Educating Medical Students as Competent Users of Health Information Technologies: The MSOP Data

Julie J. McGowan[a,b], Morgan Passiment[c], Helene M. Hoffman[d]

[a]*School of Medicine, Indiana University, Indiana, USA;* [b]*Regenstrief Institute, Inc., Indiana, USA*
[c]*Association of American Medical Colleges., Washington, D.C., USA*
[d]*School of Medicine, University of California San Diego, California, USA*

Abstract

As more health information technologies become part of the health care environment, the need for physicians with medical informatics competencies is growing. In 2006, a survey was created to determine the degree to which the Association of American Medical College's Medical School Objectives Project (MSOP) medical informatics competencies had been incorporated into medical school curricula in the United States. Methods: a web-based tool was used to create the survey; medical education deans or their designees were requested to complete the survey. Analysis focused on the clinician, researcher, and manager roles of physicians. Results: Seventy usable surveys were returned. Many of the objectives were stated in the schools' respective curricula and the competencies were being evaluated. However, only a few schools taught and assessed the medical informatics objectives that required interaction with health information. Conclusion: To insure that physicians have the knowledge, skills, and attitudes to effectively and efficiently interact with today's health information technologies, more medical informatics concepts need to be included and assessed in all undergraduate medical education curricula in the United States.

Keywords:

Education, Medical, Undergraduate; Medical Informatics; Hospital Information Systems; Decision Support Systems, Clinical

Introduction

Within the next decade, a large majority of hospitals and health care centers in developed nations and many in developing nations will have electronic health records and other forms of health information technology. Physicians will be expected to use these tools to improve patient safety, enhance the quality of care, and reduce costs. This expectation requires that physicians be trained, not as medical informaticians but as knowledgeable users of the health technology tools. However, most education in medical or health informatics has focused on the knowledge and skills needed by informaticians rather than health care professionals.

Recently in the United States, the President authorized the creation of the first Office of the National Coordinator for Health Information Technology. Several legislative initiatives were undertaken to promote the use of information technology within healthcare to improve process, quality and safety, thereby improving the health of our citizens. The promise of widespread adoption of electronic health records with the concomitant capabilities of provider order entry, decision support, and data mining for clinical research, as well as quality and safety evaluations, is about to become a reality. However, significant questions exist as to whether or not physicians will have the competencies necessary to effectively use these systems to achieve the goals outlined by the President and legislature.

Europe and Canada have long been leaders in the training of informatics-facile health care providers. The work of the European Centre for Medical Informatics, Statistics and Epidemiology (EuroMISE) has provided an early framework for such education in Europe.[1] The International Partnership for Health Informatics Education is in part an outgrowth of the earlier efforts and, in an environment of increasing globalization, emphasizes the need for international components in informatics education.[2]

Canada was also an early leader in medical informatics education and took a different but equally effective approach by integrating applied medical informatics into the undergraduate medical curricula.[3] However, such education must evolve with the changing technologies and the demand for more and more health care professionals to become information literate has resulted in an evaluation of current practices with more emphasis being given to emerging trends in both informatics and health.[4]

Other nations are beginning to recognize the need for more informatics training in the health professions.[5-7] In an attempt to address these very real issues, the International Medical Informatics Association developed recommendations on education in health and medical informatics.[8] These recommendations are the initial step in developing the educational framework necessary to insure that students possess appropriate qualifications to work in an information technology intensive health care environment.[9]

Leaders in medical informatics in these countries and others are calling for more targeted educational programs to insure that the systems being implemented will have physicians trained to use them.[10] However, the integration of such training into health professions curricula has been difficult at best and quite slow to develop.

Need for such training was beginning to be recognized in the United States in the 1980s with several calls from major organizations to prepare physicians for a future in an automated health care environment by integrating the necessary skills into the educational process.[11-13] However, little was realized in the form of concrete programs from these early inducements.

Understanding the potential impact of the growing interest in health information technology on the practice of medicine, and trying to take a more proactive stance in insuring that undergraduate medical students had a firm grounding in the knowledge, skills and attitudes necessary to become technologically savvy health care providers of the future, the Association of American Medical Colleges in 1998 convened an expert panel to develop educational objectives to satisfy this goal. The medical informatics panel of the Medical School Objectives Project (MSOP) II identified five medical informatics relevant roles played by physicians – lifelong learner, clinician, educator-communicator, researcher, and manager. The recommendations for educational content were developed within this framework and published in 1999.[14]

In part because of the increasing interest on the part of the government in facilitating widespread adoption of health information technology, in part because of the dearth of articles published about new educational programs in medical informatics in undergraduate medical curricula, and in part because of a growing need for information literate physicians, a small group of the educational leadership within the Group on Information Resources of the Association of American Medical Colleges surveyed and analyzed the responses of the 127 United States medical schools to determine whether or not they had implemented the MSOP medical informatics educational objectives and, if so, to what extent were the implemented.

