Development, Implementation, and Evaluation of Health Informatics Masters Program at KSAU-HS University, Saudi Arabia

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Abstract

The Saudi health sector has witnessed a significant progress in recent decades with some Saudi hospitals receiving international recognition. However, this progress has not been accompanied by the same advancement in the health informatics field whose applications have become a necessity for hospitals in order to achieve important objectives such as enhancing the quality of healthcare and reducing the time and cost for healthcare delivery. In this paper we introduce a new masters program in Health Informatics in a newly founded Saudi university specialized in health sciences. The program, which is the first of its kind in Saudi Arabia and the region, was designed based on the recommendations of the International Medical Informatics Association (IMIA). The program has gone through the first assessment with the help of the first group of graduates. The results are presented in this paper.

Key words: *Health Informatics, Education, Health Information Systems, and Health Studies.*

Introduction

The healthcare industry has become increasingly reliant upon Information and Communication Technology (ICT). This has resulted in a significant technology gap between those professionals entrusted to provide clinical care and those who are in charge of managing the complex information systems required to operate modern healthcare systems. Such gap threatens the effective and efficient management of healthcare information. The need to use ICT in healthcare has resulted in a new science called Health Informatics (HI) which is a socio-technical discipline concerned with the use of ICT to support the delivery of healthcare.[1] It is a broad discipline which includes many subjects such as bio-informatics, electronic patient records, telemedicine, clinical decision making, etc.[2]

The International Medical Informatics Association (IMIA) has made significant efforts to promote and enhance health informatics education world-wide. IMIA suggested that proper education is essential for healthcare professionals to meet the increasing demand for health informatics. [3] Such education would enable health professionals to take full advantage of ICT. A special issue of the *International Journal of Medical Informatics* (Volume 73, 2004) was dedicated to health informatics education. The special issue is comprised of papers presented at 2003 IMIA work group on Education Meeting which was attended by 80 educators from all over the world.

Recommendations for Health and Medical Informatics Education

IMIA has proposed a set of recommendations on education which provides an excellent foundation for health informatics education.[3] These recommendations have evolved from seven conferences organized by the Working Group for *Health and Medical Informatics Education*. Such recommendations are not only important to provide an education framework but also provide a basis for establishing an international collaboration which enables international exchange of standards and teachers. The IMIA recommendations are grouped into two sets:

1. The first set is concerned with the recommendations of courses in health and medical informatics as part of educational programs such as medicine, nursing, pharmacy, computer science and other programs. The objective of this set is to enable healthcare professionals to become good IT users.
2. The second set is concerned with the recommendations of courses for dedicated educational programs in health informatics in order to prepare graduates to become health informatics specialists.

In this paper more focus is given on the second set of recommendations as the purpose of this paper is to present a dedicated Master Program in Health Informatics aimed to prepare graduates for career in the health informatics field.

The recommendations identify the level of knowledge and skills required for each learning outcome. The knowledge and skills are grouped into three domains:

1. Health Informatics
2. Medicine, health, and health services management
3. Informatics, mathematics, and biometry

IMIA also indicates the level of knowledge and skills required as advanced, intermediate, or basic.

IMIA Recommendations for Master Programs in Health and Medical Informatics

The main goal of dedicated HI programs, as suggested by IMIA, is to provide a scientific education that includes theory, specialized knowledge, and practical skills. Graduates shall be able to:

- Apply a practice-oriented methods and tools from health and medical informatics.
- Participate in research and in the methodical advancement within the field of health and medical informatics.

IMIA recommends that master programs accept students with one of following educational degrees:

- A bachelor degree in health information management
- A bachelor degree in medicine or health sciences
- A bachelor degree in computer science

Master programs in Health and Medical Informatics should be at least one year full time corresponding to at least 60 credits based on the European Credit Transfer System (ECTS) [4] as shown in table 1.

About KSAU-HS

King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) is a newly founded university, established in early 2004, specialized in health sciences. It is housed within King Abdulaziz Medical City of the National Guard Health Affairs (NGHA). NGHA is a large health organization which provides modern medical care to National Guard employees and their dependents, as well as to Saudi Arabian nationals. Under the umbrella of NGHA, there are four hospitals and sixty primary and secondary health centers around the Kingdom with a total of 2000 in-patient beds.

