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Health and Medical Informatics Education in Japan

1. Introduction

In the past quarter century, there were significant expansions in information and communication technology (ICT or IT) and dramatic changes in the attitude of the healthcare community to the use of IT. Recent introduction of IT into healthcare institutions is also related to the so-called "e-government program" in Japan. The government is planning to establish a new nation-wide infrastructure, including legal frameworks and information infrastructure, for every citizen to benefit from the use of IT. Introduction of IT into healthcare sectors is one of the fundamental action plans of the government, and IT is now recognized as a promising method to establish healthcare services for patients, to improve patient safety, and to promote quality healthcare.

The need for education in Health and Medical Informatics (HMI) has been well recognized and various forms of educational opportunities are currently being provided . Full-fledged use of IT in healthcare institutions raised an issue of the lack of qualified "heath informatics professionals" or "health information specialists" in real healthcare settings. The need for fostering health informatics professionals or specialists was well recognized and the Japanese Association of Medical Informatics (JAMI) launched a Healthcare Information Technologists Program in 2003.

In the following, we will first overview HMI education in Japan, in particular, HMI education as part of education programs of healthcare professionals and dedicated HMI education programs. We will then introduce the health information technologist program offered by JAMI. Lastly, we discuss the recent trends in growing HMI education at the graduate level.

2. HMI Education around the World

Education in Health and Medical Informatics (HMI) has been discussed from various points of view around the world. A very fundamental issue when discussing HMI education is "What is Medical Informatics," and there has been enthusiastic discussion, for example [1-4]. Curriculum development is a core issue, and there is HMI education designed particularly for healthcare professionals [5-8] and for graduate students [9-11].

Since a variety of educational systems and educational needs exist, the curricula of HMI differs significantly from occasion to occasion. International Medical Informatics Association (IMIA) Working Group 1 (WG1) has discussed the issue intensively, and in 2001, IMIA WG1 agreed on recommendations in Health and Medical Informatics (HMI) education regarding educational needs for health care professionals to acquire knowledge and skills in information processing and information and communication technology [12]. It is not possible today to refer to standard curricula, but it is identified that a clear trend in curriculum design is the coming together of competency requirements in information processing, information systems and technologies and competency requirements in information management, i.e. how to effectively use IT to support appropriate decision-making and evidence based practice [12].

Regarding terminology, "Health Informatics" or "Healthcare Informatics" as well as "Medical Informatics" is used in the community. The 2001 IMIA recommendations adopted "Health and Medical Informatics (HMI)," and we will follow the guideline and use the term "Health and Medical Informatics (HMI)" throughout this article.

3. HMI Education in Japan - Background

3.1 Japan Medical Informatics Association

It has been more than 25 years since the academic society for Medical Informatics was established in Japan. Historically, the first academic society for Medical Informatics was organized in 1980, when Medinfo 80 (the 3rd World Congress on Medical Informatics) was held in Tokyo. The society was taken over by the Japan Medical Informatics Association (JAMI) which was established in 1983, and JAMI has been the official academic society dedicated to Medical Informatics in Japan since then. There are about 3,000 members as of Nov. 2004. The President of JAMI is Professor Hiroshi Tanaka of Tokyo Medical and Dental University. There are two vice Presidents, Professor Kazunobu Yamauchi of the Nagoya University Graduate School of Medicine and Professor Michio Kimura of the Hamamatsu University School of Medicine.

JAMI holds annual academic conferences, usually in November, which has about 2,000 entries. JAMI also holds an annual spring symposium where there are about 300 participants. Proceedings are published for accepted papers for annual conferences in the fall. For the spring symposium, papers submitted to the symposium are reviewed, and when accepted, they are presented at the symposium as well as published in the Japan Journal of Medical Informatics.

