data collected via the pre-course survey revealed that participants lived in 23 unique countries and spoke 22 different primary languages (Fig. 1). Most participants were nurses, physicians, public health, and dental workers. The median participant age was 27. Within the sample, 61% participants reported undergraduate education, 10% reported high school as their highest education, and 27% had completed a graduate degree. Just over half (52%) of the participants were female.



Fig. 1 A graphic representation of geographic locations of participants who completed the pre-course survey

Overall feedback from the post-course survey was positive. Most participants agreed that the course material was of appropriate difficulty, learning objectives were clear, materials were adequate in quality and quantity, and that they would prefer a similar course for future education (Table 1). Ten [10] participants reported the use of the language-translation tool. Seven agreed, two disagreed, and one neither agreed nor disagreed that the language-translation tool helped them understand course materials. The single theme gleaned from analysis of qualitative feedback from open-ended course questions was participant desire for more open-access educational topics, demonstrating a potential demand for more open-access healthcare educational materials (Table 2). A secondary theme was suggestions for course improvement, such as pointing out grammatical errors and suggesting video-based alternative to text-based course activities. Feedback suggesting improvements was noted and/or addressed by course faculty during weekly course content updates.

In-Person participants

Three hundred (300) healthcare providers, 80 non-governmental organization staff, 25 emergency services/rescue staff, and 100 boy and girl scouts attended at least one of the ten in-person courses, of whom 100% provided course feedback. Feedback from the $N=505$ participants in the Islamabad area indicated that a >90% majority felt

that the topics were relevant and the training method was easy to understand.

Discussion

Successful development and implementation of instructional materials for low- and middle-income countries typically focuses on local adaptation [2]. While the success of this course is not necessarily contrary to that advice, the success of the COVID course implies that there may be underrecognized benefits of developing educational materials for a wide audience. The acceptance of COVID course content in an array of settings may be a product of the highly diverse background of the development team along with design strategies that employed intentional concern for course applicability in distinct settings [3].

Educational Equity during the COVID-19 pandemic

During the peak of the COVID-19 pandemic, 90% of learners worldwide had their education disrupted and learners in marginalized groups were particularly vulnerable [9, 10]. While some learners transitioned to online education, many institutions and learners did not have access to resources and infrastructure needed to continue education remotely [10]. Learners in low- and middle-income countries were particularly vulnerable to educational resource shortages, both due an overall insufficiency of resources and lack of resources that were designed for inclusivity [11]. Most public universities in

Brazil, for example, suspended education entirely in 2020 due to lack of digital learning infrastructure [12]. However, the need for inclusive global online learning options long predates the COVID-19 pandemic, particularly for adult learners and continuing education purposes [12]. The pandemic offered an opportunity to address pre-existing and ongoing inequities in educational infrastructure and delivery methods [13]. The open access course described in this study highlights only one example of global efforts to address the need for equitable access to reliable and up-to-date COVID-19 educational materials for global healthcare workers by providing the materials and platform use to learners at no cost.

The most important infrastructure for successful online learning is robust organizational support for online learning, including adequate software for implementing online education and teacher support for technology use [14]. The course described by this study benefitted from pre-existing software infrastructure and a team of volunteer educators who were already familiar with the infrastructure available. The robustness or speed of student internet access is noted to be less important with regards to infrastructure [14]. However, many online education methods implemented during the pandemic relied video conferencing which would be difficult to impossible in low-bandwidth environments [15]. For adult learners, the need to balance learning with other responsibilities like work or family is also a potential barrier [12]. The course described in this study addressed both issues by intentionally creating low-bandwidth learning options and by designing the course as self-directed and self-paced with regards to activity engagement.

Course production and administration considerations

The development team overcame several course production and dissemination challenges. Due to advertisement bans around COVID-19, the course was not advertised through conventional means, so dissemination occurred exclusively through open-access messaging systems and word of mouth. Although only a small sample of participant surveys were received ($n=147$), about 2,000 users participated in the online course despite dissemination challenges.

