Establishing the Centrality of Health Informatics in Physical Therapist Education: If Not Now, When?

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Background and Purpose. Physical therapists increasingly struggle to manage the vast amount of information required to make sound clinical decisions. This struggle occurs, in part, because of a lack of knowledge and skills needed to effectively use the potent tool of information technology for systematically processing data and supporting information and knowledge. The field of health informatics has emerged as an interdisciplinary science that evaluates how health information and knowledge can be effectively used for clinical decision making. Health care leaders have recognized informatics competencies as essential in other health care education programs, especially as a foundation for evidence-based practice. The purpose of this article is to describe the current state of health informatics in physical therapist education, to summarize the rationale for incorporating informatics in physical therapist education, and to propose a framework for incorporating this content into physical therapist education.

Position and Rationale. Physical therapist education should identify and incorporate health informatics as a foundational domain. Failing to prepare clinicians with technology competencies will hamper progress towards our profession's goals of fully availing ourselves of technologies that can facilitate more effective and efficient care. Because adopting health information technology is a top national priority, we must move quickly to ensure that physical therapists can continue to thrive in the emerging electronic infrastructure.

Discussion and Conclusion. Although some concepts of health informatics are incorporated in physical therapist education program's core documents, this inclusion was not based on the perspective of health informatics as an applied scientific discipline. In conjunction with the APTA's concerted effort to adopt interoperable electronic health record systems, the profession should develop a strategic plan for ensuring that physical therapists have the knowledge and skills to use the tools of informatics effectively. We present specific recommendations to help strengthen the centrality of informatics within physical therapist education, such as including health informatics as a foundational domain and fully developing the set of core informatics competencies for physical therapy. We encourage the academic community to engage in activities and dialog that clarify the role of informatics in physical therapist education.

Key Words. Health informatics, Physical therapist education, Informatics competencies.

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BACKGROUND AND PURPOSE

Health professionals, including physical therapists, increasingly struggle to manage the vast amount of information required to make sound clinical decisions, in part because they often lack the knowledge and skills to effectively use the potent tool of information technology for systematically processing data and supporting information and knowledge management.[1] The field of health informatics has emerged as an interdisciplinary science that evaluates how health information and knowledge can be effectively used for clinical decision-making. With timely access to a patient's complete health record and computerized systems that make patient-specific recommendations based on best evidence, physical therapists are likely to make better clinical decisions. Few of these systems have been evaluated within physical therapy,[2] but systemic reviews from the broader health informatics field have convincingly demonstrated that computers can improve quality by increasing providers' adherence to guideline-based care, improving surveillance and monitoring in disease management, and decreasing medication errors.[3,4] As just one example from many, a computerized reminder for contact isolation for patients known to be colonized or infected with resistant organisms improved the isolation rate from 33% to 89% while simultaneously decreasing the median time for contact isolation orders to be written from 16.6 to 0.0 hours.[5] The power of intelligent, introspective information systems like this one that generated the isolation reminder can even be enhanced further when patient data is shared electronically across institutions in a regional health information exchange.[6,7] Furthermore, health information technology has been shown to improve the efficiency of the health care system by decreasing utilization.[4] The mounting evidence for information technology like electronic health records (EHRs) has caught the attention of health care leaders and policymakers, and informatics initiatives are now a top national priority.

In April 2004, then President George W. Bush issued an Executive Order calling for widespread adoption of health information technology (HIT) to aid in improving the safety and efficiency of health care and to give all American citizens the benefits of EHRs by 2014.[8,9] Since that time, Congress has written legislation to promote technology and EHRs within American health care.[10-13] More recently, President Barack Obama signed into law the Health Information Technology and Clinical Health Act (HITECH).[14] The act provides $19 billion over a 4-year period, in

grants and loans, for infrastructure and incentive payments under Medicare and Medicaid for providers who adopt and use HIT. The act also serves to reinvigorate the effort to provide every American with an EHR.

The movement toward using technology in health care has also been embraced by the American Physical Therapy Association (APTA). One of the goals of the Education Strategic Plan for Vision 2020 of APTA is to "Enhance the physical therapist's perception, knowledge, and skills in contemporary and emerging health trends and in the delivery of health care in … new practice areas based on advances in science and technology."[15] The 2008 APTA House of Delegates proposed and adopted RC 6-08, "Support of Electronic Health Records in Physical Therapy,"[16] which called for physical therapists and APTA to begin a concerted effort toward adopting interoperable EHRs in all physical therapy practice settings. In February 2009, the Physical Therapy and Society Summit had a primary focus on determining areas of opportunity to empower physical therapists to be leaders in integrating innovative technologies and practice models, including EHRs, telemedicine systems, and other HIT applications.

