Medical Informatics For Medical Students And Medical Practitioners

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The importance of incorporating medical (or health) informatics into the education of medical students and medical practitioners is being increasingly recognised. The advances in information and communication technology and the pervasion of the Internet into everyday life have important implications for healthcare services and medical education. Students and practitioners should learn to utilise biomedical information for problem solving and decision making based on evidence. The extensive introduction of electronic health information systems into hospitals and clinics and at the enterprise level in Malaysia and elsewhere is driving a demand for health professionals who have at least basic skills in and appreciation of the use of these technologies. The essential clinical informatics skills have been identified and should be incorporated into the undergraduate medical curriculum. It is recommended that these be introduced in stages and integrated into existing programmes rather than taught as a separate module. At the same time, medical schools should support the integration of e-learning in the educational process in view of the numerous potential benefits.

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And in the next century, the study of informatics will become as fundamental to the practice of medicine as anatomy has been to the last.[1]

"The last few years have seen rapid advances in communication and information technology (C & IT), and the pervasion of the worldwide web into everyday life has important implications for education. Most medical schools provide extensive computer networks for their students, ad these are increasingly becoming a central component of the learning and teaching environment. Such advances bring new opportunities and challenges in medical education, and are having an impact on the way we teach and on the way students learn, and on the very design and delivery of the curriculum. The plethora of information available on the web is overwhelming, and both students and staff need to be taught how to manage it effectively. Medical schools must develop clear strategies to address the issues raised by these technologies."[2]

Definition: Medical (or health) informatics is the rapidly developing scientific field that deals with the resources, devices and formalized methods for optimizing the storage, retrieval and management of biomedical information for problem solving and decision making.[3] It is an interdisciplinary field based on computer science, information science, the cognitive and decision sciences, epidemiology and telecommunication, among others, and is used to enhance healthcare, medical research and education.

Medical School Objectives Project. In February 1998 the Association of American Medical Colleges (AAMC) issued Report I of the Medical School Objectives Project (MSOP).[4] The purposes of the MSOP were to set forth program level learning objectives that medical school deans and faculties could use a a guide in reviewing their medical student education programs and to suggest strategies that they might employ in implementing agreed upon changes in those programs. That report set forth 30 program level learning objectives that represented a consensus within the medical education community on the knowledge, skills and attitudes that students should possess prior to graduation from medical school. Among these objectives was the need by students before graduation to demonstrate to the faculty "the ability to retrieve (from electronic databases and other resources), manage, and utilize biomedical information for solving problems and making decisions that are relevant to the care of individuals and populations". At the onset of the MSOP, AMMC staff recognised that there were special challenges that medical schools would face in aligning the design and content of the educational programs with evolving societal needs, practice patterns, and scientific developments. Medical informatics was one of them and an expert panel was established to develop more detailed learning objectives.

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Their recommendations form part of MSOP II.[5]

The Medical Informatics Advisory Panel was charged to provide guidance on learning objectives related to medical informatics. To this end, the panel developed recommendations to help ensure that medical school graduates have a foundation in medical informatics that would support them and physicians in the 21st century, to efficiently utilize increasingly complex information for problem solving and decision making. The argument that medical informatics should be a central feature of the medical curriculum is based on the following premise. "To support health care, life-long learning, education, research and management, medical students should be able, at the time of graduation, to utilize biomedical information for: formulating problems; arriving at strategies for solutions; collecting, critiquing and analyzing information; taking action based on these findings; and communicating and documenting these processes and the results.[6]

Future Roles of Medical Students. The Medical Informatics Advisory Panel identified five major roles played by doctors i.e. life long learner, clinician, educator/communicator, researcher and manager in which medical informatics plays a role. The curriculum can be designed around these roles although it is understood that the doctor plays several roles at any time. It is not expected for medical schools to provide all parts of the curriculum to begin with. In fact, because of the tightness of the programme, medical informatics should only gradually infiltrate the clinical curriculum and it should be provided as a component of existing programmes rather than as a standalone activity.[7]

Approach by New Medical School in Florida. The Florida State University College of Medicine[8] is the first medical college to open in the US after the Internet revolution. The multimedia presentations (http://med.fsu.edu/VirtualTour/flashIntro.html) provide some snapshots of the environment and the use of medical informatics, wireless networks, hand helds and a virtual medical library assessable 24 hours daily. This is the way all medical schools will work in future.

Rapid Rollout of Enterprise and Hospital Information Systems in Malaysia and the Impact on Medical School Education Curriculum Requirements. As the table below summarises, there had been a rapid deployment of Enterprise Health Information Systems (e.g. HMIS and Telehealth) and Hospital Information Systems. In Package 1 and Package 2, a total of 33 new health facilities would be equipped with information systems. Doctors would be expected to be familiar with these systems. Hospitals in the Ministry of Education, Ministry of Defence and the private sector are also deploying information systems. Private practitioners too have to use computers with Internet connectivity to provide online reports to the Ministry of Health and Ministry of Home Affairs before payment is made for medical examination of foreign workers. Several companies have developed clinic information solutions for individual and small group practices.

