Barriers That Impede the Adoption of Pediatric Information Technology

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Background: Information technology (IT) is a critical but underused component of health care. Many factors contribute to the inconsistent adoption of IT.

Objective: To review the literature to better elucidate barriers that are likely to affect the adoption of IT by pediatric professionals.

Data Sources: Manuscripts were found using a MEDLINE search combining the terms medicine, information systems, and technology transfer. I also obtained references cited by relevant articles. Finally, I explored the Internet using http://www.google.com and http://www.northernlight.com.

Study Selection: Articles discussing barriers or factors affecting the adoption of IT were considered for inclusion. Articles unrelated to clinical IT were excluded.

Data Synthesis: A variety of barriers exist that affect the adoption of useful technologies. Situational barriers include challenges imposed by the current national health environment, financial and legal risks associated with technology purchasing and use, and access to technology. The most significant barrier is that pediatric health care practitioners may lack the knowledge or training to use IT effectively.

Conclusions: Although some barriers exist that may be challenging to overcome, other barriers, such as the lack of knowledge about the uses of IT, are imminently solvable. Efforts to overcome these barriers should begin in earnest and should include educating stakeholders in the care of children and adolescents, as well as improving the knowledge about various technologies available to support pediatric and adolescent health care.


THE FIELD OF medicine is replete with revolutionary information technology (IT) that may support children’s health. However, these tools are not disseminated into most practitioners’ offices. For example, despite the presence of electronic medical records in health care since the 1970s, between 3% and 20% of US physicians use this technology1,2 compared with a much higher penetration of this technology among general practitioners in other countries.6 The poor penetration of IT contributes to the large number of laboratory tests (estimated at <11%) that are reordered because of lost results, as well as the roughly 30% of treatment orders that are undocumented.5 As stated by the Committee on Quality of Health Care in America of the Institute of Medicine, a highly fragmented delivery system that largely lacks even rudimentary clinical information capabilities results in poorly designed care processes characterized by unnecessary duplication of services, and long waiting times and delays.7(p3)

The reasons for the slow adoption of technology into pediatric practice are varied. This article will examine the barriers that are of special significance to pediatric health care professionals (PHCPs).

A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING BARRIERS

Barriers may be grouped into 4 categories, as described by Knapp8 and modified for a discussion of information systems issues by me:

1. Situational—economic realities and external environmental factors affecting access to or use of technology.
2. Cognitive and/or Physical—insufficient skills or ability to use a technology.
3. Legal—regulated or unregulated practices that affect use of a technology.
4. Attitudinal—behaviors or opinions contrary to those needed to adopt a technology.
I conducted a literature search using a MEDLINE search combining the terms medicine, information systems, and technology transfer. The resulting references were included in this article if they discussed barriers to the use of technology. I also obtained references cited by relevant articles. Finally, I explored the Internet using http://www.google.com and http://www.northernlight.com and categorized the included references according to the framework above.

Table 1 summarizes the prevalent barriers mentioned in the medical and pediatric literature that are significant in pediatric practices. This table also references articles from the pediatric literature that identify specific barriers. Because the actual pediatric literature on barriers is limited, this discussion will reference literature from other areas of medicine that, in my opinion, augment the discussion of barriers.

**CHALLENGES INHERENT IN THE US HEALTH CARE SYSTEM**

To many medical “insiders,” the inconsistent diffusion of useful technologies is, in large measure, a by-product of problems in our health care system. These problems include working in a delivery system that rewards time efficiency more than the quality of care provided, and incurring the financial burden of costly IT with a limited potential for return on investment.9,10

Time pressure represents the most significant barrier to the adoption of potentially useful technologies. Today’s PHCPs spend an average of 17 minutes per patient encounter and are reimbursed based on the time needed by each patient (J. Speller, MD, written communication, May 10, 2001). Moreover, they face an ever-increasing overhead per visit—more forms to complete, more regulations to adopt, and more time spent with insurers advocating for patients.11 Studies have shown that time pressure clearly affects the tolerance of providers for technologies such as immunization registries and computer-based documentation tools.12-14

Furthermore, IT is neither a one-time nor a low-risk investment. The sources of this risk include the financial cost of these systems to a practice or a payer and the uncertain cost-benefit tradeoff of individual systems.15-18 Even proven technologies, such as practice management systems, represent a large capital investment with a low initial rate of return relative to other investment alternatives for the busy practitioner.9 Many knowledgeable IT professionals are dissatisfied with the software they purchased for their health care providers.19-22 The diversity of our health care environment, in terms of policies, practice styles, and revenue-generating activities makes it difficult to achieve consensus about what or how technology should be applied to the field.13,21 Therefore, the diffusion of potentially beneficial technologies moves slowly, resulting in islands rather than waves of IT adoption.

