

Viewpoint ■

## The Limited Use of Digital Ink in the Private-sector Primary Care Physician's Office

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**Abstract** Two of the greatest obstacles to the implementation of the standardized electronic medical record are physician and staff acceptance and the development of a complete standardized medical vocabulary. Physicians have found the familiar desktop computer environment cumbersome in the examination room and the coding and hierarchic structure of existing vocabulary inadequate. The author recommends the use of digital ink, the graphic form of the pen computer, in telephone messaging and as a supplement in the examination room encounter note. A key concept in this paper is that the development of a standard electronic medical record cannot occur without the thorough evaluation of the office environment and physicians' concerns. This approach reveals a role for digital ink in telephone messaging and as a supplement to the encounter note. It is hoped that the utilization of digital ink will foster greater physician participation in the development of the electronic medical record.

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In 1994 the American Medical Informatics Association recommended guidelines for the electronic medical record (EMR).<sup>1</sup> The principal recommendation of the association was to progress quickly with the implementation of existing and tested approaches, despite their imperfections. They suggested that the Computer-based Patient Record Institute (CPRI) and the Agency for Health Care Policy and Research (AHCPR) assist the American National Standards Institute in developing the structure of the EMR. They also urged that SNOMED III vocabulary be used for symptoms, findings, and modifiers. Unfortunately, four years have passed and the guidelines have very little practical value for rank-and-file clinicians. Only 4.3 percent of primary care physicians utilize the EMR,<sup>2</sup> the CPRI has recommended no clear guidelines for the EMR, and SNOMED III has been licensed by only 27 vendors.<sup>3</sup>

Of practical importance is the likelihood that the Health Care Finance Administration (HCFA) will move

to more actively enforce their evaluation and management Current Procedural Terminology codes in the near future. A preliminary survey done by HCFA indicated that 60 percent of charts reviewed from physicians' offices failed to meet evaluation and management documentation standards.<sup>4</sup> It is distressing that EMR systems are not ready to help with this challenge.

Why have physicians not embraced the existing technology? Along with the often-cited roadblocks, such as inadequate infrastructure standards and staff resistance, the lack of an acceptable vocabulary looms prominent. This bottleneck in knowledge acquisition may be helped by the supplemental use of unstructured information. Digital ink, the digital representation of the path of the pen across the writing surface,<sup>5</sup> may be used for this purpose. It may also help lessen staff and physician resistance. I will suggest two such applications of digital ink in light of the challenges facing a primary care practice.

### Digital Ink and Pen Computing Background

A thorough review of the functional components and specifications of pen computers can be found elsewhere.<sup>6</sup> For the purposes of this paper I refer only to those pen computers that can functionally port the same images and graphical user interface found on