The University comprises the College of Medicine, the College of Nursing, the College of Allied Medical Sciences, and the College of Public Health and Health Informatics.

Purpose of Study

The purpose of this paper is to introduce a new masters program in Health Informatics at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in Saudi Arabia. The program is considered to be an applied health informatics program of which the graduates should be able to deploy ITC in support of health systems processes. This is due to the fact that most of health organizations in Saudi Arabia are "as-is" technology deployers. The program was designed following the recommendations presented by IMIA. [3] The paper explains the process used to develop the program including needs identification, academic development, and institutional development. The paper also addresses the implementation and evaluation processes.

Methods

HI Program Set-Up Process

The process used in setting-up the HI master program is shown in figure 1. It consists of five phases: the formation of a scientific project team, the needs assessment and justification, the program development, the program implementation, and the program evaluation and improvement. The process called for the establishment of an Academic Programs Approving Committee (APAC) to implement KSAU-HS strategy for introducing academic programs. The main goal of APAC is to translate the university's strategic plan into academic programs.

Forming the Scientific Team

KSAU-HS formed a scientific team to manage the project of establishing HI masters program in April 2004. The team consisted of 5 professors covering three knowledge areas: Computer science (2 members), Health informatics (2 members), and Health systems management (1 member). Two of the team members manage IT departments in healthcare institutes in addition to their academic assignments. The members of the team represented two Saudi Universities. The project team was charged to develop and implement a masters program of health informatics. Such a program is the first, not only in Saudi Arabia, but also in the Middle East. The core objectives are to identify needs as well as delineate academic and institutional development.

Needs Assessment and Justification

In this phase, the scientific team was charged with conducting a comprehensive needs assessment study to document and establish the true needs for a masters program in health informatics and assess its relevance to the overall priorities of the healthcare infrastructure in the Kingdom of Saudi Arabia. The program will have to be consistent with the highest international academic standards and based on the latest knowledge and developments in the field.

Over the past four decades, Saudi Arabia has spent billions of dollars in improving the quality of healthcare and in expanding its scope and coverage in the country. Due to this rapid expansion, healthcare providers in Saudi Arabia have varied. While the Ministry of Health provides around 60% of the healthcare services, the remaining portion is provided by other government bodies like the National Guard, the Ministry of Defense and Aviation, the Ministry of Interior, Universities' hospitals, and a rapidly growing private sector. This variation of health service providers has led to variations in the way the healthcare facilities are administered and managed with significant variation in the Information systems used.

As a consequence, patient information/record has become scattered in different healthcare facilities with no one provider having the complete patient record except in very rare cases where the patient chooses to receive healthcare from one provider at all times. One additional negative impact of varied healthcare systems is the great waste of efforts and money resulting from treating patients repeatedly for the same health problems in different medical centers. Patients may at times be asked to repeat x-

rays and other laboratory tests and may be given different medications which may compromise patient safety.

In the year 2000, the government of Saudi Arabia formed a Health Reform Committee to conduct a comprehensive review of the healthcare services provided to its citizens. The Committee highlighted that the lack of proper Health Informatics applications is one of the top challenges facing the Saudi health sector in addition to health services financing, health services management, and health service distribution. As a result of the Health Reform Committee's recommendations, a special taskforce was formed in 2002 to develop an IT strategic plan for healthcare sector in Saudi Arabia. The main objective of the strategic plan is to build a national electronic health record. The highest priority recommendations made by the taskforce were identified below.

1. To build cadres specialized in the field of health informatics.
2. To establish an Association for Health Informatics in Saudi Arabia.
3. To establish centers of excellence in health informatics in Saudi Arabia.
4. To design the specifications of the electronic health records.
5. To expand the telemedicine network in the country.

