Online Health Education on SARS to University Students During the SARS Outbreak

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Abstract

Little is known about how online learning may be used to disseminate health information rapidly and widely to large university populations if there is an infectious disease outbreak. During the SARS outbreak in Singapore in 2003, a six-lesson elearning module on SARS was developed for a large university population of 32,000 students. The module was developed within 2 months by 12 academic staff from medicine, economics, basic science, health promotion, microbiology, epidemiology and public health with support from 2 IT experts and 2 support staff. To ensure coverage of the entire student population, all students were required to complete the module within 9 months of its implementation to fulfill the graduation requirement. About 5,000 (16%) students read the module within the first month and almost all (96%) within 9 months of its implementation. The majority (86%) of the students who took the module for credits passed the module. Using this online format, health information was disseminated rapidly and efficiently to all university students during the SARS outbreak. This module could be adapted to other institutions with Internet support to disseminate timely health messages efficiently should an infectious disease outbreak occur.

Introduction

The bird flu outbreak in Southeast Asia and fears of an emergence of a flu pandemic highlight a need to plan proactively for the timely and efficient dissemination of health information to high risk groups to prevent transmission. The electronic communication media enables information to reach much wider audiences than possible through means such as traditional media. During the Severe Acute Respiratory Syndrome (SARS) outbreak, the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC) in the United States, and many countries utilized the Internet to disseminate SARS-related messages rapidly to the public and health care providers. The Travelers' Health Website, located within the CDC Web site, recorded more than 4 million visits to its sites on travel alerts, advisories and other SARS related documents in mid 2003.[1]

The recent rise in infectious disease outbreaks worldwide, particularly in developing countries in Asia, has prompted the Association of Schools of Public Health in the United States to work closely with CDC to deliver online training materials on public health preparedness pertaining to infectious diseases for health professionals.[2-5] Online training modules have been developed by the North Carolina Centers for Public Health Preparedness (NCCPHP) and these were provided free to public health professionals to improve their knowledge, skills, and awareness on public health preparedness. A recent survey found that the NCCPHP Training Web Site has effectively reached its target audience of public health workers in all 50 US states and 122 foreign countries.[5]

Many of these websites on infectious disease prevention and control are developed in the West. In the event of an unforeseen disease outbreak, local health messages have to be developed or adapted from these sources to suit the socio-cultural context of local communities. Delivery of these health messages should not only be timely, rapid, and efficient particularly in countries with scarce resources, but maximum coverage of high risk groups, particularly those residing in institutions, is also crucial. However, not much is known about how online learning may be used to achieve total coverage of large university populations during an outbreak. A better understanding is needed on (i) how to ensure that all of the target groups would read the materials and (ii) how to use the Internet to disseminate health information to the intended target groups not only rapidly but also efficiently.

During the SARS outbreak in Singapore in 2003, a multidisciplinary team from the National University of Singapore, with support from the Centre for Instructional Technology and the Ministry of Health developed an online 6-lesson module on SARS for its entire population of 31,983 students within 2 months, without incurring additional space, funding or personnel resources. This paper describes the development and implementation of the module, in particular, with regard to the measures instituted to ensure that all students would access and read the module.

Background

Singapore experienced a major SARS outbreak in April 2003, with 201 cases, 722 suspect cases and 25 deaths.[6] In order to contain its spread within the community, intensive public health education campaigns on SARS were conducted by the government. The National University of Singapore was at that time preparing for its new intake of students, some of whom would be coming from SARS-affected countries, for the new academic year in August 2003. As there was concern that close contact of students staying in the hostels and lecture halls might potentially lead to a worsening of the outbreak, mandatory measures were instituted for students to take their temperatures daily, so that any case of SARS would be detected early, isolated and treated. It was noted, however, from student feedback that some students were unaware of the socio-economic and public health impact of SARS, and did not understand the basis for temperature taking and personal preventive measures. Hence, there was an urgent need to disseminate health education on SARS to the large student population of almost 32,000 to increase their awareness of the importance of personal protective measures without straining the existing scarce manpower resources.

