



McMaster eBusiness Research Centre

**Health Informatics Programs for Continuing Education for
Health Executives in Western Africa, and Delivery
Using Distance On-line Education: A Systematic Review**

By

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ABSTRACT

Background

Health informatics is defined as “the intersection of clinical, IM/IT and management practices to achieve better health” (COACH)¹. In the developed world, the implementation of health informatics, with the goal of improving patient care and reducing costs, has been implemented in public health, hospitals, and physician practices. Accompanying these efforts are educational programs at the post-secondary, Bachelor, Masters and PhD level. The aim of these programs is to give graduates the skills necessary to continue the drive towards innovative health information technologies. These achievements have been documented in the health care literature. In developing countries, the lack of structured health informatics education programs is a barrier to addressing the need for these programs.

Objective

To systematically review the literature to determine: (1) what comprises a health informatics continuing education curriculum for health executives, (2) the applicability of said curriculum to Western African countries, and (3) the effectiveness of distance on-line education methods for delivering the curriculum.

Methods

Medline and Embase were searched over the time period January 2000 to February 2014. Google was also used to discover additional articles pertinent to the research objectives. Qualitative and quantitative studies were included if they focused on the use of distance on-line delivery for education and/or health informatics education, or discussed health informatics curricula for clinicians and non-clinicians, or addressed health informatics education in developing countries, or more than these three.

Results

16 studies (7 quantitative, 9 qualitative) met the inclusion criteria. Educational needs for health executives were considered. In developing countries, Information and Communication Technology (ICT) infrastructure must have sufficient capacity to support delivery of educational materials and activities in order to be effective. A majority of the quantitative studies (6 out of 7) found that distance on-line delivery of education and associated technologies (podcasts, virtual environments) had positive effects on student engagement, learning and retention.

Conclusions

For busy health executives, short courses on health informatics can offer on-line assistance in providing continuing education. Distance on-line education is now an accepted approach to earning academic credentials and acquiring knowledge. Collaborative efforts between universities in developed and developing countries, along with grant funding, can greatly aid in delivering health informatics education to developing countries.

GLOSSARY OF TERMS

AHIMA American Health Information Management Association.

Distance on-line education is any education a student receives outside of a presential setting. It could be, but is not limited to, Web-based learning (WBL), Internet-based learning, podcast, virtual classroom, or learning management system.

Health executives are broadly defined as physicians, nurses, hospital administrators, Chief Medical Officer, Chief Nursing Officer, Hospital directors, Hospital CEO.

EHR Electronic Health Records.

GPA Grade Point Average.

ICT Information and Communication Technology.

IM Information Management.

IMIA International Medical Informatics Association.

IT Information Technology.

North-South collaboration refers to developed countries cooperating with developing countries in scientific endeavours.

Presential denotes that a student is attending on site, in-class instruction.

South-South collaboration refers to developing countries cooperating with each other in scientific endeavours.

RAFT is the *Réseau en Afrique Francophone pour la Télémédecine*, an eHealth network for telemedicine in Africa.

RHIA Registered Health Information Administrator, is a health information management certification exam administered by AHIMA.

UPCH is a university in Peru, the *Universidad Peruana Cayetano Heredia*.

INTRODUCTION

The terms “health informatics”², “medical informatics”², and “health information technology”³ describe and categorize a specific family of computer applications used in health care settings. These applications have been widely utilized in disease surveillance⁴, computerized provider order entry (CPOE) systems⁵, medication management⁶, home telehealth⁷, mHealth⁸, clinical decision support systems (CDSS)² and patient record keeping (e.g., Electronic Health Records [EHR])⁹. The aforementioned applications comprise but a partial list, with new innovations and applications appearing on a frequent basis. Although some of these efforts have failed^{10, 11} and others have introduced risks to patients¹²; there have been a number of successes reported for both patients^{13,14,15,16} and clinicians¹⁷.

To introduce these technologies into a health care setting, a skilled workforce is required. In Canada, the demand for health informatics workers exceeds supply; a five-year forecast study in 2009 predicted that up to 12,000 additional professionals would be required by 2014¹⁸. To respond to this demand in Canada, health informatics programs at a post-secondary level are offered at colleges and universities¹⁹. In 2009, David Blumenthal, MD, at the time the U.S. national coordinator for health information technology (ONC), predicted that at least 50,000 new health information management jobs would be needed as the United States moved from a paper to a digital healthcare system²⁰. In 2011, the ONC funded the Workforce Development Program. Its main objective was “to train a new workforce of skilled health IT professionals who will be able to help providers implement electronic health records and achieve meaningful use”²¹.

