Electronic Medical Records And The Allergist

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Abstract

Medical Informatics has become a major player in the advancement of medicine. This article presents a comprehensive look into the advantages and opportunities that medical informatics offers physicians with little or no computer knowledge. It consolidates existing data from other sources addressing the Electronic Medical Record (EMR) and the related issues of office management workflow, cost structures and implementation with a particular emphasis for Allergy specialists. It also presents items to consider when evaluating a software solution as well as providing references to learn more about medical informatics. With HIPAA mandating that health care providers come into compliance for security standards by April 14, 2003, an EMR may be an economical and feasible method of meeting these requirements.

INTRODUCTION

Medical Informatics has evolved into an elaborate discipline crossing a multitude of subject areas ranging from health care, computer engineering, finance, to legal matters. It is an international and academic force that mandates attention as it matures into a field that will soon become commonplace to how the medical world functions and develops. Already 98% of doctors in a group practice use computers as published by the American Medical Association [1] . However, a recent survey of 593 medical practices by the Medical Group Management Association found that only 21.6% use electronic medical records (EMR) [2] . This apparent mismatch reflects the difficulty associated with committing to and implementing an EMR solution. In 1996, the Unites States Congress passed the Health Insurance Portability and Accountability Act (HIPAA), which requires the Department of Health and Human Services to establish national standards for electronic health care transactions as well as setting stringent regulations to protect the security and privacy of health data. With legal mandates like these, it is imperative for the practicing physician to understand the implication of an EMR to help them meet these requirements.This article presents a comprehensive look into the advantages and opportunities that medical informatics offers physicians with little or no computer knowledge. It consolidates existing data from other sources addressing the Electronic Medical Record (EMR) and the related issues of office management workflow, cost structures and implementation with a particular emphasis for Allergy

specialists. It also presents items to consider when evaluating a software solution as well as providing references to learn more about medical informatics. With HIPAA mandating that health care providers come into compliance for security standards by April 14, 2003, an EMR may be an economical and feasible method of meeting these requirements.

ADVANTAGES VS. DISADVANTAGES OF COMPUTERIZED PATIENT RECORDS

In today's medicine there is a growing need to share the care of patients between healthcare providers. The paper record can only be in one place at a time. In practice every healthcare entity has a separate record for each individual, thereby creating the problem of record fragmentation, duplication, and dis-integrity. This can lead to problems of continuity of care for the patient. It also threatens the freedom of patients to choose where they go for care, since clinical data may only be easily accessible in a single institution, office, or network, as well as their right to equity in access to appropriate care in a timely manner. Different users need varied types and levels of information from medical records, which is difficult to monitor when paper charts are used.

Some of the chief advantages often sited in adopting an EMR include simultaneous remote access (accessing records via LAN or internet), superior legibility, data security and safety, confidentiality, a flexible layout, integration with other information sources, customizable searches, and

tailored outputs.[3] A review of some of the disadvantages include slow data entry (for poor typists, who might consider using voice recognition available in some EMR systems), restricted range of language (e.g. no drawings), the temptation to embellish data, expensive customizability options, disruption of the patient doctor relationship, and dependence on software (e.g. inability to change software products or extract data from system). [4] Each reason mentioned holds a variable weight in terms of applicability to the practice

WHAT IS THE ELECTRONIC MEDICAL RECORD?

The Electronic Medical Record (EMR) is structured after the paper chart and focuses on capturing all pertinent data from the patient. This includes the contact information, demographics, medications, allergies, chief complaint, lab results, referring physician information, and other data pertaining to providing the patient with comprehensive care. The EMR is not to be confused with a standalone billing solution or scheduling system. An EMR specifically refers to the digital capture of patient data, diagnoses, and treatments, though it may be optionally bundled with scheduling and billing modules.

FUNCTIONALITY OF AN EMR

The EMR differs from the paper chart in its ability to offer the patient/doctor relationship a new dimension in accessibility, clarity, and security. It should be noted that all EMRs do not necessarily support the same functionality and the discussion below is to propose different considerations and major functionalities that may be beneficial for particular practice settings.

Accessibility refers to the ability to easily retrieve information through various processes. This could mean using a handheld device, the Internet, or remote access software. For example, if a physician was not on site and needed to check a patient's current medications, he could open his handheld or access the Internet and quickly retrieve the information before writing a new prescription. An EMR should optimally support accessibility.