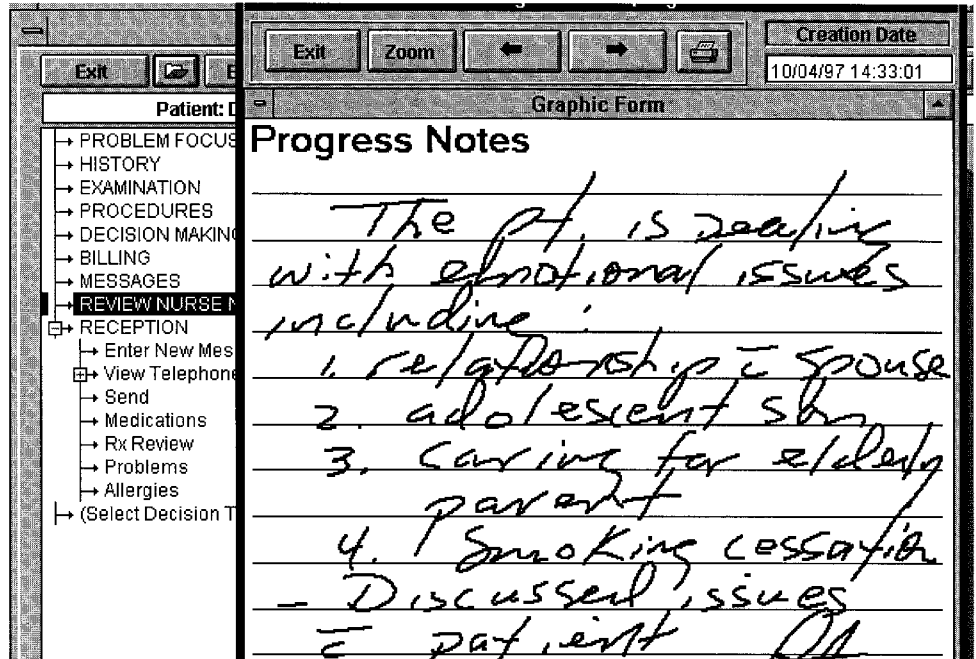
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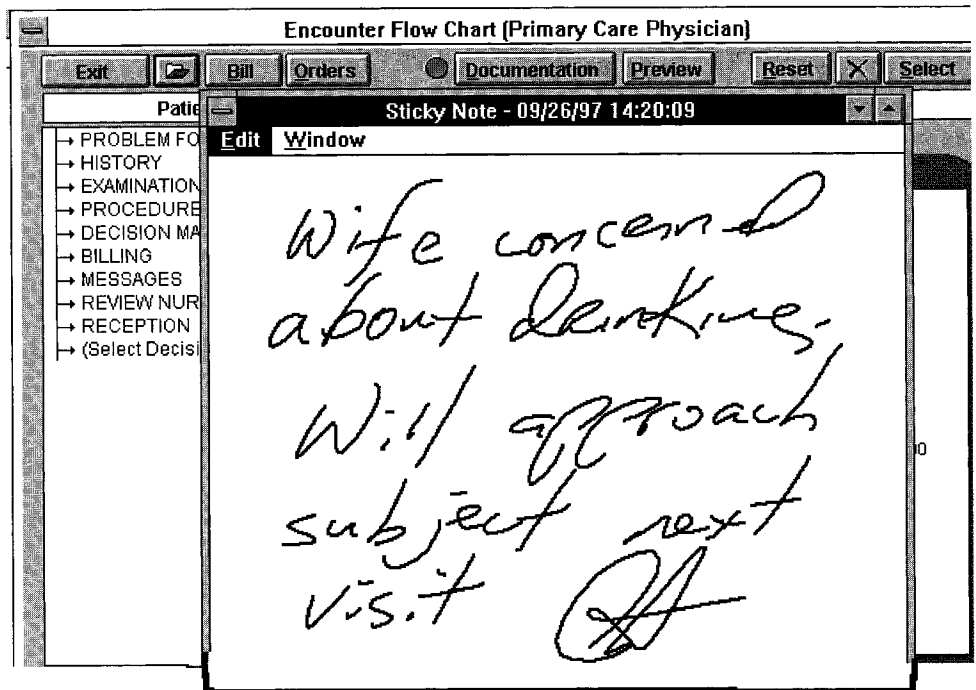
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**Figure 1** Progress note addendum. (Reprinted with permission of Medworks, Inc.)