In developing countries, the number of health technology workers required is unknown, yet there is agreement that this type of training is necessary²². The objective of this systematic review is to find evidence that using distance on-line education can assist in the delivery of health informatics education to health executives residing in developing countries, and in particular, Western Africa.

19 countries make up Western Africa²³. The official language of the following nine countries is French: Burkina Faso, Benin, Chad, Côte d’Ivoire, Guinea, Mali, Niger, Senegal, and Togo. Five countries have English as their official language: The Gambia, Ghana, Liberia, Nigeria, and Sierra Leone. Cameroon is bilingual (French, English). Cape Verde and Guinea-Bissau use Portuguese as their official language. Spanish and French are the official languages of Equatorial Guinea. Arabic is the official language of Mauritania. All 19 countries have institutes of higher education such as universities, but only two have at least one university that offers either education or a degree in health informatics. The University of Ghana, in Ghana, offers a Master of Health Informatics (MHI)²⁴. In Nigeria, the University of Jos offers a course in medical informatics, as part of its Bachelor of Medicine degree²⁵, as well as a course in nursing informatics as part of its Nursing degree²⁶. The University of Ibadan (Nigeria) offers a Masters in Health Information Management²⁷. (A scan of the universities in the countries of Burkina Faso^{28,29}, Benin^{30,31,32}, and Togo³³ did not reveal a program at either the Bachelor, Masters or Doctorate level in health information technologies.)

The objective of the systematic review is to determine: (1) what comprises a health informatics continuing education curriculum for health executives, (2) the applicability of said curriculum to

Western African countries, and (3) the effectiveness of distance on-line education methods for delivering the curriculum.

To accomplish the objective, the study will outline the results of the literature search; list the themes found in the literature; assess the quality of the quantitative studies; discuss the relevance of both the quantitative and qualitative studies to the objective; and conclude with recommendations.

METHODS

Search Strategy

A systematic review of the literature was conducted, searching Medline and Embase, using relevant search terms (search terms, and concatenation of search words are shown in Table 1). Google was also used to discover additional articles pertinent to the objective (Google search strings are shown in Table 1). References from included articles were also examined and used if relevant (hand search).

Table 1 Search Strategy

Database	Search terms
Medline	Medical Informatics/ AND health informatics education.mp.
	Medical Informatics/ AND Education, Continuing/
	Medical Informatics/ AND curriculum/ or education, distance/ or education, continuing AND Hospital Administrators
	Health informatics education.mp. AND Education, Distance/
	Health informatics education.mp. AND Developing Countries/
	Health informatics education.mp AND West Africa.mp
	Health informatics education.mp. AND Africa.mp
	Medical Informatics/ AND health informatics education.mp. AND internet.mp.
Embase	Medical Informatics/ AND health informatics education.mp.
	Medical informatics/ AND continuing education.mp.
	Medical Informatics/ AND curriculum/ or education, distance/ or education, continuing AND Hospital Administrators
	Health informatics education.mp. AND Education, Distance
	Health informatics education.mp. AND Developing Countries/
	Health informatics education.mp AND West Africa.mp
	Health informatics education.mp. AND Africa.mp
	Medical Informatics/ AND health informatics education.mp. AND internet.mp.
Google	Search strings
	use of online distance education for health informatics in the developing world
	quantitative observational studies distance online health informatics education

Inclusion and Exclusion Criteria

Quantitative (meta-analysis, randomized control trials [RCTs], surveys, quasi-experimental, and causal-comparative research method) and qualitative study designs (case studies, literature reviews, surveys [open-ended questions], mixed methods, and study of documents) were considered.

Inclusion criteria for articles

- Addressed issues in health informatics education for health executives
- Focused on starting up health informatics education programs, whether distance on-line or presential
- Offered recommendations on bringing health informatics education to developing countries
- Evaluated technology (e.g., podcasts) as an educational tool
- Evaluated distance on-line education methods
- Considered pedagogical approaches in distance on-line education

Exclusion criteria for articles

- Non-English language articles were excluded, as the author did not have access to translator resources
- Any articles before the year 2000 were excluded, as a larger body of work (articles and studies) regarding health informatics was found to be starting after that year, as well as evaluations and studies on the use of the Internet as a teaching tool
- Articles that described a specific health informatics education program at a college or university, without offering an evaluation of the program
- Did not study distance on-line education
- Did not describe health informatics education in developing countries or cooperative efforts in health informatics education between the developed world and developing countries
- Similar to articles by same author/group of authors
- Update on an educational program supersedes article
- Articles published in 2000 but discussed events that occurred before that time
- Focus on health information management (HIM), interoperability, ICD-10, librarianship, standards and/or terminology
- All other articles that did not address the objectives

Books were also excluded. As this was directed towards student education, any articles that incurred a cost for access were excluded.