Clarity is paramount in the EMR. An EMR solution can organize data in different arrangements to allow the physician to see data side by side or can help to visualize trends using built in graphing functionality. Some EMRs allow the screen to be customized so that only relevant

information is presented to the doctor. For example, if the doctor wanted to see only the current medications rather than a history of all medications an EMR with this type of functionality should be explored. Physicians may want to customize the appearance of their chart to give a brief synopsis of the patient rather than having to navigate through multiple screens or sheets of paper. Errors caused by illegible handwriting can be eliminated and communication between other departments and staff can be enhanced.

Security is sometimes misrepresented as something difficult to achieve when information becomes digital, but the reality is that computers can maintain confidentiality to a very high degree using modern technology and encryption techniques. Current practices of regularly changing passwords and the ability of software to grant different levels of access to information has addressed many security issues. If you wanted to allow the administrative staff to access only patient contact information, and diagnoses and medications to be seen only by the physician, this type of tier level security should be supported by an EMR. Currently paper records are vulnerable to security concerns as well, especially when they may be viewed by multiple individuals. Some EMR solutions offer tracking functionality that log all modifications and viewings of the chart ensuring confidentiality. International Business Machine and Microsoft Corporation have proposed a strategy for addressing security within a Web service environment. They define a comprehensive Web service security model that supports, integrates and unifies several popular security models, mechanisms, and technologies. [5]

FEATURES OF AN EMR

The American Academy of Family Physicians (AAFP) ad hoc committee on electronic medical records has published a comprehensive list of basic, advanced and optional features buyers should consider when choosing an EMR solution. Some of the basic features it mentions include around the clock access, incremental implementation of more advanced modules, supporting multiple office locations, offering online user support, having a workable exit strategy to export entered data to a new system, and allowing backup support.

Figure 1

Table 1: Basic features of an EMR

Features	Scenario
Around the clock access	Physician is at home after hours and needs laboratory data from a patient's chart. An EMR would support off site logging into the system even after the office is closed using a secure line.
Incremental Implementation	The clinic has a limited budget and decides to purchase only the EMR module without voice dictation software. Later it decides that it does want to have this more advanced module. An EMR would support this integration of advanced functionality to allow practices to pinpoint their most important needs and expand accordingly.
Multiple Office Location	Office locations are located in different cities. An EMR would allow the transfer of data securely over a high-speed connection that would allow each site to see each other's data using the same interface.
Online User Support	Front desk employee is attempting to enter a phone number of a patient but is unable to. Instead of relying on a phone call to technical support they simply query the online user support manual to troubleshoot.
Exit strategy	A physician has been using an EMR for 5 years and has accumulated 1000's of records and is thinking about changing to a more advanced system. An EMR would support the data extraction from this old system and import into the new system.
Backup Support	Electronic data can be lost just as paper can be. An EMR would support some type of backup functionality to secure the data in case of a power failure, fire, etc. Several best practices often followed in backing up data include having a written protocol detailing the backup procedures, storing a copy of the data offsite, and testing the backups before you actually need them.[6]

The AAFP lists optional features of an EMR to include read only Internet access for patients, software scalability to accommodate practice growth, and supporting encrypted e-mail capability. [7] It also discusses clinical data repository (CDR) features such as having one unique patient identifier like a social security number. This is particularly important to help ease the confusion of dealing with a patient who visits several institutions and thus maintains several different identifiers, one for each location. By having one identifier, tracking is facilitated. Other features include chart merging if a patient has more than one record (for example from more than one physician/provider), and allowing the user to query the CDR to create customized reports. [8] Generating reports is a major benefit of having an EMR solution. The database contains information that can be utilized in directing better care to patients as well as conducting research. An EMR could potentially query large amounts of information and present them in customizable outputs whether a printer, monitor, or other application. For example, if an Allergist was interested in seeing the number of patients who live with a pet and exhibit certain allergic disease compared to those without a pet, a simple search could be performed to generate 2 lists of patients. Further, more selective searches could then be conducted allowing for physicians to study trends and identify patients for possible study enrollment.