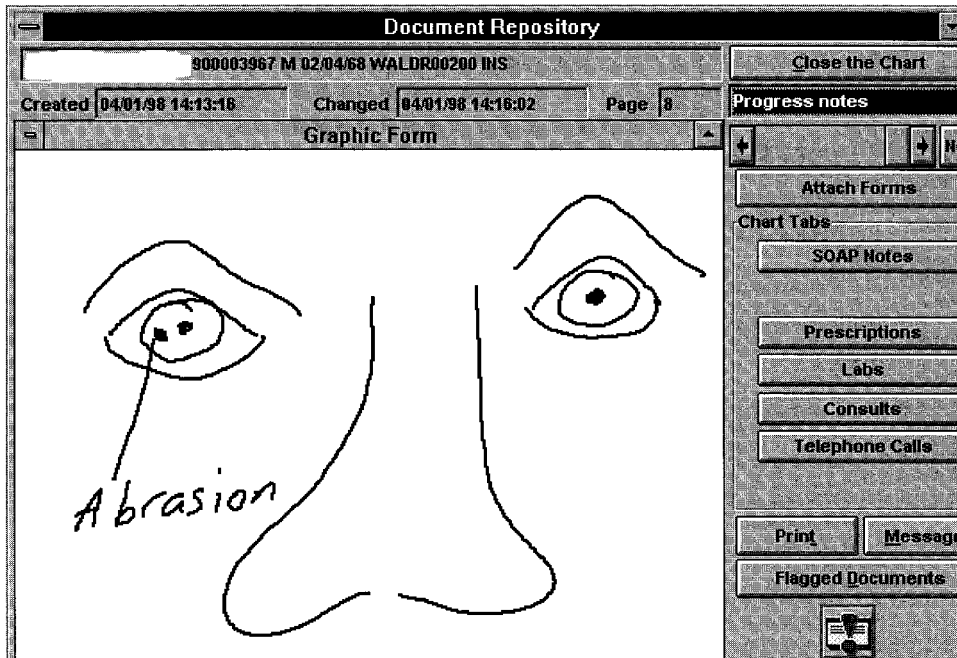


**Figure 2** Sticky note (an erasable format). (Reprinted with permission of Medworks, Inc.)



their desktop computer counterparts. The input device or pen has all the functions of a mouse. According to Bauer<sup>6</sup> and others<sup>7-9</sup> a pen is easier to use than a mouse. It requires virtually no space, has a familiar shape, and requires less eye-hand coordination than a mouse. These are particularly desirable features for inexperienced users like clinicians. In pen applications

and with special gesture-recognition software, the pen can be used to edit text. It can also function as an input device to write or draw on the screen using digital ink, as shown in Figures 1 to 4. It can be carried about like a clipboard or patient chart and can connect to a network either by hardwired or wireless technology.



**Figure 3** Drawing. (Reprinted with permission of Medworks, Inc.)

To be sure, problems with pen computers exist. Battery life is short, and the cost is high. Technical support is still hard to obtain, since manufacturers have few personnel who are knowledgeable about their pen computer products. Overall, however, these inconveniences are a small price to pay for the freedom of mobility and added features offered by graphic input using digital ink.

The legality of digital ink in signatures and documentation is discussed elsewhere.<sup>10</sup> Repudiation is always a problem with handwritten signatures, but we have relied on written signatures for centuries.

Memory requirements are surprisingly small for digital ink. Unlike scanned images, which are stored intact, digital ink images are stored in pieces, or vectors,<sup>11</sup> and are reassembled to form the desired image. On a practical note, my staff and I have created images for telephone messages (Figure 4), drawings (Figure 3), and chart notes for two years. We have not come close to filling my 2-Gigabyte hard drive.

### Rising Overhead Costs and Lower Disposable Income

Between 1992 and 1997 the number of capitated and discounted fee-for-service patients jumped from 30 to 65 percent in my practice.<sup>12</sup> The increase in the number of these managed care patients caused an increase in my office hours from 37 to 53 a week and a staffing

increase from 3.8 to 5.4 full-time employees. An income loss of 10 percent and an overall overhead increase from 63.5 percent in 1992 to 69 percent in 1997 ensued. The latter eliminated the disposable income normally available for computer and office upgrades.

My experience is not unlike that of others in our present managed care environment. Health care is still a cottage industry, where the majority of the primary care work force operates in solo practices or groups of fewer than ten. The Medical Group Practice Association reported similar overhead increases between 1992 and 1997.<sup>13</sup>

With the dissolution of disposable income, physicians need to rely on loans backed by personal assets for practice improvements. This change prompts physicians to look more and more for immediate return on investment, which is extremely difficult to assess with EMRs.<sup>14</sup>

### Patient Care as First Priority in Staffing

During the days of staff training that followed the installation of my EMR system, my nurse resisted adamantly. At one point she was driven to tears. She had been in a medicine/surgery department and had been a head nurse for 20 years as well as a school nurse and my office nurse during much of that time. She had handled the implementation of new state and federal guidelines as well as changes in staff procedures

**Figure 4** Notes of telephone encounter. (Reprinted with permission of Medworks, Inc.)

Creation Date  
01/14/97 12:55:06

Graphic Form

### Telephone Encounter

Caught a fever of 102. @ sister - in law's. 717-236-4821. Too much snow Mr. from office. Local of # 717-236-8291 HB  
- taking kids well but somewhat lethargic. Rec. come in today. Mom won't drive in. Needs eval. She will come when able.

