

Student Column

PUBLIC HEALTH EDUCATION USING SUPERCOURSE: A COMPUTER-BASED LEARNING RESOURCE FOR HEALTH-CARE PROFESSIONALS IN THE SOUTHERN PROVINCE OF ZAMBIA

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The use of technology in global health education remains a growing and challenging topic of research. Computer-based learning resources, such as the Supercourse—founded by the World Health Organization (WHO) Collaborating Center at the University of Pittsburgh Graduate School of Public Health—aim to improve the teaching of disease prevention among scientists around the globe.¹ While this particular resource has been growing in popularity, with a reported network of more than 56,000 scientists in 174 countries, there has been no formal evaluation of its effectiveness as a learning resource, particularly in a developing setting.

Supercourse is a Web-based repository for global health-related lectures in Microsoft® PowerPoint format. At the time of data collection, there were nearly 5,000 lectures available in 17 different languages. Previous studies have referred to Supercourse as an example of a successful use of Internet capabilities to disseminate health information; however, this tool has not been formally tested in a developing setting such as Zambia.² Its potential for reaching a large number of people with minimal funding or additional resources may prove an effective model for future efforts. A clear

need exists for improved access to reputable information in resource-poor health-care settings.

Zambia is one of the most economically disadvantaged countries in the world. With a gross national income per capita of U.S. \$970–\$1,280 per year, Zambia is well below the regional and global averages.^{3,4} Sixty-four percent of the population lives below the international poverty line of U.S. \$1.25 per day.⁴ The gross domestic product per capita average annual growth rate was 0.6 and the average annual inflation rate was 29% from 1990 to 2010,⁴ compared with 24% for the entire African continent and 2%–3% in high-income countries such as the U.S. and United Kingdom.⁵ Of its 13 million residents, 36% live in urban areas.³

Zambia's health profile is characterized by a higher prevalence of health problems when compared with other countries internationally as well as regionally. Life expectancy is estimated at 48 years across the population, with communicable diseases accounting for 75% of causes for years of life lost.³ Child mortality is 111 per 1,000 population, human immunodeficiency virus (HIV) prevalence is 13.5%–17.0%,^{3,6} and only 36% of adolescents aged 15–19 years have comprehensive knowledge of HIV.⁴ For comparison, regional life expectancy at birth is 54 years, communicable diseases account for 78% of years of life lost, child mortality is 119 per 1,000 population, and HIV prevalence is 4.7%.³ Furthermore, cataract accounts for 50% of the estimated 100,000 cases of blindness in Zambia.⁷

Education in Zambia has improved during the past several decades; however, higher-education facilities are still lacking in terms of staff and resources. From 2005 to 2010, primary school attendance was reported as approximately 81% for males and females, but only 37% attended secondary school.⁴ The number of academics and institutions that train health-care professionals is limited.⁸ In 2010, there were 18 registered nursing (RN) schools, 13 enrolled nursing schools, and only five RN/midwifery schools.⁹ The number of health educators is not sufficient to train the necessary workforce that Zambia needs. For example, the Ndola School of Nursing should be staffed with 27 tutors but only lays claim to three.¹⁰ At the current rate of

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graduation, Zambia will meet its current nursing needs in the year 2029.⁹ Many Zambian health-care providers graduating from Zambian institutions work abroad upon completion of their studies. When providers do stay in Zambia, most are not ready to work in rural areas because of poor pay and low incentives.¹⁰

Zambia has a history of technological instability. Only 6% of Zambians are Internet users, although this figure has risen steadily during the past two decades, particularly with the increased availability of mobile devices.⁴ Interestingly, many Zambians, specifically young people, workers, and professionals, cite the Internet as the preferred source of information gathering due to its versatility.¹¹ Targeting educated health-care professionals to participate in this investigation allowed us to mirror Zambia's profile of likely Internet information gatherers.

The Southern Province of Zambia served as an ideal location to evaluate Supercourse because its economic, health, and educational profile resembles many resource-poor locales around the globe. In many communities in Zambia, the visual/auditory learning model has been shown to be an effective teaching format.⁶ It seems reasonable to assume that Supercourse would serve as an appropriate medium to disseminate knowledge.

We hypothesized that participating Zambian health-care professionals would improve their knowledge of male circumcision and its relationship to HIV prevention, cataract, and global health after being presented lectures using the Web-based teaching resource Supercourse as measured by pre- and posttests.

METHODS

Forty-four Zambian health-care professionals were recruited to participate in a one-hour educational program where they were lectured on three topics: male circumcision and its relationship to HIV prevention, cataract, and global health. All data collection took place in June and July 2011. Forty-one individuals met all three inclusion criteria: being a Zambian native, having direct patient contact, and being employed by one of the three sites where data collection occurred. Because of limited resources and the nature of the local community, it was deemed inappropriate to include a separate comparison group. Based on conversations with key stakeholders in this community, it was determined that building rapport and trust with the community was important; it was neither feasible nor appropriate to provide information of this nature to one group and not another.

