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Mapping Skills and Competencies; Providing Access to Knowledge, Tools and Platforms; and Strengthening, Disseminating and Exploiting Success Outcomes for a Skilled Transatlantic eHealth Workforce

Case Study: Transformation in Health Information Management and Informatics Education and Training: Experiences from Manipal Academy of Higher Education in India

Manipal Academy of Higher Education (MAHE), Manipal, Udupi, Karnataka State, India

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TITLE Transformation in Health Information Management and Informatics Education and Training: Experiences from the Manipal Academy of Higher Education in India

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ORGANIZATION
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MAHE is a 'Deemed-to-be University', which is defined as an Institution of Higher education, other than universities, working at a very high standard in a specific area of study, that can be declared by the Central Government on the advice of the University Grants Commission (UGC) as an Institution eligible for the academic status and privileges of a university. MAHE was established under the third section of the UGC Act of 1956. It is one of the largest and top ranked private universities in India. MAHE hosts over 28,000 students from 57 different nations spread across various disciplines such as: Medicine, Dentistry, Allied Health Sciences, Pharmacy, Engineering, Life sciences, Nursing, Management, Communication, etc. The University has off-campus locations in both Mangalore and Bangalore, India, and off-shore campuses in Dubai, United Arab Emirates (UAE) and Melaka, Malaysia. MAHE is synonymous with excellence in higher education and every constituent institute has world-class facilities and pedagogy, which are constantly reviewed and upgraded to reflect the latest trends and developments in higher education.

The School of Allied Health Sciences (SOAHS), a constituent unit of MAHE, was established in 1999, and in 2000 was the first School in India to start a formal education program in the Health Information Management (HIM) domain. Since its inception, the Department of HIM at SOAHS played a pivotal role in creating awareness about education and training requirements within the HIM domain. The efforts of the department, in providing education and training by the integration of information and communications technology (ICT) applications and recent advancements with a global perspective, was a resolute step in the HIM education sector in an environment predominantly relying on conventional medical records management. The department focus on research has led to the first PhD in the HIM discipline in the country and another three doctorates in HIM and Health Informatics (HI) areas, which has brought more relevance for HIM in the region. The department's outlook on research has resulted in more than 100 scientific research publications in peer-reviewed journals and several scientific papers in national and international conferences covering a wide range of topics in HIM, eHealth, ICT applications, digital health, etc. The zeal for the department to address the ever-growing demand for healthcare ICT and digital health has led to the creation of the first formal master's level program in HI, which debuted in the country in 2014. The involvement of department administration and faculty in many national and global level initiatives in HIM and HI domains has brought recognition for HIM and HI professionals in India. With more than 400 alumni serving across the healthcare industry in India, this is a testimony to the HIM department perseverance in creating competent HIM and Informatics professionals to cater to the evolving eHealth, ICT and digital health needs of the nation.

BACKGROUND

India, with a population of 1.3 billion, has faced many challenges in the healthcare sector due to wide urban and rural disparity in health status, cultural diversity, a fragmented health care system, infrastructure problems, health financing issues and a need for a trained and competent healthcare workforce [2]. The Indian healthcare delivery system is covered by public and private sector providers. According to a National Family Health Survey (NFHS) in 2015-16, the private medical sector caters to 52% of urban and 44% of rural households. The growing healthcare sector in India is facing a major challenge in terms of the lack of a skilled and competent healthcare workforce. India is expected to face an acute skill gap of 12.7 million in the healthcare sector by 2022. A High Level Expert Group (HLEG) report on Universal Health Coverage also projected the need for a healthcare workforce of 4.9 million professionals across 32 professional categories by 2022 [3]. Meanwhile, the current eHealth plan for India is optimistic, as private and government hospitals are quickly adopting the latest technologies and ICT applications to provide quality service. However, factors such as lack of skilled ICT professionals and cost effective technology is a perpetual impediment for eHealth initiatives [4].

It is essential to highlight the two important initiatives the Government of India (GOI) focused on to strengthen eHealth activities and the healthcare workforce across the country. In 2015, under the eHealth initiatives Ministry of Health and Family Welfare (MoHFW), the GOI established a National eHealth Authority (NeHA) with the main objectives centered on the formulation of a national eHealth policy and strategy to guide states on the adoption of eHealth initiatives, to promote health information exchange (HIE) and manage and formulate HI standards for India and capacity building. Another area of focus under the GOI eHealth initiative is an Integrated Health Information Program (IHIP) with the aim of providing interoperability of various electronic health record (EHR) systems already implemented across the country. Formulation of EHR standards and promotion of mobile apps in the healthcare system are two other tasks carried out under the eHealth initiative [5]. In accordance with the eHealth initiatives of the GOI, six out of 29 states have already initiated many eHealth activities.