While training is provided to doctors in individual institutions to use these systems, the training is usually

Table 1. Development of Health Information Systems in Malaysia

1991 – 1995	1996 – 1998	1999 – 2005
Applications for administrative tasks, drug inventory management, finance and health management information reporting	Formulation of Information System Strategic PlanPatient Management Information System introduced in 14 state hospitals Wide area infrastructure implemented to connect state and national programme heads	Wide area network upgraded to Virtual Private Network Maternal and Child Health Care Information System, Communicable and Vector Borne Disease Surveillance and Control System and Food Quality Control Programme launched

	Automation introduced into National Drug Ordering System: significantly reduced drug wastage and improved drug availability Teleconsultation pilot teleconferencing system set up to support remote renal care management by specialists from two tertiary hospitals Also to support psychiatry and oncology management Tele-CME sessions also conducted Low-end teleconsultation pilot tested in Sarawak and expanded in stages. Wide familiarity amongst health professionals in use of Microsoft Powerpoint and Word and Excel and Outlook especially younger doctors, many of whom bring laptops to meetings. Internet sources of CME used extensively.	First fully electronic "paperless and filmless" hospital opened in Selayang in 1999 with a second in Putrajaya in 2000 (linked to paperless primary health care centre) National Telehealth Project launched in 2000 with Consumer Health Portal, CME Portal and 42 teleconsultation hubs and spokes. Work on Lifetime Health Record and Personalised Lifetime Health Plan projects in progress. Work on National Teleprimary Care Project proceeding. Kepala Batas and Lahad Datu Hospitals opened in 2004 with electronic hospital information systems. Work proceeding on Serdang Hospital and Pandan Hospitals. Another 10 hospitals in the pipeline in Ministry of Health Package 1. Hospital UKM and Lumut Naval Hospital and University of Malaya Medical Centre following suit.

brief and part of the in-service training. Prior exposure to use of information technology will facilitate the adaptation of newly graduated doctors. In fact, medical informatics skills have been identified by doctors as the single most important new skill they need to acquire.[9]

Supporting Medical Practitioners. Essential clinical informatics skills have previously been identified from a medical perspective. Coiera[10,11] proposes that, in addition to having basic computer skills, ten essential clinical informatics skills are needed in order for clinicians to properly manage information (Table 2).

Table 2: Ten Essential Clinical Informatics Skills

1. Understand the dynamic and uncertain nature of medical knowledge and know how to keep personal knowledge and skills up-to-date.
2. Search for and assess knowledge according to the statistical basis of scientific evidence.
3. Understand some of the logical and statistical models of the diagnostic process.
4. Interpret uncertain clinical data and deal with artifact and error.
5. Analyze and structure clinical decisions in terms of risks and benefits.
6. Adapt and apply clinical knowledge to the individual circumstances of patients.
7. Access, assess, select and apply a treatment guideline; adapt it to local circumstances; and communicate and record variations in treatment plan and outcome.

8. Structure and record clinical data in a form appropriate for the immediate clinical task, for communication with colleagues, or for epidemiological purposes.
9. Select and utilize the most appropriate communication method for a given task (e.g. face-to-face conversation, telephone, e-mail, video, voice-mail, letter).
10. Structure and communicate messages in a manner most suited to the recipient, task and chosen communication medium.

It is clear that effective information management requires more than basic computer literacy. Computer skills are fundamental to integrating technology and clinical practice and to facilitating the effective transformation of data to useable clinical information.

E-Learning in undergraduate medical education. At the same time, the medical school needs to explore and support the integration of e-learning in undergraduate medical education. The potential benefits are considerable, some of which have been listed by Greenhalgh.[12] The right mix of "blended learning" (face-to-face and e-learning) in medical schools is the object of many educational research projects underway.

Computer assisted learning is inevitable – Individual lecturers and departments are already beginning to introduce a wide range of computer based applications, sometimes in a haphazard way. Planned and coordinated development is better than indiscriminate expansion

It is convenient and flexible – Courses supported by computer assisted learning applications may require fewer face to face lectures and seminars and place fewer geographical and temporal constraints on staff and students. Students at peripheral hospitals or primary care centres may benefit in particular

Unique presentational benefits – Computer presentation is particularly suited to subjects that are visually intensive, detail oriented, and difficult to conceptualise, such as complex biochemical processes or microscopic images Furthermore, "virtual" cases may reduce the need to use animal or human tissue in learning

Personalised learning – Each learner can progress at his or her preferred pace. They can repeat, interrupt, and resume at will, which may have particular advantages for weaker students

Economies of scale – Once an application has been set up, the incremental cost of offering it to additional students is relatively small

Competitive advantage – Potential applicants may use the quality of information technology to discriminate between medical schools. A "leading edge" virtual campus is likely to attract good students

Achieves the ultimate goal of higher education – The goal is to link people into learning communities. Computer applications, especially the internet and world wide web, are an extremely efficient way of doing this

Expands pedagogical horizons – The most controversial argument for using computer assisted learning in higher education is the alleged ability of the virtual campus to alter fundamentally the relation between people and knowledge

Conclusions. The development of a medical informatics department and the infiltration of medical informatics into the teaching of all areas of the undergraduate curriculum would produce a graduate

from the medical college who will fit easily into the new informated connected health care environment and will hopefully be a natural leader in this setting; an end result which can differentiate the graduate of the college when such training complements the traditional teaching of clinical medicine. As mentioned earlier, the role of the medical informatics curriculum is to support existing clinical teaching, should be introduced in stages and in integrated into existing programmes. In addition, such developments can be extended to the area of continuing professional development and can be beneficial to former graduates as well as other members of the medical community including allied health personnel. (This has already been built into the Health Informatics Module in the Bachelor of Biomedical Sciences programme at the International Medical University.)

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