3.2 Education System in Japan

Figure 1 shows the Education system in Japan (details are found at http://www.mext.go.jp/english/org/f_formal_22.htm). By law, nine years of education, consisting of six years at elementary school and three years at junior high school, are compulsory. After the compulsory education period, the majority of students go to three-year senior high school (upper secondary education level). After senior high school, students may proceed to four-year universities or colleges, two to three year junior colleges, or technical (or vocational) schools. In 2003, the percentage of students who progressed to full-time high schools was 94.3% and 97.3% when including correspondence courses. The percentage of students who advanced to universities or junior colleges in 2003 was 49.0%, of which 48.3% were girls.

The term of study for universities is generally four years, but it is six years for medicine, dentistry and veterinary medicine. Education for the other health professionals is offered at four-year universities or colleges as well as three-year technical (or vocational) schools.

A university may establish a graduate school, offering master degree courses and doctoral degree courses. The number of graduate schools is steadily increasing. The percentage of the universities with master programs was about 51% in 1975, and 76% in 2003. Of all the university students, the percentage of graduate students was 2.8% in 1975 and 8.3% in 2003 (from "Report on school basic survey 2003" by the Ministry of Education, Culture, Sports, Science and Technology).

Going through three-year high school and then four-year universities or colleges is the most common pathway for students to proceed to graduate schools, but the education system is becoming more and more flexible, and there are a number of ways to achieve master
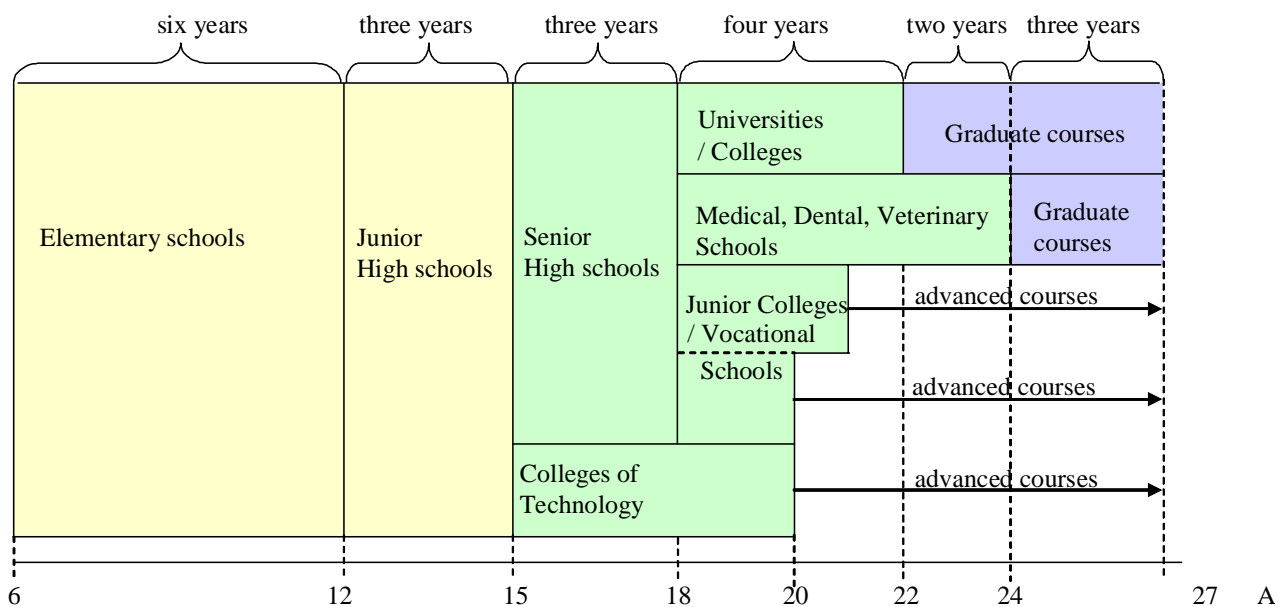

Fig. 1. Outline of Education System in Japan (Details may be found at http://www.mext.go.jp/english/org/f_formal_22.htm, Ministry of Education, Culture, Sports, Science and Technology).

and doctoral degrees no matter which course they choose after the compulsory education period.

