

**ZAMBIAN HEALTH EDUCATION USING SUPERCOURSE (ZHEUS): THE
EFFECTIVENESS OF A COMPUTER-BASED LEARNING RESOURCE AMONG
HEALTHCARE PROFESSIONALS IN THE SOUTHERN PROVINCE OF ZAMBIA**

by

Kyle Evan Freese

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This thesis was presented

by

Kyle Evan Freese

It was defended on

December 09, 2011

and approved by

Thesis Advisor:

Ronald D. Stall, PhD

Professor and Chair

Department of Behavioral and Community Health Sciences

Graduate School of Public Health

University of Pittsburgh

Committee Member:

Patricia I. Documét, MD, DrPH

Assistant Professor

Department of Behavioral and Community Health Sciences

Graduate School of Public Health

University of Pittsburgh

Committee Member:

Ronald E. LaPorte, PhD

Professor, Director of MMPH Program

Department of Epidemiology

Graduate School of Public Health

University of Pittsburgh

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By Kyle Evan Freese, MPH

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The purpose of this study was to introduce and evaluate the effectiveness of a computer-based learning resource (Supercourse) among rural healthcare professionals in the Southern Province of Zambia. This is the first field evaluation of Supercourse.

Supercourse is a free, online, open-access repository of global health and prevention PowerPoint lectures and can be accessed at <http://www.pitt.edu/~super1>. It is a way for members of the scientific community to disseminate and share knowledge with each other. While Supercourse has gained popularity in many nations, its viability is not known in a developing setting such as Zambia. This investigation aimed to examine Supercourse's viability as a learning resource in rural Zambia.

A series of three lectures was provided to 41 healthcare professionals, reporting backgrounds of nursing, midwifery, dentistry, clinical support, and pharmacy. Participants completed a pre- and post-test on topics including: male circumcision and its relationship to HIV transmission, public health approaches to cataract treatment, and general global health awareness. Qualitative feedback to gauge the real-world viability of Supercourse as a resource was gathered via small focus groups.

Participants showed a 27.7% increase in knowledge from pre- to post-test ($p < 0.001$). Midwives increased their scores to the greatest degree, with a mean improvement of 37.5% ($p < 0.02$). Participants improved the greatest deal on questions relating to global health (42%,

$p < 0.001$). Focus group responses resulted in several themes. The majority of participants enjoyed learning information in the Supercourse format; they enjoyed the combination of visual and verbal presentation. While effective, participants expressed concern over their lack of computer literacy and commonly noted a need for improved technological infrastructure within their places of work.

This program significantly increased participants' knowledge regarding male circumcision, cataract, and global health. Because of the small sample size, this information may not be generalizable to the entire Zambian population, but the results gathered warrant further investigation. This investigation has several important implications for the field of public health. Most of all, I tested a technological tool in a resource poor environment among an underserved population and found that improved access to educational materials does, in fact, increase knowledge in important health topics.

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PREFACE

To the people of Namwianga Mission, Kalomo Hospital, Zambia Medical Mission, and Namwianga Rural Health Center, without whom this project would not have been possible.

To my thesis committee, Drs. Ronald Stall, Patricia Documét, and Ronald LaPorte for providing candid advice and encouragement throughout the design and drafting process.

To the Supercourse team, for their trust and guidance.

And most importantly, to my family and friends. Their support and love has made my master's degree and traveling to work in Zambia possible.

1.0 INTRODUCTION

This is the first field evaluation of the effectiveness of Supercourse as a learning resource. While gaining popularity within the international scientific community, Supercourse has yet to be evaluated in a real world setting. Furthermore, no evidence exists as to the viability of Supercourse in a rural, developing setting such as Zambia. This investigation aimed to answer two fundamental questions. One, is Supercourse an effective way to gain and retain knowledge among Zambian healthcare professionals? Second, is the Supercourse technology a viable way for Zambian healthcare professionals to gain knowledge and continue education? The first question was addressed using a basic pre- and post-test design and the second was addressed using small, facilitator-driven focus groups.

Data collection took place between June 23-July 20 2011 in and near the town of Kalomo, Zambia. Investigator headquarters were based at Namwianga Mission, approximately 7km from Kalomo.

Three sites were chose to serve as the locations to implement this study: Kalomo District Hospital, Namwianga Rural Health Center, and Zambia Medical Mission. These sites were initially chosen because of existing relationships with key stakeholders within the community. After assessing the location further, however, it was learned that these sites added diversity to the type of locations used while maintaining an appropriate mix of facilities. Using one hospital, a rural health center, and a mobile medical unit, this investigation evaluated Supercourse in the

three main arenas where healthcare is typically delivered in Zambia (please see the “Health Profile” section for more information).

While this investigation was primarily a way to test the effectiveness of Supercourse, it was also a way to introduce this community to a new way to continue their health education. To ensure participants were treated with respect, it was important to present worthwhile information to participants in tandem with the evaluation portion of this investigation rather than generic information that would be of no use.

I hypothesized that Zambian healthcare professionals, after being provided with a series of three lectures from Supercourse, would improve their knowledge in the presented topics as measured using a pre- and post-test design.

1.1 BACKGROUND

1.1.1 Background on Zambia

Zambia lies in the Savannah region between 10-18° latitude and 22-23° longitude of Central Africa, covering an area of 752,000km².¹ Population has been estimated at 12,935,000, with 36% living in urban areas.² A landlocked country, Zambia is bordered by eight countries: Botswana, Zimbabwe, Namibia, Tanzania, Mozambique, Malawi, Angola, and the Democratic Republic of the Congo. The country itself is divided into nine provinces: Northern, Eastern, Western, Southern, Luapula, Copperbelt, Lusaka, Central, and Northwestern.

The past fifty years in Zambia's history have been defined by instability and change. Even though Zambia has not fallen victim to violent conflicts that have affected so many other African nations, since its independence in 1964, the nation has been under the rule of several leaders with distinctly different ideologies. In the 1960s and 1970s, Zambia reaped the benefits of the booming lucrative industry, but through poor leadership and infrastructure, Zambia's economy collapsed. Leadership has failed to adequately manage the privatization of major geological mining projects, one of the principle industries of the country. These woes have filtered down through virtually every industry causing social unrest and infrastructure instability. Through this, communities have been victimized and displaced, forcing many into situations that make it nearly impossible to maintain health and quality of life.

Political unrest has led to changes in agriculture, rural services, and the dynamics of available jobs.³ More than half of the nation lives in rural areas and depend upon the land for their livelihood. Many communities have lived in the same region for hundreds of years, but forced change has uprooted many of these individuals and provided new challenges. Geographic change has played a major role in how Zambians of the Southern Province have lived over the last half century.³ The building of the Kariba Dam on the Middle Zambezi River in 1958 forced the relocation of thousands of residents, which forced their adaptation to new surroundings and resources. The not so distant past nomadic nature of these peoples shaped their present state. For example, years of drought undoubtedly affected the health of these rural, dislocated individuals (perhaps one issue that helps explain the poor health status held by many Zambians). These communities have lived in a constant state of uncertainty; dealing with persistent poverty and dealing with external organizations that inject and then withdraw resources and support for communities.³ International organizations have many times failed to

create sustainable programs- only acting to hinder further development rather than aiding it. Zambia's shortcomings stem from a multi-faceted, infrastructure-based set of weaknesses that places it in a difficult position to break the cycle of poverty and poor health.

1.1.2 Education

Many Zambians have difficulty accessing affordable and quality education. The following educational information is courtesy of UNICEF's international webpage.⁴ Total adult literacy rate is estimated at 71%; youth literacy is measured at 68% and 82% for females and males, respectively. 95% of children attend primary school but that figure decreases to roughly 40% for secondary school enrollment. Depending upon the province, some primary schools offer classes in computer literacy, but to obtain this education at the secondary level, one must often attend a private, non-governmental institution, which many families cannot afford without sponsorship and scholarship.

A very limited number of higher education facilities are available to individuals wishing to pursue a career in healthcare. Nursing Schools in Zambia are in very short supply.⁵ As of 2010, there were 18 registered nurse (RN) schools. In order to complete this training, 3-4 years after high school are usually required. Zambia also offers training in "Enrolled Nursing". There are 13 schools that offer this training and it usually requires two years after high school. There are only five Registered Nurse/ Midwifery schools in Zambia; this training requires two years work and one year midwifery school after completing one's RN degree. Finally, there are six Enrolled Midwifery schools in Zambia. This training requires two years work as an enrolled nurse and one year of midwifery school.

1.1.3 Economics

Zambia is one of the most economically disadvantaged countries in the world. Gross National Income per Capita estimates range from \$970 to \$1,280 a year, well below the regional and global averages.^{2,4} Furthermore, 64% of the population live under the international poverty line of \$1.25 per day.⁴ GDP per capita average annual growth rate is reported at -2.3% while the average annual rate of inflation is reported at 30%.⁴ According to the World Health Organization in 2009, less than 5% of the GDP is spent on health.² The same figure was reported as 13% in 2008 by UNICEF.⁴ Many discrepancies often arise when reporting Zambian statistics. Perhaps poor governmental organization is to blame, but the high rural population means that many individuals are oftentimes difficult to access. Lack of reliable means of fast communication makes for another source of error. Record keeping in small villages is subpar, if existent at all, therefore many of the reported figures are often misleading.

1.1.4 Health Profile

Zambia has a poor health profile characterized by the higher prevalence of a number of health conditions when compared to other countries around the world, even regionally. Life expectancy is estimated at 48 years for men and women, six years less than the regional average and twenty years less than the global average.² Communicable diseases account for 75% of causes for years of life lost and the under-5 mortality rate has been estimated at 14.1%.² Depending upon the literature, HIV prevalence has been reported between 13.5 and 17%, with 1.8 million infected individuals.^{2,6} What's more, only 36% of adolescents ages 15-19 have comprehensive knowledge of HIV.⁴ Malaria is receiving increasing attention, with 62% percent of households reporting

owning at least one treated bed net (ITN), however only 41% of children under the age of five are sleeping under ITNs regularly.⁴

Zambia is in the midst of a dire healthcare workforce shortage. The World Health Organization reports a meager 0.6 physicians per 10,000 population (nearly two full physicians less than the regional average) and only 7.1 nurses and midwives per 10,000 population (nearly four less nurses than the regional average).^{2,5} This deficit is exacerbated in a country where half of the population is located in rural areas. This shortage is due to a variety of factors, most notably the HIV/AIDS epidemic and emigration. Between 18% and 41% of healthcare workers in sub-Saharan countries are living with HIV/AIDS.⁷ Missed work due to HIV-related complications, deterioration of health, and overall fatigue are all issues that may affect these professionals and thus, the quality of care they provide to their patients. Next, Gerein *et al.* reports that between 1998 and 2004, the number of Zambian nurse-midwives registering to work in the United Kingdom increased from 15 to 169 per year.⁷ While these would be modest figures in the United States, only 220 registered nurses graduated from a Zambian institution in 2003. At the current rate of graduation, Zambia will meet the current nursing needs of the country in the year 2029.⁵ Not only is the actual lack of nurses an issue, all of the issues associated with a shortage of healthcare professionals are affected by this. For example, with less individuals trained as skilled birthing assistants, infant and new mother mortality is surely increased. The cycle of poor health seems to only perpetuate itself. Additionally, newly trained clinicians are almost always found in regional centers with very few physicians permanently stationed at rural health centers. These skilled health professionals are not ready to work in rural areas because of poor pay and low incentives.⁸ Metropolitan areas offer better services, increased pay, healthier working conditions, and improved technological infrastructure.