Although there are many growing pressures to adopt HIT and it offers great promise to improve information management for physical therapists, the complex social–technical interactions involved in implementing HIT can lead to unintended and even deleterious outcomes.[17-18] The nature of these complexities goes far beyond basic computer skills to span issues of computation and algorithms, workflow, clinical decision-making, human–computer interaction, and other domains. Competency in the multidisciplinary field of health informatics, which as we will describe represents the intersection of these domains, is the key to unlocking the potential of HIT while avoiding these lurking pitfalls. If widespread adoption of HIT is to be a success, all health care providers, including physical therapists, must be educated in informatics and its fundamental principles.[19-22] Blind adoption of technology is unlikely to produce the intended benefits without such fundamental knowledge, the skills to optimally use HIT, and the ability to critically evaluate HIT as an intervention. Because of the need for health informatics competencies in physical therapy, we propose that physical therapist education should lead the profession into the field of health informatics so that physical therapists can reap the enormous potential advantages of information technology. To accomplish this aim, physical therapist education must include health informatics as a foundational domain, but the extent to which this content is included in physical therapist education has not been described. Thus, the purpose of this article is to summarize the rationale for incorporating health informatics in physical therapist education, to provide a gauge of the current state of health informatics in physical therapist education, and to propose a framework for incorporating content into physical therapist education.

POSITION AND RATIONALE

Health informatics education has evolved both within the training programs of individual clinical disciplines and as a multidisciplinary field in its own right. Formal training in informatics now spans the gamut of educational offerings, from undergraduate to PhD programs, postdoctoral fellowships, and continuing education programs. In support of the rationale for including health informatics in physical therapist education, we first present a brief description of the field, summarize recent recommendations for informatics competencies and a framework for developing informatics educational content, and describe the evolution of informatics education in medicine and nursing. Next, we analyze the current state of health informatics in physical therapist education. And finally, we synthesize these findings into specific recommendations to help strengthen the centrality of informatics within physical therapist education.

Biomedical Informatics

Biomedical informatics has been defined as "the rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making."[23(p24)] Biomedical informatics is inherently multidisciplinary because it covers the whole field of medicine and health care and is rooted in the contributing disciplines of computer science, decision science, cognitive science, and related fields. Within the field of biomedical informatics, many subdisciplines have emerged.[22] Although the terms *medical informatics* and *health informatics* are often used interchangeably, for the purpose of this paper, we use the term *health informatics* to represent the broad scope of informatics that applies to health care (medicine and related fields), but which is separate from the field of bioinformatics, which includes such subdisciplines as proteomics and genomics. Within health informatics, we focus most specifically on the subdiscipline of clinical informatics, which is centered on the representation, collection, retrieval, and use of health information in clinical practice.[22-24] Clinical informaticians work to transform health care by designing, implementing, and evaluating information systems that improve health outcomes, patient care, and the clinician–patient relationship.[24]

Informatics Competencies for Health Professionals

In the context of a health care environment with rising costs, a growing focus on quality through evidence-based practice, and evidence that information technology can improve the situation, several national groups have emphasized the need for informatics competencies in health professions education. The Pew Health Professions Commission concluded that health professions schools must realign their training and education to more closely address the changing needs of our current care delivery system and proposed a set of core competencies for successful practice in the emerging environment.[25] One of the core competencies they proposed was the effective and appropriate use of communication and information technology. Likewise, the Institute of Medicine (IOM) report[26] from the Health Professions Education Summit noted the severe inadequacies of current programs in preparing clinicians to provide the highest possible quality of care. The report articulated an overall vision statement that all health professions should be educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics. Reflecting the above vision statement, the authors of the IOM report proposed the following core competencies for all clinicians: provide patient-centered care, work in interdisciplinary teams, employ evidence-based practice, apply quality improvement, and utilize informatics.[26] By identifying these emerging competencies, this report underscores the importance of informatics as a relevant element of clinical education.