4. Health and Medical Informatics Educational Opportunities in Japan

There are different types of health and medical informatics (HMI) educational needs, and correspondingly, there are various types of HMI Educational opportunities. Typical opportunities are shown in Figure 2. We will describe representative examples in the following. Another topic related to HMI education is the "Healthcare Information Technologist examination" program established by JAMI in 2003, which will also be covered.

4.1 HMI Education for Healthcare Professionals

Presently, all professionals in healthcare, including physicians, nurses, pharmacists, health record administrators, and so on, are confronted with the use of IT in healthcare settings, and it is mandatory for all healthcare professionals to have knowledge and skills for efficient and responsible use of IT and information processing methodology. It is a minimum requirement for all the students enrolled in programs for healthcare professionals to be provided with HMI education at the IT user level. HMI education at this level is given as part of educational programs of health professionals, and is indicated as A in Figure 2. Here, by "program", we mean an organized, structured set of courses aimed at preparing participants for specific career paths and culminating in a degree, diploma or certificate as defined in [12].

Sakurai, et al. carried out a survey in 2001 regarding HMI education as part of dedicated programs at medical schools [13]. Inquiry was sent to 80 medical schools, and curricula and syl-
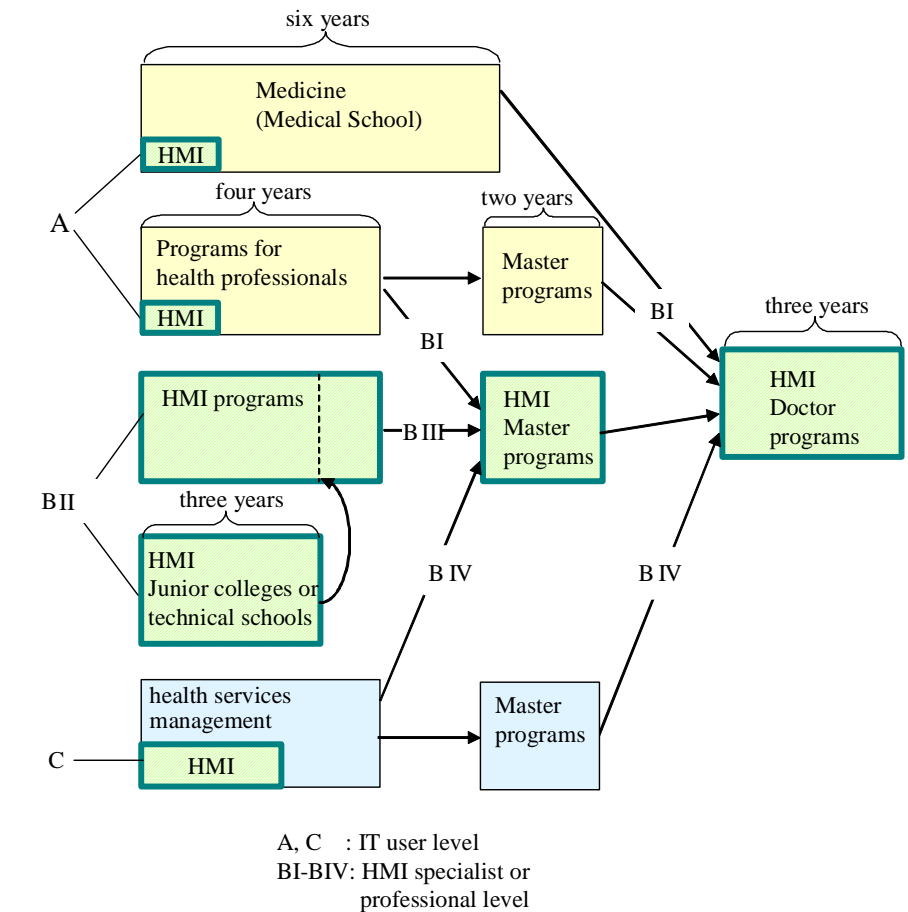