Methods

Module development: application of social marketing mix to ensure student participation

Some components of the marketing mix of the social marketing model namely, price, product, place and promotion, were used to develop the module.[7] The element of price comprises what the target audience is willing to give up in order to receive the product's benefits. We believe that students would be willing to sacrifice their much valued resources such as time to read the module if it brings benefit to them such as contributing to their successful completion of the course and helping them get their degrees. Hence, we decided to make this

module as part of the graduation requirement for all students. In addition, the module was also offered as a credit module. With regard to the product or message contents, much attention was given to enhance the 'attractiveness' of the message by making it student-centered, interesting and simple but yet clear to the students. Finally, with regard to promotion and place, we decided to use the Internet of the university as this is accessible to all students at any time and place. The stages in the development of the module are described below and summarized in Figure 1.

Determining module contents

The Head of the Department of Community Occupational and Family Medicine (COFM) formed a team to discuss the objectives, content and delivery of the SARS module. We agreed that the module should aim at increasing students' awareness about the clinical features of the disease and its impact on the community, and equipping them with the skills to protect themselves against the disease and limit its spread. We discussed and identified core information that students should know to achieve the abovementioned objectives. In view of the multidisciplinary nature of the module, we mobilized the department's team of experienced academic staff who come from a wide range of disciplines, namely, basic sciences, public health, occupational health, family medicine, health economics, epidemiology, and health promotion. In addition, we also worked with academic staff from the microbiology and medicine departments, and epidemiologists from the Ministry of Health who had hands-on experience in the investigation and control of the SARS outbreak.

The module was organized into 6 short 30-40 minute lessons:

1. The Science of the SARS Corona Virus

2. Clinical features and treatment of the disease

3. Preventive and control measures at community, national and international level

4. The scientific basis of personal preventive measures:

5. International and national responses to SARS

6. Economic, medico-legal and social science issues related to SARS:

Increasing access to message: integrating into university's web-based tools

There was an urgent need to reach the entire population of 31,983 students (23,092 undergraduates and 8,891 graduates) on two conditions: – (i) we

should not incur additional manpower and space resources to conduct the sessions and (ii) we should not gather students together in large groups as it would increase the risk of spread of infection. Hence, a decision was made to use online learning to disseminate the health information on SARS rapidly and efficiently to the students. The module was hence integrated into the university's existing web-based tools: the Integrated Virtual learning Environment (IVLE), so that it could be accessed conveniently by the students at any time and place and with various types of technology (56K or broadband access). The Centre for Instructional Technology from the university provided technical support and expertise to convert the module into the web-based format.

Designing message contents to attract the audience's attention

As there was no direct student-staff interaction, students have to be motivated to read the sessions on their own. We took the following steps to ensure that the lessons were clear, simple, self-explanatory, illustrative and interactive. The lessons were organized into learning objectives; synopsis, coverage, content, conclusion and assessment. Digitized videos of lecturers narrating and highlighting the major points as well as videos demonstrating the steps on how to wash one's hands, wear a mask and take the temperature were added to the web pages in such a way that they appeared to be seamlessly integrated with the lesson contents. Efforts were taken to minimize the use of medical jargon and ensure consistency in terminology and concepts used across the lessons so as not to confuse the students. Each lesson was also linked to relevant credible websites so that students get the latest updates of this new disease. Opportunities for interactive learning were provided by incorporating a forum for questions, comments and discussion with peers and lecturers.