John

with aplomb. She could not bring herself to use templates instead of handwriting her notes in her own words, personalized for each patient. She was and is not a good typist. The thought of replacing an excellent, compassionate nurse never arose. I offered her digital ink to write her notes. Over the last two years she has progressed to use other applications of the EMR. The compromise has worked.

The understanding of staff limitations, abilities, and desire to participate is critical in the implementation of an EMR system.<sup>15,16</sup> Staff and providers need to know they are getting something of value to help in the delivery of a good product.

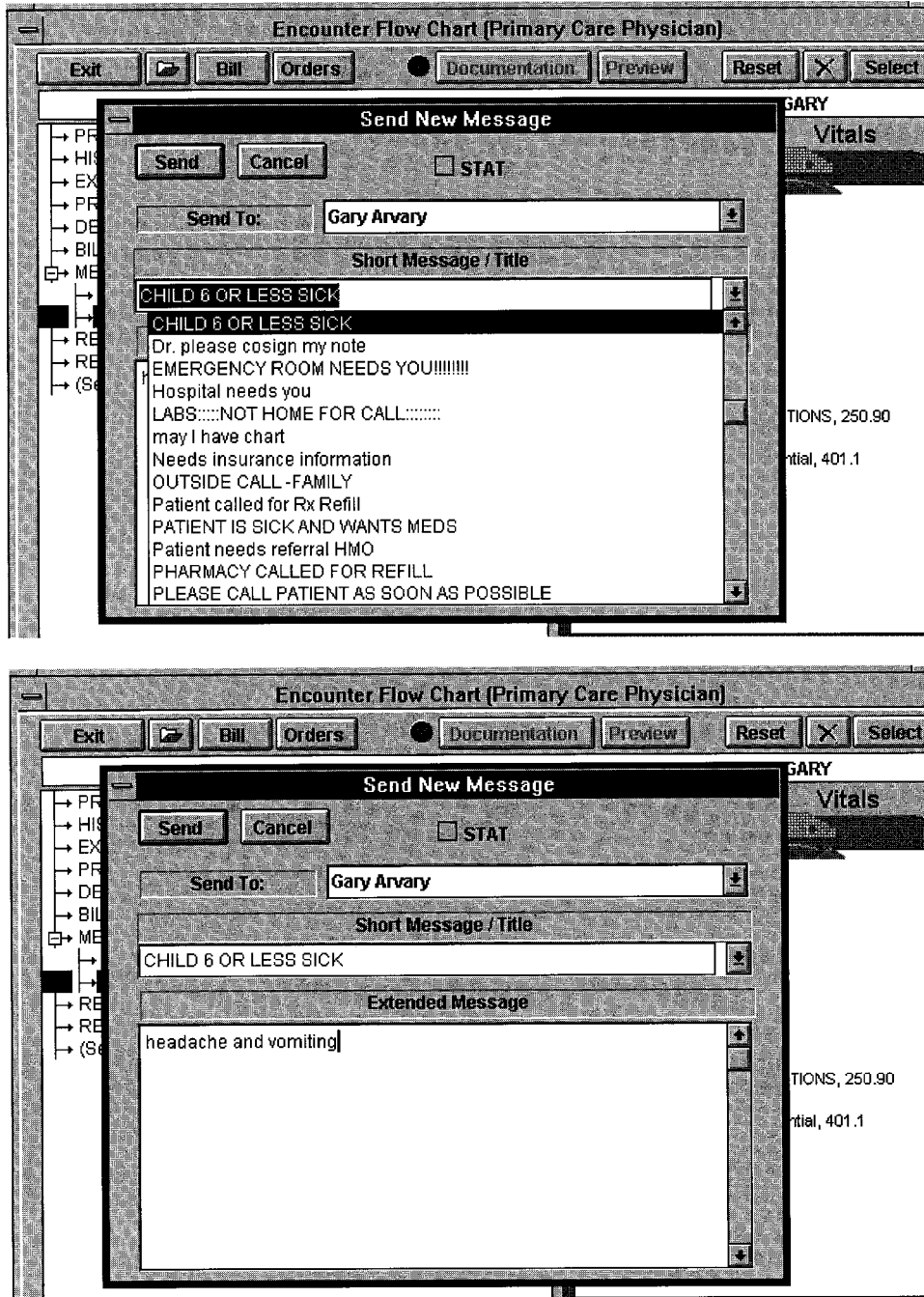
Like many primary care physicians, I live where I work. I receive constant feedback from patients on the street, in church, at the grocery store, at the post office, and at school functions. One of the most prominent areas of patient concern involves the quality of the persons I have on the phone (the telephone receptionist) and at the front desk (the office receptionist). They are the voice and the face of my office, respectively.