MEDICATION/CHARTING MANAGEMENT

Medication Management features should entail the ability to offer online prescription writing integrated with an online database like First Databank.[9] It should also offer the date of the last prescription update, provide drug-drug interactions, and print medications in lay terms for the patient.[10] As far as charting management goes the AAFP has outlined features like allowing entry of vital signs with error checking (important to eliminate accidental data input e.g.. entering the systolic as the diastolic), creating automatic pediatric growth charts, supporting various encounter types like office visits and telephone calls, and allowing for hot keys for "fill in the blanks" (e.g. using CTRL + F1 to initiate filling in multiple fields with default normal values rather than having to enter each normal value individually).[11] The goal of Charting Management is to capture all pertinent data as quickly as possible.

LEVEL OF CUSTOMIZABILITY

It is clear that the EMR is a tool to increase flexibility. This can take form in numerous ways as illustrated by the features that are available in different EMR solutions. One element of all EMRs are their level of customizability. Depending on the solution, users can customize the entire application for their practice or may have to change certain procedures of their own to be more aligned with how the software handles information. For example, recently the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) proposed that hospitals initiate routine pain assessments. In a paper-records system this may mean adding an entire new sheet to the chart, adding to extra storage space needed as well as overhead costs associated with chart maintenance. The doctor may even forget to flip to the new page, but with an EMR, a new data field could be added that appears on the screen only if a pain assessment was suggested by a certain diagnosis entry. This would serve to increase physician compliance. Added data fields are handled differently by each EMR. For the allergist, tracking immunotherapy, and allergen extracts are an important custom feature. Allergy specific programs are discussed subsequently.

OFFICE MANAGEMENT WORKFLOW

In considering office management workflow components, billing, scheduling, and patient tracking must be addressed. The flow of information begins with the patient checking into the clinic or office. A patient centered workflow is a simple method of organizing the flow of information. For example, when the patient checks in, their chart is automatically routed to the appropriate physician's workstation and the presence of the patient and time of arrival would also appear in the physician's screen. Some programs have icons for lab results, to do lists, memo's etc

and all of this information is captured and stored in relation to that specific patient. Some offices have chosen to implement a waiting room computer terminal that patients must check into. Here they enter their insurance, demographic and contact information (and possibly medical information as well as a quality of life survey) which then gets submitted to a database linked to the scheduling system. This reduces the chance of spelling errors since the patient is responsible for the actual data entry and reduces the work of the front desk staff. As the patient travels through the clinic or office the software tracks the status of the patient through sign-ins from staff at various sites. For example, if the patient is currently getting their vital signs taken by the nurse, a status of this location and activity could potentially be presented on the physician's screen in a window called "Patient status". This also allows for greater control in preventing patient overlap and delays. Office Management is often sold as a separate module to the EMR.

SCHEDULING

Scheduling systems can be integrated with the EMR. Features may include the ability to generate reports on patient behavior such as no-shows or repeat cancellations/postponements. Offices can increase efficiency by knowing which patients are always on time, which cancel repeatedly as well as which are constantly late. Scheduling systems should also address multiple user interactions. For example, if two workstations are being used to schedule and both are attempting to schedule for the same time slot there should be a built in error prompt preventing this type of overlap. Some systems even allow patients to schedule their own appointments on line. By having a flexible scheduling system, offices can maintain a constant flow of patients and effectively manage them. Electronic scheduling is often sold as a separate component.

BILLING

Electronic billing systems have a distinct advantage in office workflow management that may be able to decrease practice costs. Billing modules are usually a separate module from the EMR system. Ideally, ICD and CPT codes should be linked to diagnostic and therapeutic descriptions that are used by the physician in EMR charting. Statistical reports that can be generated from the billing software can be used as a tool for assessing the financial performance of a practice by looking at payments for various CPT codes, and by comparing reimbursements for different payers. A discussion of electronic billing software programs is beyond the scope of this article.

ASSESSING WHAT EMR SOLUTION IS BEST

For the physician who is unsure how to make that first step, a good way to begin is by conducting an assessment of what data is currently captured, additional data they would like to store, and different uses of this data that are specific to their practice. For example, a physician who is an Allergist might find that certain laboratory data is significant to their practice and that an optimal prospective EMR system would allow integration with the laboratory website where they can download the results. This type of site-specific amalgamation provides the greatest benefits of a customized EMR. The AAFP identifies several other very important goals of an EMR including reducing medical errors, improving patient satisfaction, increasing revenues, improving office efficiencies, improving quality of physician lifestyle (e.g., home access to the EMR system), and meeting regulatory standards and requirements. [12]