In March 2011, the MoH&FW launched an important activity under the aegis of the National Initiative for Allied Health Sciences (NIAHS) with a purpose of augmenting the capacity and quality of the allied health profession in the country. The NIAHS report, published in 2012, provided in-depth details about existing allied health professions, the status of the curriculum and training standards, as well as the existing gaps and future projections of various allied health professions in the country. The report also suggested several strategies for the standardization of education, skill enhancement and creation of adequate health professionals to overcome the skilled workforce gap [6]. Subsequently, NIAHS has taken very effective steps to bring out a standardized and competency-based curriculum and training for various roles amongst allied health professionals. In the first phase, NIAHS identified a set of important health professional domains and debuted a national level model curriculum, including the HIM domain. Model curriculum for various health domains emerged after subject matter experts (SME), key stakeholders and decision-makers were consulted at the national level. The HIM model curriculum (2015-16) was framed with a focus on future requirements of competent HIM professionals and was given the opportunity to provide ICT skill based training to the progressing digital healthcare industry. Now, the country possesses a national level HIM curricular standard for three levels (Diploma, Bachelor's and Master's) as well as a skills-based outcomes and monitoring indicator for differing levels of HIM professionals [7]. These important NIAHS outcomes seek to motivate the HIM profession and education sector to come forward and create more market-ready HIM or HI professionals in the country. Possessing a well-trained and skilled HIM/HI

workforce would definitely compliment the nation in successful implementation and sustenance of its various eHealth initiatives.

It was a proud moment and a great achievement for the Department of HIM, SOAHS MAHE to be part of NIAHS activities, and significantly contributed to the development of model curriculum for HIM. The constant dialogue with national level taskforce members and NIAHS officials has yielded much awaited recognition for the HIM profession. It was also able to make a major impact in deriving a model HIM curriculum of a global stature, relevant to the current and future needs of the digital healthcare work space.

STATUS/CURRENT DEVELOPMENTS

The HIM department currently offers three formal programs: Bachelor level program in HIM (BSc. HIM), Master level program in HIM (MSc. HIM) and a Master level program in HI (MSc. HI). Across all three programs, the department has an intake total of 45 admissions every year. The curriculum for all three programs was designed based on inputs from different stakeholders: the healthcare industry, students, alumni and academicians from respective domains. The program curricula for all three programs are revised every two years to incorporate recent advancements and market requirements. In the last couple of years, constant efforts were made in curricula and training development to integrate competency based outcomes driven by the ever-evolving digital and eHealth market requirements from both national and global perspectives. There is wide spread use of ICT application and eHealth models within the healthcare system through various government level initiatives. Government initiatives in eHealth, mobile health (mHealth), cloud computing, electronic medical record (EMR) integration and health data analytics are a clear indication on how the country is progressing towards an ICT enabled healthcare system. Meanwhile, the focus on developing a skilled workforce and the creation of more educational training programs to address these requirements continue to lag behind. Understanding the global level eHealth sector and its future needs in our country, the HIM department at MAHE is making constant efforts to incorporate adequate training modules and competency based courses in all our curricula.

ACTIVITIES/MEASURES

Based on the prevailing scenario in the healthcare industry, the need for a skilled workforce in the HI domain has been identified from the academic, healthcare and IT industries. Discussions were carried out with faculty members from MAHE and other Universities, health IT industry experts, hospital administration and healthcare professionals, to understand HI competency expectations for professionals and content suggestions for inclusion into all programs. The curriculum and guidelines suggested by NIAHS and the American Health Information Management Association's (AHIMA) Global Health Workforce Council (GHWC) were also considered when identifying the inclusion of core competencies and curriculum content. As the HI workforce is required to have sound IT skills, the department sought a collaborator to develop the best ICT skills among the students. The School of Information Science (SOIS) at MAHE, Manipal agreed to develop and deliver curriculum. During deliberations, it became clear there was a need to develop two types of core competencies for the workforce: first, to create professionals capable of analysing the existing hospital information system (HIS) and suggest solutions; second, to develop a set of professionals who can design and develop solutions based on hospital requirements. This resulted in the launch of the first Master of Science (MSc.) in HI - a two-year, four-semester program under the Department of HIM with two specializations offered:

1. **M.Sc. Health Informatics – Health IT Management**
2. **M.Sc. Health Informatics – Software Development and Management**