The telephone receptionist handles approximately 100 patient-care calls daily. The calls are handled on three rollover phone lines, and the telephone receptionist has approximately 30 seconds to listen, record, and send a message without tying up the phone lines. I have not hired a transcriptionist for this position, because in this region wages average \$15 an hour for a transcriptionist and \$8 an hour for a telephone recep-

tionist.<sup>17</sup> My telephone receptionist writes fluently and handles medical terminology phonetically, which I have found acceptable. Speed is essential, as are detail and accuracy. Here, where speed, detail, and fluency are essential, digital ink works well.

The office receptionist is the first person the patient encounters in my office. She is also the last person seen when leaving. She is a major focus of attention, handling appointment scheduling on the phone and with departing patients. She posts payments, reviews my transmitted orders, and sets up appointments for specialists and hospital testing. It is not unusual for the office receptionist to be seen responding to questions or complaints at the waiting room window while posting a payment for a departing patient, all while having someone on hold waiting to make an appointment. The office receptionist earns \$10.50 an hour. Because of cost constraints, she can not utilize digital ink. If she helps with phone messages, it must be done through a drop down box in the EMR (Figure 5). Some detail is typed. However, because she is preoccupied with more than one task and is not a medical transcriptionist, the messages are truncated. The lack of detail makes the message difficult to triage.

My position is much more flexible than that of the telephone receptionist or office receptionist. I have 12 to 15 minutes for each patient, to utilize a decision-tree template-based medical record (Figure 6). I now see 200 to 250 patients a week. Because of the volume