Data Extraction and Synthesis

The systematic review was driven by these three sub-objectives: (1) what comprises a health informatics continuing education curriculum for health executives, (2) the applicability of said curriculum to Western African countries, and (3) the effectiveness of distance on-line education methods for delivering the curriculum. 16 articles were selected for the systematic review. Analysis of the articles led to the development of themes associated with each of the sub-objectives. For example, using the literature to extract the contents of a health informatics curriculum for health executives led to the theme of issues in health informatics education for health executives. Researching the applicability of health informatics continuing education for

health executives to Western African countries brought forward the theme of issues in health informatics education in Africa, as well as the theme of starting up health informatics education programs. Lastly, to determine the effectiveness of distance on-line education methods for delivering the curriculum, three themes emerged: evaluation of technology as an educational tool; evaluation of distance on-line education methods; and pedagogical approaches in distance on-line education.

In all, six major themes were extracted from the literature, they are: issues in health informatics education for health executives; starting up health informatics education programs; issues in health informatics education in Africa; evaluation of technology as an educational tool; evaluation of distance on-line education methods; and pedagogical approaches in distance on-line education.

Results of the studies are presented by the six major themes extracted from the literature, as shown in the columns in the data extraction form in Table 2.

Table 2 Data extraction form

Article title/Data extracted	Issues in health informatics education for health executives	Starting up health informatics education programs	Issues in health informatics education in Africa	Evaluation of technology as an educational tool	Evaluation of distance on-line education methods	Pedagogical approaches in distance on-line education
Internet-based learning in the health professions: A meta-analysis ³⁴					Effectiveness of Internet-based learning	
Assessing the feasibility of using virtual environments in distance education ³⁵				3 different types of on-line learning, including virtual environments		
Evaluating distance learning in health informatics education ³⁶					Academic performance of distance learning students	
Using podcasts to help students apply health informatics concepts - benefits and unintended consequences ³⁷				Podcasts as an instructional method		
Health informatics education for clinicians and managers—What’s holding up progress? ³⁸	This UK survey found that physicians and nurses received different levels of health informatics education at their respective educational institutions.					

Article/Data extracted	Issues in health informatics education for health executives	Starting up health informatics education programs	Issues in health informatics education in Africa	Evaluation of technology as an educational tool	Evaluation of distance on-line education methods	Pedagogical approaches in distance on-line education
Translation, implementation and evaluation of a medical informatics distance learning course for Latin America ³⁹		The AMIA 10x10 program was used as a basis for the health informatics curriculum. After some adjustments were made for Latin America, the course was translated into Spanish. This was the first Spanish, distance on-line training in health informatics in Latin America.				
Impact of self-assessment questions and learning styles in Web-based learning: A randomized, controlled, crossover trial ⁴⁰					Assessing whether students acquired knowledge when using WBL by having the students fill out self-assessments questions for some modules and no assessment for other modules. Giving students post-test and calculating their scores assessed knowledge acquisition. Knowledge retention was also tested at the end of the academic year.	
IT IQ in varying degrees ⁴¹	A synopsis of short courses offered in the U.S. for health executives					
Evaluating the AMIA-OHSU 10x10 Program to Train Healthcare Professionals in Medical Informatics ⁴²	Distance on-line health informatics education with a duration of a semester's length					

Article/Data extracted	Issues in health informatics education for health executives	Starting up health informatics education programs	Issues in health informatics education in Africa	Evaluation of technology as an educational tool	Evaluation of distance on-line education methods	Pedagogical approaches in distance on-line education
An international course on strategic information management for medical informatics students: aim, content, structure and experiences ⁴³	An on-line course offered by the International Partnership for Health Informatics Education; content is a blend of information technology, hospital systems and strategic management					
Developing capacity in health informatics in a resource poor setting: Lessons from Peru ⁴⁴		International collaboration along with obtaining grant funding helped Peru develop a health informatics training program				
Sustainable development of medical informatics in Africa: Need for a health informatics curriculum ⁴⁵			Barriers to health informatics and health informatics education.			
Health informatics education: a global challenge ⁴⁶		AMIA 20/20 program	Language is a barrier to information retrieval, as the vast majority of journal articles are published in English.			
The RAFT network: 5 years of distance continuing medical education and tele-consultations over the Internet in French-speaking Africa ⁴⁷			RAFT is an Internet-based network used for continuing education for clinicians and also for tele-medicine consultations. To date, it has not been used for distance on-line health informatics education.			
Information technology in health professional education: why IT matters ⁴⁸						A literature review on the pedagogical issues in distance on-line education
Towards an understanding of interactions in distance education ⁴⁹						A literature review on the pedagogical issues in distance on-line education