Experts quote four primary reasons why healthcare workers emigrate from sub-Saharan Africa: salary and benefits, job satisfaction, career opportunities, and availability of resources such as infrastructure and equipment.⁷ Because much of the world cites a shortage of healthcare professionals, Zambians have little difficulty finding work in other countries. One would find it difficult to argue against a newly graduated health professional wanting to pursue a healthier and more prosperous life for him/herself and their family. While many of these problems are due to unmodifiable variables such as geography, some may be within our reach to improve.

Not only are nursing staff that maintain clinical responsibilities becoming a commodity in short supply, staff that act as educators are also dwindling in numbers. The Ndola School of Nursing, for example, should be staffed with 27 tutors but only lays claim to three.⁸ Smaller institutions such as Ndola affected, but even the University of Zambia lost 230 doctorate-holding professors from 1984 to 1994. One way of combating the issue has been addressed by the World Health Organization (WHO). They are sponsoring a program aimed at increasing retention of professors within the School of Medicine. Head educators are given salary supplements.⁸ This precise issue was one of great concern among those who participated in this investigation. Many individuals expressed interest in bringing public health to their classrooms but lacked the funding necessary to continue their education. One dentist in particular discussed the need for a sponsor in order to continue his education. Having been a clinician for nearly thirty years and an educator for over half that time, one could sense his frustration in the inability to bring additional information to his students.

The following subsections address specific issues regarding Zambian health. The issues discussed are those that served as topics of lectures used in this investigation.

1.1.4.1 HIV and Male Circumcision in Zambia

HIV prevalence in Zambia is one of the highest in the world with nearly 1.8 million infected individuals. Many issues have contributed to this increased prevalence. Lack of treatment options, funding for research, and access to affordable healthcare are major factors. First, because of political, socioeconomic, and agricultural instability, many Zambians have taken on the role of “migrant frontiersmen”. Because of this paradigm shift, migrant workers have been able to gain access to increased cash and funds. With this, locations within the Southern Province have experienced a boom in the sex industry.³ This, in turn, increases the exposure to HIV/AIDS (the prevalence of HIV among sex workers in Zambia is 65%).⁹ Although rural communities generally display lower prevalence of HIV/AIDS than urban centers, the shift of migrant workers and cash flow has challenged this norm. Public health efforts have focused on reducing the burden this disease places on the population. One such effort, promoting male circumcision, has been gaining interest from many communities in Zambia. Numerous observational studies and clinical trials have suggested a link between male circumcision and the reduction in HIV acquisition in men. One particular meta analysis between fifteen different studies showed a 20-80% (mean 60%) reduction in HIV infection among circumcised men.¹⁰

Review of the literature points to varying feelings regarding male circumcision within Zambia, especially between provinces and indigenous ethnic groups. For example, ethnic groups such as the Lunda and Luvale in the northwestern part of Zambia practice traditional male circumcision, however the Tonga in the southern Province traditionally do not.¹¹ Almost all individuals relate circumcision with improved hygiene; however feelings against circumcision were more widely distributed. Negative feelings that related to religion, the cost of procedure,

and even misnomers such as “circumcised men get colder faster” are common responses. In other literature, responses mirrored these findings of cost and tradition as being reasons not to circumcise.¹¹ One may argue that the influx of Christianity and “Western medicine” has also shaped Zambian doctrine as of late. While some negative opinions were communicated, most respondents felt that male circumcision was a good idea to help prevent against HIV/AIDS.

Condom use in Zambia remains infrequent despite more than a doubling of distribution since 1993.¹² Particularly in rural areas, availability and affordability act as significant barriers for condom procurement and use. Paradoxically, in non-healthcare facilities, condom distribution dropped nearly 60% between 2007 and 2008. Research has shown that among those in Zambia who engage in higher risk sex, less than one third report using a condom.¹³ Clearly, education needs to be a focus of those in the healthcare industry so that appropriate information can be passed along to less-educated individuals within their communities. A search on Supercourse’s main webpage for HIV and AIDS related lectures returned more than 120 unique lectures. This vast amount of information can be accessed free of charge and from any computer. Perhaps this new resource can aid healthcare professionals to spread education to those at highest risk.

1.1.4.2 Eye Disease and Blindness in Zambia

Cataract is the leading cause of blindness worldwide.^{14,15} Lens protein alterations in the eye leads to a clouding of the lens, the reason for loss of sight. Exposure to UV light, carrying a genetic predisposition, and smoking are all risk factors of developing a cataract. This problem proves more apparent in the developing world where treatment options are less effective and accessible. Field evaluations have revealed similar findings, with cataract being second only to refractive

error in eye conditions seen in four different villages throughout Zambia.¹⁶ Available literature, reveals that cataract has been a major cause of concern in Zambia for more than 25 years.¹ Attempts of implementing policy level interventions to prevent eye diseases and control blindness have had little effect on decreasing cataract prevalence. Blindness due to cataract and other eye diseases have not decreased, leading one to believe that these government-run programs have not been effective. Literature from the early 1980s and recent information provided by the Zambian Ministry of Health do not differ to a significant degree. Clearly, little improvement that has been made in preventing and controlling blindness in Zambia. Cataract still accounts for 50% of the estimated 100,000 cases of blindness in Zambia.¹⁷

One key that previous interventions have focused on was creating a “uniform, simple recording system...for the whole country”¹⁷. No such system seems to exist, particularly in rural areas where many clinics are still developing other areas of their facilities. Experts point out the importance of the cooperation of international organizations toward the goal of prevention of blindness in Zambia.¹ However, as discussed, external organizations have been largely unsuccessful in creating sustainable changes in Zambia. Investigators point to the importance of introducing mobile eye programs to existing primary health care facilities.¹⁶ After all, with a large, rural, poor population, medical care must be able to be delivered in a mobile fashion, as transportation for many rural peoples proves impossible. Zambia Medical Mission is one such effort that has been very successful for more than a decade. This approach stresses the need for knowledge in rural healthcare facilities and improving services that must be offered to serve those who have limited access to metropolitan centers.

1.1.5 Supercourse

Supercourse is a computer-based teaching resource founded out of the University of Pittsburgh Graduate School of Public Health. Supercourse's core developers are: Drs. Ronald LaPorte, Faina Linkov, Mita Lovelekar, and Eugene Shubnikov. At its foundation, Supercourse is an Internet resource of 5,000 PowerPoint lectures addressing issues in global health and prevention. Secondly, Supercourse is a way for scientists around the world to build a community of knowledge. Launched in 1997, Supercourse has offered a way for instructors worldwide to access the latest health and prevention information.¹⁸ Throughout its 14 years of existence, Supercourse has grown exponentially in popularity. In 1999, Supercourse reported a database with 80 available lectures and 750 contributors in 81 different countries. As of 2011, the database has grown to 5,000 lectures and reports a network of 46,000 scientists in 174 different countries.¹⁹

The lectures available on Supercourse are in PowerPoint format, however are condensed into single HTML-format images. These images can be inserted into a typical PowerPoint program and presented in the traditional [PowerPoint] fashion. Because of this compressed size, all relevant lectures can be copied to a single DVD, making the information available to those without an Internet connection. This proves very important in communities such as Zambia whom often lack the necessary technological infrastructure to access the Internet effectively. Mirrored servers have also played an important role in Supercourse's success since the late 1990s. Mirrored servers are utilized to increase the speed at which Supercourse lectures can be accessed. Graphics and figures often slow down download speed, therefore including a copy of the Supercourse site on multiple computers allows one accessing that network to connect to

Supercourse more rapidly.¹⁸ The use of HTML, condensed formatting, and mirrored servers have improved the accessibility of Supercourse to new populations.

Maintaining quality control and providing reputable lectures from respected sources are the primary focus of the Supercourse team. Because Supercourse is a free, open-access repository, in theory, anyone is able to submit a lecture to be uploaded. Therefore, the Supercourse faculty must review each lecture before it is uploaded.¹⁸ As the Supercourse network grows, so does the availability of potential reviewers. With more reviewers available, one may imagine that the quality of reviewers would also improve, adding to the “expert-pool”. In other words, it may be reasonable to assume that as the Supercourse network grows, the quality of lectures will only improve because of the increased infrastructure of peer reviewers.

Previous studies have used Supercourse as an example of a successful use of Internet capabilities to disseminate health information.²⁰ Its potential for reaching a large number of people with minimal funding may prove an effective model for future resources. Most importantly, Supercourse fosters an environment focused on sharing knowledge, recognizing achievement, and creating community among some of the brightest scientific minds worldwide.

No known literature exists evaluating Supercourse in a developing setting, but there appears a clear need for improved access to reputable information among the healthcare community. With adaptation, Supercourse may fill this need in an innovative, unique way.

1.1.6 Communities

1.1.6.1 Namwianga Rural Health Center

Namwianga Rural Health Center is located roughly two kilometers from Namwianga Mission and five kilometers from the town of Kalomo. The facility contains laboratory facilities, separate female and male wards, several examination rooms, as well as a newly-constructed building that houses two surgical suites. Namwianga Rural Health Center provides voluntary testing and counseling (VCT) services, anti-retroviral therapy (ART), cataract correction surgery, as well as various medical support services. The staff is comprised of registered nurses, clinical officers, midwives, and other technical support staff.

1.1.6.2 Kalomo Hospital

Located on the outskirts of Kalomo, Zambia, Kalomo Hospital provides healthcare to the entire district. Kalomo Hospital offers similar services as Namwianga Rural Health Center and employs a staff of physicians, registered nurses, laboratory technicians, pharmacists, and various support staff. The facilities are larger, however conveniences such as hospital meals and bedding are not provided by this facility. The patient's family must provide meals and bedding. The hospital serves individuals from across the district.

1.1.6.3 Zambia Medical Mission

Established in 1997, Zambia Medical Mission is a subsidy of Namwianga Mission, a spiritual effort funded, primarily, through the Church of Christ. The effort first began as a dental outreach program to provide basic care to rural communities and has since grown to a 250+ person outfit that provides medical, dental, optical, spiritual, laboratory, physical therapy, pharmacy, and wound care services to thousands of underserved individuals each year. This is not a permanent mobile medical unit. A team comprised of 120 Americans and 150+ Zambians converge on Namwianga Mission each year in July. For ten days, the team travels to four different villages (varies each year), setting up clinics in schools and providing the aforementioned services. In 2011, the team reached and treated 16,029 patients in six days of clinic. As mentioned, ZMM acts to exemplify a successful effort introduced by an external organization. Traveling to treat patients rather than remaining stationary, ZMM is able to treat a large number of underserved individuals in a short time.