CHOOSING THE RIGHT EMR SOLUTION

Choosing the right software solution can seem like a confusing and difficult task. Vendors often call the same features by different names and programs run on different platforms, use different data storage standards, and offer different levels of integration. In choosing a solution the first step for the physician is to decide how much computerization they would like to employ in their office. A fully paperless office has very different requirements from a dual paper-electronic practice. A fully paperless office would need sufficient equipment, fast networking capability, and a well-trained staff. There would have to be a digital signature capability that would be the equivalent of signing a name for official purposes. The traditional pen signature is now being circumvented by having EMR software team up with programs like InkTool (developed by Communication Intelligence Corporation) which provides electronic signature capture and display, biometric signature verification and ink compression. [13] These types of software combinations traverse the complaints of an EMR lacking the validity of a paper system. There would also have to be a backup plan in case the system goes down or if there is a power failure. A dual paper-electronic practice would automate certain steps but would still require paper for complete documentation. Some paper might be scanned directly into the system to reduce the amount of storage space for paper documents.

A maintenance contract that includes upgrades that are HIPAA (Please refer to section on HIPAA) compliant may play a particularly important role in choosing the correct

EMR. With HIPAA rules being modified a system may need updates to ensure alignment with HIPAA.

The EMR market is constantly changing with vendors often merging with others or going out of business. Research into the vendor's history can be evaluated followed by an inquiry into clients that are currently using the vendor's software. A trial of the software can be conducted with a sales representative on hand to demonstrate features and answer questions. A detailed chart comparing current vendors of Medical Informatics Software and each program's current functionality was assembled by the AAFP. [14] They compared 29 vendors on more than 50 features.

IMPLEMENTATION OF THE EMR

Once the physician decides to make the step to go digital, implementation of the chosen software to drive the practice should be done methodically and possibly in phases, especially in a practice with many staff members. The Computer-Based Record Institute (CPRI) launched a recognition program in 1995 to distinguish and emphasize lessons learned from successful implementations of informatics technology. [15] They have put together an exhaustive paper that reviews the insights and experiences shared by the organizations that were recognized in the first four years and is summarized here. [16] Leadership as detailed in the paper is essential especially in a practice/clinical setting with several staff. Having a person who is in a position of authority is preferred to advocate to the others the importance of adopting these new modifications. A training program should be initiated that focuses on role specific duties as well as addressing the big picture of the implementation. This is so employees don't see their job as separate or insignificant in the broader scheme of things. A team effort is crucial to any successful execution.

Implementation should also focus on developing standard protocols. For example this would include a written procedure to follow in handling new patients as well as a modified procedure in handling existing patients. To aid in this, often times drop down boxes or checkbox items are used. The potential for misspellings is reduced and speed in data entry is often enhanced. The AAFP has published an article titled, "How to Select a Computer System for a Family Physician's Office". This article addresses hardware and software platforms, barriers to entry, implementation issues, as well as a section profiling the successful implementation by other practices that would be helpful for any physician getting ready to enter the EMR market. [17]

COSTS OF AN EMR

Economic considerations in going digital present one of the largest barriers to entry for practices. Costs can include purchasing hardware, software, networking equipment as well as time spent for data extraction and input. The initial price for software typically ranges from $1000 to $3000. There are costs associated with transition time in addition to training costs. Transition time refers to the time it takes to move from the paper record to an actually functioning EMR. Upgrades/maintenance contracts, extra modules, and vendor support can cost extra. Being able to manage these financial risks by becoming knowledgeable in the field and assessing the practice's needs exhaustively is essential. A spreadsheet has been prepared by the American Academy of Family Physicians (AAFP) that allows a practice to calculate initial and annual operating costs. [18] Using this spreadsheet as a tool can aid in coming up with a proposed budget and expected expenditures.

HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT (HIPAA)

The Health Insurance Portability and Accountability Act (HIPAA) is probably the most important piece of legislation affecting electronic transactions and it is important to secure software that can become aligned with these standards. HIPAA already includes strict codes for the uniform transfer of electronic data, including the following transaction types:

- 837 Health care claims or equivalent encounter information
- 835 Health care payment and remittance advice
- 837 Coordination of benefits
- 276/277 Health care claim status
- 834 Enrollment and disenrollment in a health plan
- 270/271 Eligibility for a health plan
- 820 Health plan premium payments and
- 278 Referral certification and authorization. [19]

HIPAA also addresses patient rights regarding personal health information, including the right to access this information and to limit its disclosure. [20] Also to be implemented in 2003 are specific physical, procedural and

technological security protections all health care organizations must take to ensure the confidentiality of patients' medical information. [21] There are more than 400 online formats for processing health claims. HIPAA will mandate everyone to use the same format.