Moreover, health informatics is of a particular importance in Saudi Arabia for the following reasons:

- Most hospitals and medical centers in Saudi Arabia still rely on paper records.
- The amount of health information is increasing. However, different health sectors use disparate systems with little interoperability between these systems which created non-connected islands of information.
- Most of the existing information systems are administrative in nature rather than patient-care focused.
- There is a serious lack of qualified individuals in health informatics in Saudi Arabia and the neighboring countries, which results in many health organizations that find it very difficult to identify and recruit HI professionals. As a consequence, many organizations invest unproductively in ICT.
- Some literature has shown that taking advantage of ICT in healthcare will have significant economic benefits and will enhance quality and patient safety. [5]
- The growth rate of the Saudi population is one of the highest in the world which dictates the need for proper utilizations of resources. The use of ICT is essential to achieve that objective.

As a result of the needs assessment exercise, the scientific project team strongly recommended that KSAU-HS should offer a Masters program in Health Informatics (HI) in order to provide advanced health informatics education and to prepare health informatics specialists who would be able to participate in research and in the advancement of health informatics field. The program should provide graduates with the technical, humanistic, and practical skills in health informatics to meet the increasing demand on ICT use in healthcare. Graduates would be able to lead the management, planning, and implementation of health information systems. The availability of skilled and knowledgeable HI specialists is becoming a critical issue in today's health system.

Program Development

The needs assessment study was presented to the APAC and to the university boards and a decision was made to invest on this scientific project. The scientific project team was charged to develop the program. The program development phase covered academic development and institutional development. In order to develop the academic program, the project team was tasked to:

- Develop a strategic plan for the program including mission statement, goals, objectives and strategy with regard to academia, personnel, finance and management.
- Develop study plans for the Masters Program in Health Informatics following guidelines and regulation of the Ministry of Higher Education in Saudi Arabia.
- Design an outline for curricula for the program.
- Identify priority core research priority work areas and outline work programs as relevant.
- Design and plan an appropriate and up to date library and information technology (IT) systems for the program to include computer lab, computer teaching courses, IT requirements and resources for management, staff, and students.

Additionally, in order to develop the required institutional environment, the project team was tasked to:

- Develop staff and faculty requirements for the program and define recruitment and management processes.
- Develop teaching requirements and resources including space and aids.

In order to achieve the expected outcome of this phase, the scientific project team conducted the following activities:

1. Reviewed most of existing health informatics education programs in terms of their objectives, candidates, contents, and outcomes.
2. Reviewed the IMIA recommendations on education in health and medical informatics.
3. Reviewed the literature on HI education.
4. Organized workshops with participants selected based on a stakeholder analysis including: HI scientific project team, HI teachers, potential HI students, and employers.
5. Identified an initial list of courses mapped to the list of knowledge and skills that were suggested by IMIA.

Intervention

The scientific project team made a strategic decision to follow IMIA recommendations in designing the masters program and to use these recommendations as a framework. The decision was to allow for international exchange of students and teachers and for sharing of courseware. The outcome of the program development phase is presented in the following paragraphs.

A. Program Mission

The mission of the Program is to advance the quality and efficiency of the Saudi healthcare system through improved information management.

B. Program Objectives and Target Students

The program main goals and target students match the recommendations of IMIA. However, our program has more emphasis on the applied health informatics skills and knowledge to meet the country's demands on qualified health information specialists to fill the increasing demands in the field of health informatics to manage, plan, develop, and provide expert consultations to the healthcare sectors. Additionally the program provides the students with the foundation to conduct doctoral studies in the HI field.

C. Program Infrastructure

The program depends on the following infrastructure:

- A Program level Academic Council and director with strong credibility in academic and health informatics.
- Faculty members with a clear vision and philosophy, who values the students and the teaching.
- Effective collaborations with local and international academic institutions. Some of these will be able to provide part time teaching, research and project mentoring opportunities.

D. Program Structure

The Masters program in Health Informatics is a dedicated full time two-year program. It is organized in modules (courses) consisting of 3 hours of lectures per week excluding the time spent for exercises, seminars, and practicums. It requires a minimum of 14 courses totaling 42 semester credit hours (a credit hour is equivalent to an hour of lecture a week for a semester of 16 weeks. For example, 3 semester credit hour may be equivalent to 6 ECTS of course work). The program of study includes a variety of graduate level foundation courses, HI courses, health courses, and informatics courses as shown in table 2.