1.1.7 Internet in Zambia

Computer-based learning has not been explored in this population. Zambia's first connection to the Internet came in 1994 through a South African leased line for about 250 users.²¹ That number has increased to an estimated 50,000, however these users are concentrated in the capital of Lusaka and the Copperbelt province. Six percent of Zambians are Internet users and 28% are phone users.⁴ Low Internet prevalence leads to a myriad of problems for the Zambian people. As the world becomes more integrated, the lack of technological infrastructure has deprived millions of Zambians of knowledge that could otherwise help with development. This disparity

leaves many individuals isolated in a society dominated by information gathering.²¹ On a positive note, as mentioned above, some progress has been made to provide Internet capabilities to major metropolitan centers. Exchanges intra- and internationally between individuals have increased in speed; a correspondence that would have once taken several weeks between Zambia and the United States now takes minutes or hours. Although progress is slow, many Zambians recognize the huge impact the Internet can have on their community and are anxious to have the resource available. Many Zambians cite Internet as the preferred source of information gathering among youth, workers, and professionals due to its versatility.²²

In Kalomo Hospital and Namwianga Rural Health Clinic, computers were present, but were not used to gather health information. Hardware was never available in common areas; all resided within offices of the directors and hospital coordinators. During this investigation, nurses from various clinics throughout the Southern Province indicated that computers were more accessible due to influence of various NGOs and academic institutions. Health professionals from more technologically advanced areas scored higher on pretests than those who came from less privileged areas, although this variable was not extensively examined here. Institutions like Johns Hopkins University have acted to improve technological infrastructure in various clinics like those in the town of Macha, a short distance from Kalomo. These individuals are more comfortable discussing computer technology and how resources such as Supercourse could benefit them in their clinics.

Available literature points to the fact that communication infrastructure “lacks capabilities to support a strong telecommunications system because prohibitive costs”.⁶ Namwianga Mission allocates tens of thousands of dollars to maintain wireless Internet service. Internet service in Zambia is oftentimes costlier than it is in the West due to satellite operating

charges.²¹ The high cost of computers proves a major barrier for communities. When over 60% of the nation's citizens earn \$1.25 or less a day, the cost of a computer is higher than the annual income of most citizens. Earned wages first go to basic living needs before funds would be spent on computer hardware. Resources must be cheap to buy and easy to maintain in order to be sustainable.

1.1.8 Cellular Technology in Zambia

Cellular telephone use has increased dramatically over the past decade in Zambia. In 2004, reports claim 420,000 cellular subscribers (up from 270,000 in 2002).²² If this rate continued through 2011, there would currently be over 900,000 cellular subscribers. Most cellular phone use is concentrated in major towns and other urban districts (22% and 6.8%, respectively), with only 6.2% of rural communities reporting possessing a mobile phone. However, since this data is seven years old, it may be safe to assume that mobile phone use has penetrated to additional areas.²² During the course of this investigation, I found that many individuals in rural communities had access to a cell phone, whether they claimed ownership or had access to a community mobile phone. Others have reported that in 2004, third generation (3G) phones were only affordable to the elite, however expects that these phones will “eventually become commonplace”.²²

2.0 METHODOLOGY

2.1 SETTING

All data collection was performed in the Southern Province of Zambia, in and near the town of Kalomo, roughly 120 kilometers northeast of Livingstone. Three locations were chosen to introduce and evaluate Supercourse: Kalomo Hospital, the Namwianga Rural Health Center, and Zambia Medical Mission, a mobile clinic that visits four rural villages each year. These locations were chosen because with the help of existing contacts within the community, arrangements were made with the district health director of the Southern Province, Kalomo Hospital, as well as the administrator of Namwianga Rural Health Center. The population of interest was comprised of individuals who identified as Zambian and part of the healthcare workforce. The nature of the information and the impact it could potentially have on this community made it inappropriate to have a separate control group for comparison.

2.2 ACCESS TO COMMUNITY

In the months preceding the implementation of this investigation, relationships were developed with key stakeholders within this community. The director of Namwianga Mission was first introduced to this investigation via a series of phone interviews. Her support was needed because data would be collected at Namwianga Rural Health Center as well as in rural mobile clinics, facilities that she oversaw. She also played a key role in deciding which lectures were going to be presented to participants. This is discussed below in “Lecture information”.

Because Namwianga Mission has been an integral asset of the Southern Province for over half a century, they maintain relationships with various healthcare organizations. During participant recruitment, introductions were facilitated with the director of Namwianga Rural Health Center, Kalomo Hospital, as well as the director of medicine of the Southern Province. All directing officials were very intrigued with Supercourse and seemed excited with its potential in the area. These relationships were important to establish because without their collaboration, it would not have been appropriate to conduct this study in any capacity. It is because of these relationships that interactions were made possible with individuals at Kalomo Hospital and Namwianga Rural Health Center.

2.3 SELECTION OF LOCATIONS

Namwianga Rural Health Center (NRHC) was the first location selected for data collection. Funded through Namwianga Mission (a Christian mission complex located roughly 7km from Kalomo in the Southern Province), NRHC is one of the fastest-changing clinics in the area. This

year alone, NRHC can boast the construction of a new surgical suite housing all equipment necessary for performing cataract surgery. NRHC is becoming a major resource for neighboring villages to seek medical treatment. There are many rural, underserved areas surrounding Namwianga, therefore having a permanent clinic that serves these individuals is important. Also, Namwianga Mission is now home to a radio station that was dedicated in July 2011. This radio station reaches communities as far as 120 kilometers away, which is oftentimes the only way of accessing information and communicating. Targeting a health center attached with a radio station that reaches a large amount of individuals provided a unique opportunity because not only could this information be presented to patients visiting NHRC, new information may be presented on the radio that could reach the 25,000-30,000 annual listeners. NRHC is a topic that is addressed often on Namwianga Radio. Interviewing directors of NRHC and Namwianga Radio revealed that having the ability to advertise medical services that are available has increased patient flow and thus, increased the services needed to adequately serve new patients.

Introducing Supercourse on a more permanent basis to the healthcare professionals at NRHC may be quite feasible. Because patient load will undoubtedly continue to increase, these healthcare professionals need to have access to the most recent and accurate information available in order to continue their education and treat patients to the best of their abilities. The technological framework is improving at NRHC (as demonstrated by the newly constructed surgical suite); therefore it seems realistic to think that in the near future, this clinic will have the infrastructure to accommodate such a resource.

After arriving in Zambia and meeting with the director of NRHC, advice was given to pursue gathering additional data at Kalomo Hospital. This location offered slightly different characteristics than NRHC and thus, helped to diversify the participant pool. Kalomo Hospital is

located in the more urban setting than NRHC; the facilities are larger and employ more staff. This location represented the second type of facility that Zambians typically pursue healthcare, government-controlled regional hospitals. For more information on Kalomo Hospital, please see Table 1.

Lastly, the mobile medical unit “Zambia Medical Mission” (ZMM) was chosen as a third “location” for data collection. It represented the third type of facility that Zambians typically pursue healthcare, non-governmental run mobile medical units. Operated from Namwianga Mission, ZMM is a multinational effort that brings American and Zambian healthcare professionals together to provide free medical care to rural, underserved communities. This was chosen as a location for data collection because nearly sixty Zambian healthcare professionals were a part of this effort, providing a large pool from which to recruit participants. Furthermore, because this was a mobile clinic, the environment was much different than the other two locations. Mobile medical units are becoming more prevalent in Zambia, so it was important to include as a location of evaluation and introduction of Supercourse. Because of ZMM’s nomadic nature, lectures were given in a variety of locations as much adaptation had to occur to fit the rigorous schedule of ZMM. ZMM visits four villages in ten days and each location presented its own challenges. Lectures were given to small groups in areas such as: school-desk-type seating, conference tables, and the even the back of large school buses available to the mission team.

Including a variety of settings allowed for an increase in heterogeneity of participants, something that may have been inappropriate for other study designs worked quite well for this pilot investigation. Also, by mirroring the three major areas that people seek health care (district

hospitals, mission facilities, and mobile clinics), this investigation aimed to remain as culturally appropriate as possible while including locations that were feasible to visit.

2.4 PARTICIPANT SELECTION

Forty-four Zambian health professionals were recruited to participate in a forty-minute educational program where they were educated on male circumcision and its relationship to HIV prevention, public health approaches to cataract treatment, and general global health awareness. All participants were informed that their participation was voluntary and that no personal information would be collected in accordance with the Institutional Review Board of the University of Pittsburgh. In order to meet the inclusion criteria, individuals must have been currently working as a healthcare provider in Zambia and identify as Zambian. Of forty-four potential participants, forty-one met all criteria and were enrolled in the study. The vast majority of participants reported being a part of nursing staff (n=37). Of the remaining participants, individuals reported being a part of the dental staff (n=2), pharmacy staff (n=1), and clinical administration (n=1).

Three individuals did not meet the criteria for participation and were excluded from all analyses. One individual was excluded because while a member of the healthcare industry, he identified himself as a member of the “information and technology” staff and did not have any patient contact. Another individual was excluded from analysis because although she provided patient care, she did not identify as Zambian national, but rather Japanese. Finally, one individual chose not to declare her occupation, therefore her responses were not included in analysis. Table 1 located on page 29 reports participants’ occupations.

2.5 LECTURE INFORMATION

Studies have suggested that “teaching with visible images and oral traditions [are] effective in disseminating didactic information in the Zambian culture”.⁶ It was important to teach information in a way that was culturally relevant as well as informative and effective. Because Supercourse allows a lecturer to present information in a visual format with oral accompaniment, it adheres to cultural norms while investigating a new medium to present information. Three lectures were designed in conjunction with the core developers of Supercourse to accurately reflect the style of lectures available on the website. All lectures were given in Microsoft PowerPoint format and were between seven and fifteen slides in length.

One lecture addressed male circumcision and its relationship to HIV prevention. Information was presented on general biology, epidemiologic trends, typical procedure guidelines, and potential problems of circumcision. Focus was placed on sterile surgical conditions and proper post-operative treatment.

The second lecture educated participants on general knowledge and public health approaches to cataract treatment. Information was provided on general biology, epidemiologic data, typical corrective measures, as well as potential problems of such treatment. As with the first lecture, particular importance was placed on potential problems that could be encountered during such a procedure. Surgical photos were also presented that helped illustrate several key steps of the procedure.

The third lecture educated participants on general global health knowledge. Information was provided on the World Health Organization (WHO) and the leading causes of death and life expectancy worldwide. Special attention was given to the WHO’s definition of health, the

importance of preventive health measures, and preventive education. The lecture concluded with the 1948 Universal Declaration of Human Rights.

These lecture subjects were chosen for three reasons. First, this investigation aimed to evaluate Supercourse as an effective learning tool, therefore, lectures had to mirror information available on the website. Secondly, issues were chosen that were important to local Zambian stakeholders. Male circumcision and cataract are two issues that are on the forefront of medical attention in this particular community. In July, Namwianga Rural Health Clinic began providing corrective surgery for cataract, therefore a decision was made that healthcare professionals in neighboring areas must be educated on the basic science behind the issue. Male circumcision was chosen as a topic because while still in its infancy, the procedure is beginning to gain more popularity throughout Zambia as an effective way to reduce the probability of HIV transmission. Lastly, to reflect Supercourse's mission of educating health professionals around the world about global health, fifteen slides were chosen from the "Golden Lecture of Global Health" from the Supercourse website to present to all participants.