The module included an assessment of 5 questions (True/False format) at the end of each lesson, and a final assessment of 30 questions at the end of the module. The assessments were intended to motivate and help student learn as they received immediate feedback of their scores on completion of the assessment exercises. The questions assessed the students on core information, common misconceptions and important practical facts that students should know to prevent spread of the disease. Examples of questions in the lesson on preventive measures included the following:

1. The paper mask is just as good as the N95 mask in protecting oneself against SARS. (False).

2.   If I have a cough and cold, I should wear a mask to prevent spreading the infection to others. (True).

3.   To ensure that my temperature reading is accurate, I should wait at least one hour after vigorous exercise. (True)

Dissemination of the module

The multidisciplinary module was developed within 2 months in August 2003. All students were notified about the module through their personal emails and the registrar's office. The module was also publicized in the students' intranet. Three of the lessons namely (i) the clinical features of SARS (ii) personal preventive measures and (iii) control measures at community, national and international level were made compulsory. Students were informed that they had to read all 3 lessons as a graduation requirement by the end of the second semester in April 2004, which was at the ninth month of the implementation of the module. After they had read all 3 lessons, they were required to submit the declaration forms online.

Students were also informed about the SARS module being offered as a credit-module. A student would be awarded 1 modular credit if he/she passed the module assessments. Generally, students need 100 to 120 modular credit units to graduate. There were 6 individual lesson assessments and a final assessment which covered all 6 lessons. Each of the lesson assessments consisted of 5 True/False statements while the final module consisted of 30 questions. Students who opted to take the SARS module for credits have to pass all the assessments. The marks from the 6 lesson assessments accounted for 30% of the total assessment marks, while the final assessment accounted for 70%. The latter assessment could be attempted only after all the 6 lessons assessments have been completed. Up to 3 attempts were allowed and the best result was recorded. Students who did not want to take the module for credits were not required to take the assessments to fulfill the graduation requirement.

Results

Students' participation rate

Figure 2 shows the cumulative number and percentage of students who completed the module. After the first month of its implementation, almost 5000 (16%) students had accessed the module and more than half completed the module within six months. At the ninth month of its implementation in

April 2004, almost all (96%) of the total enrolment of 31,983 students completed the module. There were 3 peaks where a higher proportion of students logged onto the IVLE to read the module. These peaks corresponded to the beginning of the semester when they were first notified of the module, the reading week just before the first semester examination and the mid-semester break.

Table 1 shows the distribution of students by faculty who took the module for credits and obtained a pass in the module. Of the 28,981 students, who were offered the credit module, 2,786 (9.6%) took the module for credits. The proportion of students by faculty who took it for module credits ranged from 4.2% to 26.8%, with the lowest percentage coming from the Institute of System Science and School of Business and the highest percentages coming from the Schools of Music and Computing.

Of those who took it for credits, the majority (86%) passed, with the pass rates ranging from 72.8% to 93.3%. The highest pass rates from the big faculties (92-93%) came from Computing and Science while the lowest pass rates (72.8-79.8%) came from the School of Design and Environment, School of Business and the Faculty of Arts and Social Sciences. Seven thousand seven hundred students (26.6%) who did not take the module for credits also completed the self-assessment exercises even though it was not compulsory for them.

Student feedback and rating of module

A total of 1,198 students (4%) participated in the feedback of the whole module. Four thousand two hundred and eighty two students (13.4%) responded to the on-line feedback of the specific compulsory lessons.

As shown in Figure 3, the majority reported that the contents of the module could best be learnt by the current e-learning format (66.7%) and that it is an effective medium for them to learn (69.9%). Half would recommend this module to other university students (Figure 4). However, a much higher percentage (73%) would recommend the lesson on preventive measures to other university students (not shown in the figures). Figure 5 shows the students' ranking of the usefulness of the lessons. Of the six lessons, the lesson found to be most useful was the scientific basis of personal preventive measures (26.2%), followed by the science of the corona virus (18.5%) and clinical aspects of the disease (18.4%). With regard to the rating of the specific lessons (not shown in the figures), more than 80% (83.0% - 88.0%) found the 3 compulsory lessons useful and more than three quarters (79.4% - 86.7%) found the lessons easy to understand.