Recommendations From the Informatics Discipline

Although the call for informatics competencies in health professions education is now proclaimed widely, the informatics community has recommended such competencies since the mid 1990s.[27-28] The International Medical Informatics Association (IMIA) has developed a comprehensive set of recommendations and learning outcomes to help develop courses, tracks, and even complete programs.[29] IMIA's recommendations recognize 3 important domains of education:

1. Professionals in health care (physicians, nurses, physical therapists, informatics professionals, etc)

2. Type of specialization in informatics (users of information technology, informatics specialists, etc)
3. Stage of career progression (bachelor, master, doctor, etc)

The IMIA recommendations are based on a framework that makes explicit the notion that there are different informatics educational needs for clinicians who use information technology in their everyday practice than for the informatics specialists that make up the discipline (who may also be clinicians). Informatics specialists are focused on developing, implementing, and systematically evaluating the applications to help accomplish these goals. Clinicians have a primary need to be able to use information technology tools to enhance their delivery of care using evidence-based practice in the context of a cost-conscious practice environment. IMIA has identified broad education in efficient information processing and effective use of information and communication technologies as a top priority for all health professionals and recommends allocating training in relative percentages to the areas of:

1. Methodology and technology for the processing of data, information, and knowledge in medicine and health care (67%)
2. Medicine, health and biosciences, health system organization (8%)
3. Informatics/computer science, mathematics, biometry (25%)

IMIA's recommendations have formed the core conceptual basis around which informatics educational programs and initiatives have developed in many areas. A few examples include graduate[30] and postgraduate health informatics programs,[31] multidisciplinary continuing education offerings,[32] and broad initiatives like the American Medical Informatics Association–American Health Information Management Association partnership, titled "Building the Workforce for Health Information Transformation."[33] The IMIA recommendations and framework would provide a strong foundation upon which to develop content in physical therapist education.

Informatics Education in Medicine

Within medicine, educational opportunities for clinicians interested in becoming informatics specialists have existed for more than 40 years. One of the most popular training tracts is the postdoctoral fellowship, a mechanism that early informatics pioneers used to help train the informaticians who established informatics as a recognized field. Recently, the American Medical Informatics Association has led an effort to define the core content[24] and program requirements for fellowship education[34] for the subspecialty of clinical informatics. These 2 documents (core content and requirements for fellowship education) are used by the American Board of Medical Specialties when deciding whether to formally establish a new medical subspecialty.

Several major organizations[35,36] began the call to prepare physicians with informatics skills in the 1980s, but implementation of these recommendations has taken a very slow course. Much of the early work focused on infrastructure building, such as the National Library of Medicine's (NLM) Integrated Academic Information Management Systems (IAIMS)[37] program that was started in 1984. In 1999, the Association of American Medical Colleges (AAMC) recognized that medical school curricula needed revisions in order to keep up with the advances in information technology and informatics.[38] The AAMC convened an expert panel that developed educational content recommendations based on 5 informatics-related roles played by physicians: lifelong learner, clinician, educator–communicator, researcher, and manager. About this same time, the AAMC partnered with the NLM to evaluate the outcomes of the IAIMS programs in a study titled "Next-Generation IAIMS: Binding Knowledge to Effective Action."[39] While many of the initial challenges academic health centers faced were related to a robust computer network infrastructure, this study revealed that as those linkages have been built, new challenges have emerged in acquiring, shaping, and delivering knowledge in ways that drives effective action.

Informatics Education in Nursing

Nursing has a long history of contributing to the evolution of health informatics. The first undergraduate course focused on applying computers in nursing was offered in 1977,[40] the textbook was published in 1984,[41] and the term *nursing informatics* originated in 1980.[42] The American Nurses Association approved the formation of nursing informatics as a new specialty in 1992,[43] with the first credentialing examination leading to a certificate as a Nursing Informatics Expert being offered in 1995. In addition, education programs in nursing informatics cover the full spectrum from undergraduate to postdoctoral education. Nursing informatics has had a particularly strong focus on the development of standardized vocabularies in support of electronic data processing.

Similar to medicine, the development and advocacy of informatics competencies began in the mid 1980s.[45] The School of Nursing Accrediting Agencies, the American Association of Colleges of Nursing, and the National League for Nursing Accrediting Commission have identified the essential elements of informatics competencies for nursing practice and required educational institutions to include them in their curricula as early as 1998.[46] Nursing informatics competencies for specific nursing subgroups also have been described in the literature, such as nurse practitioners,[47] psychiatric nurses,[48] and nursing leaders.[49] Recently, the Technology Informatics Guiding Education Reform Summit[50] brought together key stakeholders to develop a comprehensive vision for using informatics in the field of nursing and nursing education. The summit identified competencies needed in the areas of basic computer competencies, clinical information management competencies, and information literacy.