Fig. 2. Typical paths for learning HMI at higher education.

labus were collected from 73 medical schools (92%). From the collected curricula and syllabus, 538 classes or courses were extracted and were classified into (A) medical informatics or closely related subjects (mandatory); (B) statistics, medical electronics and engineering or closely related subjects; (C) information processing or computers that are not associated with medicine; (D) information processing or science provided as part of other courses or lectures; and (E) information processing or information science as part of general education. 32 universities (44%) provided courses or classes of category (A) and there were 45 courses or classes. There was, however, a wide range of variation in hours, from two hours to 104 hours with median 26 hours. Here "course" means a unit of study con-

sisting of a set of lectures and exercises dedicated to a certain field [12].

4.2 HMI Education for Dedicated Program in HMI

There are HMI educational opportunities for candidates who aim to become qualified HMI professionals or specialists, and different paths are now available to achieve this goal. One way is to study HMI at graduate schools after completing educational programs for healthcare professionals (the path indicated as BI in Figure 2). Another way is to be enrolled in dedicated programs of HMI (the path indicated as BII in Figure 2). For the path BII, candidates may or may not proceed to graduate level (BIII).

In recent years, dedicated programs in HMI or closely related disciplines were offered at four-year undergradu-

IT and Information processing	Programming	
	Database Systems	
	Network	
	Software Systems Aanalysis, Design, and Development	
Healthcare Statistics and methodology	Mathematics	
	Healthcare Statistics	
	Decision Support	
Health and Healthcare	Structure and function of the human body	
	Basis of disease	
	Healthcare Service Systems	
	Health Information Management	

- Health Informatioin Systems
  - Systems architecure and examples of hospital/physicians office information systems
  - information systems
  - Management of Hospital Information Systems
  - Security Policy, etc.
- Electronic Health Record
  - Practice of EHR systems management
  - Information ethics of patient information
  - Structure of EHR
- EBM, Assessment of healthcare
  - Principles and Practice of EBM
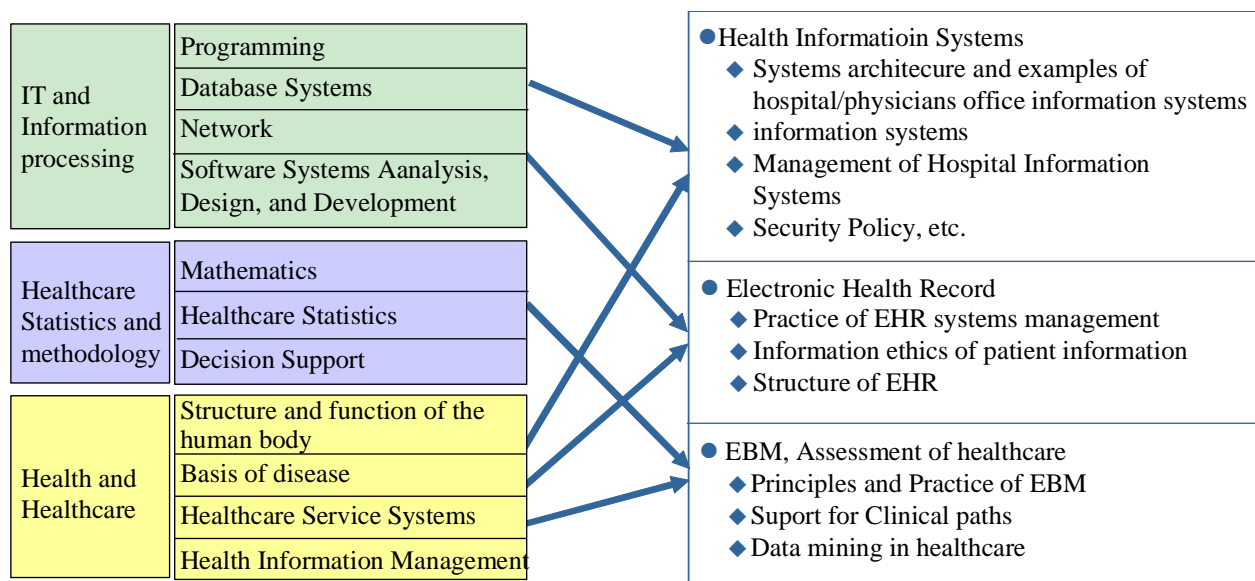 - Suport for Clinical paths
  - Data mining in healthcare