Due to the emerging nature of pandemic science, many of the earliest practice recommendations came from intermediaries managing COVID-19 patients in surge areas rather than peer-reviewed literature. As scientific literature became available, course content was updated to incorporate the available evidence and changes to practice recommendations. While we believe this to be necessary for curating open-access education materials during an evolving crisis, it did represent a sizable administrative burden to the nonprofit organizations that developed the course.

Course updates are an administrative consideration for any course, and the COVID course saw several types of updates. While some content may be updated to address changes in scientific data, other changes may be required to accommodate participant needs. In this study, numerous participants requested additional video-based and fewer text-based activities. Ultimately, we chose to keep the text-based activities to accommodate low bandwidth users but opted to add more video-based components as optional content to address participants who preferred video-based content. Knowledge imparted and solidified by the open-access course empowered community healthcare workers to step out of their usual practices and meet community needs for COVID-19 mitigation and management.

Limitations

Further research is needed to better understand the needs of learners in open-access courses, especially when dealing with learners from different cultures and geographies. Self-selection bias through convenience sampling and small sample sizes potentially limit this study. Course participants were encouraged to bring course materials/information back to their respective organizations to further increase the number of beneficiaries, however no data from second-hand use of the course materials was collected and any potential community benefits from such information dissemination were not captured by this study. The question “I believe the education I received from NextGenU.org is equal or better quality than the education available from a traditional university in my home region” is biased, particularly for this cohort in which 10% of participants reported no university education. Data from the ten in-person implementations in Islamabad was limited in quality due partly to political instability in Pakistan that limited inter-organizational communications.

Language barriers represent an ongoing limitation in international education. While non-English speaking learners who completed the post-survey reported the built-in language translation tool as helpful, this may be due to selection bias as users who struggled with language barrier issues would logically be less likely to complete English language survey(s). More in-depth research is needed on the feasibility, implementation, and shortcomings of automated language translation tools for education. Regrettably, more advanced statistical analysis or comparisons between student groups was impossible due to the small sample size.

Conclusion

The COVID course successfully provided evidence-based guidelines for frontline healthcare workers during the first 9 months of the pandemic. Incorporating

course updates weekly was essential due to the changing nature of the pandemic and offering unique challenges and accomplishments. The use of translation programs may reduce barriers to educational resource uptake, but further evaluation of automated translation programs is needed to ensure efficacy. Optimal course development for global usage may include highly diverse course development teams, low-bandwidth course activity options, offline readings, mobile phone-friendly course design, and language translation options. Online open-access course curricula may have underrecognized potential for successful implementation as live course offerings in underserved areas. Further research on the efficacy, accessibility, and feasibility of open-access educational courses is needed to better understand the benefits and limitations of future course development.

Acknowledgements

Our heartfelt thanks to all of the educators who contributed to the Covid-19 Orientation for Frontline Healthcare Providers in the Acute Care Setting course, as well as all healthcare workers who persevered in providing patient care during the Covid-19 pandemic.

Author contributions

JC – Data collection, data analysis, manuscript development, manuscript revisions EF – Data collection, data analysis, manuscript development, manuscript revisions MC – Data collection, data analysis, manuscript development, manuscript revisions SK – Manuscript development, manuscript revisions.

Funding

The course was created by Nurses International in partnership with the NextGenU.org. Ms. Chickering is the founder, president, and CEO of Nurses International and the CEO of NextGenU.org. Dr. Frank is the Inventor/Founder of NextGenU.org.

Data availability

and Resources: Data collected during this study may be made available upon reasonable request to the corresponding author. The course described in this study is free and publicly available at: <https://courses.nextgenu.org/course/view.php?id=251>

Declarations

Ethics approval

This study protocol was reviewed and approved by the University of British Columbia Institutional Review Board for ethics in human research.

Consent for publication

All authors have contributed materially to, reviewed, and approved of this manuscript prior to submission. Participant publication consent was not applicable as no personally identifiable data were collected.

Competing interests

The authors declare no competing interests.

Consent to participate

Participation in the anonymous course surveys described in this study was voluntary, informed consent was affirmed at the beginning of the surveys.

Note

A reflective sample of responses from the post-course survey, $n=96$. All responses are represented as direct quotes, unedited for grammar/spelling.

Received: 1 July 2024 / Accepted: 6 January 2025

Published online: 13 January 2025

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