Please see appendices A, B, and C for the full lectures given.

2.6 PRE- AND POST-TEST DESIGN

A pre- and post-test study design was chosen to maximize the available time and resources available to conduct this study. Several previous studies have implemented a pre- and post-test study design among healthcare professionals to test knowledge retention and found it an effective way to measure knowledge retention.^{23,24} In contrast with previous studies, the current investigation did not distribute a long-term follow up test due to limited resources and restricted

access to personal contact information. Because of the limited means in which to contact participants several months following the study, this would not have been a feasible option to implement. For this study, in accordance with the wishes of key stakeholders within the community, all materials had to be designed to fit within a forty-five minute timeframe; therefore tests were limited to eight questions.

The pre- and post-tests were identical to one another. A multiple choice/ answer completion format was chosen for simplicity and time-effectiveness. Three questions addressed issues from the “Male Circumcision to Reduce HIV Transmission”, two asked participants’ knowledge regarding cataract, and three questions gauged knowledge on global health and related topics. As illustrated in Appendix D on page 79, question type was varied between questions. It was believed that in order to accurately measure knowledge gained in the shortest amount of time, a variety of question types should be used. A multiple-choice format was debated, but because there existed the slight probability of respondents guessing the correct answer without actually knowing the information, this approach was deemed inappropriate. If the tests were lengthier, then this approach may have been effective.

2.7 PROTOCOL DETAILS

As per protocol, each participant was asked to complete the pre-test immediately following a short personal introduction and explanation of the study. Participants were instructed to report their occupation at the top of each pre-test. No other personal data was collected. Following the pre-test, the three aforementioned lectures were presented. Participants were asked to not look at the pre- or post-test during the lectures. Presenting to and testing small numbers of participants

made it possible to monitor their activities between pre- and post-tests (i.e. preventing cheating). Upon the completion of the three lectures, participants were allowed to request the facilitator to return to any slides that may have been unclear. Following any clarification, the post-test was administered.

Tests were collected by the facilitator and immediately filed; all were graded and analyzed at a later date. Participants were asked to participate in short focus groups to gather information exploring the viability of Supercourse as a learning resource in Zambia. The initial layout of the focus groups included specific questions that participants were asked to respond to. After attempting this format with several individuals, it was clear that this approach was not effective. Individuals within this community are known for being very polite and for often responding with answers that will be considered pleasing to the questioner, regardless if their opinions mirror such a response. For this reason, focus group questions were modified to more direct prompts for participants to provide responses. Participants were asked to respond, if applicable, with one positive comment about learning using Supercourse and one negative comment. This format was used for the remainder of the investigation. As compensation for their time, each participant was provided a DVD copy of the Supercourse website.

2.8 NOTES ON RESOURCES

Allocating available resources became a major challenge when conducting an investigation in an environment such as rural Zambia. Literature agrees, sparse resources lead to limitations, however, if managed well, one may be able to provide enough resources to fulfill needs.⁶ Strict attention was paid to creating appropriate and effective communication materials. Because there

was no outside funding utilized during this study, creativity played a role in having the ability to create materials that were both effective in measuring the desired variables while remaining culturally sensitive. Tests needed to be short so that resources such as paper, writing utensils, and teaching materials were not wasted. Furthermore, because this study took place in a rural African community, all research materials had to be created and compiled prior to departure from the U.S. Limited space while traveling dictated the materials that could feasibly be included. This problem was addressed in several ways. Pre- and post-tests were designed to fit on a single sheet of 8 ½ x 11” sheet of paper, front and back. Not only did this help limit the space materials occupied, but also it eliminated confusion between scores for each participant.

2.9 DATA ANALYSIS

Grading of pre- and post-tests was completed by two coders after being given specific instructions and provided with standardized answer rubrics. The principal investigator evaluated any discrepancies between graders. Data was analyzed using “IBM SPSS Statistics” Version 19, Copyright 1989, 2011, SPSS. Means between pre- and post-test were compared using paired t-tests. Score improvement was compared crudely as well as by occupation. Potential differences in score improvement as related to specific topic (male circumcision, cataract, and global health) were also examined. Qualitative data was used as a supplement of discussion and was not analyzed for statistical significance for this particular investigation.

3.0 RESULTS

A total of 41 individuals consisting of 37 nurses, 5 midwives, 4 nurse/midwives, 2 dental staff, 1 pharmacy staff, and 1 clinical officer participated in the Zambia Health Education Utilizing Supercourse (ZHEUS) investigation and were included in data analysis. All of the participants completed the required forms at the time of the program.

The program was conducted live on multiple occasions and had some natural variability. Therefore, the pre- and post-test responses were combined for all locations.

Table 3 first depicts the combined responses and mean score improvement between pre- and post-tests from all participants. All participants improved from pre- to post-test with a 95% confidence of 23.5%-32%. Next reported are the differences in improvement between pre- and post-tests in regard to each topic covered in the lectures. Test scores improved 10.7%-25%, 11%-35.4%, and 33.2%-51.4%, for male circumcision, cataract, and global health awareness, respectively.

Table 4 reports analysis results of crude pre- and post-test score differences grouped by occupation. Nurses improved 20%-29% and midwives improved 12.9%-62%. Differences in scores for dental staff, pharmacy staff, and clinical officers all improved, however not to a significant degree, probably due to the lack of additional participants in each of these groups. Due to this lack of significance, these three occupations were grouped into one inclusive group along with nurse/midwives and labeled as “other” for all data analysis.

Table 1: Community Information

Location	Facilities	Staff Available
Kalomo District Hospital	Pharmacy, Lab, General Medical Care	Physicians, Nurses, Various Support Staff
Namwianga Rural Health Center	Lab, X-ray, Cataract Surgery, Women's services, Environmental Health Services, Dental, Optical, Anti Retroviral Therapy	Physicians, Nurses, Midwives, Clinical Support Staff
Zambia Medical Mission (est. 1997)	Dental, Optical, Medical, Wound Care, Pharmacy, Lab, PT	Physicians, Nurses Physical Therapists, Clergy, Technicians

Table 2: Participant Information

Occupation	Number of Participants
Nurse	28
Midwife	5
Nurse/Midwife	4
Dental Staff	2
Pharmacy Staff	1
Clinical Officer	1

Table 3: Mean (SD) for knowledge-based questions by topic

Topic	Pre-test	Post-test	Percent improved
Crude	44.2(13.7)	72(13)	23.5-32*
Male circumcision/HIV infection	78(21.8)	96(13.3)	10.7-25*
Cataract	39(30.6)	62.2(21.7)	11-35.4*
Global Health	13(19.5)	55.3(29.4)	33.2-51.4*

Notes: All participants (n=41) completed both the pre- and post-test.

Percent Improved is reported with 95% confidence and <0.001

*p<0.001

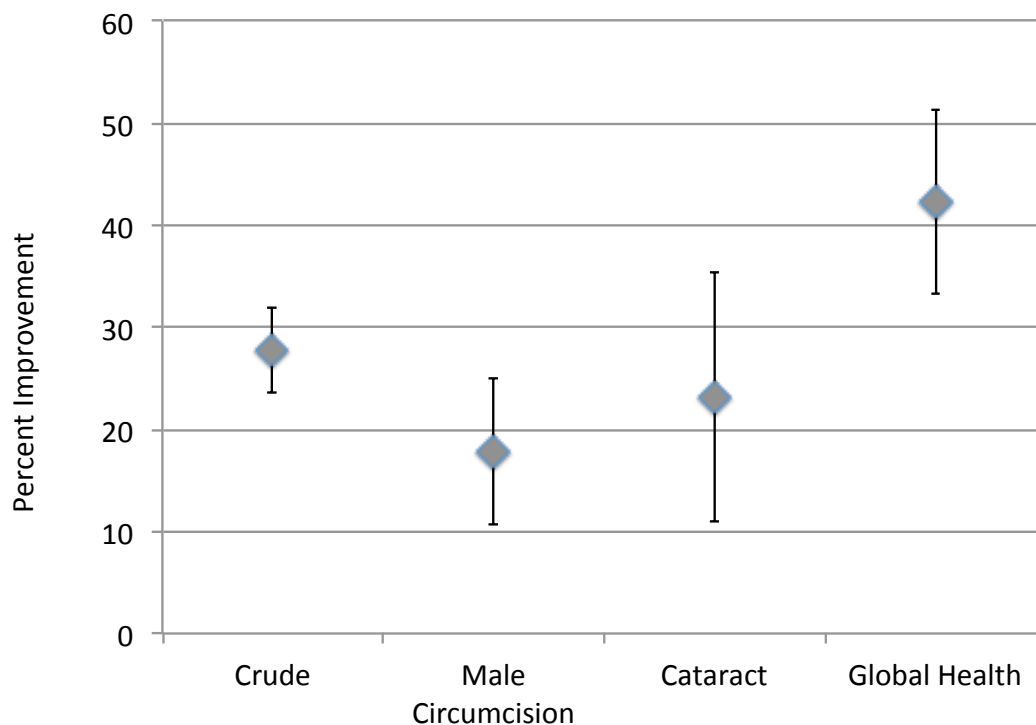


Figure 2: Percent Improvement Pre- to Post-test by Topic (95% CI included)

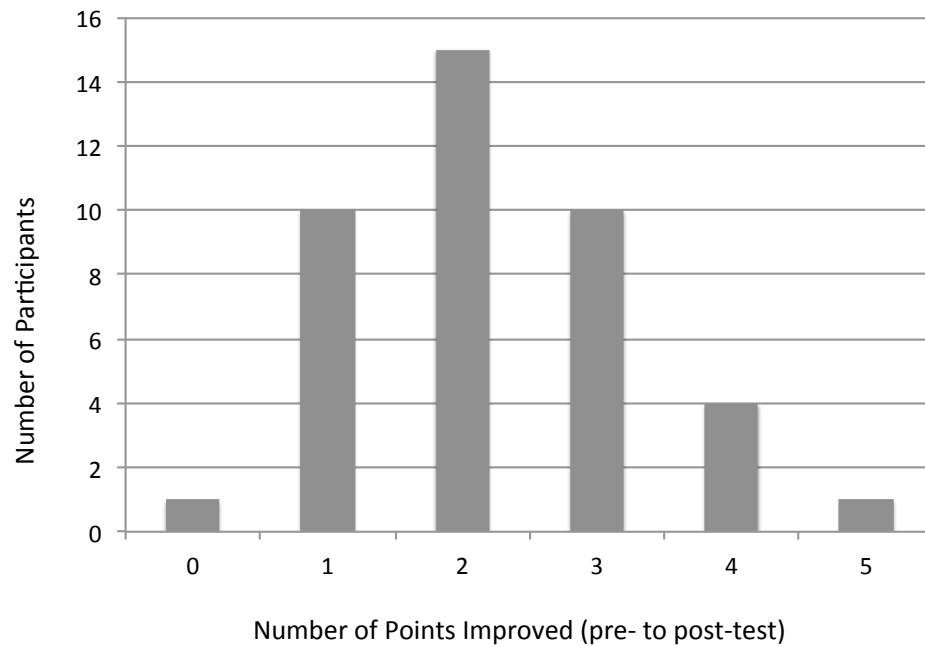


Figure 3: Distribution of Crude Score Improvement Pre- to Post-test

Table 4: Mean (SD) for knowledge-based questions by occupation

Occupation	Responses (N)	Pre-test	Post-test	Percent Improved (%)
Nurse	28	46.4(13.5)	71(11.8)	20-29**
Midwife	5	35(16.2)	72.5(13.7)	12.9-62*
Other	8	40.6(14.6)	70.3(14.8)	18.6-40.7**

Notes: All percent improvements are reported with 95% confidence.