According to AAFP's article "What You Need to Know About HIPAA Now", claims submissions, claims status reporting, referral certification and authorization, and coordination of benefits will be affected. [22] The article also outlines HIPAA's privacy and security regulations. HIPAA applies to "protected health information (PHI)," which is basically medical information that contains any of a number of patient identifiers including name, Social Security number, telephone number, medical record number or ZIP code. The regulations protect all individually identifiable health information in any form (electronic, paper-based, oral) that is stored or transmitted by a health care provider. [23]

HIPAA also mandates that health care providers, health plans or clearinghouses (all known as covered entities) that electronically transmit medical information such as billing, claims, enrollment or eligibility verification adhere to HIPAA regulations. Business associates like a billing service are not exempt from HIPAA and must have security measures in place to secure individually identifiable health information. This is known as a "chain of trust" relationship. Business associates must also ensure that the individuals who are the subject of the information have access to it. [24]

HIPAA protects an individual's right to the privacy of his or her medical information. Providers would have to obtain a signed consent form in order to use and disclose PHI for activities related to treatment, payment and health care operations and to obtain a separate authorization to use or disclose PHI for any other purposes (e.g. marketing). [25]

A covered entity under HIPAA would be expected to protect the integrity of the health information it holds and prevent unauthorized breaches of privacy such as might occur if data is lost or destroyed by accident, stolen by intent or sent to the wrong person in error. "Security measures can be physical (e.g., locking rooms and storage facilities), administrative (e.g., policies and procedures covering access to information, user IDs and passwords) or technological (e.g., encryption of electronic data and use of digital signatures to authenticate users logging into a computer system)." [26] The security and privacy requirements for HIPAA are expected to be published in the Spring 2003. Details of these requirements are expected to have an important impact on EMR programs, as they would be expected to perform within these guidelines. [27]

HIPAA directs the Secretary of the Department of Health and Human Services to coordinate with the Secretary of the Department of Commerce in adopting standards for the electronic transmission and authentication of signatures with respect to the transactions referred to in the law. [28] This rule was developed in coordination with the Department of Commerce's National Institute of Standards and Technology.

It should be noted that an electronic signature is not required for any of the currently proposed standard transactions. [29] The electronic signature process involves authentication of the signer's identity, a signature process according to system design and software instructions, binding of the signature to the document and non-alterability after the signature has been affixed to the document. [30] The generation of electronic signatures requires the successful identification and authentication of the signer at the time of the signature. [31]

David C. Kibbe, author of "What You Need to Know About HIPAA Now" comments that "it will be almost impossible to control access to PHI using paper-based systems and processes." He goes on to say, " Consider the haphazard treatment of paper documents in most offices. They are passed from one person to the next, photocopied, occasionally misplaced and often left out in public view. The intent of the HIPAA standard is to discourage this practice." [32] He believes "the unmistakable legacy of HIPAA will be to encourage computerization of all personal health information, regardless of who creates, stores or transmits it", addressing the inevitable question of "How else can providers meet HIPAA's exhaustive requirements to document all releases of information, produce audit trails, and be able to inform patients about who has accessed their medical information?" [33] He goes on to conclude that "the alternative to computerizing patients' medical information will be to maintain massive paper logs kept under lock and key." [34]

Kibbe's comments support the immediacy of medical informatics in today's practices. With legal infrastructure being laid out now, all offices will need to evolve their practices. Medical Informatics will become the tool to facilitate this change.

HIPAA was passed by Congress without additional federal funding for Human Health Services (HHS) promulgation of

the regulations, industry education or industry implementation. HHS has thus adopted a sequential approach to the release of HIPAA standards. [35] Final modifications in the Financial/Administrative Transactions and related Code Rules, the Security Rule, Employer Identifier, Notice of Proposed Rule Makings (NPRMs) for the National Provider and National Health Plan Identifiers, and Final Privacy Rule Modifications can be found on the HIPAA Administrative Simplification website at http://www.aspe.hhs.gov/admnsimp. [36]

HEALTH LEVEL 7 (HL7)