RESULTS

Description of Studies

The literature search returned 364 articles. 292 of the corresponding abstracts were reviewed, resulting in 16 studies selected for this systematic review, as shown in Figure 1. All studies were published after 2000. Whether quantitative or qualitative, all but one of the studies exhibited one or all of these characteristics: health care setting, health informatics education via short courses or degree program, and effect of distance on-line education methodologies on health care professionals. Eight studies were from the United States, 3 were from the UK, 1 was from Europe, 2 were from Latin America, and 2 were from Africa.

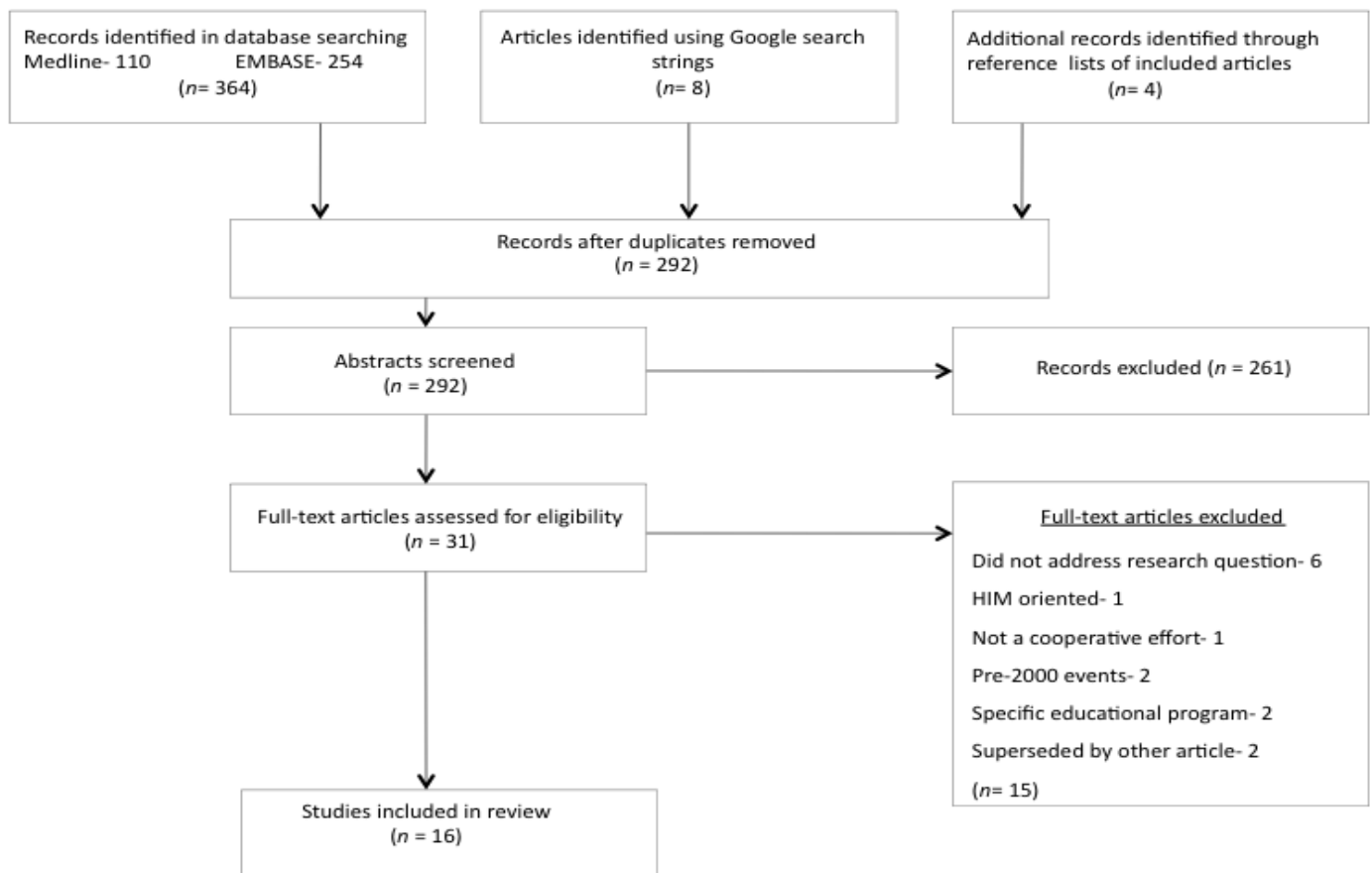


Figure 1 Study Selection

Assessment of study quality

Study quality was assessed using a scoring methodology developed by Garg et al⁵⁰ for medical informatics studies. Methodological quality was scored using a 10-point scale, consisting of 5 categories, each with 3 possible measures, as depicted in Table 3. Meta-analyses were scored as a 10, due to their rigorous statistical nature. As qualitative studies, by definition, are not quantifiable, no scoring was performed on the qualitative studies used in this systematic review. On this scale, Murphy et al 2004³⁸ resulted in a 3 (method of allocation in a study group = 0; unit of allocation = 2; baseline differences = 0; outcome objectivity = 1; attrition = 0; total = 3). Cook et al 2006⁴⁰ resulted in an 8 (method of allocation in a study group = 2; unit of allocation = 1; baseline differences = 2; outcome objectivity = 1; attrition = 2; total = 8).

Table 3 Scoring Methodology

Measures/ Categories	2	1	0
1- Method of allocation to a study group	Random	Quasi-random	Concurrent or no controls
2- Unit of allocation	Health executives	Single type of health executive	Other
3- Baseline differences between groups that may be linked to study outcomes	No baseline differences or differences adjusted with appropriate statistical methods	Baseline differences reported and no statistical adjustment	Baseline characteristics not reported
4- Outcome objectivity	Objective outcomes or subjective outcomes with blinding	Validated subjective outcome	Subjective outcomes poorly defined
5- Attrition (drop-out rate)	<10%	10-20%	>20%

Methodological Quality Assessment

Of the 16 studies, 7 used quantitative study designs. The first of these was a meta-analysis³⁴, using quantitative data syntheses. The second and third were an RCT⁴⁰ (Randomized Controlled Trial) and a quasi-experimental design³⁷ respectively; both added learning tools to an existing curriculum to determine the effects on test scores and student satisfaction. The fourth paper used a causal-comparative research design³⁶ to compare GPA (Grade Point Average) and external certification exam scores between distance and presential students studying the same curriculum. The final three papers used surveys to evaluate curricula^{38, 39} and on-line educational methods^{39, 35}. Table 4 presents a summarized view of the quantitative studies (source, study design [includes participant type], score, study characteristics, outcomes).

