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ORIGINAL ARTICLE

Measuring readiness for and satisfaction with a hand hygiene e-learning course among healthcare workers in a paediatric oncology centre in Guatemala City

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Abstract

E-learning has been widely used in the infection control field and has been recommended for use in hand hygiene (HH) programs by the World Health Organization. Such a strategy is effective and efficient for infection control, but factors such as learner readiness for this method should be determined to assure feasibility and suitability in low- to middle-income countries. We developed a tailored, e-learning, Spanish-language HH course based on the WHO guidelines for HH in healthcare settings for the paediatric cancer centre in Guatemala City. We aimed to identify e-readiness factors that influenced HH course completion and evaluate healthcare workers' (HCWs) satisfaction. Pearson's chi-square test of independence was used to retrospectively compare e-readiness factors and course-completion status (completed, non-completed, and never-started). We surveyed 194 HCWs for e-readiness; 116 HCWs self-enrolled in the HH course, and 55 responded to the satisfaction survey. Most e-readiness factors were statistically significant between course-completion groups. Moreover, students were significantly more likely to complete the course if they had a computer with an internet connection (p=0.001) and self-reported comfort with using a computer several times a week (p=0.001) and communicating through online technologies (p=0.001). Previous online course experience was not a significant factor (p=0.819). E-readiness score averages varied among HCWs, and mean scores for all e-readiness factors were significantly higher among medical doctors than among nurses. Nearly all respondents to the satisfaction survey agreed that e-learning was as effective as the traditional teaching method. Evaluating HCWs' e-readiness is essential while integrating technologies into educational programs in low- to middle-income countries.

Key words: Learning; Education; Internet; Hand hygiene; Developing countries

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Introduction

E-learning is a teaching-learning strategy that promotes interactive learning and has been successfully used to improve hand hygiene (HH) practices in healthcare settings.[1,2] This method offers many advantages and may be particularly useful to train large healthcare worker (HCW) populations.[3,4] However, constraints such as limited technology access, lack of online skills, and little motivation may hinder HCWs' e-learning performance in low- to middle-income countries (LMICs).[5] Here, we examine the influence of some of these e-readiness factors on completion of an e-learning HH course developed for a paediatric cancer centre in Guatemala.

Background

Readiness for e-learning or e-readiness, may vary among learners because of the variability of resources, cultural backgrounds, disciplines, and prior academic qualifications.[6] Thus, measuring e-readiness among learners is necessary before implementing e-learning interventions.[7,8] Although the importance of conducting a comprehensive learner analysis while developing educational materials has been established, little is known about the use of e-readiness measurement tools as a part of the learner analysis, particularly among HCWs at paediatric cancer centres in LMICs.[9]

In 2006, stakeholders at St. Jude Children's Research Hospital (St. Jude; Memphis, TN, USA) and Unidad Nacional de Oncologia Pediatrica (UNOP) established UNOP's infection prevention and control team, which included a paediatric infection disease physician and an infection preventionist nurse, to prevent and reduce infection complications among UNOP patients. Since 2008, another paediatric infectious disease physician joined the team, and monthly mentoring meetings with the St. Jude Infectious Diseases-International Outreach (ID-IO) team are held through the St. Jude www.cure4kids.org teleconference virtual rooms to report and discuss aggregate infection data and other indicators of quality of care. Several infection control and prevention initiatives have been established since the start of the team, including a robust HH program.[10,11] The World Health Organization (WHO) Multimodal Hand Hygiene Improvement Strategy was used as a guide to implement the HH program.[12] In 2011, to understand HCWs' motivation and perceived barriers to practicing HH in the centre and to tailor the HH education provided, a focus group study of different types of HCWs was conducted. Ongoing HH training, introductory training to new employees, and incorporation of visual aids were some of the suggestions that focus group participants mentioned as recommendations to overcoming barriers to HH adherence in UNOP.[11] In 2012, a St. Jude ID-IO program team member [MLG] under the guidance of faculty [MG, DL] from the University of Memphis Instructional Design and Technology Department started developing an e-learning HH course that follows WHO recommendations[3,13] and incorporates UNOP focus group findings.[3,11,14] The 4-week HH e-learning course was released in our virtual classroom via the St. Jude educational website www.Cure4Kids.org in June 2013. Data from the first release of the HH course in this virtual classroom were used for this study.