Student must complete two foundation courses dependant on the student background. Students are also required to complete successfully seven courses from the health informatics knowledge area as well as two courses from the knowledge area of Medical, Health Sciences, and health system organization. Finally, students are required to complete three courses from Informatics knowledge area.

The HI courses listed in table 2 are common in most Health informatics programs reviewed except for the HI 561 course which is concerned with the legal, ethical, and social aspects of HI. The introduction of ICT into healthcare raises some ethical, legal, and social issues. Very few health informatics programs address these issues in a formal way.[6] Ethical education should be as important as clinical and technical education for health professionals. Some of the ethical issues include:

- Health information on the web that does not

- The web is also changing the doctor-patient relations, as some patients seek information on certain health issues from the web without consulting their doctors.
- Electronic Medical Record (EMR) systems present an issue of confidentiality due to probable breaches of security. The ownership of the health information is becoming an issue.
- Telemedicine raises an issue whether physicians can practice medicine (through ICT tools) in a remote country in which they do not have a practicing license.

Due to these ethical issues, the Masters program in health informatics at KSAU-HS offers a dedicated course addressing most of the ethical, legal, social aspects of health informatics.

The selection of informatics courses was influenced by the survey conducted by Logat et al.[7] of HI specialists with Master's level credentials that asked about computer science topics or skills that they need in their employment. In this survey, the topics of database design and web technology were given a high rate while the topic of network management was given a low rating. As a result of this study, the Master of Health Informatics at KSAU-HS offers an advanced database course consisting of a database design and management. Another course is also offered to meet the need for advanced skills and knowledge in web-related subjects including database interface. Even though the program does not have a dedicated course in network management, general networking concepts are covered in other IT courses.

Moreover, proper project management is one of the critical success factors for information systems implementation.[8] In addition, due to the fact that a lot of hospitals in Saudi Arabia are going through automation projects including the deployment of health informatics applications, the Masters program offers a dedicated course in IT project management. This course presents students with the knowledge, skills, tools, and techniques to organize, execute, and monitor the work of healthcare IT project activities in order to meet the expectation of stakeholders. The content of these courses is presented in the following section.

E. Program Content

First Semester's Courses

- *Fundamentals of Medicine and Medical Terminology*: This course is designed to provide students whose background is not health sciences with the knowledge necessary to understand the information contained in the medical record, to function within a medical environment through an understanding of the fundamental of medicine, and to effectively use disease classification systems. Students will be introduced to the basic concepts of anatomy and physiology, epidemiology, pharmacology and pathology, disease process and their treatment, and Medical terminology.
- *Introduction to IT*: This course is designed to provide students whose background is not IT with the knowledge necessary to understand the basic concepts of IT including computer-based system and its use, Information processing, hardware, software concepts, and data communications. The course provides hands-on experience with word-processing, spreadsheet, database design using access, and file management software.
- *Statistical Analysis*: The aim of this course is to provide students with general knowledge of advanced statistical techniques appropriate to health research and information management, including the appropriate uses of each technique, its strengths and weaknesses. Additionally, students will explore and learn how to use statistical software packages such as SPSS, SAS, etc...
- *Introduction to Health Informatics*: The objective of this course is to provide students with the history and current status of information systems in health care and health care information systems. Topics include Information architectures, administrative and clinical applications, strategic planning, security, and benefits realization.

Second Semester's Courses

- *Health Information Systems (HIS):* This course is designed to familiarize students with the general characteristics of HIS. This covers the architectures and examples of HIS. The course also covers management issues of information systems in healthcare.
- *Research Methodologies in Healthcare:* The objective of this course is to provide students with an in-depth knowledge of research

concepts, designs, and methodologies used in healthcare. Topics include philosophy of scientific investigation, theory and research, experimental designs, non-experimental designs, participant, survey research, construction of questionnaires, measurement and scales, the validity and reliability of data collection tools, and dealing with missing data.