In addition to the efforts of HIPAA there is a standard in data exchange known as Health Level 7 (HL7). Health Level 7 is one of several ANSI (American National Standards Institute) accredited Standards Developing Organizations (SDOs) operating for the healthcare arena. A description as well as the mission of HL7 can be found on their official website. [37] "Most SDO's produce standards (sometimes called specifications or protocols) for a particular healthcare domain such as pharmacy, medical devices, imaging or insurance (claims processing) transactions. Health Level Seven's domain is clinical and administrative data. Their mission is: "To provide standards for the exchange, management and integration of data that support clinical patient care and the management, delivery and evaluation of healthcare services. Specifically, to create flexible, cost effective approaches, standards, guidelines, methodologies, and related services for interoperability between healthcare information systems." [38]

The key of HL7 lies in the potential integration of different software applications working together. This is best illustrated by the HUB model, which has been adopted by Columbia Presbyterian Hospital in New York. The HUB model focuses around a middleware application known as the hub. Its main job is to provide data translation and control. Other departments using different applications "plug" into the HUB's sockets. Each application can be configured to access another department but must go through the HUB to be routed. This allows for the sharing of information across various platforms. The flow of information from one application to another makes use of the HL7 standard. For example, the billing department may need to access a patient's address information to send out a bill, however the contact information lies on the database maintained by the Admissions, Discharge, and Transfer (ADT) department. The billing software will send a request to the HUB, which will relay that information to query the

ADT's database and package the data in a format that is accessible by the billing software. This model allows for tremendous flexibility because it works with existing software that may already be in place at different departments and gives control to where information is allowed to flow. This would also give each department some autonomy in using a software application that is best fit for their functionality. By not getting locked into a software application there is less dependence on one single vendor. Sockets for the HUB can be added or removed as the needs of the practice evolve. Though this paradigm is more applicable for larger institutions it has practical implications for small group practices, which is to consider flexibility and expandability when choosing a product.

COMMERCIAL EMR SOLUTIONS FOR THE ALLERGIST

The number of commercial products on the market continues to rise with each application providing a different level of functionality for each practice. With respect to the Allergy specialty a few products have been specifically designed for this entity's requirements. One such solution developed by Medical Technology International called Harmony® offers an Allergy module that plugs into its main system. This tracks important Allergy relevant clinical information at each encounter including: treatment planning, pulmonary function tests, laboratory results, prescriptions, educational handouts for patients, patient assessment forms, immunizations, workmen's compensation screens, and antigen profiles. [39]

The Harmony suite is composed of separately purchased modules including electronic billing, EMR, scheduling, inventory tracking, business card scanning (I-scan), accounting, and voice recognition. This program can also be integrated with external informational services including laboratories, is thus far HIPAA compliant, and uses the standard HL7 technology (Please see HL7 section discussed previously). [40]

Digichart Allergy is another commercial Electronic Medical Record (EMR) application that focuses on the history, tests and treatment of patients as it pertains for Allergists. Limited programs presently are tailored towards the needs of allergists, but larger players in the EMR arena are likely to reach out to develop software for specialists.

HOME BREWED AND OPEN SOURCE EMR SOLUTIONS

A group of doctors have developed a basic electronic

medical record system that runs on Microsoft Access. This system not only captures patient data, but also provides reminders for prevention procedures.[41] A reminder database that has been inspired by physicians wanting to manage patients who frequently fail to return for follow-up visits for diabetes, lipid management, pap smears and mammograms has been developed by Dr. John Bachman. This database is also run on Microsoft Access and is downloadable for no charge.[42] There are also shareware solutions that can easily be found at sites like http://www.download.com and http://www.nyerrn.com/z/s.htm . These shareware applications are often free for a period of time and carry a fee ranging from 20 dollars to 200 dollars, however, they do not have the breath that commercial software programs offer. Nor do they directly address HIPAA compliance issues.

There are also open-source organizations that are specific to medical informatics. The basic idea behind open-source is distributing software to anyone completely free with no strings attached. The source code is provided to allow modifications and users to add functionality to it. The result is the software evolves at a much faster rate with no price tag. Three such sites revolving around open-source in health care include Euspirit [43] , Openhealth [44] , and Oshca. [45] Downloadable software is available as well as direct communication with programmers who have been updating the software.

THE FUTURE OF MEDICAL INFORMATICS

Medical Informatics continues to re-invent itself with the advancement of technology and the changing demands of medicine and medical bureacracies. This article has attempted to arm the health care professional with knowledge in this field and to serve as a stepping stone for further inquiry, interest, and action.

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