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REVIEW ARTICLE

Computerization of data in diabetes centers

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Information technology has made its in roads into clinical diabetes practice. Both hardware and software are accessible and available. The reason why its full potential is not being harnessed is the bottleneck at the end-user or the practicing clinician. It is not to berate the practising physician but to say that implementation requires more than mere availability [1].

Currently computers are in widespread use in administrative work: to set up appointments, for billing purposes and printing of prescriptions. They are often linked to the lab services and the pharmacy for error-free transmission of information and drug delivery. Many of the current clinical laboratory instruments have embedded microchips which interface with a computer and quality control software. IT is being used quite extensively even though many of us are not aware of the same.

What are the practical difficulties in using electronic medical records (EMR) at the point of care by the physician in the consultation room? This brings out a number of constraining factors, although the strengths of capturing data by computerization is well recognized. The constraints against the use of EMR include a relatively rigid system of data entry, difficulty in capture of non-structured data (including descriptions and line diagrams), and the need to acquire skills to communicate with the patient while feeding data to the computer system. The last requires work-flow analysis in which the physician must have a logical sequence for eliciting the information (viz diabetes-related eg duration of diabetes, treatment, associated conditions such as hypertension, coronary artery diseases, system wise, viz general condition, related to cardiovascular, respiratory, abdominal and skeletal system, personal habits including smoking, alcohol use, physical exercise, and in women, menstrual status) [2].

The depth and breadth of information capture also depends on the purpose to which the information is sought to be used; is it to have a medium or coarse grained information on the large patient population who undoubtedly presents to physicians? Or is it to use specific information for a specific purpose? For someone wanting focused information, that part is expanded (eg diagnosis of angina, frequency and severity of physical exercise). One must bear in mind it is a trade-off between the depth of information gathering versus the time that is available for each patient encounter. It also depends on the kind of infrastructure that is available. One can have a physician-assistant enter the data outside the consultation room while the patient has arrived and is waiting. This can be made available to the physician before the patient presents to him/her. Or an internet-based system may be used for the patient himself/herself to enter the information. Alternatively a touch-screen system may be arranged for patients to key in the data in the waiting space.

In addition to the infrastructure, it also depends on what kind of interaction the physician wants to maintain with the patient. By entering all the information while the patient sits across the table, it is possible to observe and assess not just what but *how* the information is given.

Once the ground plan for data capture is in place, it must be converted into an appropriate software. This requires close interaction with software professionals.

Such physician-specific instruments are like ‘bespoke’ clothes: good but expensive. Should generic software be made available, most of the outlines would be ready, but

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customization is still essential for appropriate use in the particular physician's office [1, 2].

The systems can be linked among the physician, nutritionist, podiatrist, clinical psychologist, nurse educator and any other members of the health-care team. All the data would be entered, consolidated and accessed by each member. Controls can be devised to regulate what and how much can be seen, entered or edited by each member of the team. An edit-track system with electronic signatures can be generated for later review.

Such electronic medical records (EMR) can be constructed to capture data in detail at the first encounter. Limited but relevant information can be displayed in the follow up visits (e.g. duration of disease, current age, weight, blood pressure, biochemical values, smoking status, exercise, compliance). Follow up data can be scrolled down.

The system can incorporate a logical rule based system in which the diagnoses or instructions are automatically generated in the diagnosis field, depending on the data (e.g. diagnosis depending on the age of onset, hypertension if entry for 'hypertension' field is yes, 'to stop smoking' in the prescription if the entry shows that the person smokes.

Flags can be generated to repeat the lipids at the next visit if dyslipidemia exists, or at the annual visit as a routine depending on the quality guidelines provided by national or international diabetes organizations.

Images (X ray, ultrasound, MRI, CT) can be captured and be part of medical records [3].

Rule based flagging system can be incorporated to warn against drug interactions and to suggest the use of drugs prophylactically (e.g. aspirin).

Online information can be used for differential diagnosis [4]. Similarly knowledge information systems such as Update [5] give point of care information both on the desktop and mobile devices.

It is also possible to have touch-screens where patients and their attendants can access interactive educational material about diabetes and healthy lifestyle advice, to prevent diabetes and to manage the disease. An internet based diabetes risk screening instrument can also be provided. Amalgamation of demographic, clinical and genetic information can improve the sensitivity of predicting the risk of metabolic complications; such additional data can be added on to the existing screening procedures [6, 7].

Interactivity offers personalized information and can also profitably use the waiting time, while optimizing the time of health care professionals who can use the resultant extra-time for more value-based activities.

The clinical performance by the diabetes-care team can be audited once the information and procedures are captured live [8]. Rather than retrospective analysis, live capture will offer real-time feedback on performance and suggest corrective actions. This feedback can be either passive (i.e. the health-care provider will be able to access when required) or proactive, in which the information is provided even without being specifically asked (i.e. rule-based or expert-system).

In addition, questionnaires on well-being, quality of life and other parameters can be captured using touch-screens on-site or via the internet. These would provide a measure of psychological parameters, based on which clinical-care is fine-tuned. Geographical networking among different diabetes care centers located anywhere would offer a method to pool the data [9], which can be analyzed perhaps by neural-network or other artificial intelligence systems so that the performance can be further refined [10, 11].

Patients on self-home-blood glucose monitoring or continuous glucose monitors can upload their readings and send it across in advance of their visit to the diabetes centre. Visual representation of the glucose values over time and summary and descriptive statistics would improve the advice offered by the physician.

Privacy issues must be considered and ensured once the data is scattered in different physical locations and is not confined to the hard disk at the physician's office. Reliable encryptation methods are available and must be implemented [2]. Similarly the issues of data ownership and of ethics also arise, which must be addressed.

Images (X rays, CT, MRI, angiograms) can also be lodged on a central server(s) and information accessed at the point of care.

'Smart card' technology can be used to carry medical information with the patient, synchronizing the updated data after each clinic visit. Security issues must be addressed by incorporating either biometric (e.g. finger print) or other encryptation methods to prevent misuse of data in case of physical loss. Methods can be devised to lock the data as in case of cell phone loss now. Accessibility of medical information is important when the patient presents to a different medical care facility [12]. Both internet-based and smart-card based systems offer such data sharing methods. However it would be necessary to sort out data-sharing and privacy issues.

Point-of care access to evidence-based information prevents errors in prescriptions, supply of drugs and in warning against possible drug interactions. This requires transport of systems to hand held devices such as smart phones or dedicated equivalent portable systems.

Technology exists to describe, model and improve delivery of medical care [13] National societies such as Research Society for Study of Diabetes in India (RSSDI) are in a position to take a lead in translating these concepts to reality in the management of diabetes.

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