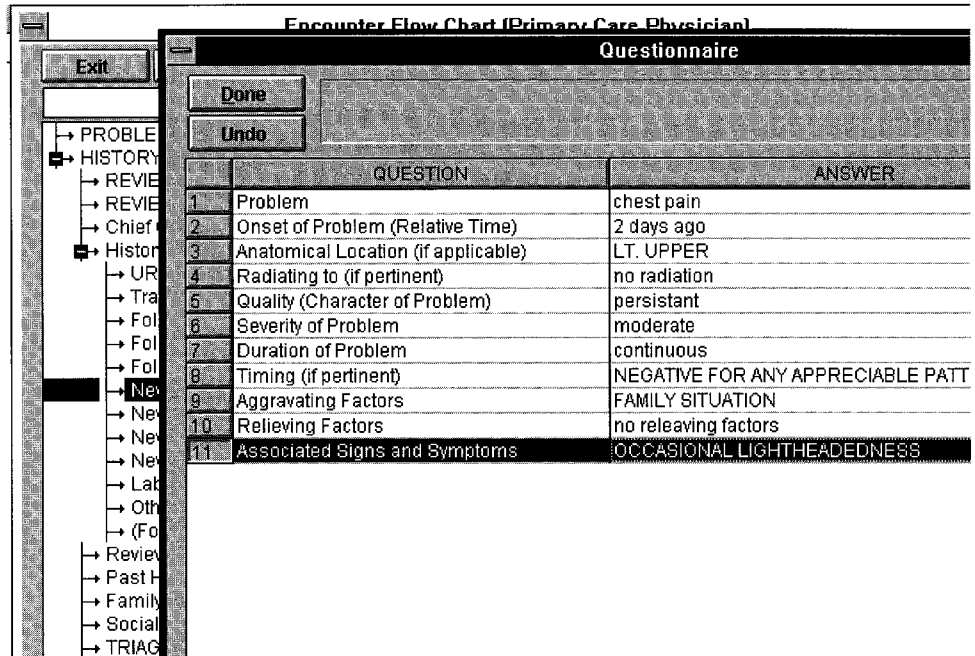


**Figure 5** Drop-down telephone message for keyboard use. (Used with permission of Medworks, Inc.)

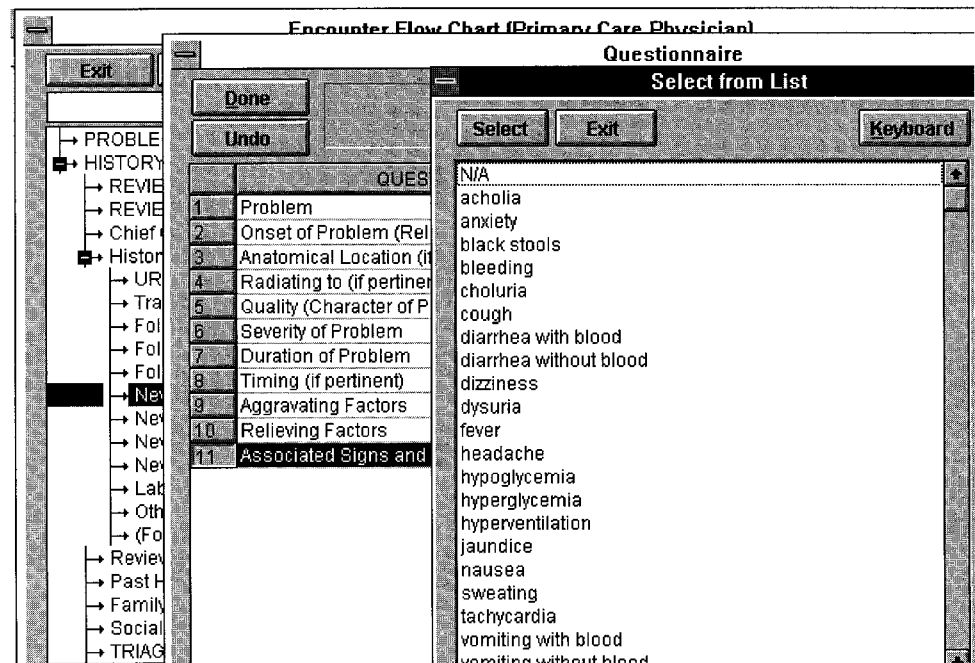
of work and added demand for detailed documentation,<sup>18</sup> I cannot afford to complete my notes after hours. I frequently must go to the hospital, so each note has to be completed while I am still with the patient. Let me illustrate.

It's 4:30, and I am only 15 minutes behind. I am in the process of completing my history, examination, and note for a patient with a chief complaint of headache. Suddenly, I discover she wants to talk about recent problems with her teenaged son. Because of the

apparent urgency of her issues, we consult for about half an hour. During the talk I add personal information to the note using digital ink. At the end of the session the patient seems relieved, but my telephone message list has grown by several calls. I am now 45 minutes behind. As I try to make a few calls back on my hall phone, I can hear the office receptionist listening to an irate patient who is, understandably, upset about the long wait. I turn to the phone but am distracted by an elderly gentleman moving toward me. Mr. Jones has, uncharacteristically, maneuvered



**Figure 6** Drop-down lists. (Reprinted with permission of Medworks, Inc.)



his way into the back hall. When he is next to me, he asks if he could talk to me for a few minutes about his wife, whom I am treating in the hospital.

The purpose of this vignette is to show that diversions come quickly and frequently. The inconspicuous and limited use of digital ink in recording our concerned mother’s personal information could not have been done using a customized vocabulary (like that of my EMR) or a controlled medical vocabulary like SNOMED III.<sup>19</sup>

### Physician Reluctance and Patient Concerns

The demand for greater documentation from third-party payers has increased. Yet, as previously mentioned, fewer than 5 percent of primary care physicians have embraced the apparently helpful applications embodied in the EMR.<sup>2,16</sup> A review of available literature scrapes the surface of concerns clinicians have about the present offerings in the EMR. Among these concerns are depersonalization of the

physician–patient interaction,<sup>15,20</sup> lack of staff acceptance,<sup>21</sup> and the need to type.<sup>11,21</sup> Smith and Zastro<sup>22</sup> determined that 40 percent of physicians would not even consider the possibility of an EMR in the examination room.