- *Web Technologies:* The main purpose of this course is to provide students with a strong understanding of web design principles for the planning, building, publishing, maintaining, and publicizing of a Web site. This course focuses on the complete Web development cycle from the conception of the idea of a site through the building and publishing of the site. Construction components for this course will focus on the HTML and XML programming languages.

Third Semester's Courses

- *Electronic Health Records and Standards:* This course is designed to familiarize students with steps leading to the implementation of the EHR. This course examines the potential roles and usage of EHR systems and standards. Topics include EHR history and vision, structure, building blocks and contents, vocabularies, coding, classification and text processing, data quality and security, and challenges to implementation and integration.
- *Database Design and Management:* The objective of this course is to provide students with knowledge about database structure, database design, and database management. The course covers topics like Data collection for enterprise; reportable and specialized databases; data mining of healthcare data; data information; file structures; data security; and data retrieval
- *IT Project Management:* Through case studies and field investigations of actual health information projects, students will gain a real-world understanding and will learn the basic principles of project management as well as teamwork and leadership skills needed within projects. Topics include project management tools, process and planning, cost, schedule and size, staffing, directing and control. The course covers the requirements necessary for formal certification.
- *Elective Medical and Health Course*: Students should select one of the elective courses listed in table 2. These courses aim to provide students with an in-depth knowledge of selected health management issues.

Fourth Semester's Courses

- *Legal, Ethical, and Social aspects of HI:* This course describes the importance of ethics in the management of health information, professional values and obligations as guided by professionals' codes of ethics. It starts with ethical theories, principles, and tools that are important when making ethical decisions. Then explores privacy and confidentiality within the context of the many uses of health information, and covers ethical dilemmas faced in the process of clinical coding, pricing, access, and quality management. It addresses the importance of patient safety and organizational values, research and decision support for data acquisition, access and reporting.
- *Decision Support in Healthcare and Knowledge Management:* The aim of this course is to provide students with an in-depth knowledge of healthcare knowledge management. This course evaluates the technical aspects related to knowledge management solutions to support the decision-making in healthcare management. In addition, students will explore and learn the general techniques and knowledge of the data-mining infrastructure. At the end of this course students will be able to utilize health information and provide them to the right people at the right time to support decision-making.
- *Health Informatics Project:* The objective of this course is to provide practical experience and opportunity for students to learn new skills and to apply previously learned skills and theories in the health informatics field, such as system analysis, design, implementation, and evaluation. The student is required to conduct a real-life project in health informatics under the supervision of a faculty member and a supervisor at the workplace where the student takes the internship.
- *Elective Health Informatics Course:* Students should select either Topics in HI course or Directed Study in HI course. These courses give flexibility to the program as recent research topics in the area could be addressed in these elective courses without affecting the

structure of the program. These courses also provide a mechanism for students to explore issues of students' personal interest in the field of HI.

Implementation and Participants

After the development phase, the program was endorsed by APAC and later approved by the University Board in March 2005. The accreditation of this program by the Ministry of Higher Education was achieved in April 2005.

The program, which was announced in different media channels, attracted more than 150 students that applied to the program. The program started in September 2005 with a group of 25 students (16 female students and 9 male students). The group came from different education background including medicine, health, IT, and biomedical engineering. Twenty more students were accepted in the following year.

The implementation of the masters program requires an equivalent of five full-time faculty positions. Yet, approximately 12 faculty members with backgrounds in health informatics, computer science, medicine, public health, biostatistics, health systems management, contribute to the program on a part-time basis.

Evaluation

To verify whether we succeeded in fulfilling the goals we set in developing the Masters program, we conducted a systematic evaluation of the program focusing on subjective evaluation by the participating students. The evaluation was conducted in a form of survey sent to the entire group of graduates of the program. The 23-graduates who graduated in May 2007 included 15 female students and 8 male students.

The survey questionnaires were distributed to students' mail boxes in the school. The questionnaire's cover page indicated to students that they are free not to participate in this study and if they decide to participate, they do not have to write their names. They were also informed that once they complete answering the questionnaire they can insert it in a box that was located next to their mail boxes. The main objective of the evaluation was explained to students and its importance was emphasized.