**INSUFFICIENT COMPUTER PENETRATION INTO PEDIATRIC PRACTICES**

About 80% of pediatric practices have Internet access.12 Despite this, only 5% of ambulatory care practices use computer-based patient records.2 Access to IT is influenced by the financial situation, the location of the practice (rural vs urban),5,22-24 the size of the practice,25 and the average age of the PHCPs—with older PHCPs less likely to have access to (or comfort with) technology.26 Other environmental barriers that are critical to primary care practices include the expense of systems9 and the cost of training personnel and customizing systems for a PHCP-based practice.27

**COGNITIVE AND/OR PHYSICAL BARRIERS**

Many PHCPs have had to learn to use IT without the benefit of formal study. For example, many PHCPs continue to struggle with using MEDLINE.28 When surveyed, PHCPs identify a lack of IT training as a major barrier to using technologies they consider valuable.20-31

**CONFIDENTIALITY CONCERNS**

The adoption of IT often is impeded by questions about liability associated with the dissemination of information, as well as concerns about what balance between security and access is acceptable to consumers.12,16,32,33 Concerns about security, patient confidentiality, and liability have affected the PHCP’s confidence in using e-mail to communicate with patients (T. Houston, MD, personal communication, 2000).34-37

**KNOWLEDGE AND ATTITUDDINAL BARRIERS**

Perhaps the importance of this area is best summarized by Nancy Lorenzi and Robert Riley, PhD:

As our new systems affect larger, more heterogeneous groups of people and more organizational areas, the major challenges to systems success often become more behavioral than technical... A “technically best” system can be brought to its knees by people who have low psychological ownership in the system and who vigorously resist its implementation.38(p138-139)

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**Table 1. Summary of Barriers to the Adoption of Information Technology (IT)**

<table>
<thead>
<tr>
<th>Situational barriers</th>
<th>Time and financial pressures inherent in US health care systems13,35,38</th>
<th>Unproven return on investment15,17,19</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insufficient or no access to the Internet or to computer technology</td>
<td>IT software unaffordable for small practices9</td>
</tr>
<tr>
<td></td>
<td>in the office setting23</td>
<td>IT software not developed for pediatric practices</td>
</tr>
<tr>
<td>Cognitive and/or physical barriers</td>
<td>Cognitive and/or physical barriers</td>
<td>Physical disabilities</td>
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<tr>
<td></td>
<td>Physical disabilities</td>
<td>Insufficient computer skills15,17,18</td>
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<tr>
<td>Liability barriers</td>
<td>Insufficient computer skills15,17,18</td>
<td>Liability barriers</td>
</tr>
<tr>
<td></td>
<td>Insufficient knowledge about IT (types and benefits)29</td>
<td>Confidentiality concerns16</td>
</tr>
<tr>
<td></td>
<td>Aprehension about change21</td>
<td>Knowledge and attitudinal barriers</td>
</tr>
<tr>
<td></td>
<td>Philosophical opposition to IT</td>
<td>Knowledge and attitudinal barriers</td>
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*References refer to evidence supporting this barrier in pediatrics or adolescent medicine.*
People in this context include patients, parents, PHCPs, and other stakeholders in the enterprise. Their lack of ownership may be due to a variety of factors, including a lack of insight about the benefits of IT, their concern about the magnitude of change caused by IT, and their ambivalence about the processes that IT is designed to improve. Finally, PHCPs tend to embrace IT solutions in health care that result in at least 1 of 3 benefits: more time, more money, or a higher quality of care for their patients.12,25,39

LACK OF INSIGHT ABOUT THE BENEFITS OF IT

Caregivers who are not informed about the capabilities of IT may discourage or fail to support its use.60,61 For example, one study of children invited to participate in an electronic support group found that some children accessed the site less frequently because their parents were unaware of how they were using the Internet.62 The lack of knowledge about what is available on the Internet has affected the PHCP’s perceptions of the value of that tool.12 Similar misconceptions have affected the use of computer-generated visit reminder cards in pediatric practices.17

APPRECIATING THE MAGNITUDE OF CHANGE

In busy pediatric practices, seemingly minor changes—changing the form on which growth curves are plotted—may result in larger systemwide effects, such as teaching PHCPs and patients about the body mass index, or deciding whether to copy old patient information onto the new form. This low-technology example begins to scratch the surface of what PHCPs face with even small IT modifications in a busy practice. The magnitude of these effects may lead to indecision, or worse, a wrong decision.63 Primary care physicians also may be less enthusiastic about the pace with which benefits are realized after implementing IT. For example, physicians have found that new systems result in increased patient waiting time and staff workload for a while after the system is implemented.44

OVERCOMING BARRIERS

It is clear that some of the barriers, such as the impediments to home and office computer access, may be out of the immediate control of the stakeholders in health care, while others, such as the lack of knowledge about existing policies and laws, are easily remedied. Table 2 summarizes possible strategies to overcome each barrier, using the conceptual framework described herein. Adoption of ITs may be improved by providing education about IT, additional research addressing barriers and benefits of IT adoption, IT advocacy by experts, and collaborations among professional societies and other stakeholders.