For some time the cumbersome nature of the desktop computer environment has also been a common complaint among physicians using an EMR in the examination room. According to Brownbridge and Lilford,<sup>23</sup> physicians in the United Kingdom in 1988 were concerned that the format-controlled vocabulary made detailed construction of a history too time consuming. Surprisingly, primary care physicians in 1996<sup>24</sup> and 1997<sup>25</sup> still had the same complaint. They were also concerned about how long it took to complete a note in the desktop computer environment. Brownbridge's initial inclination was to expect the user to utilize the computer as it is rather than redesign the hardware and software to suit the way a physician works. This view is shared by others.<sup>9,24</sup> He subsequently relented, however, noting that the assumption that clinicians would adapt has set back many a computer application.

Patients, on the other hand, have been comfortable with physician use of the EMR in the examination room. Johnson et al.<sup>26</sup> showed that even in 1984 patients were not disturbed. They were more concerned that the physician demonstrated care and compassion and concern for the patient's well-being. Likewise, in Chin's 1996 study,<sup>24</sup> patients were comfortable with the computer in the examination room while the physicians were not.

## Telephone Documentation

Marvin Belli, the famous malpractice attorney, once said physicians would remain easy prey as long as they continued to practice medicine over the telephone.<sup>27</sup> Nevertheless, many primary care physicians in the private sector give advice and even treat patients over the telephone. In family medicine it is part of our training. Twenty percent of a primary care physician's workload involves the telephone.<sup>28</sup> Moreover, 40 percent of surveyed patients indicated that their choice of primary care physician rested on the physician's availability by telephone.<sup>28</sup> With all that attention in the office to the telephone, why hasn't it been investigated in medical informatics literature? During the preparation of this paper, an information scientist indicated that a simple drop-down box should suffice for any telephone message. The time pressures on both the telephone receptionist and the office receptionist prohibit the use of drop-down boxes as they are currently designed, however (Figures 5 and 6). Likewise, the personalized, detailed documentation

recommended by Richards<sup>29</sup> would be too complex in a template setup. Richards writes, "The telephone message should document the message in detail. The documentation makes sure the chart is complete and prevents misunderstandings."

An example from my practice illustrates the point. Mrs. Smith called me on a snowy January day. Her 4-year-old had a cough and a temperature of 102° F. I asked her to bring the child to the office. She indicated that she was at her sister-in-law's house, which was an hour from the office. Eight months later, Mrs. Smith, in the office with another child, said she had had to take her 4-year-old child to the emergency room the day after our phone conversation. He was diagnosed as having pneumonia. She complained that we would not see him when she had called. After reviewing the message from January (Figure 4), I told her I had asked her to bring in the child. She did not recall that. I read her the note that she was at her sister-in-law's house and that it was snowing too hard to get to the office. I then showed her the sister-in-law's phone number. She then remembered the conversation and apologized. Patients lead busy lives, and memory becomes blurred with time and emotions. Patients rely on us as their physicians to keep accurate and detailed records of all our discussions.<sup>30</sup>

One strong argument against digital ink is illegibility. This contention is relevant. Speed, detail, and accuracy are, however, more important. Drop-down lists and typing do not satisfy these requirements. Digital ink does.

## Effects of Computers on the Physician–Patient Relationship

The best mode of input for EMR information by the primary care physician in the examination room has not been settled. Some researchers and practicing physicians prefer to use a desktop computer in the examination room.<sup>24,31</sup> When faced with the finding that only 20 percent of physicians type, they reason that the rest must learn. Others, like Rindfleisch and Fagan at Stanford, have done extensive work on the graphical user interface and pen computing.<sup>21</sup> They have viewed the physician–computer interaction as an environment. The desktop computer represents a complete environment. However, in clinical medicine the computer should be a tool, and its presence should not interfere with the task of conducting an interview. The environment is and should be based on the relationship between the physician and patient. Also, the physician is mobile and should be able to use the tool (chart) wherever he or she chooses.