Bauman [9] stated that to increase content validity researchers need to review relevant literature, consult experts, and conduct a pilot study. Therefore, the questionnaire items were developed after reviewing relevant literature. Then specialists (experts) in health informatics, health administration, research methodology, and statistics were consulted to get their opinions. Their comments and suggestions were taken into consideration in developing the questionnaire in order to increase the content validity.

The first part of the survey had the following questions:

1. What is your gender (Male or Female)?
2. Have you been exposed to HI applications prior to attending the program (Yes or No)?
3. Would you like to pursue PhD study (Yes or No)?
4. Why did you join the program?

The second part of the survey contained Likert-scale questions. In this part, students were asked about their opinion about the overall program, faculty and staff, topics and knowledge, teaching environment, library, student group coherence, educational tools, interrelation of subjects, and significance of the program to government and private health sectors. For Likert-scale questions, a rating of 1-5 was used with the following indications: (1) totally disagree; (2) disagree; (3) not sure; (4) agree; (5) totally agree. The survey was returned by 22 students with a response rate of 96%.

Results

Table 3 shows the overall results with mean response and standard deviation. Students in general agreed that the program met their expectation (mean=3.73) and they would recommend this program to others (mean=4.32). Students think that the program is very significant to both government and private health sectors (with mean 4.64 and 4.45 respectively). Students indicated they found the staff and faculty of the program supportive (mean=4.04) and topics and knowledge useful (mean=4.23). Although students came from different background, they indicated that the student group was very coherent (mean=4.59). Students were satisfied with the educational tools (mean=4.27) and interrelation of subjects (mean=4.18), however they had concerns about the library (mean=3.09). When asked whether they like to pursue their studies for doctoral degree, 82 % of

students responded positively. However, more female graduates responded positively (93%). Only 41% of the respondents had worked with HI applications before they joined the program. Table 4 Shows students' responses to why they joined the program.

Discussion

Results of the survey indicated that even though students expected more from the program, they would still recommend it to their colleagues, which is a sign of success. Moreover, female students showed more interest to pursue their doctoral studies in this field.

Students appreciated the diversity of each others background, which was expected to be an issue in the beginning of the program, after they graduated. This was clear in the final project as students from different background teamed up.

It was expected that students would not be happy with the library due to the fact that the program was conducted in a temporary building with limited space. KSAU-HS University is constructing a state of the art academic complex that will host all colleges including the college of Public Health and Health Informatics. As a result of the survey, we have allocated more space for the library with more computers that have access to online journals and books with more subscription to health-related journals.

Students agreed on the importance of HI in improving the healthcare sectors in Saudi Arabia. Their responses were encouraging as they are expected to help promote HI in Saudi healthcare. The Masters program is aimed to produce qualified HI specialists who should lead the Health IT transformation in Saudi Arabia. However, there is also a need to review all the undergraduate curricula leading to a health professional qualification and include HI learning outcomes in order to enable healthcare professionals to efficiently and responsibly use ICT to enhance their practices through better use of information resources. IMIA recommendations for HI courses as part of health education programs can be very useful to achieve this goal.

Future Plans

We recommend that a follow-up survey should be conducted to ask the employers of these graduates to evaluate them based on the set of skills and knowledge as suggested by IMIA. We suggest that a formal interview with the employers of these graduates should be conducted to ask them about the changes that have taken place in the skills, knowledge and attitudes of these graduates as a result of their two year study program. If employers and paymasters and possibly some end users (peers and colleagues) can identify areas of change and improvements, it would be a very good evaluation. One other thing may be to plan a follow up study with these graduates in the form of career development and change, continuing education, meeting regularly, formation of a community of practice and research on their performance.

Conclusion

Proper education in health informatics is essential to help fill the technology gap between healthcare professionals entrusted to provide healthcare and those who are in charge of managing the complex information systems required to operate modern healthcare organizations. In this paper we have introduced the Masters program in health informatics in a newly founded Saudi university specialized in health sciences. The two-year program is based on the recommendations of IMIA on education in health and medical informatics.