Methods

Study setting

UNOP is a semiautonomous public paediatric cancer unit in Guatemala City that treats children younger than 18 years old. It has 67 beds, including a six-bed intensive care unit, with a bed occupancy rate over 89%. In 2015, UNOP had 123 registered nurses, 80 auxiliary nurses, 38 physicians, 13 pharmacy staff, 12 respiratory therapists, and four nutritionists. The most common cancer diagnosis at this centre is acute leukaemia, followed by lymphoma and retinoblastoma.

Study design and Participants

This cohort study included HCWs (physicians, nurses, nutritionists, respiratory technicians, and auxiliary personnel) who voluntarily completed the e-readiness assessment tool during any of seven recruitment sessions held at UNOP by an ID-IO member [MG] and the local infection prevention and control team on June 8-12, 2013.

Hand hygiene e-learning course

The e-learning course development followed a behaviourist and cognitivist theoretical approach.[9] It consisted of four 35- to 40-minute asynchronous narrated sessions. Course content was based on WHO Guidelines on Hand Hygiene in Health Care.[13] We obtained copyright consent to include WHO figures and videos in our educational materials.[12]

Learning objectives using Bloom's taxonomy were stated at the beginning of each session. Each session included a pre- and post-test evaluation based on the session's learning objectives and adapted from the WHO knowledge questionnaire on hand hygiene for healthcare workers.[14] The course was available free of charge through the St. Jude educational website (www.cure4kids.org). General instructions about virtual classroom use and assistance with opening an account and course enrolment were provided during recruitment sessions. Participants completed one session per week during four weeks. During each week, supplemental material was provided, which included a PDF version of the narrated material and video scenarios to apply the WHO "My Five Moments of Hand Hygiene" concept. A passing grade on the post-test assessment was required to move forward to the next week's session.

E-readiness assessment tool

Before course enrolment, HCWs were asked to complete an adapted, validated, e-learning Readiness Scale.[8] This tool measures self-perceived readiness to engage in e-learning in six domains: technology access, online skills and relationships, motivation, online audio/video preferences, readiness for online discussions, and the perceived importance of e-learning to their success.[8] For this study, participants responded to selected questions on five-point Likert scale for the technology access and online skills and relationships ratings, with 5 being "completely agree" and 1 being "completely disagree". Demographic information, such as gender, age, profession, and previous e-learning course experiences, were also included in this paper-based questionnaire.

Satisfaction survey questionnaire

This electronic format questionnaire was completed through the virtual classroom by the end of the HH e-learning course. It consisted of two sections: 1) questions directly related to course satisfaction (learning objectives, delivery method, content, duration, and supplemental materials) and 2) questions to assess the course's presenter and coordination. Questions were presented using a five-point Likert scale, with 5 being "completely agree" and 1 being "completely disagree." Some open-ended questions were also included.

Definitions

Classification as *course completed* required that a participant had listened to the four weekly online lectures and obtained a passing grade on all four post-tests. Participants who listened to at least the first weekly online lecture and then dropped out of the course at any point were classified among the course *non-completed* group. The *never started* classification included all participants who completed the e-readiness assessment tool but either never enrolled or enrolled but never took the first online lecture. After calculating average scores for items in the e-readiness assessment tool, we defined *good readiness* for e-learning as self-reported scores above 3 for each item included.

Statistical analysis

Analysis was performed by using SPSS version 23.0 software (IBM, Armonk, NY, USA). The Pearson's chi-square test of independence was used to compare e-readiness factors among course-completion groups. One-way analysis of variance (ANOVA) was used to compare means difference of e-readiness scores among HCW categories. Post-hoc analysis using either Tukey's HSD (honest significant difference) or LSD (least significant difference) test was performed to determine which pair-wise comparison differed. All comparisons were two-sided, and p values ≤ 0.05 were considered to be statistically significant.

Results

Participants

A total of 194 HCWs completed the e-readiness assessment tool during recruitment sessions; 75% were female, 81%were nurses and the most common age group was 20 to 30 years old (54%). Of these, 116 (60%) voluntarily enrolled in the HH e-learning course. Of our initial cohort, 87 (45%) completed the course, 29 (15%) did not complete it, and 78 (40%) never started the course (Table I).

E-readiness factors

Overall average readiness scores among HCWs were greater than 3 for all of the factors included under the technology access domain except availability to a cell phone with internet connection (mean ± SD; 2.79 ± 1.74). Good readiness in regard to online skills and relationships was also found among all HCW categories (Table II).