Fig. 3. Core curriculum of a dedicated undergraduate HMI program.

ate programs or three-year junior college courses. An example is the Department of Medical Information Science, Suzuka University of Medical Science, and another is the Department of Health Informatics, Kawasaki University of Medical Welfare. Both were established in 1991. Also, another example is the Department of Healthcare Informatics, Takasaki University of Health and Welfare, established in 2001. At a junior college, HMI education has been provided at the Medical Information Systems Course, Fujita Health University College since 1996.

4.2.1 Dedicated Undergraduate Program in HMI - an Example

Since there are variations and it is difficult to speak about a HMI curriculum in general, we will take the department of Health Informatics, Kawasaki University of Medical Welfare as an example. The curriculum was reformed in 2001 based on the IMIA WG1 recommendations [12], and a core curriculum as shown in Figure 3 was developed for the dedicated undergraduate program in HMI [14]. Shown on the left in Figure 3 are the knowledge and skill domains that comprise the core of the curriculum. The do-

mains are classified into 1) IT and information processing; 2) Healthcare statistics and methodology; and 3) Health and Healthcare. Shown on the right hand is "Integrated domain." Typical subjects in the integrated domain and the relation between the three core domains are shown in the figure.

The curriculum is rather academic and scientific, and it is necessary to provide practical education and training. For this purpose, two to four-week practical training at a hospital is carried out during the summer, where the students learn the organization and functionality of hospitals, flow of patients, flow of information, attitude toward helping and taking care of patients, and so on. Practical training at a hospital is carried out at most of the universities specializing in health and welfare. Another effort is the development of a software system called "Electronic Patient Record (EPR) Laboratory." Healthcare institutions are increasingly recognizing information as a vital resource to improve quality of healthcare. The system aims to provide students with knowledge and skills needed to manage patient records through the appropriate use of IT, including basics of patient records, medical terminol-

ogy, coding systems, master file management, communication technology, and databases (Figure 4).

4.2.2 HMI and Health Information Managers

Most of the students at universities specializing in health and welfare such as nurses, physical therapists, speech therapists, certified social workers, and so on, take national examinations for healthcare professionals when graduating from the university. Successful candidates of the national examinations will be certified professionals (certified by the Minister of Health, Labour and Welfare). It is a natural tendency then that students enrolled in HMI also desire to obtain certain qualifications to prepare for working in healthcare institutions.

For the moment, there is no national qualification or license system for HMI professionals. A certification system that is related to HMI is that for "health information managers," run by the Japan Hospital Association (JHA). It was originally called certification for "medical record librarian," and was renamed in 1996. To be qualified as a health information manager, a candidate must take a two-year correspondence course provided by JHA. In

Fig. 4. EPR Laboratory.

recent years, an alliance system between JHA and universities has been established, and if the curriculum offered by a university is accredited to cover the curriculum specified by JHA, the students may take the examination for health information manager without taking the correspondence course.

There are six accredited universities as of November 2004, and the number is still increasing. Three out of six provide programs in HMI. The two provide programs in health services management. At both institutions, HMI education is given as part of a dedicated program of health service(s) management (indicated as C in Figure 2).