The principal investigator, stakeholders within the

Zambian community, and faculty at the University of Pittsburgh Graduate School of Public Health selected the lecture topics that were presented to all participants based on the community's needs, availability of information on Supercourse relating to each topic, and feasibility of providing an adequate lecture in a limited time frame. "Male circumcision and its relationship to HIV prevention" was selected as a topic because of the procedure's affordability in this setting and the evidence supporting a reduction in HIV acquisition in circumcised men (20%–80%, mean = 60%).¹² Also, the Tonga people, the primary ethno-linguistic group in the study area, do not traditionally practice male circumcision as compared with other ethnic groups such as the Lunda or Lavale.¹³ A lecture on cataract was chosen because (1) cataract accounts for 50% of blindness in Zambia¹⁴ and (2) affordable surgical cataract treatment has been gaining popularity in the Southern Province, and Namwianga Zonal Health Center (NZHC) is the site of a newly constructed surgical suite for this purpose. Lastly, "global health" was selected as a topic because it mirrors Supercourse's main focus, to increase knowledge of global health issues among scientists and health-care professionals around the world. Special emphasis was placed on the WHO definition of health, changes in life expectancy in Zambia as compared with other countries, and leading causes of death in Zambia and worldwide. With this information, rural health-care professionals not only obtain a broader perspective on public health, with the increasing prevalence of chronic disease in low- and middle-income countries, but they also learn the importance of detecting early signs of preventable chronic diseases (i.e., coronary heart disease).

All data collection was performed in the Southern Province of Zambia, with headquarters near the town of Kalomo, 127 kilometers (km) northeast of Livingstone. The investigation was conducted at three sites. Sites were selected based on trends in the available literature and supported by conversations with local health-care professionals and community members suggesting that Zambians in rural areas typically receive medical attention from three main sites: district hospitals, mission facilities, and mobile clinics. The sites for data collection were Kalomo District Hospital (KDH), NZHC, and Zambia Medical Mission (ZMM). Figure 1 shows a map of Zambia and its major cities and townships. KDH and NZHC were closest in proximity, roughly 7 km apart. While these two sites were in close proximity, they were different types of medical facilities and served unique patient populations. NZHC is primarily funded through private donations; houses smaller, specialized clinics; and provides advanced treatments

Figure 2. Pre- and posttest given to Zambian health-care professionals before and after being given Supercourse-based lectures on male circumcision and its relationship to HIV transmission, cataract, and global health: Southern Province, Zambia, June–July 2011

Pre/Posttest Instructions: Please circle or fill in correct answer.

- 1) What is the first thing to remember during a male circumcision procedure?
 - a. Saving the prepuce after removal
 - b. Maintaining a sterile environment
 - c. Making sure the patient is under general anesthesia
- 2) By what percentage can circumcision reduce the probability of HIV transmission?
 - a. 30%
 - b. 45%
 - c. 60%
 - d. 75%
- 3) Please name one potential problem that could be encountered during or after a circumcision procedure.

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- 4) What is the number one cause of blindness in the world?
 - a. Glaucoma
 - b. Injury
 - c. Cataract
 - d. Genetic predisposition
 - 5) All of the following are potential problems that could be encountered during or after an extra-capsular cataract extraction procedure EXCEPT:
 - a. Capsular rupture
 - b. Endophthalmitis
 - c. Retinal displacement
 - d. Unsterile surgical conditions
 - 6) According to the World Health Organization, what is the leading cause of death worldwide?
 - a. Infectious disease
 - b. Coronary heart disease
 - c. Road traffic accidents
 - 7) What is the term “glocal” short for?

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- 8) “Everyone has the right to a standard of living adequate for the health and well-being of herself and her family, including food, clothing, housing, and medical care” is referred to as the

HIV = human immunodeficiency virus

RESULTS

Quantitative

A total of 41 individuals reporting backgrounds of nursing ($n=28$), midwifery ($n=5$), and other clinical staff ($n=8$) were enrolled and included in the analysis. At KDH, participants reported occupations of nursing and pharmacy. At NZHC, nurses, a clinical officer, and midwives participated. At ZMM, participants included nurses, midwives, nurse/midwives, and dental staff. All participants completed the required forms at the time of the program. The principal investigator presented all lectures, moderated testing, and facilitated focus groups. Two coders completed scoring of pre- and posttests after being educated and provided with standardized scoring rubrics. The principal investigator evaluated any discrepancies between graders. Each participant could potentially answer a maximum of eight questions correctly on the pre- and posttest.