Methods

An initial request to participate in the survey was sent to the respective deans of medical education at the 143 discrete medical schools in the United States and Canada. The deans were asked to either respond to the survey or refer it to someone who was knowledgeable about medical informatics content in the curriculum. The Web-based survey asked participants to respond to questions formulated directly from the MSOP II medical informatics educational objectives. These questions were grouped by the physician role with sub-groupings around concepts.

An initial question addressed whether or not the respondent was familiar with the MSOP Medical Informatics educational objectives. The subsequent questions asked the respondent whether or not each of the objective concepts was taught, had stated objectives, and was assessed. At the end of each of the five role divisions the respondent was asked to indicate who taught the concepts and how the concepts were assessed.

While virtually all of the respondents indicated they were familiar with the MSOP medical informatics educational objectives, the responses differed widely in regards to teaching, stated objectives, and assessment. In following up with a number of the participants about responses, it became apparent that many thought the medical informatics content was being taught as an integrated component of the clinical years. However others from the same institutions, many with long standing clinical information systems, stated that their medical students were exposed to these systems but did not have formal training or experiential learning with these systems.

Because of these discrepancies, a second survey was developed that limited responses to stated objectives and assessment because of the belief that having a stated objective would result in some educational action and would eliminate the possibility of someone assuming rather than knowing that the concepts were being taught.

The request to participate in the survey was again sent to the deans of medical education unless there was a different respondent on the first survey. The second survey was also Web-based and a request for participation was made in early 2006, almost a year after the first survey. Interestingly, individual school responses showed little change, however, several additional schools indicated establishing objectives.

Because the attributes for being facile with health information technology in the today's health care environment focused on three of the five physician roles, the responses for Life-long Learner and Educator-Communicator were not considered for this study. In addition, while data was collected on Canadian medical schools, because of their early embracing of the need to teach medical informatics in undergraduate medical education, only the responses from United States Medical Schools have been evaluated.

Results

Seventy usable surveys were "virtually" returned. Ninety-six percent of the respondents were familiar with the MSOP medical informatics educational objectives and eighty-eight percent indicated that there had been an overall strategy to integrate medical informatics objectives into the curriculum. However, the results of the specific competencies did not support this.

Clinician

Within the sub-group of effective use of clinical information systems, 60% of the respondents indicated that they had a stated objective on retrieving patient-specific information from a clinical information system and 49% assessed the

competency. Forty-four percent had a stated objective on displaying selected subsets of information available about a given patient and 36% assess the competency. Forty-six percent had a stated objective about recording specific findings about a patient in a clinical information system while 47% assessed the competency. Forty-six percent had a stated objective on recording orders (CPOE) directing the further care of the patient and 36% assessed the competency.

The sub-group of interpreting laboratory tests scored higher. Seventy percent of the respondents had a stated objective about recognizing the knowledge limitations of standard laboratory measurements and 66% assessed the competency. Seventy-seven percent had a stated objective about demonstrating the ability to integrate clinical and laboratory findings while 86% assessed the competency.

Within the sub-group of incorporating uncertainty explicitly into clinical decision making, fifty-seven percent of the respondents had a stated objective on demonstrating the ability to quantify and communicate the degree of certainty associated with specific items of scientific and clinical information and 50% assessed the competency. Forty-six percent had a stated competency on demonstrating the ability to identify and locate when possible the crucial pieces of missing clinical information and determine when it is appropriate to act on incomplete information and 40% assessed the competency. Sixty-three percent had a stated objective on demonstrating the ability to integrate verbal and statistical sources of medical knowledge with the facts of a specific clinical case and 61% assessed the competency.

Within the critical use of decision support tools sub-group, sixty-nine percent of the respondents had a stated objective on using textbooks and journal articles and 67% assessed the competency. Thirty percent had a stated objective on using diagnostic expert systems and fourteen percent assessed the competency. Twenty-three percent had a stated objective on using advisories or alerts issued from a computer based records and fourteen percent assessed the competency.

In responding to a student's ability to formulate a treatment plan, fifty-seven percent of the respondents had a stated objective that students should demonstrate the ability to express the relative certainties of a differential diagnosis while 69% assessed the competency. Sixty-one percent had a stated objective on expressing the relative risks and benefits of outcomes and treatment options while 66% assessed the competency. Forty-six percent had a stated objective on taking action by balancing risks and benefits while 53% assessed the competency.