Table I. Demographic characteristics and e-readiness factors stratified by course completion status

Characteristic	All HCWs (N=194) n (%)	Completed (N=87) n (%)	Non-Completed (N=29) n (%)	Never Started (N=78) n (%)	p value[a]
Sex					0.735
Female	145 (75)	67 (46)	22 (15)	56 (39)	
Age (years)					0.112
20-30	104 (54)	53 (61)	17 (59)	34 (44)	
31-40	62 (32)	26 (30)	9 (31)	27 (34)	
>40	28 (14)	8 (9)	3 (10)	17 (22)	
HCW category					0.123
Nurse	158 (82)	65(75)	26 (90)	67 (86)	
Physician	16 (8)	12 (14)	1 (3)	3 (4)	
Other	20 (10)	10 (11)	2 (7)	8 (10)	
Self-reported as having good e-readiness in these areas:					
Technology access					
Computer with internet*	144 (74)	78 (54)	25 (17)	41 (29)	**0.001**
Fairly new computer*	125 (65)	72 (58)	21 (17)	32 (25)	**0.001**
Computer with adequate software*	131 (68)	72 (55)	23 (18)	36 (27)	**0.001**
Cell phone with internet*	80 (42)	41 (51)	11 (14)	28 (35)	0.279
E-mail account*	142 (74)	73 (51)	25 (17)	44 (31)	**0.001**
Online skills and relationships					
Basic computer skills*	150 (78)	79 (53)	21 (14)	50 (33)	**0.001**
Basic internet skills*	149 (79)	78 (52)	21 (14)	50 (34)	**0.001**
Computer use several times a week*	154 (81)	80 (52)	25 (16)	49 (32)	**0.001**
Communicates effectively*	150 (81)	79 (53)	23 (15)	48 (32)	**0.001**
Other					
Previous e-learning courses[1]	17 (9)	7 (41)	2 (12)	8 (47)	0.819

HCW=healthcare worker

* Percentages for e-readiness factors among the course-completion groups were calculated based on the number of HCWs who reported good readiness for that factor rather than on the total number of HCWs in the overall study. Note that the value of N (i.e., the value of n listed in the All HCWs column) varies for each e-readiness factor.

[1]Percentages for previous e-learning courses were calculated based on the number of all HCWs who participated (N=194)

[a]2-sided p values calculated by using the Pearson's chi-square test of independence for e-readiness factors and demographic characteristics.

Table II. Average e-learning readiness scores of selected factors among healthcare workers (HCWs)

	Mean ±SD Scores in subgroups of HCWs						
E-readiness factor	**ALL HCWs** N=194	**Nurses** (n=158)	**Medical Doctors** (n=16)	**Nutritionists** (n=4)	**Respiratory Therapists** (n=11)	**Other** (n=5)	**p value***
Technology access							
Computer with internet	3.92±1.54	3.82 ±1.56	4.93±0.25	5±0.00	4.36±1.20	1.80±1.78	<0.001
Fairly new computer	3.65±1.55	3.58±2.44	4.75±0.44	4.55±0.333	3.60±1.50	1.80±1.78	0.002
Computer with adequate software	3.74±1.53	3.58±1.56	4.87±0.50	4.75±0.50	4.09±1.22	1.80±1.78	<0.001
Cell phone with internet	2.79±1.74	2.66±1.71	3.56±1.67	4.75±0.50	3.54±1.86	1.00±0.00	0.002
E-mail account	3.94±1.53	3.81±1.56	4.93±0.25	4.75±0.50	4.90±.30	1.80±1.78	<0.001
Online skills and relationships							
Basic computer skills	4.11±1.26	4.02±1.32	4.81±0.40	5±0.00	4.54±0.68	3.2±1.48	0.020
Basic internet skills	4.13±1.69	4.01±1.86	4.87±0.34	5±0.00	4.72±0.46	3.4±1.67	0.016
Computer use several times a week	4.15±1.42	4.05±1.24	4.75±0.44	5±0.00	4.63±0.67	3.6±1.67	0.041
Communicate effectively using online technologies	4.13±1.21	4.03±1.25	4.75±0.44	5±0.00	4.81±0.40	3.2±1.78	0.007

[a]2-sided p values calculated by using one-way analysis of variance.