As illustrated in Table 1, all participants improved from pre- to posttest (95% confidence interval [CI] 23.5, 32.0). Additionally, test scores improved for topics of male circumcision (95% CI 10.7, 25.0), cataract (95% CI 11.0, 35.4), and global health (95% CI 33.2, 51.4).

Table 2 reports improvement categorized by occupation. Three groupings were created for data analysis: nurse, midwife, and other. Due to small numbers, individuals reporting backgrounds of dentistry, pharmacy, clinical administration, or a combined focus such as nursing/midwifery were combined into “other.” Nursing/midwifery was not included in the nursing or midwife category because the educational background is unique for these individuals. Midwives improved the most from pre- to posttest (95% CI 12.9, 62.0).

Qualitative

Qualitative data collected from participants revealed that most enjoyed learning using the Supercourse format. Responses included: “The thing about this is . . . you can listen and see. You can either remember the words or the pictures” and “No university or hospital provides this information. You must go outside the country for information like this.” The combination of visual cues and traditional lecturing resonated well with the study population. Several participants also liked having the ability to return to a lecture after it was given as well as having a large amount of information available in one location. For example, one nurse remarked:

“[...] so at least maybe even at the hospital they can introduce [this resource] because it is very important, really. Because you can put this [DVD] in your bag

Table 1. Improvement in Zambian health-care professional knowledge of male circumcision and its relationship to HIV transmission, cataract, and global health, before and after Supercourse-based training: Southern Province, Zambia, June–July 2011

Topic	Pretest percent Mean (SD)	Posttest percent Mean (SD)	Improvement Percent (95% CI)
Crude	44 (13.7)	72 (13)	27.1 (23.5, 32.0) ^a
Male circumcision/HIV prevention	78 (21.8)	96 (13.3)	17.8 (10.7, 25.0) ^a
Cataract	39 (30.6)	62.2 (21.7)	23.2 (11.0, 35.4) ^a
Global health	13 (19.5)	55.3 (29.4)	42.3 (33.2, 51.4) ^a

Note: All participants (n=41) completed both the pre- and posttest. There were eight possible points for the crude score, three possible points for male circumcision/HIV prevention, two possible points for cataract, and three possible points for global health.

^ap<0.001

HIV = human immunodeficiency virus

CI = confidence interval

at home and if you are free at home, maybe you can just go through it. This would save time because going through a book takes a lot of time, and this is faster.”

When negative feedback was provided, participants often agreed that lectures needed to be translated into the local language to be more effective. Also, a number of participants said that longer lectures with more detailed information would be beneficial. Paradoxically, high numbers of participants reported enjoying the brief format of the presented lectures.

Most feedback was given when participants were asked if/how this resource could be used in Zambia. Lack of education, the level at which computer education is offered, cost, and limited access to computers were the barriers most often cited to implementing Supercourse in Zambian health-care facilities. Some responses included:

“To us, they are too expensive [...] most of us, though very much in need, we are failing. Like you’ll be in an office where there is one computer, three of us have to use the same computer, so it is a bit difficult.”

“[...] most of the people in our community are from rural areas [and] do not have access to a computer. In Kalomo, there is only one Internet café. . . . Some have children in schools where they will charge you for computer lessons, but . . . they do not have teachers to teach those lessons. . . . Even when you have a computer in Zambia, you are not very adequate in using it. You even find that the flipping of slides becomes a problem. Something that is supposed to be done in a few minutes . . . takes a lot of hours.”

“If this thing is to succeed, it has to start at . . . the primary level, where those children . . . are able to pick it up and some children will be able to teach their parents about computer use.”

DISCUSSION

Significant improvement of crude test scores across all groups provides a glimpse of the potential that Supercourse could have in this setting. Crude score improvement may be the most notable finding from this study because the analysis included the entire study

Table 2. Improvement in Zambian health-care professional knowledge of male circumcision and its relationship to HIV transmission, cataract, and global health, before and after Supercourse-based training administration, by occupation: Southern Province, Zambia, June–July 2011

Occupation	Responses N	Pretest percent Mean (SD)	Posttest percent Mean (SD)	Improvement Percent (95% CI)
Nurse	28	46.4 (13.5)	71.0 (11.8)	24.5 (20.0, 29.0) ^a
Midwife	5	35.0 (16.2)	72.5 (13.7)	37.5 (12.9, 62.0) ^b
Other ^c	8	40.6 (14.6)	70.3 (14.8)	29.7 (18.6, 40.7) ^a

^ap<0.001

^bp<0.02

^cIncludes nurse/midwives, pharmacists, physicians, and dentists

HIV = human immunodeficiency virus

SD = standard deviation

sample and all lecture topics. Mixed success has been reported when using e-learning among nursing professionals.¹⁶ This investigation offers additional insight into the potential of offering Internet-based learning among a specific nursing population in a global health setting. When analyzed by topic, the largest improvement was made in the global health section. While not entirely surprising because of the remote nature of these clinics, it was encouraging to see significant improvement after such a short lecture. Analysis was also performed to distinguish score improvement based on occupation. Midwives increased their knowledge to the most significant degree. Nurses' scores mirrored improvements in the crude increase at 30%. Although not included in the official analysis, one individual, an information technologist, scored a 0% on the pretest and an 88.5% on the posttest. It may be interesting for further investigations to target those with very little health-care knowledge.