The competencies included for both specializations are:

1. Basic and Advanced Concept of Health Informatics
2. Application of Information and Communication Technology in Health Information Management
3. Data Analytics and its Application
4. Public Health Information Management and Informatics
5. Medical Language
6. Entrepreneurship and Project Management in Implementing Health IT Solutions
7. Management of Information and Communication Technology in Healthcare
8. Management and Organization Behaviour
9. Hospital Administration

The core competencies included in each specialization are:

1. **M.Sc. Health Informatics – Health IT Management**

a) Basic and Advanced Tools and Techniques in analysing Health IT solutions
b) Opportunities and Innovation in rural healthcare
c) Hospital Profiling and Branding Health IT Solutions

2. **M.Sc. Health Informatics – Software Development and Management**

a) Advanced Programing Languages in Developing Solutions for HIM
b) Imaging Informatics
c) Mobile Application Development Using Android
d) Software Engineering

The prerequisite and the minimum eligibility for admission into each specializations are:

1. **M.Sc. Health Informatics – Health IT Management**
   Health Science Graduate - MBBS/BDS/Nursing/Allied Health Courses
2. **M.Sc. Health Informatics – Software Development and Management**
   Graduates with a Bachelor in Computer Application/Engineering, or Physics/Mathematics as one of the subjects

The content included to acquire the above mentioned competencies include: Medical Documentation, Health and Hospital Information System, EHRs, CDSS, eHealth, mHealth, Ethics, Confidentiality, Security and Privacy of HI, Impact of HI, Knowledge Base and Expert System, Data Analytics Using R (programming language and software environment), Terminology of various disease conditions, HTML, Java, XML, .Net Technology, Technical Standards in HI, Health Economics, Planning, Organizing, Monitoring and Controlling, Resource Management in IT, Knowledge Management in IT, Quality Assurance Approach in Managing IT Solutions, IT Product Development, Branding and Pricing, Organizational Behaviour, etc.

Content for each course was derived with an understanding that these competencies would enable the students to achieve personal, professional and academic development required to become a competent HI professional, with the ability to meet the needs of the health care system/industry when taking into account the transitional context of digital health in India.

TABLE 1 M.Sc. HI Curriculum at MAHE, Manipal

*Credit Designation: Theory - 1h/week – 1 Credit; Practical – 3h/week – 1 Credit

Primary Competency Areas	**Total Number of Credits**	**Competencies**
1. Basic and Advances in HI	8	• Understand the concept of HI, its theory and literacy • Interpret the application of HI in patient care and evaluation • Describe the various technologies used for communication between Healthcare Providers and Health Information Vendors • Understand the functioning of knowledge-based and expert systems in healthcare • Interpret the ethical principles and values in practicing the HI discipline • Interpret the trends and influences in HI and their development
2. Application of ICT in HIM	4	• Design a database for the given database application requirements • Write and implement database schema • Design and develop webpages • Develop a graphical based interface application using C# (object-oriented programming language from Microsoft) • Develop a web-based application using ASP.Net 2.0 (open-source server-side web application framework) to write web services
3. Data Analytics and Its Application	4	• Understand the various analytic concepts and methodology • Apply statistical package R (*a free programming language and software environment for statistical computing and graphics that is supported by R foundation for Statistical Computing*) [8] in managing and interpreting healthcare data
4. Public Health Information Management and Informatics	4	• Understand the objective of designing and implementing HIM for populations

		• Identify various components and management functions related to health information systems at each level of the healthcare facility • Carry out assessment of a population based community HIS • Understand the process of designing and developing public HI applications
5. Medical Language	8	• Understand and analyze the meaning and usage of various medical and surgical terms • Understand various, general disease conditions
6. Entrepreneurship and Project Management in Implementing Health IT Solutions	4	• Understand the basics of entrepreneurship • Innovations in entrepreneurship • Enterprise creation and venture start-ups • Preparation of project reports
7. Management of Information and Communication Technology in Healthcare	4	• Understand the planning and organizing of HIS • Monitor, control and evaluate the HIS and its related applications • Understand the various quality approach and knowledge management in the HIS and its related aspects
8. Management and Organization Behaviour	4	• Learn the various functions of management and understand their usage in managing healthcare organizations
9. Hospital Administration	4	• Understand various aspects of management and administration in healthcare settings • Understand the functioning of various hospital departments

The competencies are designed to develop basic and advanced level understanding of HI and its applied areas: understanding of the correct usage of medical terms in HIS design; HI applications; managerial skills; understanding ethical practice; analytical skills in handling healthcare data and its practical approach using R; entrepreneurship skills; ability to carry out various group projects from idea to proof of concept; and understand the market force shaping the healthcare industry. The students specializing in Software Development and Management, are expected to have an in-depth understanding of advanced IT concepts such as software engineering, networking, medical imaging, development of mobile applications, etc.

