Nursing Informatics
U. Gerdin et al. (Eds.)
IOS Press 1997

New Challenges for Nursing Informatics

M.J. Ball[a], J.V. Douglas[b] and B.J. Hoehn[c]
[a]*University of Maryland School of Medicine, 100 North Greene Street, Baltimore, MD 21201.*
[a,b]*First Consulting Group, 2 Hamill Road, Quadrangle West 359, Baltimore, MD 21210.*
[c]*First Consulting Group, 341 Madison Avenue, Suite 1700, New York, NY 10017.*

Long a leader in health informatics, nursing faces new challenges. The full and effective use of technology requires an understanding of cognitive processes and organizational behavior. Nursing can play a key role in addressing aims supportive of a new vision of health informatics. The evolving paradigm for knowledge transfer will give rise to new educational models and new institutional entities which will nurture learning and relearning.

Background

Nursing has long been a champion of informatics, bringing technology to bear upon patient care.[1] At the center of care delivery process, nurses were critical to the success of the first clinical information systems. Among the health professions, nursing took the lead in formally recognizing informatics competencies and in establishing informatics as a discipline.

Today nursing informatics programs are growing in numbers and influence as their graduates move out into the field.[2] As health care continues to evolve and change, nurses, including nurse informaticians, are playing new roles. Increasingly, health care is being delivered by interdisciplinary teams. Nurses and physicians are working with a growing number of colleagues from a wide array of health professions.

Nursing can indeed lead as it has in the past, helping address the challenges confronting health care and forging new horizons as we move into the clinical informatics era and telehealth.

The vision

We are about to leave the century of information technology, which began with the hardware era and ended with the software era, with the rule of IBM giving way to the reign of Bill Gates. Soon we will enter into a new age, devoted to peopleware. Who will be the new king and lead us into this new era? We cannot make full use of these new capabilities unless we educate and train ourselves, our co-workers, and, ultimately, our patients to use the new enabling technologies that are propelling us into the 21st century.

We are living in a new information-rich environment, and we have new and powerful tools. We must learn how people think, how they seek and use information to create knowledge. We must understand how organizations behave and how they relate to one another. We need to expand our own expertise by drawing upon the so-called soft sciences, notably cognitive science and organizational development.[3,4] They hold the power to shape the future and to bring us into the era of knowledge navigation.

For nursing and for all of health care, collaboration with these emerging fields is imperative. To cite the classic change model, we have moved through the phases of substitution and

replacement, and we are now entering into the transformation of health care. Major challenges remain, and we must complete vital tasks to make this transformation a reality. The new paradigm for knowledge transfer involves both content and the methods for learning and using that content.[5]

Increasing, medical schools and nursing schools are moving toward problem-based learning.[6] Three decades after Larry Weed first advanced his revolutionary concepts, we are beginning to see his visions realized for education and for clinical care, with knowledge coupling, linking medical problems to the biomedical literature.[7]

The transformation of health care demands the involvement of practitioners already out in the field and individuals who make up the patient population. Knowledge transfer will build upon the paper-based resources of health sciences libraries and incorporate the growing repositories of multimedia resources. Practising professionals will be able to access continuing education via the information infrastructure.

Clearly, we need a new approach to learning in the age of the Internet and World Wide Web.[8] In the public sector, the National Library of Medicine (NLM) in the United States encourages the use of high performance computing and communications technologies, while continuing to explore new roles for libraries.[9] Through its initiatives, the NLM provides libraries world-wide with access to its resources and serves as a model for the virtual library which is at heart the quintessential informatics institution.[10] In attempting to fulfil its mission, the NLM focuses on the needs of practitioners. The recent introduction of Internet access to Medline carries forth the concepts inherent to Grateful Med and Loansome Doc, making the library's resources accessible to a growing population, including not only health professionals but the citizenry of the world.

The tasks and aims

Reinhold Haux has set forth a vision of medical informatics,[11] to which other informaticians were invited to respond.[12] Chairman of Working Group 1, Education and Training, in the International Medical Informatics Association (IMIA), and Professor of Medical Informatics at Heidelberg/Heilbronn, Haux lists ten aims and states that the field is a "cross-sectional discipline for virtually all other disciplines of medicine and of the health sciences." These aims are enumerated below, along with a brief look at their implications for nursing informatics and the profession as a whole.

Aim 1: Diagnostics: the visible body. Remote access to high quality digital images supports new modes of care delivery.[13,14] These can minimize cost, ensure access to specialists, create new requirements for co-ordinating and managing care. Other developments include the incorporation of images of various types into electronic patient records. These advances will enhance the information available to caregivers, including nurses, and impact the ways in which they deliver care.[15] The NLM's Visible Man and Visible Woman are now accessible via Internet or CD ROM; the availability of such images can increase the knowledge of the human body and ultimately contribute to nursing assessment, diagnosis, and treatment. We cannot neglect to integrate these new resources in the training we offer to nurses who will practice in the 21st century.