Within the sub-group of respecting patient (and physician) confidentiality, 76% of the respondents had a stated objective on demonstrating the knowledge of the legal, ethical and medical issues surrounding patient documentation including confidentiality and data security while 79% assess the competency. Thirty-three percent had a stated objective on demonstrating the ability to use security-directed features of an information system while 27% assessed the competency.

Researcher

The first of the researcher group deals specifically with the use of clinical information systems. Twenty-four percent of the respondents had a stated objective on determining a practice's case mix and 20% assessed the competency. Twenty-nine percent had a stated objective on determining the incidences of diagnoses in a practice and 26% assessed the competency. Forty percent had a stated objective on testing the efficacy of a new treatment and 33% assessed the competency. Fifty-six percent had a stated objective on formulating testable hypotheses and 50% assessed the competency. Fifty-one percent had a stated objective on collecting, organizing, and interpreting data while 53% assessed the competencies.

Within the sub-group about determining what data exist relative to a clinical question or formal hypothesis, seventy-one percent of the respondents had a stated objective for demonstrating the ability to use information technology to locate existing data sources and 60% assessed the competency. Thirty-three percent had a stated object for demonstrating knowledge of data sources (including medical records claims and reimbursement information and online data) at one's own institution by identifying how these might be used to address a specific clinical question posed as research and 20% assessed the competency. Thirty-one percent of the respondents had a stated objective for demonstrating the ability to identify and locate existing data sets no maintained at one's own institution (e.g., national registry data) that might be used to address a specific clinical question posed as research and 16% assessed the competency.

For the sub-group executing a plan for data collection and organizing data for analysis, 24% of the respondents had a stated objective for selecting and appropriate computer database tool for collecting and organizing data and fourteen percent assessed the competency. Twenty-nine percent had a stated objective for properly representing data from a study in a form that is useful and supports computer-based analysis and sixteen percent assessed the competency.

Within the sub-group of analyzing, interpreting, and reporting findings, 23% of the respondents had a stated objective for selecting the appropriate computer software tools for analysis of data and ten percent assessed the competency. Thirty-one percent had a stated objective for using software to perform simple statistical analysis and portraying the results graphically and 23% assessed the competencies. Thirty-one percent had a stated objective for interpreting the reports of statistical software analysis and 27% assessed the competency.

Manager

There are three sub-groups within the Manager grouping. The first of these is the appreciation of the role of information technology in relation to managing the cost of medical care and its impact on individuals and society. Twenty-three percent of the respondents had a stated objective on using on-line sources of health care financing information and eleven

percent assessed the competency. Thirty-nine percent had a stated objective on continuous quality improvement and process management and twenty percent assessed the competency. Twenty-four percent had a stated objective on how information technology can be used to develop, implement and monitor compliance with clinical pathways and other forms of patient care protocols and eleven percent assessed the competencies. Thirty-three percent had a stated objective on how clinical information in the aggregated can be used to determine health care services planning for populations and 23% assessed the competency.

Within the sub-group of formulating and making decisions for individuals and groups, 55% of the respondents had a stated objective on demonstrating knowledge of cost/benefit issues in health care and 29% assessed the competency. Fourteen percent had a stated objective on using a decision-analysis package and seven percent assessed the competency. Thirteen percent had a stated objective on using software utilities assessing patients and six percent assessed the competency. Thirty-nine percent had a stated objective on incorporating economic and cost perspectives into decision making and 23% assessed the competency.
The last sub-group dealt with working effectively as an individual in inter-professional groups and as a member of a complex health care system. Nineteen percent of the respondents had a stated objective on using electronic personal and clinical scheduling systems and nine percent assessed the competency. Twenty-one percent had a stated objective on archiving and organizing digital information of personal and clinical import and fourteen percent assessed the competencies. Twenty-four percent had a stated objective on demonstrating knowledge of online resources for legislation, political advocacy, and local health care policy setting and six percent assessed the competency.

General Questions

In all three of the physician role groupings, the content was taught generally through embedding it in core course. A few schools had an elective course in medical informatics and fewer still had a core course in medical informatics. Because the primary mode of teaching was through integration with other content, almost all of the assessment of competencies was done as part of a general educational evaluation schema. However, several schools had tests specific to medical informatics or used these in conjunction with the general assessment methodologies.

Discussion

The medical informatics educational objections presented by the MSOP expert panel were developed around the concept of information discovery and not predicated on computer literacy. For this reason, a number of the competencies can be taught without use of a computer. Examples of this are found in the interpretation of laboratory tests and the ability to formulate a treatment plan.