The mission of the program is to advance the quality and efficiency of the Saudi healthcare system through improved information management, communication and the generation of new forms of knowledge. The program strives to produce qualified health informatics specialists who can effectively partner with healthcare professionals in developing, applying, and evaluating the use of information technology to respond to the changing dynamics in healthcare. This will be achieved through cooperation with other universities and research centers applying international educational standards endorsed by the IMIA.

The masters program started in 2005 and has already celebrated the first group of graduates. The graduation ceremony was attended by high officials in Saudi. IMIA was also presented in the ceremony through a video message speech by the IMIA president elect Prof. Reinhold Haux. In order to ensure that the aim of the program has been realized, a survey was sent to the graduates of the program. The results indicated that they are satisfied with the program outcomes.

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Table 1- Recommended Workload in ECTS for the Masters Program in Health and Medical Informatics

	Knowledge and Skills area	ECTS Workload
1	Health and Medical Informatics	40
2	Medicine, health, and health systems organization	10
3	Informatics, computer science, mathematics, and biometry	10
Total ECTS Workload		60

Table 2 - The Masters Program Structure

Study Area	Course Code	Course Title	Credit Hours	Semester
Foundation Courses	Students are required to complete 2 courses from the following:			
	HI 500	Foundation of Medicine & Medical Terminology*	3	1st
	HI 501	Introduction to Information Technology+	3	1st
	HI 502	Statistical Analysis	3	1st
	Total Credit Hours for Foundation Courses		**6**	
Health Informatics Courses	HI 503	Introduction to Health Informatics	3	1st
	HI 531	Health Information Systems	3	2nd
	HI 532	Electronic Health Records & Standards	3	3rd
	HI 561	Legal, Ethical, and Social Aspects of HI	3	4th
	HI 562	Decision Support in Healthcare & Knowledge Management	3	4th
	HI 570	HI project	3	4th
	Students are required to select one course from the following:			
	HI 564	Topics in HI	3	3rd
	HI 566	Directed Study in HI	3	3rd
	Total Credit Hours for HI Courses		**21**	
Health Sciences Courses	Students are required to complete HI 540 and select one other course from the following:			
	HI 540	Research Methodologies in Healthcare	3	
	HI 535	Health Services Administration	3	4th
	HI 536	International Health Systems	3	4th
	HI 537	Financial Management of Health Organization	3	4th
	HI 538	Organizational Behavior in Healthcare	3	4th
	Total Credit Hours for Health Sciences Courses		**6**	
Computer Science Courses	HI 539	Web Technology	3	2nd
	HI 560	Database Design & Management	3	3rd
	HI 565	IT Project Management in Healthcare	3	3rd
	Total Credit Hours for Computer Courses		**9**	
Total Credit Hours for the Master Program			**42**	

* Required course for students from non-health sciences background.
\+ Required course for students from non IT background.

Table 3 - Students Responses on the Masters Program

Question	Mean	S.D
Program met student's expectation	3.73	0.85
I would recommend the program to others.	4.32	0.64
My colleagues from other fields appreciate HI	4.09	0.75
My employer appreciate HI field	3.95	1.00
Satisfied with the program staff and faculty	4.04	0.65
Satisfied with topics and knowledge covered in the program	4.23	0.67
Satisfied with Library	3.09	1.11
Satisfied with the group (students) coherence	4.59	0.50
Found the educational tools useful	4.27	0.80
Satisfied with interrelations between subjects	4.18	0.59
I think the Program is significant to public health sector	4.64	0.65
I think the program is significant to the private health sector	4.45	0.86
Attained more insight about HI	4.90	0.29

* The responses ranged 1-5 with 5 being the highest rating.

Table 4 - Reasons for Joining the MS Program by the Graduates

Question	Why did you join the M.S program?
Responses	• To be more professional in the field • To improve my knowledge and skills in HI • Because HI is a unique field with a good future • To have more understanding of this era. • To have a higher degree in an important field • I felt the need for HI while working in a hospital • Due to its importance to today's healthcare • Because it is a new field • To improve my carrier • I believe on the importance of HI • Market demand will be high on this field • To improve public health using HI

Figure 1- The Process Used to Develop the Masters Program in HI