Of the 9 qualitative studies, there were 3 studies of documents^{46, 41, 45}, 2 literature reviews^{48, 49}, 3 case studies^{43, 44, 47}, and one qualitative survey⁴².

Table 4 Summary of Quantitative Studies

Source	Study design (n)¹	Quality score	Study characteristics	Outcomes
Evaluation of distance on-line education methods				
Cook et al 2008 ³⁴	Meta-analysis (201) Participants: health executives	10	Compared Internet-based learning to no learning; compared Internet-based learning to non-Internet learning	Internet-based learning and non-Internet learning offered same results in terms of knowledge outcomes, skills
Cook et al 2006 ⁴⁰	Randomized, Controlled, Crossover Trial (121) Participants: residents	8	Case-based self-assessment questions were added to Web-based learning (WBL) modules	Post-test scores at the end of each module were higher for students using the question format Post-test scores at the end of the academic year: no significant statistical difference found between question format and non-question format Format preference: students preferred the WBL with questions
Russell et al 2008 ³⁶	Causal-comparative (31) Participants: health informatics students	8	Distance learning students worked full-time while studying in the full-time program; presential students did not have this constraint	Final GPA scores: no significant statistical difference found between distance learners and presential learners External certification exam scores: no significant statistical difference found between distance learners and presential learners

¹ n = number of participants in a study

Evaluation of technology as an educational tool				
Meek et al 2012 ³⁷	Quasi-experimental crossover design (15) Participants: graduate (Masters level) online nursing students	7	Health informatics curriculum already offered on-line ("course as usual"); added Podcasts to determine effect if positive effect for students	Student cognition scores: no significant differences between use of podcasts and "course as usual" conditions Student engagement scores: no statistically significant difference found in either group Student satisfaction with course: when students were part of the Podcast group, satisfaction increased.
Johnson et al 2011 ³⁵	Mixed methods (surveys) (10) Participants: nursing informatics students	6	Comparison of 3 different types of on-line learning environments	Students preferred the virtual learning environment, followed by webinar, and lastly learning management systems
Starting up health informatics education programs				
Otero et al 2007 ³⁹	Two surveys, each administered to the same 142 participants	5	1st survey: course format 2nd survey: course characteristics	The course format survey used a 10-point Likert scale, with an overall average score of 8.6. The course characteristics used a 5-point Likert scale, with an overall average score of 5.2.