Aim 2: Therapy: medical intervention with as little strain on the patient as possible. Non-invasive diagnostics and minimally invasive surgery are growing significantly, thanks to laparoscopic procedures and computer-aided visualization. Clearly these advances affect

nurses involved in the procedure itself; they also affect nurses involved throughout the care process, joining with other forces limiting the number of hospital days and changing the role of the hospital-based nurse.

Aim 3: Therapy simulation. Nurse educators have been leaders in using simulation-based training for their students, offering simulation labs for basic skills. Further development of simulation technologies will allow nurses to refine advanced skills. Multimedia computer-based training will supplement hands on lab experiences.

Aim 4: Early recognition and prevention. Today increasing numbers of nurse practitioners are providing primary care, and nurse-managed clinics are becoming the mechanism for delivering affordable primary care in some settings. Both trends suggest that nursing will become responsible for patient education, working with patients to develop health behaviors that prevent illness and promote wellness.

Aim 5: Compensating physical handicaps. Any device used in an ongoing basis by the patient tends ultimately to involve nursing in its support, as a daily living skill. These skills have long been the concern of nursing and other allied health professionals. New informatics applications in this area will require a new level of knowledge and sophistication among nursing staff. Haux's inclusion of this aim implies a view of health care which is patient-centered in a broad sense.

Aim 6: Health consulting: the informed patient. The patient-centered approach underlies this aim as well. Patient education is receiving new attention in the United States. Multimedia programs guide patients in deciding on interventions for prostate cancer, and videotapes published by Time Life Medical are now available for purchase in pharmacies. Thirty titles address diagnoses from alcoholism to ulcers (gastrointestinal). This series reflects the belief that "no prescription is more valuable than knowledge." As more health-related information becomes available to consumers via the Internet, patients will definitely need guidance in evaluating and using information, guidance which nursing has often provided in the past and will do so increasingly under "ask a nurse" programs and a host of Internet services in which nurses will act as counsellors and teachers of patients.

Aim 7: Health reporting. To date, public health has relied on retrospective reports to control disease. Today the information infrastructure offers the capability to intervene in a more timely manner through ongoing surveillance of certain conditions and through programs such as the NLM's clinical alerts. The National Institute of Health is extending the boundaries through its Human Genome Project and Gene Bank. We have yet to realize the benefits that can result from large-scale data repositories providing population-based health statistics. Nursing will play a key role using understanding and using outcome information to improve the management and quality of care.

Aim 8: Health care information systems. Nurses have long been the frontline users of information systems. Many of them have, regrettably, come between the nurse and the patient. Clinical informatics must focus on making information tools integral parts of the caregiving process, noticeable only by their absence. Technology should free up the caregiver, eliminating cumbersome and repetitive data entry. Increasingly, technology will need to support health professionals, including nurses, in a wide variety of settings within large-scale integrated health service networks. Members of the health care team, nurses will continue to

be at the hub, or center, of patient care--even when they are functioning within a telehealth or telemedicine setting.

Aim 9: Medical documentation. Movement toward the computer-based patient record (CPR) continues, albeit less rapidly than hoped. The major obstacles are nontechnical; questions remain regarding medical knowledge representation and structure of the record. Work is underway to integrate the Unified Nursing Language System (UNLS) into the NLM's Unified Medical Language System (UMLS);[16] other initiatives, both national and international, hold promise. Of course, data protection and patient confidentiality remain key critical issues, as do standards for access.

Aim 10: Comprehensive documentation of medical knowledge and knowledge-based decision support. The eventual full-scale implementation of the CPR will transform patient/provider encounters. Today practitioners are receiving support from a growing number of computerized reminders, alerts, and guidelines for case management. These efforts are closely linked to outcomes and quality assurance. Self-learning systems, like APACHE, continuously construct their own databases from data gathered in the caregiving process and revise the probabilities that guide their users. New ethical considerations arise. How will these systems affect issues of clinical judgment and responsibility? Clearly the nursing professional will have to address these questions, in concept and practice.[17]

The grand challenge

The extent to which we succeed in realizing these aims, in moving informatics from theory into practice, depends in large part upon the commitment we make to education. Although we have acknowledged the importance of education in the past, we have given it only limited resources and treated it as a compartmentalized function, even when we expanded it past traditional schooling into continuing education.