**Figure 7** The physician-patient relationship in the examination room with paper chart (*left*), with pen computer (*middle*), and with desktop computer (*right*).

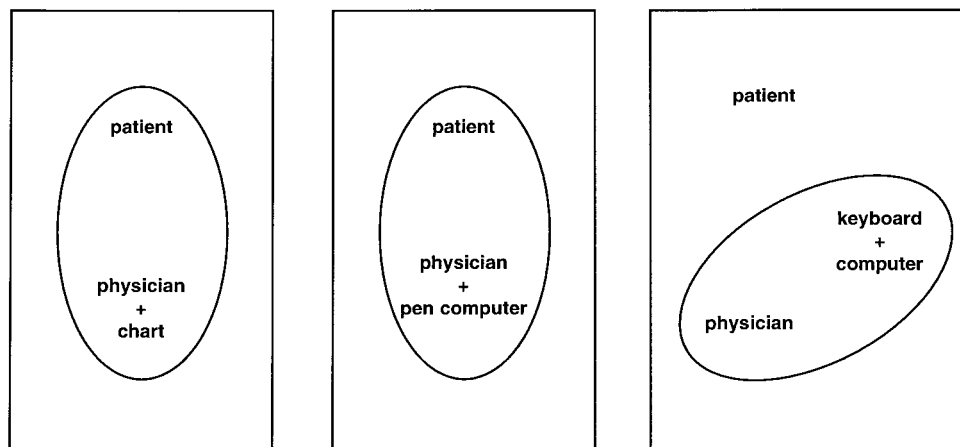


Figure 7 illustrates the relationships in the examination room schematically, as described by Rindfleisch et al.<sup>21</sup> In the sketch on the right, the physician enters the examination room, walks over to the desktop computer, reviews the record, and then enters the relationship with the patient. Huang<sup>25</sup> admits that this is cumbersome to the physician.

Safety and damage are two other reasons to avoid leaving computers in the examination room. A mother of four cannot always control three active children while comforting a sick child. One random, albeit accidental, act can be costly. Physical security devices for desktop computers are cumbersome and inconvenient when a different patient is seen every 15 minutes. In contrast, the pen computer moves with me.

### Need for Unstructured Information

Some authors have advocated forcing the user to choose from a controlled medical vocabulary. The principal arguments are that the information is immediately useful for research and physicians are forced to use mutually agreed on terminology.<sup>19,32</sup> However, investigators have discovered that providers still prefer to express some of their findings in a personalized manner.<sup>20,33</sup> Added information can easily be attached to the EMR using digital ink for a handwritten statement or drawing. This would take nothing away from any essential information entered using templates or check boxes. The New Zealand Public Health Information Service agrees.<sup>16</sup> They suggest that structured text in the form of templates and check boxes be limited to areas where this can more readily be accommodated, as in detailing a patient's chief complaint, medical history, social history, review of systems, medication, prescriptions, diagnosis, and

procedural codes. Other areas, such as history of the present illness and decision making, would be expressed in structured *and* unstructured formats. The flexibility might help gain the cooperation of clinicians. In the mobile environment of a medical practice, the limited use of digital ink would, at the present time, best accomplish this task.

### Summary

Primary care physicians in the private sector have little representation in the current hierarchic structure of EMR evaluation and development. Accomplishments of the CPRI Davis award winners are considered the benchmarks for the EMR.<sup>34</sup> The 1998 winner used EpiCare, an EMR product that, as of 1997, was intended for use only with desktop computers in the examination room<sup>35</sup>—a situation that physicians have found cumbersome and that researchers have found far from optimal.<sup>8</sup> Large groups like Kaiser Permanente have shown that an EMR can be implemented, but only at tremendous cost. These models are not practical for a large number of primary care physicians in private solo and small group practices. We need standardization of software, and hardware that meets the needs and restrictions described in this paper.

The pen computer needs to be resurrected from its days of association with failed handwriting recognition. As a tool of the pen computer, digital ink is at *worst* a disposable means of completing an encounter note. At *best* it is a tool to engage primary care physicians who have been alienated by the image of the keyboard in the examination room. Clinicians must relay their needs in the development of a standard EMR design and not be forced to use designs unsuitable for their practices.



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