Issues in health informatics education for health executives				
Murphy et al 2004 ³⁸	Survey Supplemented by case studies	3	<p>Survey sent across the UK to healthcare providers and educational institutions</p> <p>Supplemented by case studies (interviewed senior and middle managers, and junior staff at three acute trusts [hospitals])</p>	Medical schools and post-registration nursing programs were inconsistent in terms of health informatics education provided to students. There are no standard health informatics education requirements for these health care providers. Moreover, there is no coordination between acute trusts and local universities in terms of continuing education and health informatics.

Health Informatics Education for Health Executives

In 2004, Murphy et al³⁸ reported on the results of a UK survey of health care providers and educational institutions to assess the state of health informatics education and knowledge acquisition to health care providers and health care managers. The survey results were supplemented by case studies at three acute trusts (hospitals). There was very little health informatics education given to health care providers while they are in school and even less as part of their continuing education. (This is also the case in Canada. Dalhousie University, in 2009, conducted an environmental scan of Canadian medical schools⁵¹ and found “that none have included what is formally known as health informatics in their core curriculum”⁵²). The authors of the study put forth a number of recommendations to remedy the situation, including integrating a structured health informatics curriculum into clinician training in medical school, and enhancing cooperation between universities and health services employers in developing a continuing education program.

To address the issue of training health executives while they are working full-time, a number of universities in the United States have created short courses in health informatics (including biological and clinical informatics, organizational strategy, preventive medicine and public health informatics, and health services research), although only some of them are offered via distance education⁴¹. In 2005, the American Medical Informatics Association initiated the AMIA 10x10 program, designed with distance education in mind, and geared towards training professionals in health informatics. This course runs the length of a semester, but a person with a full-time job can accommodate the workload. An open-ended survey administered to those who had taken the course in 2006 revealed that respondents felt that the course had benefited them in their careers and that the on-line aspect was also a tremendous benefit. Responses were gathered from physicians, IT professionals, and clinical analysts⁴².

The International Medical Informatics Association (IMIA), at their conference in 2009, presented the IMIA Scientific Content Map, which organizes health informatics education into six themes: applied technology, information technology infrastructure, applications and products, data, organizational, and education and knowledge⁴⁶.

Also available on-line, a course offered by the International Partnership for Health Informatics Education (“Strategic information management in hospitals: an introduction to hospital information systems”). This is a blend of information technology, hospital systems and strategic management. Although initially developed in German, the course is now available in the English language⁴³.

Starting Up Health Informatics Education Programs in Developing Countries

Otero et al³⁹ reported on the results of two surveys administered to students who participated in the first distance on-line education program in health informatics in Latin America. The AMIA 10x10 program was used as a basis for the health informatics curriculum. It was comprised of a number of courses that make up the medical informatics program at the Oregon Health & Science University: biomedical informatics; electronic health records; decision support and health care quality; privacy, confidentiality and security; information retrieval and digital libraries; telemedicine; and information systems in public health. After some adjustments were made for the

Latin America environment, the course was translated into Spanish. This was the first Spanish, distance on-line training in health informatics in Latin America. Response to the course was positive; both the course format and the aspects of distance on-line learning were evaluated³⁹.

Another Latin American country that has had success in implementing health informatics training is Peru. Peru characterizes itself as a low resource setting. To bring health informatics training and subsequent workforce capacity to their country, two Peruvian universities (UPCH and University of San Marcos) collaborated with the University of Washington to develop a training program, called AMAUTA, with the support of a grant obtained from the Fogarty International Center (part of the U.S. National Institutes of Health). Four short courses are offered at the graduate level (electronic medical records, organizational issues in health informatics, surveillance and evaluation of health informatics systems, and genomics⁵³). The AMAUTA program continues to expand by obtaining grants from other organizations besides Fogarty. At the time of writing, Peru's efforts to bring health informatics education on-line were under way⁴⁴.

Issues in Health Informatics Education in Africa

At the Health Informatics in Africa (HELINA) Conference in Bamako, Mali, in 2007, Kouematchoua et al⁴⁵ outlined the barriers to health informatics and health informatics education in Africa: lagging behind developed countries in ICT; low level of computer literacy; some countries are English-speaking, others are French-speaking (mostly in West Africa), which means that the curriculum cannot be easily transferred to all countries. Language has been noted elsewhere as a barrier to accessing the literature⁴⁶.