Cost in module development

An estimated 1120 person-hours (ten 7-hour days per person for 16 persons) were expended by the 12 academic staff, 2 IT experts and 2 support staff. The time spent included two 3-hour IT briefing sessions, five 3-hour meetings to discuss content and assessment, one 3-hour video shoot for each academic staff, and each individual's time of about 46 hours to develop the content. Based on an estimated mean monthly salary of US$7,000 for teaching faculty, US$5,000 for IT experts and US$1,200 for support staff, the development of the module with regard to man-hours spent cost US$42,860.

Discussion

This multidisciplinary module on a serious infectious disease was developed within 2 months during the SARS outbreak and was disseminated to all students in a convenient and efficient manner within a defined time period, without the need for gathering them together in lecture halls. This module draws on the pedagogical merits of elearning such as wide accessibility of materials irrespective of venue, self-directed independent learning, and integration of learning materials from many sources. Students could access the module at any place within or outside the campus and at anytime. Each lesson was also linked to video websites demonstrating important skills such as hand washing and temperature taking. One of the disadvantages of the elearning module was the lack of face to face communication to clarify and respond to students' queries. However, the need to spread information rapidly without posing a risk for spread of the disease far outweighed the benefits of interpersonal communication. The lack of face-to-face contact was overcome to a certain extent by the incorporation of an online forum for discussion between students and faculty. The pedagogical merits of the elearning format were supported by positive student feedback of the module. The majority (>67%) of students reported that the best way to learn about SARS was from this online format compared to only a small percentage (<11%) who preferred lectures or tutorials.

As this outbreak was unexpected, funds and manpower resources had not been set aside for developing the online module. It is well known that developing online and computer assisted learning materials is a lengthy and skilled process.[8,9] When speed is critical during an outbreak, there is no time to train senior health professionals - the content experts, on how to develop online health modules that are user-friendly, creative and customized to the target audience. A multidisciplinary team approach would be most appropriate. We, in fact, adopted this approach whereby the academic staff focused on developing the content and left the technical aspects of design and delivery to the IT experts. However, frequent meetings between the two groups were held so that they shared a common understanding on how to maximize the expertise from both sides to deliver an attractive online learning package.

Some findings from our study are worth noting as they have practical implications for planning online health information programs. We found a rather wide variation in the pass rates of the module among students across the faculties. The lowest pass rates from the bigger faculties (<80%) came from arts-related faculties such as arts and social science, business and design and environment, while the highest pass rates (>90%) were from computing and science. A reason for this may be the variation in interests and familiarity of the students with the module as the content dealt with the science and epidemiology of the disease. This may be a finding that is specific to Singaporean students only as they have been streamed into Arts or Science classes as early as after less than 7 years of schooling. Nevertheless, the findings suggest that we may need to make some slight changes to the module to better meet the needs of non-science students.

Another important finding is the pattern in the diffusion of information to students over time. A steady number of students ranging from about 5 to 16% of the total target group logged on every month, with the highest proportion reading the module at the start of its implementation and during their semester breaks at the fourth and seventh month of the implementation of the module, when they were less occupied. It is heartening to note that students did not need to be continually reminded and that there was no sudden increase in the number of students logging on to the system at the last month of the module implementation.

Students found the lesson on preventive measures the most useful of all the lessons. A possible explanation is that students could relate to this lesson better than the others as it was personalized and perceived to be beneficial as it provided practical tips on how to protect themselves from the disease. Based on this finding, we believe that we can increase the effectiveness of health messages in attracting the target group by personalizing the messages and presenting them in the right order, with messages on how to protect oneself first. Messages which may be perceived by the target audience as less relevant to them personally such as scientific facts about the virus and international response can be presented later.