The mean e-readiness scores of HCW subgroups for technology access and online skills were all significantly different (Table II). Post-hoc analysis found significantly higher e-readiness scores among medical doctors than nurses for email account (p=0.031), and access to a fairly new computer (p=0.029) with adequate software (p=0.015) and an internet connection (p=0.038). Compared to the e-readiness scores of nurses, those of medical doctors were significantly higher for basic computer skills (p=0.015), internet skills (p=0.011), computer use several times a week (p=0.026), and communication skills using online technologies (p=0.022). There was no significant difference between the e-readiness factors of medical doctors or nurses and those of nutritionists or respiratory therapists. Contrarily, doctors had significantly higher e-readiness scores across all e-readiness factors than did 'others'. Several other comparisons between any subgroup of HCWs vs. 'other' yielded significant differences. The 'other' group had the lowest scores of any subgroup across all e-readiness factors (Table II).

Most e-readiness factors were significantly associated with successful course completion (p=0.001), and only 2 factors were not. Neither access to a cellphone with an internet connection (p=0.279) nor having previously participated in an e-learning course (p=0.819) significantly affected the course completion status of participants (Table I). Comparing e-readiness factors and final outcome (i.e., course-completion status) yielded no significant differences in gender (p=0.735), age group (p=0.112), or HCW categories (p=0.123) between the three groups.

Satisfaction Survey

In all, 55 HCWs (63% of participants who completed the course) responded to the satisfaction survey. Mean satisfaction scores for all HCW categories were high, generally greater than 4.0 of 5.0 (Figure 1). Furthermore, 96% agreed that e-learning was an effective teaching method for a HH course, and 89% considered e-learning to have been as effective as the typical teaching method.

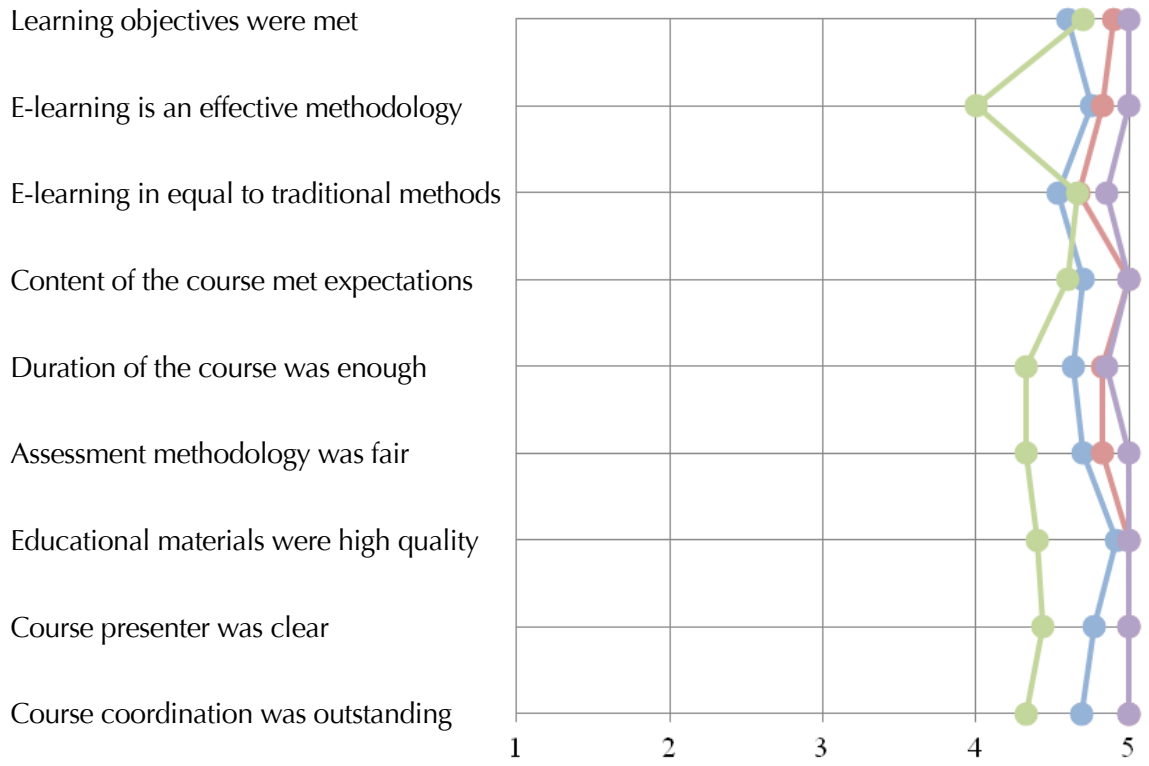

Figure 1. Results of our hand hygiene e-learning course satisfaction survey among nutritionists (green), nurses (blue), physicians (pink), and respiratory therapists (purple). Questions were presented on a 5-point Likert-scale, with 5 being completely agree and 4 being strongly agree.