Another barrier to education is access. Without a robust ICT infrastructure, professionals who aspire to continuing education must attend on-site in-class courses, instead of accessing courses through an on-line tool such as a learning management system. In West Africa, the Réseau en Afrique Francophone pour la Télémédecine (RAFT) network is available to physicians for continuous education (it is also used for telemedicine consultations). RAFT is an Internet-based network, initiated in 2000 in Mali and expanded in 2006 to the other French-speaking West African countries and two European countries (France, Switzerland). The ability to access continuing education through RAFT when practicing medicine outside of major cities is used as an incentive to direct physicians to rural areas. To date, RAFT has not been used to provide health informatics education⁴⁷.

Compounding these barriers is the lack of a reliable supply of electricity across Western Africa, where blackouts are frequent⁵⁴. For example, in 2013, despite its government's efforts, the entire country of Ghana was experiencing unpredictable power outages⁵⁵. This situation continues across the entire West African region, and is expected "to worsen if no adequate measures are adopted by the West African electricity sector to meet forthcoming electricity demand."⁵⁶

Evaluation of Distance On-Line Educational Methods for Health Informatics

Russell et al³⁶ used final GPA scores and external certification exam scores to determine if there was a difference in each score category that could be attributed to distance learning students v. presential students in a health informatics program at the Medical College in Augusta, Georgia (curriculum was identical for distance and presential students). Final GPA scores showed no significant statistical difference between distance learners and presential learners. External

certification exam scores also showed no significant statistical difference between distance and presential learners. The certification exam written by the students was the Registered Health Information Administrator (RHIA examination), and students were tested on their knowledge of health data management, health statistics, biomedical research and quality management, health services organization and delivery, information technology and systems, as well as organization and management.

Evaluation of Distance On-Line Educational Methods in The Health Professions (But Not For Health Informatics)

Cook et al³⁴, using 201 studies, conducted two quantitative data syntheses: one compared Internet-based learning with no learning; the second compared Internet-based learning to non-Internet learning; participants across both data syntheses were health professionals. The investigators concluded that Internet-based learning had positive effects (knowledge outcomes, skills) compared with no learning. There was also evidence that Internet-based learning showed similar results to non-Internet learning.

Cook et al⁴⁰ conducted a randomized controlled crossover trial to determine the effect of adding case-based self-assessment questions to Web-based learning (WBL) modules. Students were randomized to modules with and without questions; their test scores were evaluated on a post-test after completion of the modules (to test knowledge acquisition), and then again after completion of the academic year (to test knowledge retention). On knowledge acquisition, students using the WBL with questions scored higher on post-tests. On knowledge retention, no significant statistical difference was found between question format and non-question format. Overall, students preferred the WBL with questions.

Evaluation of Technology as an Educational Tool for Health Informatics

Johnson et al³⁵ examined nursing informatics students' preference for on-line learning environments, used a mixed methods study design that was composed of a closed-ended survey and an open-ended survey. Each type of survey was periodically administered to students following their use of a specific learning environment (learning management system, webinar, virtual environment). A virtual learning environment was favoured over the other two types, due to its synchronous, participative nature.

Meek et al³⁷ examined the effects of adding podcasts to an on-line curriculum. The graduate nursing program (Masters level) at Indiana University, Indianapolis, Indiana, includes on-line health informatics coursework. Podcasts were added to enhance the learning experience. In this crossover study, all enrolled students were randomly assigned to two groups, one using podcasts and the other not ("course as usual" group). Halfway through the semester, the groups were switched. Student cognition scores and student engagement scores showed no significant differences between use of podcasts and "course as usual" conditions. When students were part of the podcast group, student satisfaction with the course increased, as the podcasts could be played on handheld devices in locations convenient to the students. There were 14 podcasts. Among the topics included were: use of relational databases for quality improvement; roles of a nurse informaticist; use of technology in nursing research; use of dashboards for executive decision-making; clinical decision support applications; and electronic medical records.

Pedagogical Approaches in Distance Education for Health Informatics

Johnson et al³⁵ noted that an on-line environment, be it virtual, Internet-based or webinar format, should take into account the students' comfort level in being part of such an environment. Creating an interactive environment is preferable to an asynchronous environment. Regular feedback between instructors and students using on-line sessions, similar to videoconferencing, should be part of the instructional activities. In her analysis of IT in education, which includes accessing content via computer, Haigh⁴⁸ also reports on the importance of student-instructor interaction as an aid to understanding concepts presented in the material. Therefore, an interactive environment should be part of the learning experience. Both Johnson et al³⁵ and Haigh⁴⁸ mention the importance of students learning from each other, thus reinforcing the necessity of peer interaction in distance on-line synchronous and asynchronous learning environments.