Our study has a few limitations. There could be some bias in the feedback as not all students responded. In addition, we do not have information about the non-respondents to compare with the respondents. However, the primary objective of this study is not to evaluate the feedback of the module but rather to assess whether the module reached all the intended audience during the outbreak. It is possible that some students having accessed the module might not read it. However, the mandatory online declaration form would reduce the number of students who logged onto the module just to fulfill the graduation requirement without reading it. We were unable to assess whether knowledge gained from the module was translated into change in practices. For example, we do not know what percentage of students, having realized the importance of hand washing, actually practiced it after reading the module. In addition, we did not assess the level of knowledge of the students before reading the module. The level of knowledge attained by those students who did not undertake the assessment was also not known, as those who did not take it as a module credit were not required to undertake the assessments. Such programs in future should be linked to online surveys to evaluate the above outcomes.

Implications for public health education

In the event of an infectious disease outbreak, health professionals play an important role in disseminating information in a timely and rapid manner to high risk populations on how to protect themselves and prevent further spread of the disease to the community. The Internet would be an ideal medium for disseminating health information rapidly and efficiently to those groups of individuals who are educated, technology-savvy, and are at high risk of spreading the infection. Such groups would include students residing in hostels or students gathered together at lecture halls in institutions of higher learning. Our online module on health could be adapted to other universities, polytechnics or even workplaces with good Internet support, to disseminate timely messages in a variety of disciplines. Based on our experience with this module, we propose the following measures to improve the quality of future online modules during an outbreak. First, a shorter time frame should be given for participants to complete the module. Second, the effectiveness of the module could be more rigorously evaluated by incorporating the assessment exercise before students get to the lesson contents so that the students' level of knowledge before and after reading the module could be assessed. Finally, it should be followed up by a repeat online survey a few months after the completion of the module to assess whether the increased level of knowledge was translated into change in practices.

Notwithstanding the above limitations of our module, an unforeseen positive outcome from this project was that academics from different disciplines were provided with an enriching experience to work and learn from one another. The interaction between the IT staff and the academics had not only generated much interest in online learning and but it had also increased the self-efficacy and resourcefulness of academic staff to develop further modules. The Department of Community, Occupational and Family Medicine plans to work with the Centre for Instructional Technology to develop similar online modules for its Masters in Public Health programs.

In conclusion, the online module on SARS is an efficient and convenient method to disseminate important health information rapidly to large university populations during an outbreak, when gathering together in crowded places is discouraged. We also find it feasible to institute measures to ensure participation by all students. This online format could be adapted to other universities or even workplaces with good Internet support to disseminate timely health messages with maximum coverage in an efficient manner during an outbreak.

Acknowledgement

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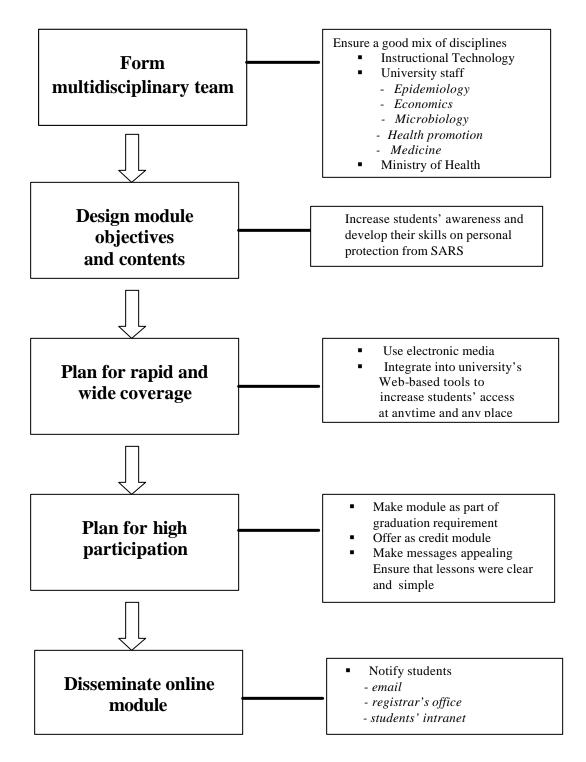
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Figure 1: Stages in developing the online module on SARS