Informatics Education in Physical Therapy

Unlike medicine and nursing, physical therapy has not had a long history of advocating for informatics competencies, nor has the profession developed profession-specific subspecialty training in informatics. Based on reading the core documents that define professional physical therapy curricula, it is clear that programs are given allowance to vary in their philosophical approaches, structure, and course offerings.[51-54] In spite of these differences, all programs are held accountable to one body, the Commission on Accreditation in Physical Therapy Education (CAPTE). CAPTE publishes the Evaluative Criteria for Accreditation of Education Programs for the Preparation of Physical Therapists. This document serves as a guideline for institutional and program requirements in professional physical therapist education. Two other documents describe the profession of physical therapy and are used as sources in curriculum development and as sources for the Evaluative Criteria. These documents are *A Normative Model of Physical Therapist Professional Education: Version 2004 and the Guide to Physical Therapist Practice*.[52] In November 2005, the Board of Directors of the APTA adopted Minimum Required Skills of Physical Therapist Graduates at Entry-Level as a core document to be a reference for all academic programs, students, employers, and CAPTE.

DISCUSSION

In developing this position statement, we reviewed these essential documents as a barometer of the current understanding of the role of informatics in physical therapy education. This review indicated that while physi-

cal therapist education has incorporated a number of informatics components into curricular requirements or expectations, these components have been adopted with the hope that they will meet the need of future physical therapy practice, but without a concerted approach to ensuring informatics competencies among practitioners. The Normative Model provides an exhaustive outline of the curricular requirements for the educational preparation of a physical therapist. The requirements are divided into 3 elements, each of which includes expectations of the state of knowledge of a physical therapist graduating from a professional-level education program. In the Normative Model, informatics content is interspersed and incorporated into many of the educational matrices that define the 3 elements of the document: practice expectations, foundational sciences, and clinical sciences (Table).

Health informatics related content and all other expectations are ultimately incorporated into the Evaluative Criteria, the only required content for a physical therapy program curriculum. Since the Evaluative Criteria set a minimum standard and programs have the opportunity to establish objectives and teach content beyond these criteria, it is possible and likely that additional informatics content is and could be addressed. To date, there has not been a concerted effort to determine the nature and level of informatics content being taught in physical therapy curricula. Additionally, the *Minimum Required Skills of Physical Therapist Graduates at Entry-Level*[54] document specifically identifies "Informatics" in the Practice Management Skill category and describes the minimum skill as "Uses current information technology, including word-processing, spreadsheets, and basic statistical packages." If these are the minimum expectations for skills, the bar is certainly set too low in the area of informatics as we have defined it in this position paper.

The current APTA Strategic Plan[15] incorporates a model of strategic outcomes that rely heavily on informatics and technology. In fact, the plan identifies a number of informatics issues that will influence the relevant future for physical therapists and warrant attention. These issues include a section specifically identifying "technological factors" and the statement that there will be "an increased use of the electronic medical record." The strategic plan should influence the future of physical therapist practice and, thus, the future of physical therapist professional education.

In summary, we have found that the physical therapist education community has embedded concepts of health informatics into its core documents, but has in no way given recognition to health informatics as a distinct field of study with its own theoretical basis. Although there are publications describing physical therapists using information technology applications as early as 1968, only recently have publications in the physical therapy literature mentioned informatics as a discipline.[2,22,55,56] This lack of explicit recognition could result in a profession that is not prepared for the informatics-based changes that will be mandated by legislation and health care accrediting bodies and/or driven by market changes.

Table. Informatics Identified in a *Normative Model of Physical Therapist Professional Education*

MATRIX	INFORMATICS CONTENT
Professional Practice Expectation 1: Accountability	Understands security protections such as access control, data security, and data encryption related to the use of information technology in practice. Directly addresses ethical and legal issues related to the use of information technology in practice.
Professional Practice Expectation 6: Communication	Uses information technology such as word processing, presentation, data analysis software, e-mail, and electronic records to improve clarity and efficiency of communications.
Professional Practice Expectation 9: Evidence-based Practice	Consistently uses information technology to access sources of information to support clinical decisions. Manages knowledge and information using online databases, disease registries, electronic medical records, and other information technology systems to facilitate the delivery of health care (informatics).
Professional Practice Expectation 10: Education	Develops expertise in the use of technology available for patient/client or clinical staff education and consultation.
Clinical Reasoning	Uses current technology resources to gather information about health personnel supply and demand, models of health care delivery, and efficacy of practice.