Pedagogical Approaches to Distance Education in The Health Professions (But Not For Health Informatics)

In a literature review of student interactions in Web-based courses, Thurmond et al⁴⁹ analyzed a number of considerations for distance education in the health professions. They found that on-line discussion boards were a preferred method of interaction for students. Some students reported that, while they were shy in a traditional classroom setting, they found themselves contributing more frequently in a virtual environment. Distance on-line education introduces the opportunity of a larger class size. Where one instructor may have been sufficient for a traditional learning environment, two or more instructors may be necessary to provide adequate frequency of interaction with students. Timely marking of assignments (a form of feedback) is important to students; hiring additional teaching assistants (T.A.s) may be required. Lastly, the technology used by the student should enhance the learning experience, not hinder it.

DISCUSSION

Health executives, whether employed in the developed or developing world, require continuing education to acquire and refresh skills and knowledge in health informatics. 7% of the participants in the AMIA 10x10 program implemented in Latin America said that the education received would help them transition into the role of Chief of Medical Informatics 39. North-South collaborative efforts to implement a (northern) university's existing health informatics curriculum to a developing country, when adapted to that country's culture, diseases and health care challenges, produced very good results ^{39, 44, 53}.

Distance on-line education is appealing to health executives, largely because of the convenience factor. In terms of using distance on-line education methods, some studies found no difference in students' knowledge outcomes and skills, while other studies showed a positive effect. A distance, on-line learning environment can be rich with feedback, self-assessment, and interaction with other students, or flat and asynchronous. Institutions and instructors who are using this pedagogical approach should collect regular feedback from students throughout the progression of the course, to gauge students' comfort level and whether learning is occurring. The type of environment made available to students will depend on the age-old constraints of budget and resources; these constraints must be balanced with the best interest of the students, their institutions and the countries they serve, as well as the long-term viability of the educational program.

In West Africa, where “international bandwidth” is not readily available ⁴⁷, using the RAFT network could be a possible platform for distance on-line health informatics education. Podcasts should also be considered as a viable learning tool, and grant funding could be used to purchase handheld devices. South-South collaboration with local universities should be considered to determine if a health informatics program, such as the University of Ghana’s MHI program, could be adapted to using distance on-line technologies.

Current ICT infrastructure in West Africa may preclude Web-based on-line interactions with instructors and students. However, a project named SAHEL, under the auspices of the European Space Agency (esa), is underway to create a platform with the aim of using satellite communication for distance on-line health education, eHealth and tele-medicine purposes⁵⁷.

LIMITATIONS

There are German and Spanish papers written on topics relevant to the objectives of this paper, but only English-language articles were used in this systematic review.

This systematic review relied to some extent on health informatics education outcomes in developing countries and assumed the findings could be generalized to Western Africa.

FUTURE DIRECTIONS

A qualitative approach to determining educational needs for health executives in Western Africa should be undertaken before any firm directions are established for the related curriculum. A technology assessment should also be performed, with the goals of ascertaining the current infrastructure in place and infrastructure requirements necessary to support distance on-line education.

Collaborative efforts with organizations that have established health informatics curricula designed with distance on-line education methods, such as the AMIA’s 20/20 program³¹, and the Fogarty International Center’s “Informatics Training for Global Health” initiative⁵⁸, are becoming the norm between the developed and the developing world. These curricula should be assessed for suitability and adaptability to Western Africa. Applying for and obtaining grants could assist in funding the translation of the course material into the French language.

CONCLUSION

Health executives struggle to keep up with developments in health information technology and at the same time to juggle the responsibilities and obligations of working in a demanding environment. Short courses, offered on-line and using technologies that allow for the opportunity of revisiting content material as often as one likes, can assist in providing continuing education. Course content should reflect innovative technologies and if the possibility arises, be built in cooperation with institutions that have already developed curricula. In the developing world, ICT capacity, or lack of it, is a constraint in delivering distance on-line education; this constraint might be alleviated by using satellite Internet to download podcasts to hand held devices.

Distance on-line education is now an accepted approach to earning academic credentials and acquiring knowledge. Due to the nature of this teaching method, pedagogical approaches differ from on-site presential learning. When developing an on-line course, feedback and interaction mechanisms must be built in to the course design, as these are important features to students. This indicates that synchronous education may offer better learning outcomes than asynchronous approaches. Evaluation of course content, format and presentation should be gathered periodically, ideally using quantitative research methods, as these studies can yield objective data for improvement. Qualitative approaches should also be employed, as useful information can be gleaned from open-ended survey questions.

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