5. Healthcare Information Technologist

At the one end of HMI education, there are the theoretical and scientific aspects, and at the other end, there are practical and technical aspects. Since there was a need for technologists who specialize in health and medical information, the Japan Association of Medical Informatics (JAMI) inaugurated the Healthcare Information Tech-
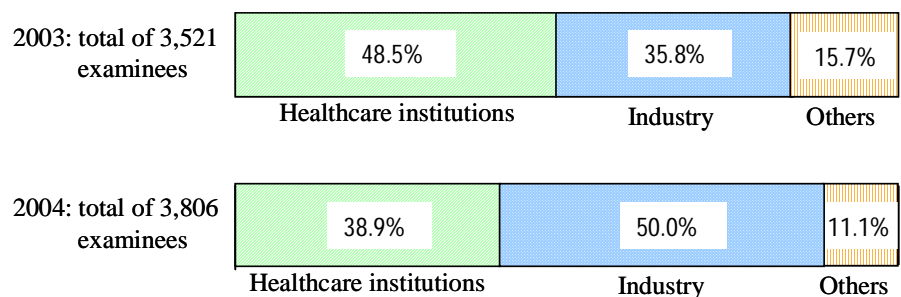
nologist Examination in 2003. The required skills and knowledge is comprised of the following three areas: 1) Health information systems; 2) Information technology; 3) Healthcare. The examination is not only for healthcare professionals, but also for software developers, vendors or other engineers working in the fields of medicine and healthcare. Students are also among the expected examinees. The first examination was given in August 2003 where there were 3,521 examinees. Among them, about 48.5% were from healthcare institutions, 35.8% were from healthcare industry, and 15.7% were from others. The second examination was given in August 2004. There

were 3,806 examinees, an increase of 8% from the previous year. Among the examinees in 2004, 39% (1,482) were from healthcare institutions, and 50% (1,902) were from industry. The distribution of examinees is summarized in Figure 5.

In 2003, the overall pass rate was 27.8%. It was 30.3% for those from healthcare institutions and 28.7% for those from industry. It was 17.1% for the others. In 2004, the overall pass rate was 32%. It was 34.3% for candidates from healthcare institutions, and 33.5% for those from healthcare industry. It was 16.8% for the others.

The first edition of the textbooks was published in March 2004. Text-

Fig. 5. Distribution of examinees in 2003 and 2004.

books are composed of three volumes:
1) Health Informatics - Health Information Systems.
2) Health Informatics - Information technology;
3) Health Informatics - Healthcare;

The core is "Health Information Systems," and the chapters are shown in the following:

1. Features of Health Information and Current Health Information Systems
2. Hospital Information Systems
3. Health Information Systems based on a Wide Area Network
4. Coordination between Organizations
5. Standardization in Health Informatics
6. Electronic Health Records
7. Health Information Ethics
8. Data Analyses and Evaluation for the Support of Healthcare

6. Concluding remarks - Continuing growth of HMI education

Qualifications in HMI programs leading to accreditation at the master or Ph.D. level should be considered. Many universities nowadays offer masters programs and there are some that provide doctors programs. Graduate school offerings are largely classified into two areas, one for research and the other for practice. There are enthusiastic initiatives in HMI or closely related disciplines at graduate schools. One of the obvious trends is to establish a string of graduate schools for working people, or upgrade practical courses for working people. As an example, there is an initiative at the Graduate School of the International University of Health and Welfare to establish a graduate program for a Healthcare Chief Information Officer

(CIO). Professionals or specialists or researchers, whatever title they assume, it is clear that people with strong technical and scientific ability are of necessity in the coming era of full-fledged computer society in healthcare. If there is a variety of need, we should prepare corresponding opportunities to meet these needs.

There is a serious decrease in the number of children in Japan. The population of 18 year olds is decreasing whereas the number of universities and graduate programs are still increasing. The ratio of students who proceed to universities had steadily increased in the past but is now leveling out . However, educational opportunities for HMI are expanding these days. Advancement of the information society in the healthcare community opens new opportunities to continue the growth of health and medical informatics education.

Acknowledgement

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