* $p < 0.02$

** $p < 0.001$

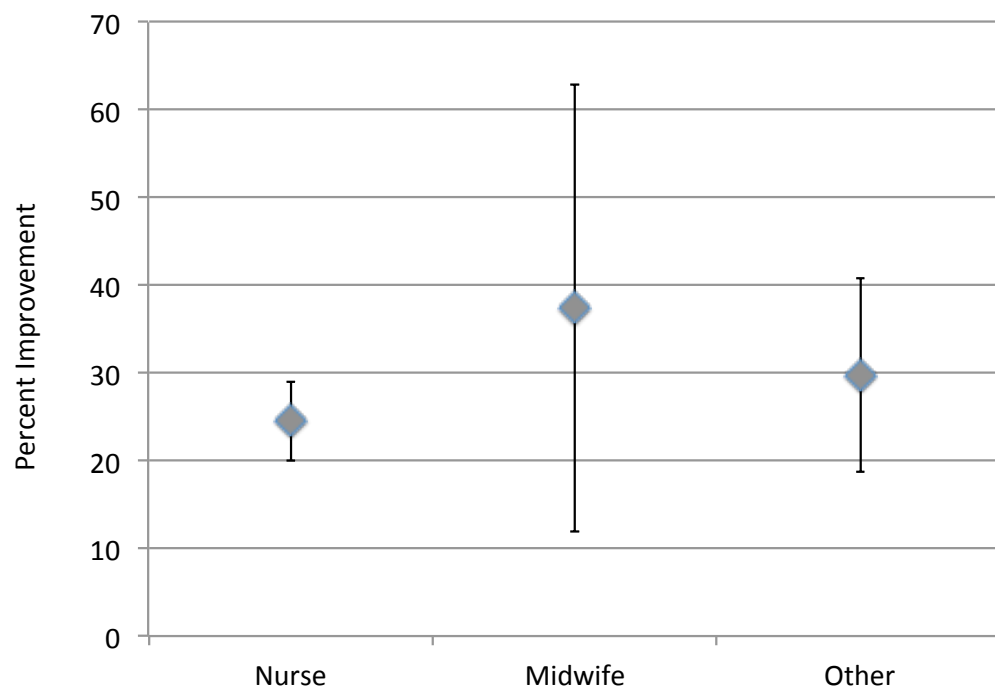


Figure 4: Percent Improvement Pre- to Post-test by Occupation (95% CI included)

A: About this....the thing about this is you learn and see. You can listen and see. You can either remember the words or the pictures.

B: It's actually, somehow easy to understand.

C: Yes, it is really, um, an effective way of finding, or acquiring useful information, because, what can I say, it involves fellow health workers and gives their inputs on what they think, on these two topics that we learned, the male circumcision and the cataract. On the particular community, if such a way of collecting information is used. If you want to reach out to more people, like those with cataract and we may treat them because it is treatable. And for the other thing is for male circumcision I think something is happening, something is happening, and it is very useful. Not necessary confining yourselves with fellow health workers but going deep into the community.

D: No university of hospital provides this information. You must go outside the country for information like this.

E: Ah, circumcision. All the talks were just okay. Yes, the Internet is okay.

F: It was very useful. They were brief and to the point.

G: When someone is just explaining something you can't see anything, so for me to get the information straight from there.

H: It is brief and straight to the point. And also if you are not sure you can again click and go back. A replay (all laugh). And you are there to explain everything to us just there and then.

I: I can keep on knowing what is in the global health.

Figure 5: Positive Responses from Focus Groups

A: Um, like, um, yes. Of course it has to be put into the local language because we are looking at it. The community. Like here, maybe we could teach it in Chitonga, Nyanja, Bemba. So these simple simple languages people can look and it is planned very well.

B: I'm not sure if the short of minutes that you are...the time that you are giving is actually due to [unrecognizable word], but otherwise it could be lengthened because it would be a bit detailed.

C: And um, in case we have a lot of like people, and, (cough) excuse me, PowerPoints (motions to large screen on wall)

D: I think, I think, translating into the local language into Chitonga

E: there is nothing unless we encourage people to just do what we want. To go for male circumcision.

Figure 6: Negative Responses about Supercourse from Focus Groups

B: Um, like at the clinic, in case, they are not very sure what they have, trying to do it you can always go back to the notes and see what is the write procedures and the like. The college as well, it can be very useful, know, for students who are just like starting.

F: Like you said, this is mostly this will help the community. Like if you look at the community, most of the people in our community are from rural areas who do not have access to a computer themselves and the Internet. In Kalomo, there is only 1 Internet café. So you find that very few have access to it. In the schools, some have children in schools where they will charge you for a subject for computer lessons, but when you follow the children, they are not doing the computer lessons, they do not have teachers to teach those lessons. They fact that they don't have teachers; they don't have people competent in those. 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 it takes a lot of hours because someone is not proficient in using it. If this thing is to succeed, it has to start at like the primary level, where those children at primary level are able to pick it up and some children will be able to teach their parents about computer use.

Facilitator: I noticed they offer computer lessons at El Pantano?

F: Yes, they offer computer lessons but one thing I see with computers is the more you have it in the house, the more you use it, the more you get used to using it. I've seen it with my, I'll give my next example. I have a son, he's about 12. I have a daughter, she's about 19. But the 12 year is better at the computer than the daughter. The reason being is that the 12 year was introduced earlier than the 19 year old. When it's introduced at this age the computer to someone who is old, it is more difficult.

Facilitator: You said there are computer lessons at the primary level?

F: There are only in private schools, not the government schools. Even in secondary schools, in government schools, if you got Kalomo secondary school, they will tell you that "we have a computer lab", but ask them the students if they have access and it is nothing. If it is done more at primary level, and they can have more teachers to teach at primary level, so when they go at secondary level, then they wont need a teacher to teach them, they students themselves will know enough themselves.

G: Let me just talk about myself. I was working at the city center and was posted there straight from school so I have never been exposed to computers so I don't even know how to operate one. So at least maybe even at the hospital they can introduce and expose to such because it is very important, really. Because you can put this (DVD) in your bag at home and if you are free at home maybe you can just go through it. The time is very important. This would save time because going through a book takes a lot of time and this is faster. But at least with something like this, the knowledge keeps on changing, so it is important really to be in contact with the information at all times.

H: We have some [computer access] but it's not much. It is, I will just say, it is under represented. And, eh, also, there is a resistance to change. As adults, our schools we are not using computers now just to just now starting to use the computers there is a problem unlike the young ones. So someone knows the is telling us after learning computers that we are, ah, "BBC", born before computers (all laugh). So to answer we are finding a bit of a problem. And also the other thing is that we are also having a problem with the eyes.

Like in my case, my vision was very clear now that I have started to exposing myself to this screen I'm finding some difficulty which I can't see properly now. I'm noticing the change. So that also brings the resistance to this type of learning. So I don't know what could be done. And the other thing is having access to the same computer (other's say "yes"). To us, they are too expensive. They are too expensive so 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.

And at other thing is that people to maintain these computers. At times we would have them but they would break down and no one would be able to fix them. So that is also a discouraging factor.

And you have said global health learning opportunity. Are you offering any courses and they are giving certificates, degrees, or masters?

I: We have [the knowledge], but we don't have the access. We do some courses but afterwards because we have no computers we have that problem.

This is easier. There is more than just one book. And the storage of the information.

Figure 7: Focus Group Responses on the viability of Supercourse in Zambia

Qualitative data collected from participants revealed several themes. First, most participants enjoyed learning using the Supercourse format. Participants reported such things as "You learn and see, you listen and see. You can either remember the words or remember the lecture". The combination of using visual cues and traditional lecturing seemed to resonate very well with this community. As mentioned in previous sections, many communities within Zambia are used to learning in a visual/auditory format.⁶ Several participants also mentioned enjoying having the ability to return to lectures after it is giving as well as having a large amount of information available in one location.

Negative opinions were difficult to gather. As mentioned many times, Zambians are known as being very polite and providing answers, which are deemed pleasing to the questioner. Regardless, when feedback was provided, participants most oftentimes agreed that lectures need to be translated into the local language in order to be effective. Also, a number of participants

reported that longer lectures with more detailed information would be beneficial. Paradoxically, many participants reported enjoying the brief, to-the-point format of the presented lectures.

Most feedback was given when participants were asked if/how this resource could be used in Zambia. Of all responses, the lack of education and limited access to computers were the two most cited barriers of implementing Supercourse in Zambian healthcare facilities. While some reported a lack of education themselves, most were concerned with the lack of computer education in the current school system, suggesting an interest in their children's education rather than their own. When asked about their own barriers, many reported that even though they possessed basic computer knowledge and felt moderately comfortable using the technology, many complained of limited access to computers. Cost was most commonly reported as the source of limited access.

4.0 DISCUSSION

This study examined if Supercourse was an effective way to present and retain knowledge among healthcare professionals within three rural health facilities in the Southern Province of Zambia. A pre- and post-test design was used to assess knowledge of the information included in three lectures, all of which were presented in traditional Supercourse PowerPoint format. Small focus groups were used to collect qualitative feedback from participants regarding the viability of using such a resource in Zambia. The main findings indicate that Supercourse is an effective way for Zambian healthcare professionals to learn information and that with infrastructural and education improvements, this tool may be a viable way for this specific population to continue their health education.

4.1 QUANTITATIVE DATA

These data suggests that information presented from Supercourse is an effective way for healthcare professionals in the Southern Province of Zambia to obtain new health knowledge. Although this study utilized a relatively small participant pool, data analysis revealed that all crude score improvements were normally distributed, with a slight right skew (as reported by Figure 1). This was surprising not only because of the small sample size, but the short length of

the pre- and post- test and the limited resources available. Secondary analyses were completed following data collection.

No control group was used during this investigation because it was deemed inappropriate to provide information to one group and not another. Building trust and rapport with participants was important; providing education to one group and not another would have been acting outside ethical boundaries. A pre- and post-test design provided an accurate measure of change while remaining within the confines of available resources. Please see below in “notes on resources” for further information on why this type of design was utilized.

Significant improvement of crude test scores provides an excellent glimpse into the potential that Supercourse has as an educational tool in this setting. Crude score improvement may be the most important finding from this investigation because the analysis included the entire participant pool and included all topics, eliminating any issues that may have been unique to a certain section of the pre- and post-test such. The relatively small sample size prevented significant results to be obtained when analyzing subgroups within the population.