There were a total of 41 questions in the clinician, researcher, and manager role groups. Of those, 27 required interaction with a clinical information system or some ancillary system containing patient information. Eleven questions involved educational objectives that could be met without such interaction. Three questions related specifically to the competencies within the life-long learner role group but were also closely linked to clinician and researcher information management.

Of the five roles, the greatest number of medical school having stated objectives and competency assessments was found in the life-long learner role. This corresponds to the increase in teaching evidence-based medicine and the greater involvement of libraries for development of knowledge-based searching capabilities. For this reason, the life-long learning correlates, although requiring the use of computers to find information, were grouped separately.

In analyzing the responses by question type, less than a third (30.7%) of the medical school respondents had stated objectives for the 27 questions requiring use of computer systems and only slightly more than a fifth (21.1%) assessed competencies. There was one exception. Sixty percent of the respondents did have a stated objective about retrieval of patient-specific data from a clinical information system and 49% assessed the competency.

Of the three life-long learner correlated questions, approximately two thirds (67.7%) of the medical school respondents had stated objectives and slightly less (62.7%) assessed the competencies. Of those questions that did not require interaction with a computer system, over half (58.6% and 56.7% respectively) of the medical school respondents had both stated objectives and assessment of competencies.

In looking at the raw data and comparing the assessment to the stated objectives in all three of the physician role groups, there were 28 instances in which competencies were assessed within seven sub-groups without having stated objectives. These were virtually all in the clinician role and fell primarily under the non-computer based questions. A possible explanation is that the concept might have been considered too granular to include as a stated objective while it was included as part of a clinical evaluation schema.

Conclusion

Seventy of 127 surveys assessing the degree to which the MSOP medical informatics educational objectives have been incorporated into undergraduate medical curricula in the United Stated were completed. An analysis of these found that while many of the medical informatics concepts relevant to the clinician, research and manager roles were being addressed in the curricula, when broken down by those concepts that required health information technology interaction, only a few schools had stated objectives and fewer assessed the competencies.

The survey respondents were self-selected, and anecdotal information suggests that many who did not complete the surveys chose not to do so because they had little or no medical informatics in their curricula. Also, while these objectives are valid today, as HIT systems evolve and become more integrated into the health care system, the objectives also need to evolve. Some progress has been made but much more needs to be accomplished to insure that physicians will be able to efficiently and effectively use the health information technology being installed in hospitals and health centers.

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References

[1] Zvarova J, Engelbrecht R, and van Bemmel JH. Education and training in medical informatics, statistics and epidemiology in EuroMISE. Int J Med Inf 1997: 45: 3-8.

[2] Jaspers MW, Gardner RM, Gatewood LC, Haux R, Schmidt D and Wetter T. The International Partnership for Health Informatics Education: lessons learned from six years of experience. Methods Inf Med 2005: 44(1): 25-31.

[3] Kaufman DM and Jennett PA. Preparing our future physicians: integrating medical informatics into the undergraduate medical education curriculum. Studies Health Tech & Info 1997: 39: 543-6.

[4] Moehr JR. Where to in the next ten years of health informatics education? Methods Inf Med 2006: 45(3): 283-7.

[5] de la Calle G, Maojo V and Benito M. The INFOBIOMED Network of Excellence: facilitating training and mobility in biomedical informatics in Europe. Stud Health Technol Inform 2006: 124: 893-8.

[6] Sarbadhikari SN. Basic medical science education must include medical informatics. Indian J Physiol Pharmacol 2004: 48(4): 395-408.

[7] Hasman A and Haux R. Curricula in medical informatics. Stud Health Technol Inform 2004: 109:63-74.

[10] Haux R. Health information systems – past. Present, future. Int J Med Info. 2006: 75(3-4): 268-81.

[11] Muller S (Chair). Physicians for the twenty-first century: report on the project panel on the general professional education of physicians and college preparation for medicine. J Med Educ 1984: 59(11pt2): 1-208.

[12] Myers JD (Chair). Medical education in the information age. Proceedings of a symposium on medical informatics. 1986: Washington, DC: Association of American Medical Colleges.

[13] Association of American Medical Colleges. Advisory Panel on Assessing Change in Medical Education – The Road to Implementation. ACME – TRI Report: Educating Medical Students. Assessing Change in Medicine Education. The Road to Implementation. 1992: Washington, DC: Association of American Medical Colleges.

[14] Association of American Medical Colleges. Contemporary issues in medicine – medical informatics and population health: report II of the Medical School Objectives Project. Acad Med 1999: 74(2): 130-41.

Address for Correspondence

Julie J. McGowan, Ph.D., FACMI
Indiana University School of Medicine
975 W. Walnut Street IB-310
Indianapois, IN 46202-5121 USA