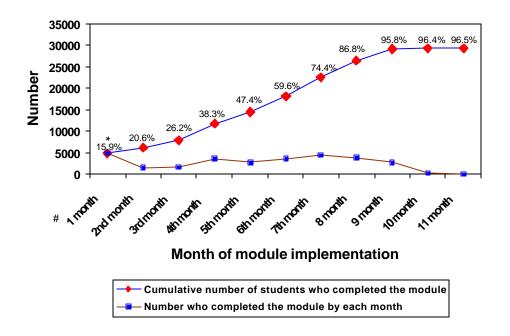|	
Form multidisciplinary team	Ensure a good mix of disciplines ▪ Instructional Technology ▪ University staff - *Epidemiology* - *Economics* - *Microbiology* - *Health promotion* - *Medicine* ▪ Ministry of Health
Design module objectives and contents	Increase students' awareness and develop their skills on personal protection from SARS
Plan for rapid and wide coverage	▪ Use electronic media ▪ Integrate into university's Web-based tools to increase students' access at anytime and any place
Plan for high participation	▪ Make module as part of graduation requirement ▪ Offer as credit module ▪ Make messages appealing Ensure that lessons were clear and simple
Disseminate online module	▪ Notify students - *email* - *registrar's office* - *students' intranet*

Figure 2: Cumulative number of students who completed the SARS module

*Percent of total student population in the university
#The module was implemented in August 2003.
 Students were required to complete the module by April 2004
 Students were followed up till end May 2004, 10 months after module implementation

Table 1: Distribution of students who took and passed the module by faculty, August 2003- June 2004

Faculty/school	No. completed module for graduation requirement	No. (%) taking it for module credits	No. (%) passed
	(a)	(b)	
Music	56	15 (26.8)	14 (93.3)
Computing	2,642	467 (17.8)	429 (91.9)
Medicine	449	NA**	NA
Others*	951	40 (4.2)	35 (87.5)
Science	5,595	585 (10.5)	509 (87.0)
Engineering	9,198	820 (8.9)	704 (85.9)
Law	814	67 (8.2)	57 (85.1)
Dentistry	152	11 (7.2)	9 (81.8)
Arts and Social Sciences	5,981	499 (8.3)	398(79.8)
Business	1,532	87 (5.7)	64 (73.6)
Design and Environment	2,060	195 (9.5)	142 (72.8)
Total	**29,430**	**2,786 (9.6)**	**2397 (86.0)**

* Others represent affiliated NUS departments that are not in any Faculty, like Institute of System Science

**Note: Medicine is the only course that is not offered as a credit-module course.
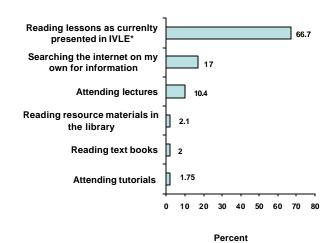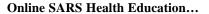   Hence, 28,981 students were offered the SARs module for credit points.

Figure 3: Students' rating on the best way to learn about the
contents of the SARS module

n-=1,198

*IVLE: Integrated virtual learning environment- the university's web-based tools
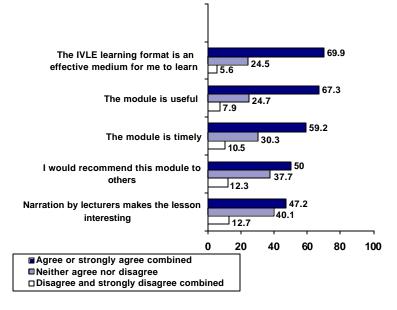
Figure 4: Students' rating of the SARS module

n=1,198

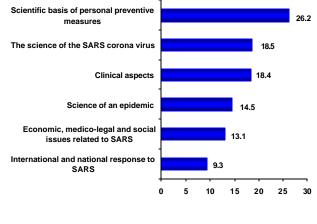**Figure 5: Students' rating of the most useful lesson**

n=1198