When analyzed by topic, the largest improvement was made in the “global health awareness” section. This finding is not entirely surprising considering the environment from which these individuals come. Zambia is isolated from information available to other countries around the world. Healthcare professionals seem to be aware of health conditions within their own borders, as demonstrated in question six of the pre- and post-test, however lacked knowledge of global health issues. Question #6 asked the number one cause of worldwide mortality. Nearly all participants initially selected “infectious disease” or “road traffic accidents” (the correct answer is “coronary heart disease”). It also seemed that while participants were interested in global health, they were more interested in issues that directly

affected their community. During focus groups, questions were almost always focused on male circumcision or cataract. While global health is important to these participants, coming from a setting where this concept is not readily visible in everyday life, it is not surprising that most interest is paid to issues seen on a daily basis.

As illustrated in Appendix B, question types varied on the pre- and post-tests. The questions that address global health issues were more fill-in-the-blank format and demanded that the participant actually know the answer. Compared to the other sections where participants may have been able to guess correctly, these questions were most often missed on the pre-test. Perhaps this format was the most effective in measuring actual knowledge gained. Future investigations should examine testing this knowledge in various ways, but it seems that answer completion was effective here.

Analysis also examined the effect of occupation on score improvement. Because of the small sample size, particularly among specific subsets, many conclusions could not be made so subcategories were combined into an “other” group. The most significant increase in scores were displayed by midwives. Even with the small population, the improvement among every individual warrant further investigation. In the nursing arm, improvements mirrored the crude improvement of nearly 30%. Important to note is that every participant improved pre- to post-test, regardless of occupation. Furthermore, although not included in the official analysis, individuals who identified as technical staff improved the greatest amount. One individual, an information technologist, scored 0% on the pre-test and an 88.5% on the post-test. Although it cannot be generalized to the entire population, it may be interesting to include technicians in future studies- perhaps this population (those with very limited healthcare knowledge) may benefit the most from using Supercourse.

4.2 QUALITATIVE DATA

The beginning of the implementation of this investigation held several complications, particularly during focus group discussions. Modifications had to be made almost immediately. As discussed, Zambians are known for being polite and will often respond to questions in the manner they think is pleasing to the questioner. Before each discussion, participants were instructed that the information they provided would not offend and that the more honest responses would help generate the most accurate results. This approach was only moderately effective. After deliberation, focus group prompts were changed. Instead of asking questions that could result in closed-end answers, inquiries were made that forced open-ended responses. Once this change was made, answers seemed to immediately improve. “Was this presentation useful?” was substituted with “can you tell me one positive thing about this presentation and one negative thing about this presentation?”. This simple change seemed to resonate well with the participants and resulted in much longer responses and more meaningful discussion.

When asked what could be improved about Supercourse, many respondents reported low computer literacy and limited access to computer hardware. As seen, Zambia suffers from poor education and limited technological infrastructure. The locations visited during this investigation had very basic resources; Supercourse could be implemented, but the staff located at these locations oftentimes did not have the necessary education to operate the computer hardware. However, significant emphasis was made on the state of the current education system and the lack of computer classes for their children. It seems as though many of these individuals feel like “their time has passed” to learn about computers. Responses focused on the school system rather than their personal computer skills. For these particular locations, computer classes would be very beneficial (mentioned by several individuals in conversation). Lack of access was the

most commonly cited barrier for implementing Supercourse. The exorbitant cost of computer hardware is beyond the financial means of a large majority of individuals and institutions. Increasing the number of computers within these facilities may be a feasible intervention for external organizations, but a problem arises in the ability to maintain the provided hardware. Hardware would have to be provided alongside basic technical training so repairs could be made by on site staff rather than having to rely on external assistance.

Thirdly, many respondents agreed that Supercourse would benefit their community, especially for those who have limited healthcare knowledge, such as those living in surrounding communities. A challenge arises in the ability to disseminate information available on Supercourse to members of surrounding communities. Electricity and Internet availability are not factors that are going to change in the immediate future. However, with the expanding market of tablet computers and increasing prevalence of mobile phones, a new, creative solution to overcoming these barriers may be close at hand. As an example, Supercourse could be preloaded onto any tablet computer so that Internet access would not be necessary. This small device could be taken into rural communities and used to provide health information to its residents. As long as those providing information have the resources to maintain a battery charge, tablet computers and other mobile technology could be exceedingly beneficial in rural, developing settings such as Zambia.

If one were to introduce improved resources such as additional computers as well as education, perhaps some of these facilities would become more desirable locations to work. As discussed during the “Background” section, many newly graduated healthcare professionals are not willing to move to rural locations to practice because of limited infrastructure and poor working conditions. As long as the approach is sustainable, international assistance to

ameliorate some of these problems may entice new graduates to take positions in these types of locations.

There exists a need for Supercourse lectures to be translated into Chitonga and other local languages. Many participants agreed that in order to be able to take this type of technology into rural communities, the information must be available in the local language. English was acceptable for this investigation, however if one of the eventual goals of Supercourse is to be able to reach those in rural, developing settings, lectures must be able to be translated. With the growing network of scientists that contribute to Supercourse, having key lectures translated into the local Zambian language is very feasible. Through contacts made throughout the course of this investigation, this investigator has learned of the willingness of those to join the Supercourse effort. Surely, many of these qualified medical professionals would be able to assist in translation of various lectures.

4.3 NOTES ON METHODS

Zambian healthcare professionals were selected as potential participants for this investigation. First, because the official language of Zambia is English (a remnant of colonial days), all official business is conducted as such. This eliminated the need for the hiring of a translator, which would not have been feasible given the limited resources available. Also, lectures did not have to be translated and could be presented in a fashion that was familiar to both the facilitator and participants. Focus group discussions produced information of substance because a language barrier between facilitator and participants did not exist. Time was a major concern; having the ability to effectively communicate a large amount of information in a short timeframe was

paramount. As mentioned, a window of 30-45 minutes was all that was allowed to complete the full protocol.

Second, because one of the major target audiences of Supercourse is the healthcare community, it was important to mirror Supercourse's intended population in order to effectively evaluate its potential. For example, one of Supercourse's efforts has been to educate budding health professionals on the "WHO definition of health". The Supercourse team found that a vast majority of medical and nursing students do not know this definition; therefore teaching this information was imperative. As a side note, the three communities that were used as study sites were relatively close to one another, allowing transport to and from base facilities in a safe and convenient manner.

4.4 NOTES ON PARTICIPANTS

Zambian health professionals are very well trained, but resources to continue medical education are not readily available. Computer access is scarce and even when available, many individuals do not have the necessary skills to operate the hardware. These circumstances provided a unique opportunity. With increased globalization, technology seems to be present in virtually every community around the globe. Even within rural communities in Zambia, cell phone use is extremely prevalent. Having the opportunity to explore a new technology in a novel setting that has very limited infrastructure proved very exciting. It was surprising that as foreign as Supercourse is to this community, data suggested that learning using Supercourse is very effective.

This population would benefit by having access to a new learning resource such as Supercourse in the clinical setting. There is very little access to information outside of Zambia regarding new research, treatments, or protocols. Knowledge regarding basic public health and prevention issues was lacking. For example, most participants were not aware that coronary heart disease is the number one cause of mortality worldwide, not a surprising fact in a country where HIV prevalence hovers above 15%. Issues encountered on a daily basis are much different from the typical clinic in developed nations. It is important to explore resources such as Supercourse in unique communities such as these. Public health efforts have been very successful in prolonging life worldwide, but these communities may not be prepared to deal with issues that are common among an aging population. Little knowledge about the prevention and treatment of heart disease and other chronic health problems may prove detrimental if not addressed proactively.

The first field evaluation of Supercourse provided a glimpse into the potential that this type of resource holds for health professionals of Zambia. This study obtained quantitative data suggesting that using a computer-based learning resource in a rural, developing community was an effective way to learn. Qualitative data pointed to a disparity in the area of technological infrastructure and education.

4.5 LIMITATIONS

Because this study was designed as a pilot investigation, many of the limitations were inherently unavoidable due to a lack of funding, etc. The small sample size served as the fundamental

limitation. A limited number of participants limit the generalizability of results as well as the power of the analysis. Limited resources (funding in particular) prohibited extensive travel to recruit additional participants at varying health centers. With increased funding, travel could be made possible, increasing the potential participant pool. Next, Zambia has been fighting an extreme healthcare worker shortage. As mentioned, in 2003, only 220 registered nurses graduated from Zambian nursing schools and 169 of those emigrated to practice elsewhere. Because of this, recruiting more individuals may have simply not been possible. This study was conducted in a rural setting; therefore, the lack of healthcare professionals was only exacerbated. Literature has shown that rural areas suffer a great deal more than urban facilities due to lack of incentives, low quality of life, and low pay.⁸ Also, because of relatively strict inclusion/exclusion criteria, many individuals who worked at each facility were not able to take part in this investigation. Many technicians were excluded because they did not have patient contact. Non-Zambian natives were excluded. It may be worthwhile to include these individuals in future studies.

Limited demographic information was collected from participants. This investigation was deemed “exempt” by the Institutional Review Board of the University of Pittsburgh and therefore was limited by ethical restrictions. It would have been interesting to collect data on gender, age, years since graduation from nursing/midwifery school, place of residence, etc.). Collecting this data may have been useful to determine if there were certain subsets of participants that benefitted most learning from Supercourse. However, this lack of demographic information did not hinder the implementation of the investigation, but would have made data reporting more complete.

Strict guidelines prevented personal information to be collected from participants and thus, made it impossible for a long-term follow up post-test to be administered to participants. Even if this information had been provided, it would have made contacting participants virtually impossible. Email would not have been feasible, considering many of these participants do not know how to use a computer, let alone have access to the Internet. Conventional mail would not have been reliable; correspondence takes several weeks between Zambia and the United States and would not have been financially possible. In future investigations, locations could be placed on a one-month rotation in order to collect follow-up data after information has been presented. For example, if four locations were selected to present information from Supercourse, the investigator could present lectures to participants in a location each week. By the time the last location was visited, the investigator could return to the first location to administer a post-test four weeks after the initial information was presented. This would provide a more holistic picture of whether information from Supercourse is effective in providing knowledge that is retained over longer periods. Additional IRB approval would be necessary for this to be possible.

Longer pre- and post-tests may have provided stronger insights into the questions of interest. Each test was only eight questions in length; therefore each missed question was worth 12.5%. Tests were designed to be short because of time and funding constraints. With additional funding, tests could be feasibly lengthened. If tests were lengthened to twenty questions with equal numbers of questions for each topic, perhaps scores between pre- and post-test would have been even more evenly distributed. Furthermore, while much care was taken to design questions that would be appropriate for this population, perhaps more homogeneity between question types would have been more suitable. For example, it was learned that this

population had difficulty completing fill-in-the-blank responses, however, these questions may be the most accurate in measuring knowledge because guessing was reduced to a minimum. It was believed that providing a variety of question types would be more effective at gauging participants' knowledge (rather than having a 25% chance of guessing the correct answer with a multiple choice format). While it was apparent that this was a valid assumption (nearly all participants left fill-in-the-blank responses for global health knowledge blank on the pre-test), it may be appropriate to include only one type of question rather than a variety.