EDUCATION

Pediatric health care professionals, patients, parents, and insurers need to be educated about a variety of topics, ranging from overcoming situational barriers (obtaining grants and loans to gain access to IT) to understanding the true risks and benefits of IT in health care. Educational initiatives targeting PHCPs and patients are among the first steps that should be taken to eliminate barriers. As we understand more about the risks and benefits of these technologies, we should identify approaches to disseminate this knowledge and to enlighten both our target audience and ourselves about the issues that are of concern. Pediatric health care professional education is best conducted through both risk management forums in local areas and continuing medical education offerings. Continuing medical education courses should be developed that teach not only computer literacy skills but also cover issues such as:

- Confidentiality and security of information on the Internet, as well as existing policies affecting the use of IT in medicine, such as the Health Insurance Portability and Accountability Act65
- Benefits of adopting specific IT tools, such as computer-based patient records e-mail, electronic prescribing, or

Table 2. Overcoming Barriers to the Use of Information Technology (IT)

<table>
<thead>
<tr>
<th>Approaches to Barriers</th>
<th>Situational barriers</th>
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<tr>
<td>Conduct demonstration projects, funded by payers, to explore new models of reimbursement</td>
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<tr>
<td>Disseminate information about how providers may obtain grants, loans, or gifts to gain access to IT</td>
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<td>Collaborate with vendors to include the unique requirements of children and adolescents into the specifications of their systems</td>
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<tr>
<td>Work with pediatric health care professionals (PHCPs) and payers to develop and garner support for providing meaningful and enticing incentives for practices that use IT</td>
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<tr>
<td>Cognitive and/or physical barriers</td>
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<td>Convene hands-on seminars and workshops in regions with less exposure to IT</td>
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<td>Conduct research to better understand the significance of cognitive and physical barriers in pediatrics</td>
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<tr>
<td>Develop IT adoption models that pair experts with less experienced PHCPs to help provide education, guidance, and training</td>
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<tr>
<td>Legal barriers</td>
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<tr>
<td>Establish educational offers that review the legal aspects of information management</td>
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<tr>
<td>Develop policies or legislation to protect the rights of patients and PHCPs with respect to IT</td>
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<tr>
<td>Attitudinal barriers</td>
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<tr>
<td>Increase publications about IT initiatives in pediatrics—both failures and successes</td>
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<tr>
<td>Convene seminars and workshops in regions with less exposure to IT</td>
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<tr>
<td>Collaborate with federal agencies, payers, pharmaceutical companies, and other stakeholders to disseminate the knowledge about IT in pediatric health care</td>
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<tr>
<td>Increase exposure to IT vendors, experts, and researchers at major PHCP meetings</td>
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<tr>
<td>Conduct research evaluating how specific IT interventions affect specific outcomes</td>
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<tr>
<td>Conduct research to understand the knowledge, attitudes, and behaviors of PHCPs with respect to IT</td>
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<tr>
<td>Develop a newsletter for PHCPs summarizing IT initiatives, news, and policies</td>
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<tr>
<td>Increase education about IT during pediatric residency training</td>
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immunization registries, even in a time-pressured environment
• How to evaluate IT solutions for “your” practice
• Where to learn more about IT in medicine

Of note, the Section on Computers and Other Technologies of the American Academy of Pediatrics receives accolades for its annual “Pediatric Office of the Future” lectures held each fall. This lecture series is one of the few objective venues available to the PHCP interested in learning about office automation.

Many professional societies already have a strong commitment to IT. Through continuing medical education courses, seminars, position statements, scientific meetings, patient education materials, and advocacy, these groups can provide a foundation that improves the “comfort zone” of potential adopters of IT. Furthermore, their policy statements and advocacy initiatives will help to educate stakeholders about various publicized issues, ranging from improvements in office efficiency through IT to practical considerations when implementing an electronic medical record.60-69

Although not widely known by most pediatricians, there are special peer-reviewed journals and proceedings that often publish evaluations or demonstrations of IT in medicine. The Web site of the American Medical Informatics Association (http://www.amia.org/) includes a resource center that contains a bibliography of recent articles from many of these specialty journals. Unfortunately, it is unrealistic to assume that the overworked, underpaid PHCP will seek out these journals or browse the Web looking for this evidence base. Rather, to aid in the dissemination of new knowledge to PHCPs, pediatric core journals should become familiar with the study of IT and should encourage the submission of quality research from leading conferences such as the American Medical Informatics Association Symposium. Articles published in pediatric journals should be about subjects or contain data that are most relevant to PHCPs, and may be more likely to result in organizational change than articles that are published in journals with which PHCPs are less familiar.

