Implementing an electronic medical record system in a rural general practice

To the Editor: Worldwide, there is an inexorable trend towards electronic medical records (EMR), particularly in developed countries. Virtually every general practice in the United Kingdom is now computerised and half use electronic patient records.[1] The National Programme for Health and Information Technology (NPfIT), for the health and social services in England, aims that every patient's medical record will be held electronically. This EMR will be available online, as required, to healthcare professionals and patients, both for hospital and ambulatory care.[1] In the United States (US) in 2005, it is estimated that 25% of physicians in ambulatory practice used some form of EMR.[2] The US government has made promotion of Health Information Technology one of its highest healthcare priorities.[2] EMRs are also used in developing countries, although they are generally small projects funded and supported by organisations in the developed world.[3]

There is evidence that EMR could increase the delivery of care that would adhere to guidelines and protocols, enhance the capacity of providers to perform surveillance and monitoring for disease conditions and care delivery, reduce rates of medication errors and decrease utilisation of care. Effects on the efficiency of care and the productivity of physicians are mixed.[4,5] Despite the limited evidence of its effectiveness, advocates of EMR view its adoption as a fundamental catalyst for change in medical practice. With EMR systems, it is hoped that doctors will have all the information they need at the exact time and place they need it and computerised decision support will ensure that they use the information to make and implement correct decisions. Patients will also be able to interact directly with their EMR and become partners in maintaining their health and managing their own illnesses.[2]

After 16 years in solo general practice, I decided to change from paper to EMRs. My reasons were as follows. I had 68 912 registered patients, each with a paper record. I needed more storage space, records seemed increasingly misfiled, and thick records were falling apart. I was frustrated in monitoring chronic conditions, e.g. HIV/AIDS, diabetes, hypertension and asthma. These conditions generate data that needs tabulation to quickly follow trends over time. As a dispensing practice, I needed a program for stock control and compliance with dispensing regulations. By law, each medicine dispensed has to be recorded and have its batch number and expiry date linked with a named patient. The billing program that I use in my practice for submitting accounts to medical aid schemes did not have these facilities.

This report describes the process of development, implementation and an evaluation of an EMR system in a rural general practice after 24 months of operation.

Development of an EMR system

I sourced an IT firm from the Internet to develop a software program specifically for my practice. I did not choose an existing commercial program as (1) I wanted ownership of the program so that it would do what I specifically wanted in my practice. (2) In the event that a software vendor ceased trading or charging excessive support costs, I had the option of getting support elsewhere. Data may be lost or corrupted when changing to another software program. (3) I wanted an open-source program that could be freely used by other doctors or clinics. There was a report on the development of an EMR for the South African public sector[6] but development was handed over to a commercial company (L de Wet, personal communication). I requested that the program have the following features or functions: open-source software, fields for patient demographic data, weight and height with automatic calculation of actual and ideal Body Mass Index (BMI), recording in a Subjective, Objective, Analysis, Plan (SOAP) format, a problem list, past medical history, allergies, laboratory results, a field for comments (e.g. mother has HIV/AIDS, smoking), stock control and printing of medication labels. Additional features that are planned are fields for specific chronic disease data that can be displayed as a graph, prescribing controls so that I cannot inadvertently prescribe a drug to which a patient is allergic and avoid adverse drug interactions, patient information leaflets, International Classification of Primary Care, Second Edition (ICPC2) coding, incorporation of scanned copies of patient correspondence, ECGs and digital images, and links for Mini-Mental examination and paediatric development assessment.

Linux (Suse version 10.1) was used for the operating system mainly for its security, stability, and the ability to maintain the server via the Internet from a remote location. The servers use Apache Web server software, currently the most popular web server software in general use. MySQL was used for the database engine. Data is entered through a web-based interface powered by PHP as the scripting engine and flash technology as the front-end. The data model was a coded database structure.[3]

A local area network (LAN) system was installed with five computer workstations linked to a central server. A second server was installed for backup. Data is replicated between the machines so in the event of problems, the second server can take over. The network was linked by wireless initially and later changed to cable. The five workstations were located in the reception area, two consulting rooms, a treatment room and the dispensary. Each computer and server has an Uninterruptible Power Supply (UPS) for protection again power spikes, sags and outages. A 7-kW petrol generator was bought for backup power.