Lastly, although obtaining equal numbers of nurses, midwives, nurse/midwives, pharmacy staff, and dental staff was impossible for this investigation, future studies should attempt to include equal numbers of participants in each arm. Particularly during data analysis, this investigator learned that because there was great variability between numbers of participants in each arm, it was sometimes difficult to draw comparable conclusions across occupations. Taking care to include equal numbers in each group would have led to sounder conclusions being reached as to what population learned the most from the lectures.

4.6 NOTES ON SUSTAINABILITY

As introduced under the “Internet in Zambia” section, Zambia’s current technological infrastructure makes the sustainability of Supercourse challenging. Exorbitant costs and lack of service prevent most Zambians from procuring and maintaining a computer. Earned wages would much rather be spent on other priorities such as health, basic education, and availability of food and other basic commodities.²¹

Social network mapping may also assist in creating a sustainable system. It has been used for a variety of purposes- from tracing allocation of resources to the use of a certain product. Christakis *et al*, for example, examined the dynamics of smoking in a large social network and found discernable clusters of smokers within the network.²⁵ Data suggested that individuals connected to each other through mutual acquaintances often share information and display similar behaviors. Perhaps one may use this a similar model to develop a system of information sharing. In theory, one may intentionally insert a variable that one wishes to spread (say a resource such as Supercourse), and measure the distribution of that resource after several months. With the data, “hubs” of information or connection may be visible, giving interventionists a starting point of where to target efforts. It is not feasible to introduce Supercourse to the entire Zambian population. Instead, though tactical placement of Supercourse, the information therein and the resource itself may “naturally” spread to surrounding communities. In this case, after identifying key hubs (health facilities with the necessary resources, willingness, and access to surrounding communities) within the health network in the Southern Province. Supercourse would be introduced to staff members. Education and computer hardware and tablet computers would be provided to each of these sites. Key individuals within the staff would be taught how to train others to use Supercourse. In theory, this information would spread, first to direct contacts of the trainers, then to individuals further removed from the central hub. One could even provide tablet computers to make information available to rural communities with limited resources. Therefore, by creating “hubs” of information, health education may be spread through surrounding contacts into communities without the necessary resources.

Supercourse will only prove a sustainable resource if individuals are trained to teach others how to use the resource. By training existing members of the community to use and teach others about Supercourse, one would minimize outside involvement regarding its implementation, thus increasing the probability of Supercourse becoming a sustainable way in which to gather health information.

Some of this secondary training will not resonate with some individuals because of the lack of available resources, however by learning how to effectively teach information that is available on Supercourse, these individuals may still gain valuable tools with which to serve others. Even if the resource itself is not accepted, the information taught may be spread and help individuals maintain and improve their health with greater ease. Furthermore, with increasing availability and affordability of mobile technology, introducing Supercourse using a mobile platform may help disseminate information to a whole new population.²⁶ Harnessing the tools that are most prevalent in this community is the best way to ensure sustainability. Research is needed to evaluate the effectiveness of Supercourse using mobile devices as this may hold the key to reaching the largest number of individuals and communities

4.7 FUTURE DIRECTIONS

Future studies should investigate testing this material in additional communities. Additional participants may help improve overall significance and generalizability. Longer pre- and post-tests may give better insight into improvements between topics covered. A follow up test given

several weeks following the initial pre- and post-tests would help indicate if Supercourse is effective in teaching information that is retained into the future. Attention should be given to how questions are designed and whether variability between question types is appropriate. Interventions should focus on providing computer hardware as well as education so that this type of learning can be sustained into the future. Improving communication between clinics to map epidemiologic trends of disease, share new knowledge, and provide referral services to more capable facilities should be at the forefront of any intervention targeting this issue. In the long-term, individuals within the community should be taught how to educate others to use Supercourse with the hope that this resource can be propagated throughout rural health clinic networks with minimal external involvement. Previous investigations have utilized a “training-of-trainers” program in Zambia to help educate clinical midwives on issues such as essential newborn care.²⁷ Data from this particular study suggest that implementing this type of intervention is both effective in reducing costs and improving neonatal mortality rates. Perhaps the same of approach could be used in Zambia to spread knowledge of Supercourse.

The Supercourse team must convene a strategic meeting to set an agenda for the implementation of this resource in rural, developing settings. For Zambia in particular, the data suggests that lectures must be translated into the local language. This means that more staff must be included in the process. Creating a specific agenda on the correct use of Supercourse may benefit this community as well, particularly if a “training-of-trainers” program is to be utilized in the future. By creating a specific agenda and implementing Supercourse properly, perhaps the team can address the lack of resources available to healthcare professionals, thus acting to retain skilled workers. The quality of information available on Supercourse will ensure that Zambian healthcare professionals are receiving the best education with the least amount of external input,

improving the probability that this resource will serve them well into the future. If the resource is proven to work, the approach can then be adapted to other communities in Zambia as well as other countries in the region.

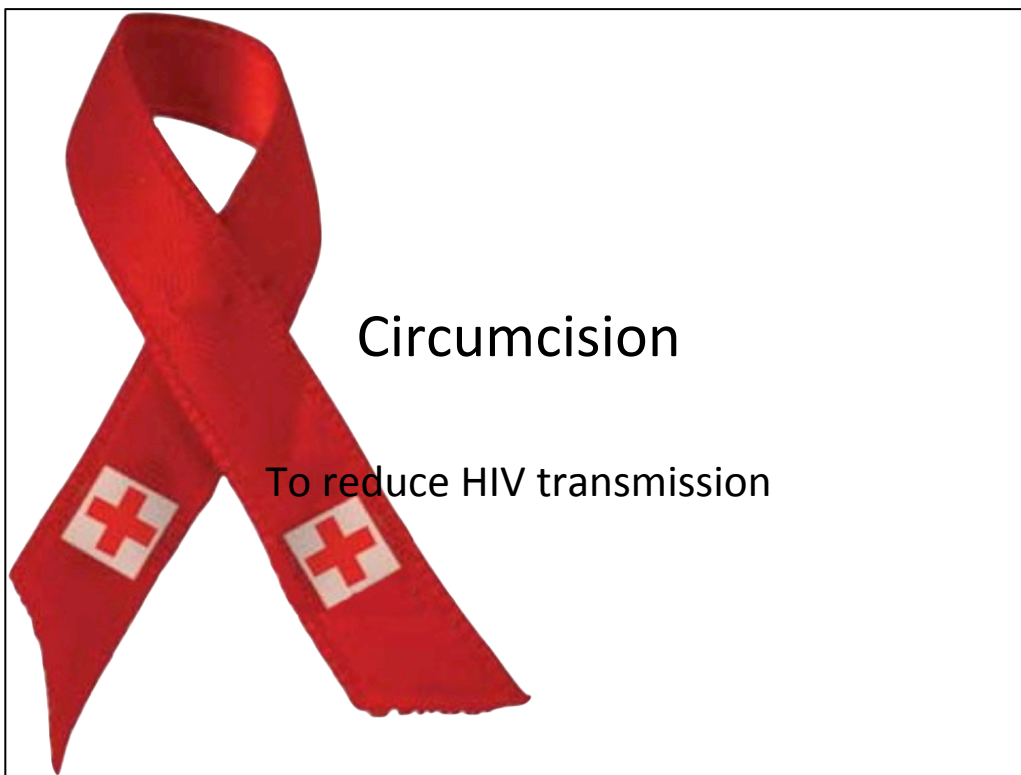
5.0 CONCLUSIONS

As this investigation points out, Supercourse seems to have great potential of serving as an educational resource in Zambia. A pre- and post-test design was used to evaluate whether lectures presented in the Supercourse format were effective at presenting new knowledge. All participants improved knowledge after a series of three lectures, and qualitative data suggests that Supercourse is an enjoyable way to learn new health information, but several improvements must be made to the local infrastructure if Supercourse is to be a viable addition to local facilities. While many challenges make implementing Supercourse difficult, several strategies may assist in tackling these barriers. Utilizing research on social network mapping may help target specific hubs as centers for Supercourse implementation and training in order to reach the most individuals with minimal resources. The potential use of mobile technology to reach rural communities with Supercourse warrants further research. Finally, in order for Supercourse to act as a long-lasting resource, special focus must be made on sustainability. With the cooperation of international organizations, we may improve the available equipment within rural health clinics as well as offer education to modernize workplace organization. Introducing updated computer hardware or laboratory equipment and sharing knowledge regarding record management are two examples of feasible interventions. Training local individuals to train others will prove exceedingly important. As the world continues to become more integrated, resources like

Supercourse will become more important as ways to share information and create community among healthcare professionals around the globe.

APPENDIX A

MALE CIRCUMCISION AND HIV TRANSMISSION LECTURE

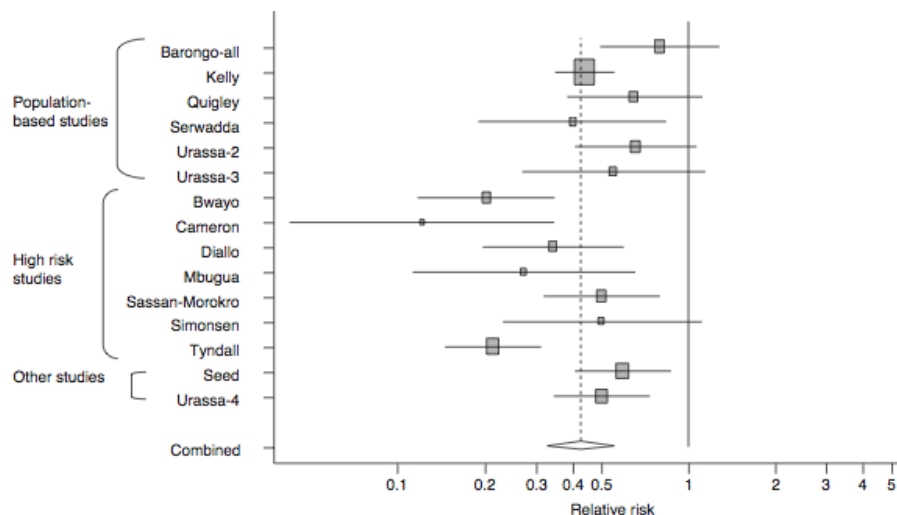


Why circumcision?