As we enter the new era of peopleware, we will need a new model for knowledge transfer, one which nurtures lifelong learning for health care professionals and consumers alike. Whatever the setting, be it classroom or clinic, hospital or home, this new model must make information available when, where, and how it needed. Only then will we realize the potential that clinical informatics offers.

Today, as our traditional educational institutions re-examine their roles in society, private sector organizations are exploring how best to nurture knowledge transfer. The tremendous advances possible in information technology and health care will occur only through the involvement of new entities offering new approaches to lifelong learning. Professionals and consumers alike must deal with exponential increases in the volume of data and information--and with staggering decreases in the half lives of biomedical and technical knowledge.

New models and organizations are evolving to support the learning and relearning which lie at the heart of knowledge transfer and knowledge navigation. We have made tremendous gains in educating new professionals, who can earn degrees in nursing informatics. We need also to dedicate resources to retraining health practitioners, including nurses, and to rethinking how they and the institutions they serve manage the care process. We can learn from experiences like those at Brigham and Women's, in Boston, Massachusetts, where support was offered on the floor around the clock to clinicians using new their new information systems. We can learn from organizations making their educational offerings available to health professionals via intranet, Internet, and CD-ROM.

The 21st century will carry us all, ready or not, into the world of telematics and telehealth. By actively seeking and implementing new models for education and training, we meet the challenges that await us.

References

1. Ball MJ, Hannah KJ, Peterson H, Gerdin-Jelger U. *Nursing informatics: Where caring and technology meet*, 1st edn. New York: Springer-Verlag, 1988.
2. Gassert CA. Academic preparation in nursing informatics. In: *Nursing informatics: Where caring and technology meet*, 2nd edn. Ball MJ, Hannah KJ, Newbold SK, Douglas JV (eds.). New York: Springer-Verlag, 1995: 333-349.
3. Tang PC, Patel VL. Major issues in user interface design for health professional workstations: Summary and recommendations. *Int J Biomed Comput* 1992;34:139-148.
4. Lorenzi NM, Riley RT, Mall MJ, Douglas JV. *Transforming health care through information: Case studies*. New York: Springer-Verlag, 1995.
5. Ball MJ, Douglas JV, Hoehn BJ. Clinical informatics: A new paradigm. *MD Comput* in press.
6. Blake J. Library resources for problem-based learning: The program perspective. *Comput Methods Programs Biomed* 1994;44:143-146.
7. Weed LL. *Knowledge coupling: New premises and new tools for medical care and education*. New York: Springer-Verlag, 1991.
8. Lindberg DAB. Global information infrastructure. *Int J Biomed Comput* 1994;34:13-19.
9. Ball MJ, Weise FO, Freiburger, Douglas JV. Building the library/information center of the future. *Comput Methods Programs Biomed* 1994;44:143-146.
10. Ball MJ. The library of the future: An informatics institution. *Int J Biomed Comput* 1995;40:85-88.
11. Haux R. Aims and tasks of medical informatics. *Int J Biomed Comput* in press.
12. Ball MJ. Response to Haux. *Int J Biomed Comput* in press.
13. Dayhoff RE, Siegel EL. Digital imaging within and among medical facilities. In: *Computerizing large integrated health networks: The VA experience*, Kolodner RM (ed.). New York: Springer-Verlag in press.
14. Zimmerman KL. Clinical imaging: applications and implications for nursing. In: *Nursing informatics: Where caring and technology meet*, 2nd edn. Ball MJ, Hannah KJ, Newbold SK, Douglas JV (eds.). New York: Springer-Verlag, 1995: 184-187.
15. Turley JP. Nursing's future: ubiquitous computing, virtual reality, and augmented reality. In: *Nursing informatics: Where caring and technology meet*, 2nd edn. Ball MJ, Hannah KJ, Newbold SK, Douglas JV (eds). New York: Springer-Verlag, 1995: 320-330.
16. Skiba DJ. Health-oriented telecommunications. In: *Nursing informatics: Where caring and technology meet*, 2nd edn. Ball MJ, Hannah KJ, Newbold SK, Douglas JV (eds). New York: Springer-Verlag, 1995: 40-53.
17. McCormick KA. An update on nursing's medical language system. In: *Nursing informatics: Where caring and technology meet*, 2nd edn. Ball MJ, Hannah KJ, Newbold SK, Douglas JV (eds). New York: Springer-Verlag, 1995: 112-129.
18. Havens GAD. The legacy of advancing technology: ethical issues and healthcare information management systems. In: *Healthcare information management systems: A practical guide*, 2nd edn. Ball MJ, Simborg DW, Albright JW, Douglas JV (eds.). New York: Springer-Verlag, 1995: 193-212.