CHANGES

The Department of HIM, SOAHS started the postgraduate program in HIM with the title of MS Medical Transcription and Data Management (MTDM) as an 18-month program in 2000 with a major focus on medical transcription and basic medical records management competencies. Immediately, the department realized a need to convert the existing program into a program which would address the HIM market needs. Based on the review of other international programs and Indian market requirements, the

department felt the need to include more content related to HIM and Hospital administration and decided to revise the MTDM program. This resulted in title and program duration changes from MS-MTDM of 18 months (three semesters) to M.Sc. Hospital and Health Information Administration (MHHIA) of 24 months (four semesters). The MHHIA program focuses on graduate level competencies in HIM, health insurance, medical coding and billing, data base management and hospital administration, as there were no established HIM professional roles within the Indian healthcare industry.

The last decade saw the implementation of health IT applications in the healthcare industry on a large scale and the need for an HI educated workforce. Understanding the healthcare industry requirements, in 2012, the department felt the need for a HI program at a master's level with more emphasis on health IT. It was also observed that students would need more hands-on sessions focused on IT solutions and a better understanding of the HIMS functionality. Upon successful completion of this program, graduates are better able to support hospitals in implementing the best health IT solutions. Finally, the department succeeded in receiving University Senate Committee approval in 2014 to formally launch the first HI program in the country.

Due to the evolving role and requirements of HIM professionals in the Indian healthcare industry and standardization of curriculum at a national level, the MHHIA program was revised and converted into an internationally accepted MSc. HIM program with adequate IT competencies in 2016. The focus of this program is to create a HIM workforce whose role is to manage the HIM system and assist the administration in various eHealth activities.

RESULTS

To meet with the national level (NIAHS) and GHWC requirements, the department was successful in converting the existing MSc. Hospital and HI Administration program into the MSc. HIM program with courses and competencies more relevant to the global requirements. The M.Sc. HI program was launched in 2014 with two specializations. As the program was designed based on academia and industry requirements, the first three student cohorts graduated with an HI degree and have acquired employment in reputable hospitals and IT industries throughout India, while those who chose to pursue a doctoral degree were accepted into universities in India and abroad. The department also received praise from the healthcare and IT industries for creating the best HI workforce in India. As an outcome of these important efforts, the faculty, students and departmental leadership received multiple opportunities to carry out various projects such as: assessment and implementation of HIS modules and EHR modules; development of conceptual models for wearable devices for diabetes; development of a Geographical Information System (GIS) for cancer and created a thematic map to understand the incidence and prevalence of cancer in districts throughout South India; development of mHealth reminder systems for maternal and child healthcare; development of dental information systems, etc. Some of the work focused on these projects were also published in peer reviewed journals.

OUTLOOK/LESSONS LEARNT

With a strong foundation created, the department is working to establish increased collaboration with the health IT industry and public health agencies with an aim of providing field training for students focused on eHealth and ICT applications. This need was identified based on our experience and feedback received from our alumni and industry, and would further align the academia and industry driven outcomes. The department also intends to strengthen research to develop digital health solutions vital for the country in

collaboration with governmental agencies and professional organizations. The odyssey of transformation will be continued by our committed team in the years to come.

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Case Study Checklists

Checklist of eHealth topics (competencies)

Role of "Peopleware": human factors, awareness, satisfaction and acceptance of health IT, usability measurements, evaluation of health IT, communication, leadership, change management, ethics and IT and similar topics

Applicable as we need to inculcate these competencies in student training to prepare them for working in a healthcare education setting, which is interdisciplinary in nature.

Role of inter-professional approaches: inter-professional versus mono-professional training and learning activities. What subjects lend themselves to inter-professional vs. mono-professional classes, learning environments and similar topics

Our training program is inter-professional in nature as it involves the engagement of healthcare, IT, law and ethics and management professionals. To cater to this requirement, our curriculum includes topics such as basic and advanced level HI topics, programming languages, management and organizational behaviour, medical ethics and legal aspects in practicing HI, medical language and communication skills.