Focus group responses gave further insight into the viability of this resource in Zambia. When first asked what could be improved about Supercourse, many respondents reported low computer literacy and limited access to computer hardware. Significant emphasis was made on the state of the current education system and the lack of computer classes for their children. However, when the facilitator asked participants to add more information about themselves, many responded that computer classes would be very beneficial. To address variations between participants in regard to computer literacy, previous research has suggested that introductory development courses and built-in tutorials could address individual needs.¹⁷ Participants reported that purchasing a computer was not economically feasible. Also, communication infrastructure "lacks capabilities to support a strong telecommunications system because of prohibitive costs."¹⁶ However, two sites of data collection had stable power systems and relatively reliable Internet services.

A disconnect seems to exist between participants reporting little access to computers and what was observed during tours of the facilities. Perhaps these professionals would benefit from separate facilities where equipment does not need to be shared with administrators. Again, any training must be designed to fit the needs of the target community.⁸ Finally, many participants agreed that Supercourse would benefit their communities, especially those with limited health-care knowledge; however, a challenge would arise in disseminating that information. Other literature has shown that there remains enormous potential for supplementing learning using the Internet; however, it is important to assess the access and comfort level

of each community.⁸ The need to create sustainable programs to accomplish this goal complicates matters. These communities have lived in a constant state of uncertainty. They deal with persistent poverty and external organizations injecting then withdrawing resources and support for communities.¹⁸ For this reason, a twofold intervention of providing computer hardware (which can be easily maintained or updated) along with computer education would be the most appropriate first step in ameliorating this problem. Introducing improved resources such as Supercourse could help fill a niche of not only improving the available resources to help entice professionals to stay in the country, but also to provide a reliable way to rapidly train those who wish to further their education.

Supercourse could serve as a new tool to improve the health of underserved, resource-poor communities. Particularly with the growing advances in Internet technology on mobile devices, a new field is emerging where these devices will play a critical role in improving people's health.¹⁹

Limitations

Because this study was designed as a pilot, exploratory investigation, many of the limitations were unavoidable due to restricted resources. The small number of participants limited the generalizability of results as well as the power of the analysis. Reduced resources (funding in particular) prohibited extensive travel to recruit participants in various health centers. Furthermore, because this investigation was implemented in a rural setting, a health-care worker shortage may have been more apparent than if the investigation had been carried out in a metropolitan area. Also, while the investigation was not hampered, collecting more demographic data would have enabled more complete data reporting. In future investigations, specific information on province of birth, place of education, and years since graduation from nursing/midwifery school should be collected.

Additionally, the directors of ZMM, NZHC, and KDH limited protocol implementation to one hour because their staffs were responsible for other tasks throughout the clinics. If more time was available, pre- and posttests could have included more questions and lectures themselves could have been lengthened, perhaps providing a more robust measure of knowledge improvement. However, one strength of this intervention was that it took into account the realities of working in this setting. Lastly, if more time was available, follow-up assessments could have been administered several days after the initial meeting, giving another set of data to measure knowledge retention.

CONCLUSIONS

This program significantly increased participants' knowledge regarding male circumcision, cataract, and global health. Even with a small population, every individual improved his/her knowledge from pre- to post-test. Although not generalizable to the entire Zambian health-care population, results show the potential of applying Supercourse to a resource-poor environment and the importance of future investigation.

Clearly, any realistic improvement in the technological backbone of Zambia must start at the local level and target specific populations to promote sustainability and reduce dependence on foreign aid. For health-care professionals working at KDH, NZHC, and ZMM, advocating for facility improvement at the policy level, improving computer education, and providing basic technological hardware will make the most immediate, cost-effective impact. To reduce the limitation of available resources and technology, users may be provided with Supercourse on a preloaded DVD, and information can be accessed on any computer with an Internet browser installed, without having to purchase expensive software (e.g., Microsoft Office) or even having an Internet connection.

Health-care professionals are some of the key gatekeepers in rural communities. By establishing computer-training courses that cater to health-care professionals, we can help increase their capacity to collect valuable information that will improve their ability to care for their patients and improve health in underserved communities.

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