The actual literature describing barriers that are unique to PHCPs is limited. As we encourage more adoption of IT, there is much to learn from both our successes and failures.60 Therefore, we must encourage the publication of both successful and unsuccessful initiatives. Journals such as the ARCHIVES and other American Medical Association publications have been instrumental in disseminating medical informatics articles. Continued effort within these pages and those of other journals is a critical step to overcoming many of the cognitive barriers I have outlined.

Various professional and national groups already provide seminars and workshops about the use of IT in medicine. Table 3 lists a few of these organizations. Their Web sites contain information that is informative, up-to-date, and relevant to all PHCPs. We should make PHCPs aware of these opportunities, and provide incentives (such as continuing medical education credit) for attending these sessions.

Table 3. Important Information Technology Organizations

<table>
<thead>
<tr>
<th>Organization</th>
<th>Web Site</th>
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<tbody>
<tr>
<td>American Medical Informatics Association</td>
<td><a href="http://www.amia.org">http://www.amia.org</a></td>
</tr>
<tr>
<td>Healthcare Information and Management Systems Society</td>
<td><a href="http://www.himss.org">http://www.himss.org</a></td>
</tr>
<tr>
<td>Society for Medical Decision Making</td>
<td><a href="http://www.gwu.edu/~smdm/">http://www.gwu.edu/~smdm/</a></td>
</tr>
<tr>
<td>American Academy of Pediatrics: Section on Computers and Other Technologies</td>
<td><a href="http://www.aapscot.org">http://www.aapscot.org</a></td>
</tr>
<tr>
<td>Ambulatory Pediatrics Association: Medical Informatics Special Interest Group</td>
<td><a href="http://www.ambpedsb.org">http://www.ambpedsb.org</a></td>
</tr>
<tr>
<td>Medical Records Institute</td>
<td><a href="http://www.medrecinst.com">http://www.medrecinst.com</a></td>
</tr>
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</table>

RESEARCH

A possible reason for the shortage of publications in pediatrics is the dearth of informatics researchers within the pediatric community. Given the unique needs of pediatric patients, it is most likely that only PHCPs will conduct evaluative or observational studies of IT implementation projects that will provide our specialty with generalizable results.

Researchers should address the following questions:

1. What are the knowledge, attitudes, and behaviors of PHCPs with respect to IT?
2. What are the perceived barriers to the adoption of IT by PHCPs in both academic medical centers and private practice? Is the lack of time, lack of money, or lack of knowledge the key barrier to overcome?
3. How prepared are today’s IT tools for use by PHCPs, and what future changes are needed in these tools?
4. How should the curriculum of pediatric residencies be modified to improve knowledge about IT and its role in children’s health?
5. What is the current state of adoption of IT by PHCPs in both academic medical centers and private practice?
6. What are the benefits and costs of using IT in academic or private care facilities?

We must encourage academic PHCPs to evaluate IT in pediatric settings. Of course, to carry out this research, funding needs to be available, or funding agencies need to focus on the area of medical informatics. One of the biggest challenges facing any researcher is how to garner financial support for important projects. In addition to consulting the National Institutes of Health guide (http://grants.nih.gov/grants/guide/), PHCPs interested in conducting technology research should consult pharmaceutical, laboratory, and IT vendors—all of whom may be able to provide support for focused efforts. Managed care companies typically operate with a lower capital reserve, and may be less likely to fund research unless it directly affects their revenue recovery or results in ob-
What This Study Adds

To my knowledge, to date, there have been no reviews summarizing what stifles the adoption of IT by PHCPs. This article summarizes the findings of other studies that have deployed IT. I also suggest some strategies that pediatricians, as stakeholders in the provision of health care, should support or use to help overcome many of the barriers described in the article. Finally, for those readers interested in research in the field of medical informatics, this article exposes some of what is not yet understood about barriers, and suggests areas in which well-designed studies would result in valuable contributions to the current body of knowledge about overcoming barriers.
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22. Forsetlund L, Bjordal A. Do public health practitioners have satisfactory access to important information sources [in Norwegian]? Tidsskr Nor Lægerforen. 1999;119:2456-2462.