Role of healthcare data sciences: data and information acquisition including documentation, data quality, data, information and knowledge management, data analysis and statistics, clinical decision making instruments, reporting and similar topics	The curriculum extensively covers these aspects throughout the training program as the majority of our graduates work in the healthcare industry, which needs these competencies.
Fusion of medical technology & informatics: software as a device, smart devices, automatic data acquisition via devices, risk and safety management	N/A
Role of process and workflow management: clinical and administrative processes, information continuity and information logistics, management of processes, workflow management systems and similar topics	The training also focuses on clinical workflow and management systems, as our graduates have many opportunities to work as intermediaries in developing HIS and other eHealth applications in various healthcare settings/IT industries in the healthcare domain.
Role of ethics, legal and data protection issues: ethics and IT, legal requirements, data protection and information self-determination, data safety and similar topics	These competencies are included in the training in order to promote and ensure ethical practice of HIS in any healthcare setting.
Role of learning and teaching: learning techniques ("learn how to learn"), learning and teaching styles (online, blended, face-to-face), learning management, information management for learning and teaching and similar topics	We predominantly use face-to-face (lectures, seminars, Continuing Health Information Education programs) and industry oriented (postings, credit based internship in Healthcare/IT industries under supervision) teaching/learning techniques in our training programs.
Role of management related topics in health informatics and IT: principles of management, strategic management, stakeholder and change management, leadership, financial management, risk management, quality and safety management, resource planning and management and similar topics	All of these competencies are covered in our training programs.
Role of technology: information and communication systems, telemedicine, telematics, assistive technologies, mHealth, life-cycle-management including systems development/engineering	All of these competencies are covered in our training programs.

Role of consumers and populations: consumer health informatics, public health informatics

All of these competencies are covered in our training programs, as graduates have the opportunity to find employment in the public health sector.

Role of Research: information management in research, data analytics

We expect graduates should possess sufficient research and analytical competencies to carry out various research and publication in HIM/HI domains, as a requirement of the curriculum and their professional career.

Role of interoperability: systems integration, IT standards, terminologies and classifications

All of these competencies are covered in our training programs.

Checklist of eHealth topics (gaps and deficiencies)

Teaching the teachers: Are there any activities in your organisation to teach health IT/eHealth to teachers in healthcare?

We conduct professional CE activities such as seminars, workshops and conference to address these needs.

Supporting participatory design and acceptance testing/research: Are there any educational activities to teach or practice participatory design? Are there any activities including research in user acceptance testing and satisfaction measurement?

We address this through carrying out interdisciplinary projects/research at different academic levels.

Integrating eHealth/health informatics into traditional curricula: Are there any activities to include eHealth/health informatics into traditional curricula of physicians, nurses and other health professionals with direct patient care?

No, these are regulated by respective Councils.

Motivating clinicians and managers: Are there any incentives and opportunities for clinicians and healthcare managers to acquire and update digital eHealth/health informatics skills and knowledge?

No, the current system and practice in our organization does not include this scope.

Engaging women: Are there any activities to attract female students in eHealth/health informatics or employ female health IT staff?

There is no separate policy in our organization as we believe in equal opportunity for both genders. However, the majority (60-70%) of our students and staff are female.

Adjusting job descriptions and enable continuing education: Are there any activities to adjust job descriptions, e.g., for clinicians, that include health informatics competencies (also proper use of health IT/eHealth systems) and are there activities to support staff updating and upgrading their health IT related skills and knowledge? This topic is mainly related to provider organisation and also to IT vendors.

N/A – The management team of our associated hospital is leading this process.

Updating teaching and learning material: Are there any activities to ensure that the material is up-to-date and of high quality?

We have established a process to revise curriculum based on input from academicians, healthcare industry, alumni and students. This has been done through a regular academic review process at the department and institution level, and by the Board of Studies at the university level every quarter.

Availability of courses including electronic courses: Are there any additional activities to improve the availability of courses such as implementation of new courses, new course formats that recognise previous experiences/training in particular for continuing education?

Currently we are not offering any courses electronically.

Informal caregivers: Are there any educational activities to teach health IT usage to informal caregivers, e.g. for assistive technologies?

N/A – we do not have this role in our system.

Shortage of health informatics specialists: Are there any programmes to attract health informatics specialists?

No.

eHealth Budget: Does your organization, area or region have a dedicated budget set aside for eHealth/health informatics training, education or workforce development initiatives?

N/A outside of this program

eHealth Specialty Areas: Does your organization address any of these speciality settings/areas of training or outreach for eHealth education or workforce development: ambulatory care, social medicine, geriatric/ageing medicine, rehabilitation?

No.