Recommendations for the Integration of Health Informatics in Physical Therapist Education

Physical therapist education should include health informatics as a foundational domain. Failing to prepare clinicians with the appropriate competencies in information and knowledge management will hamper progress towards our profession's goals of fully availing ourselves of technologies that can facilitate more effective and efficient care. Because adopting health information technology has become a top national priority, we must move quickly to ensure that physical therapists can continue to thrive in the emerging electronic infrastructure. In an effort to synthesize our findings about the current state of health informatics in physical therapist education and the changing health care landscape into practical next steps, we have developed recommendations to help focus limited resources on the most salient and achievable areas:

1. *Fully develop core informatics competencies for all physical therapists.* Informed by the recommendations of the IOM, the informatics community, and the initiatives in other health professions, the physical therapy educators should work with health informatics specialists to more specifically and precisely define a core set of competencies for physical therapists.
2. *Physical therapist education programs should incorporate core informatics competencies into their curricula.* Because of its

scientific and clinical importance, we advocate for placing informatics as a recognized content area within the foundational sciences matrix. Amongst the many institutions and initiatives involved in developing health informatics competencies, the Common Interprofessional Informatics Competencies joint initiative of AMIA and Association of Academic Health Centers may be particularly fruitful.[56] The primary goal of this initiative is to half the number of years before each health professional has the informatics competencies required to deliver quality health care, with current participants including: the American Association of Colleges of Nursing, the Association of American Medical Colleges, the American Dental Education Association, the Association of Schools of Public Health, the American Psychological Association, and the American Association of Colleges of Pharmacy, among others. Notably absent from this list are professional associations in rehabilitation.

3. *The profession of physical therapy should support and encourage physical therapists to pursue training as health informatics specialists.* Presently, there are too few physical therapists who possess sufficient expertise in health informatics to practice, teach, and evaluate the role of information technology in physical therapy. We need clinical informaticians in physical therapy to participate and shape the movement of the health informatics field and apply their expertise to develop, implement, and evaluate health informatics applications in physical therapist practice settings.[2,58] The movement toward the Doctor of Physical Therapy degree has opened opportunities for physical therapists in postdoctoral health informatics education, but physical therapy should also consider the potential benefit of developing discipline-specific training programs in health informatics, such as residencies and fellowships.
4. *Physical therapist education programs should partner with health informatics professionals in evaluating the efficacy of informatics interventions in physical therapist practice, education, and research.* As we build the workforce of physical therapists with expertise in health informatics, we should not delay in partnering with existing health informatics professionals to evaluate the potential value of informatics interventions in physical therapist practice, education, and research. Existing literature suggests that applications such as EHRs have important benefits in physical therapy[2] and that the computer's ability to suggest and remind clinicians of preferred-care options is one of the most potent tools we have for implementing evidence-based practice.[3,4] Physical therapy desperately needs rigorous evaluation of informatics applications, such as the decision support functionality of EHRs, so that as we move to adopt electronic systems we can invest our limited resources wisely and effectively.
5. *APTA should support the adoption of health informatics as a foundational domain of physical therapist education.* With the passage of RC 6-08,[16] APTA established its support for adopting interoperable EHRs in physical therapy, but physical therapists also need the skills and knowledge to use EHRs and other informatics applications effectively. Essential to this aim is the need to teach the teachers. As we identify the core informatics competencies most essential for physical therapists, APTA should develop training opportunities in health informatics for faculty members and other clinical educators. To insure that these opportunities do not slip past, APTA should develop a strategic plan to ensure that we have the knowledge and skills to use the tools of informatics effectively. Should the American Council of Academic Physical Therapy become a viable voice and entity in physical therapy education, we encourage this body to consider health informatics content as integral to excellence in physical therapist education.

CONCLUSIONS

Adoption of health information technology has become a top national priority, and physical therapy must move quickly to ensure that we can continue to thrive in the emerging electronic infrastructure. Failing to prepare clinicians with the appropriate competencies in information and knowledge management will hamper progress towards our profession's goals of fully availing ourselves of technologies that can facilitate more effective and efficient care.

Although some concepts of health informatics are incorporated in physical therapist education's core documents, this inclusion was not based on the perspective of health informatics as an applied scientific discipline. We present specific recommendations to help strengthen the centrality of informatics within physical therapist education, such as including health informatics as a foundational domain and fully developing the set of core informatics competencies for physical therapy. In addition, we should encourage the development of physical therapist health informatics specialists who can lead our development, evaluation, and application of health informatics applications within physical therapy and help us apply these potent tools effectively. We encourage the academic community to engage in activities and dialogs that clarify the role of informatics in physical therapist education, practice, and research, and hope that the rationale and recommendations we present here provide a useful framework for advancing that effort.

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