Implementation

The EMR was implemented on 1 February 2006. An IT consultant was on hand for a week to train the GP and staff (a receptionist and two assistant nurses), and to sort out any glitches. For most registered patients, I estimated that it took one or three minutes to summarise the paper record on the EMR system. It was time well spent as it was valuable to summarise. For example, I had missed Pap smear intervals in some patients and forgotten to put incidental findings, like haematuria, in the problem list. I had concerns that I would be engrossed in typing with the computer and would lose eye contact and all the non-verbal cues in the consultation. With practice, I can now touch-type and there is no loss of eye contact when taking a history. While consulting one family member,

it is now very easy and fast to access the record of any family member without requesting the secretary to take out paper records. Thus details of deaths, HIV/AIDS status or any other information can be recorded in all relevant records. Prescriptions and patient orders are legible and clearly visible. I take the portable hard drive (that backs up all the EMRs) home every evening so that a copy of data is safe from fire or theft. Finally, I use Open Office and do not pay licence fees for Microsoft® products.

After two years of EMRs, there have been problems. I had an alphanumeric system, in MS Excel®, of patient names and addresses for my card system. The card numbers for surnames beginning with S were corrupted on transferring to the new system. The wireless system needed frequent resetting, particularly after power failures or surges. It was easy to reset after being once given instructions by phone. However, after a year, two computers were not operational due to wireless card malfunctions. The support provider couldn't source wireless cards compatible with Linux Suse version 10.1. As technology had improved, newer cards would not work. A cable network then had to be installed. After 15 months, the backup server and portable hard drive both malfunctioned and were sent for repairs. During that time, one of the two hard drives in the remaining server crashed and I had to open the server to disconnect that hard drive. The downtime was 30 minutes and the data for one day was lost. There were two instances during the year when we could not register new patients. This was sorted out within 15 minutes by remote Internet support. The UPSs for the servers both failed during a power surge and the software malfunctioned so that I couldn't enter medicine prescriptions. Again, this was corrected by remote support. For locums, it is initially difficult. However, my staff can show a locum how to work the system and the readily accessible list of drugs makes prescribing easy. Scanners and printers do not routinely support Linux and it is necessary to download software from the Internet to operate them. The system is not integrated with the practice billing program and medical aid accounts are sent separately. This involves a staff member's transferring information from the EMR to the billing program.

The costs of the EMR system to date are as follows:

- Software development: R13 500
- Hardware, wireless and LAN: R35 000
- Generator and installation: R7 000
- Monthly support: R700 per month

Lessons learned

The development and the software was the easiest part of the EMR process. Operational issues are the challenge. Telephonic and Internet support is vital and must be available during office hours.[7] The GP (or manager) in a practice must be willing to learn about computers. This is particularly so in a rural practice where support is 900 km away in Johannesburg. Under telephonic instruction, I learnt to open the casing so that I could replace wireless cards and hard drives, and blow out dust. The staff (none of whom had done a computer training course) needs continuous training. They need to know how to teach a locum to use the system, reset passwords, reset a UPS, and switch over to a generator in the event of a power failure. It is expensive to change to an EMR system.

It is difficult to quantify any gains in productivity and efficiency. The EMR system has made data entry and retrieval very fast, and it is very efficient in following disease markers. I look forward to doing research with the readily accessible information. There was no disruption to the practice in switching over to EMRs. This is in contrast to implementing EMR systems in more complex organisations where the process is fraught with difficulties. Introduction of an EMR to a non-profit healthcare organisation in Hawaii created several challenges. Many users felt the selection of the system was detached from the local environment, sparking doubt and resistance, and problems with software development increased local resistance, as did clinicians' reduced productivity.[8] Implementation of a hospital information system in Limpopo Province failed for similar reasons.[9]

Future developments

The program is ready to go to another level of development, with the incorporation of additional features and decision support. However, decision support is technically difficult[3] and it is now prudent to seek partners in its development. This EMR system, together with other candidate systems, could be assessed by the South African Academy of Family Practice with a view to developing a system for use in clinics and GP practices, both in South Africa and in WONCA African countries. Software development could be supported by collaboration between departments of family medicine, in association with university computer departments or an IT firm. Improvements should be available free to anyone using the EMR system that is selected. Users of the system can contract an IT firm of their choice to install the system for them and provide operational support.

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O'Mahony D, MBBCh, DCH, DTM&H, DPH, DIPMIDCOG(SA), FRCGP
Family Physician

Correspondence to: Dr Don O'Mahony, e-mail: omahonyd@softdux.co.za

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