- Viral entry may occur through micro lesions of the foreskin or through trauma to the mucosal surface of the foreskin
- The inner surface of the foreskin contains a high density of “HIV target cells” (Langerhans cells)
- Genital ulcers may be less recognized in uncircumcised men, thus delaying treatment and increasing susceptibility to HIV transmission

Karim, Columbia University Forgary AIDS Training & Research Program, Accessed June 2011

Epidemiology of HIV and Circumcision



Weiss, et al. Male Circumcision and HIV infection in sub-Saharan Africa: a systematic review and meta-analysis, 2000

Typical Procedure

(Oversimplified)

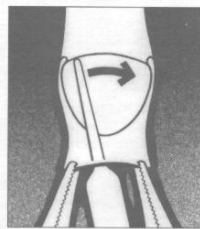
- 4+1 stages

****Sterile Environment****

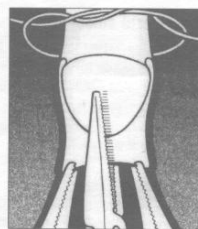
- 1) Local Anesthesia
- 2) Removal of Prepuce (shown on next slide)
- 3) Sutures/Sterile Dressing
- 4) Instruction to patient for proper care



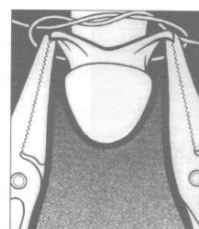
Basic Procedure diagram



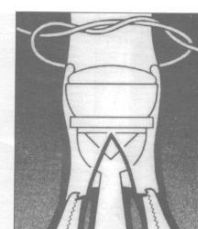
1



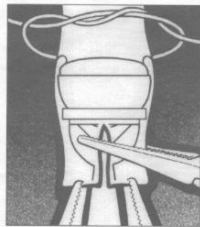
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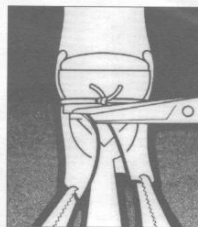
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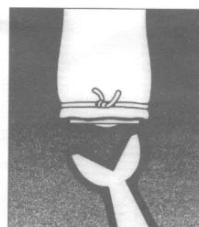
4



4a



5



6

<http://www.childurologist.co.uk>

Potential Problems

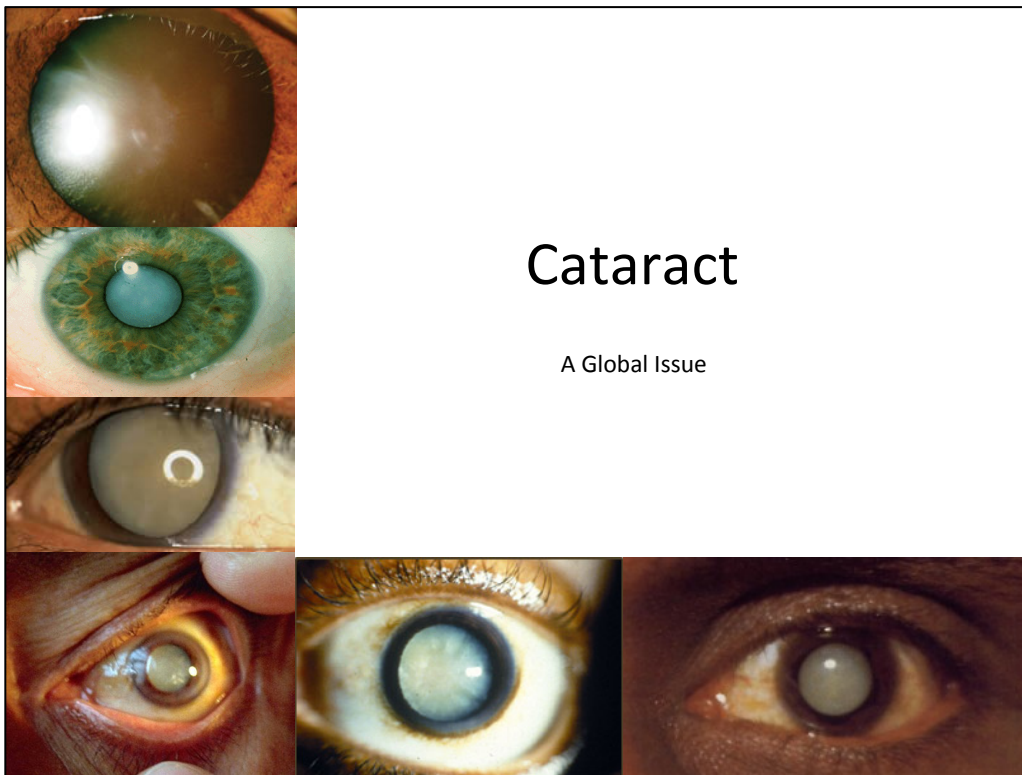
- Blood loss
- Infection from using non-sterilized instruments
- Post-surgery infection from improper care
- Transmission of infection through open wounds (must counsel patients of importance of responsible sexual practices)
- Transmission of infection between patients if surgical instruments are not sterilized

Conclusions

- HIV transmission can be reduced by promoting male circumcision, HOWEVER one must be aware of potential problems that might arise from this procedure.
- Behavioral counseling and proper instruction is important with all circumcision patients to prevent against further HIV transmission
- Although circumcised men are shown to have a 60% reduced risk of HIV transmission, preventive education may be the most effective tool to help reduce HIV prevalence in Africa.

APPENDIX B

PUBLIC HEALTH APPROACHES TO CATARACT TREATMENT



Causes of Worldwide Blindness

- Cataract 17 million
- Trachoma 6.0 million
- Glaucoma 3.0 million
- Xerophthalmia 0.5 million
- Onchocerciasis 0.5 million
- AMD 1.0 million
- Diabetic retinopathy 0.25 million
- Leprosy 0.25 million
- Others 2.5 million

- 85% of blindness is in Africa and Asia
- 85% of cases are potentially treatable or preventable

Allen Foster in Clinical Ophthalmology - Duane, ed. (1991)

What is a Cataract?

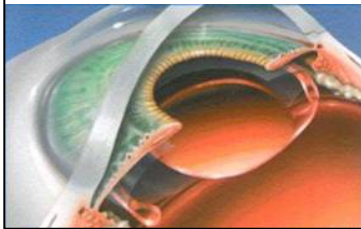
- Clouding of the lens of the eye
 - Lens fibers are continuously laid down, originating in the nucleus of the lens. Old fibers left in the nucleus lead to enlargement and hardening of lens
- Left untreated, leads to blindness



Images courtesy of:
www.ptolemy.ca

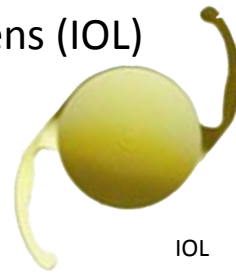
Modern Procedure in Africa Extra-capsular cataract extraction

- 1) Scleral incision made (10-12mm)
- 2) Circular opening made in the anterior capsule
- 3) Removal of nucleus and aspiration of cortex of lens (remainder of capsule is left to act as a scaffolding for the intra-ocular lens (IOL))



IOL in capsular bag

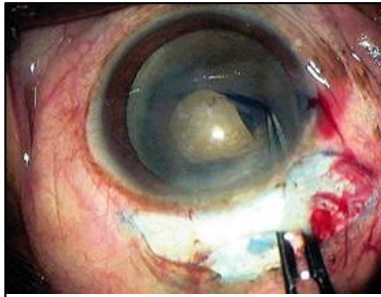
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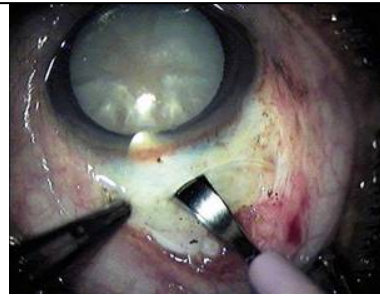
IOL

****Disclaimer****

Graphic Surgical Images on next slide



1) Opening the anterior capsule



2) Making a scleral tunnel



3) Delivering the brown nucleus



4) Aspirating the remaining cortex with a cannula

Images courtesy of
www.ptolemy.ca

Potential Problems

- Performing surgery under unsterile conditions
- Capsular rupture and vitreous (fluid) loss
- Infection (endophthalmitis) ~6% of cases. Leads to blindness in 15% of cases
- “Couching” (dislocating entire lens into vitreous)
 - First successful treatment of cataracts, however complications are common, such as:
 - Uveitis (inflammation of middle layer of eye (blood supply to retina))
 - Glaucoma
 - Permanent and untreatable blindness


Conclusions

- Cataracts is the #1 cause of blindness in the world
- Extra-capsular cataract extraction (ECCE) is an effective surgery to correct cataracts
- Maintaining a sterile environment promotes a positive surgical outcome free of infection
- With continued education, blindness due to cataracts in developing nations may be decreased.

<http://www.ptolemy.ca/members/archives/2009/Cataract/index.html#T1.8>

APPENDIX C

GLOBAL HEALTH AWARENESS



Global Health

So near, so far

Slides provided by www.pitt.edu/~super1/

Mission of this lecture

- Teach every working health professional as well as health student in the world about global health
- Develop a global health network for health professionals to tackle local to global (“glocal”) health problems.

“Health is not only the absence of infirmity and disease, but also a state of physical, mental, and social well-being.”

-WHO

What is WHO?

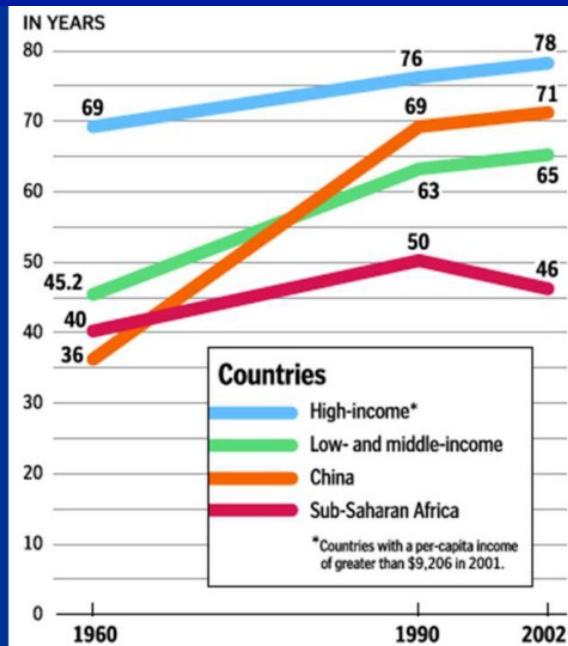


WHO is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

Public health, medicine, and nursing: parts of the same puzzle



Life Expectancy



10 leading causes of death around the world (WHO)

Cause of death	Death in Millions	Percent of Death
Coronary heart disease	7.20	12.2
Stroke and other cerebrovascular diseases	5.71	9.7
Lower respiratory infections	4.18	7.1
Chronic obstructive pulmonary disease	3.02	5.1
Diarrheal diseases	2.16	3.7
HIV/AIDS	2.04	3.5
Tuberculosis	1.46	2.5
Trachea, bronchus, lung cancers	1.32	2.3
Road traffic accidents	1.27	2.2
Prematurity and low birth weight	1.18	2.0

Most important problems of global health today

- Communicable, maternal, perinatal and nutritional conditions
- Noncommunicable diseases
- Injuries

Most important problems of global health today

- Communicable, maternal, perinatal and nutritional conditions
- Noncommunicable diseases
- Injuries

“Everyone has the right to a standard of living adequate for the health and well being of himself and his family, including food, clothing, housing, and medical care.”

-Universal Declaration of Human Rights, 1948

Who are the developers of this lecture?

- Global Health Network Supercourse Project
- Library of Alexandria, Egypt
- WHO Collaborating Centre, University of Pittsburgh Graduate School of Public Health

APPENDIX D

PRE- AND POST-TEST

Pre/Post Test 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.

- 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 (WHO), 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? _____
- 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 _____.

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