Ethics

This study was approved by the Institutional Review Boards of Universidad Francisco Marroquín, Guatemala, and the University of Memphis, TN, USA. Informed consent was obtained from the study's participants.

Discussion

Our results demonstrate the significance of measuring e-readiness among HCWs before implementing a HH e-learning intervention in paediatric cancer centres in LMICs. Measuring e-readiness allowed us to identify a number of HCWs who had good readiness for online skills but limited access to technology to complete the course. Information about e-readiness scores was fundamental to our offering additional teaching options to HCWs who have limited access to technology. The local infection control team not only requested local leadership to enable resources at the paediatric cancer centre but also scheduled weekly sessions for HCWs who wanted to listen to the course as a group.

We found that a significantly greater proportion of HCWs completed the HH e-learning course when good technology access and online skills readiness factors were reported. However, the overall response of HCWs to completing the HH e-learning course was less than expected (40%, 87/196). Thus, although assuring technology access and online skills is essential while developing e-learning HH educational programs, other factors need to be addressed. For example, learner motivation, leadership engagement, and institutional support are key to any e-learning strategy in LMICs.[5] After the release of the first HH e-learning course, which was a voluntary course, the paediatric oncology centre leadership included the course in their mandatory training curriculum, and other incentives were implemented. After leadership engagement, four versions of the HH e-learning course have been provided to UNOP personnel, and all HCWs who have direct/indirect contact with patients have taken the course at least once.

The positive effect of the e-learning intervention on HH compliance rates at UNOP has been reported elsewhere.[15]

Although physicians are usually less prone to attend HH educational sessions than are other types of HCWs, we found that a greater proportion of physicians completed the HH e-learning course than did other types of HCWs.[16,17] The difference may be attributable to the fact that our HH e-learning course used an asynchronous method, and physicians had access to the weekly lecture at any time in any place where an internet connection was available. Traditional teaching methods might require physicians to decline attending HH educational activities due to multiple time-restraint scenarios. Moreover, physicians were the HCWs with the highest mean scores across all e-readiness factors. Therefore, e-learning offers a venue to explore as a strategy to increase physician participation in HH educational activities in healthcare facilities. This teaching/learning method was well received among all HCW categories, but physicians and respiratory therapists were the most satisfied with the HH e-learning intervention.

To successfully implement HH or other e-learning interventions, healthcare facilities in LMICs should have strategies to homogenise technology access and online skills among HCW categories. Guaranteeing institutional access to technological items such as computers, software, high-speed internet, and information technology technical expertise might facilitate the introduction of e-learning. Furthermore, additional training should be provided for those who lack basic online skills. Finally, it would be important to use standardised tools that allow healthcare facilities to determine readiness for e-health at the institutional level before implementing any e-learning intervention to avoid losses in time, money, and effort if they are not prepared.

Our study had several limitations. The sample size of our study group was relatively small, and because it was conducted at a single centre, it cannot represent paediatric cancer HCWs in all LMICs. Moreover, course completion might have been influenced by the voluntary nature of our study and by the inclusion of a pre-sensitized group of HCWs who are more compliant with infection prevention and control strategies due to their contact with a highly vulnerable patient population. Thus, generalisability of our study to centres that care for other patient populations or to a target audience with a different perspective about the long-term goal of the training is limited. Finally, we did not include other e-readiness factors, such as individual motivation, institutional readiness, and leadership engagement, which would have independently contributed to course completion. A future prospective study, with a larger sample size and multi-centre participation, must be conducted to address this limitation.

In summary, we describe e-readiness factors at the learner level that might have positively influenced completion of a HH e-learning course in a paediatric cancer centre in a LMIC. Our findings not only identified significant e-readiness factors to address before implementing HH e-learning interventions but also should encourage infection control professionals in LMICs to use e-learning as a strategy to increase physician participation in HH educational activities. Finally, our findings demonstrate the feasibility of implementing HH e-learning interventions in LMICs, especially when a solid twining program with an institution in a high-income country, such as that between UNOP and St. Jude, is in place.

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