

## Electronic Medical Record Systems in Israel's Public Hospitals

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**Key words:** electronic medical record, physicians' use of computers, medical data sharing, patient data, standards for data transfer

### Abstract

**Background:** Various medical centers in Israel have recently incorporated electronic medical record systems. Knowing the EMR systems' features and pattern of use is an essential step for developing locally and nationally integrated systems.

**Objectives:** To evaluate the status of EMR systems in all major general hospitals in Israel in terms of the applications used and the patterns of use.

**Methods:** Structured questionnaires were sent to hospital directors and directors of medical informatics units of 26 general and pediatric hospitals serving the vast majority of the population in Israel. The questionnaire included questions pertaining to the EMR systems, their usage, and the attitude of the participants to data security issues.

**Results:** Of the 26 general hospitals 23 (88.4%) returned the questionnaires. Of these, 21 (91.3%) use EMR systems. Twenty-seven different types of systems are in use in Israeli hospitals, and generally more than one type is used in a hospital. Physicians work with EMR systems in over 98% of the departments. Also, the EMR systems are used for clinical admission and discharge in over 90% of the departments and for medical daily follow-up in about 45%.

**Conclusions:** Most of the hospitals in Israel use EMR systems but there is no standard data model. Physicians are the main users but the amount of data entered is still limited. Adoption of standards is essential for the integration of electronic patient records across Israeli healthcare organizations.

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The term electronic medical record refers to the electronic collection and storage of clinical narrative and diagnostic reports specific to an individual patient. The EMR system is an evolving concept that responds to the dynamic nature of the healthcare environment and takes advantage of ongoing technological advances.

It is common belief that EMR systems can improve the quality of care and decrease healthcare's total costs [1,2]. EMR systems allow for more complete and accurate data collection [3,4], access to decision support tools, alerting of medication contraindications, and reminders to physicians [5,6]. In addition, data accumulated in EMR systems can be used for clinical and pharmaceutical analysis, for outcomes research, for public health decision-making and for long-term healthcare policy planning. However, in practice, EMR systems are still far from fulfilling their potential within healthcare organizations [7]. The number of physicians using EMR systems around the world is still relatively small, and the existing systems are not as efficient as they were expected to be. Several issues have

consistently constrained the efforts to build effective medical record systems. These are: a) the need for standardized clinical terminology; b) concerns about data privacy, confidentiality, and security; c) challenges of data entry by caregivers and allied personnel; and d) difficulties associated with the integration of record systems with other information resources in the healthcare setting [5,8].

Community physicians and hospital physicians have differing needs from EMR systems. Community physicians work in their consulting room, seeing one patient at a time on a one-to-one basis. Hospital physicians work in teams and in many places within the hospital: wards, outpatient clinics, and offices. Hospital EMR systems should be connected to all the service units like imaging, pathology, pharmacy, and operating room. Consultants see patients in wards, patients sometimes get readmitted to different departments, and physicians and nurses work closely with daily orders that can be computerized. Thus, in hospital medicine there is a complex workflow, job specialization and division of labor, which create a complex and diverse pattern of information use [9].

The reduced motivation to use EMR systems can be attributed mainly to the fact that not all the information about a patient can be captured in a single system. One of the main benefits of EMR systems is that they allow continuity of care between the community and hospitals [10]. Due to its electronic nature, EMR systems provide the means to access all clinical information about a patient and are available to the patient's healthcare providers at all times despite geographic distances. The value of an EMR system to a physician depends on its contents. Access to laboratory and radiologic examinations and to data from other patient-provider encounters increases the usefulness of EMR systems [8,11]. Through a patient's encounters with healthcare providers the patient leaves a trail of medical information in many systems. Even within a single organization such as a hospital, many pieces of information exist. Each system may contain different data and different data structures and often uses a different coding system to identify similar clinical concepts [8].

External systems owned by other organizations differ even more than those within an institution, making the integration of data a very difficult task. In a recent survey by the Medical Records Institute, an American institution that promotes the development and acceptance of electronic healthcare records, information technology managers, physicians, nurses and non-IT healthcare managers stated that the main reason for implementing electronic health records is to improve the sharing of patient data [12]. It is

EMR = electronic medical record

IT = information technology

therefore clear that the integration of information from disparate sources is crucial for making EMR systems more relevant and for increasing their use.

In some countries efforts are being made to develop regional or national networks for integrated EMR systems that will allow access to patients' data from the various points of care. While healthcare organizations may have their own EMR systems, common standards for terminology and technology allow communication of data. In Greece, for example, the HYGEEAnet project is creating a regional health information network for the island of Crete [13]. Similarly, one objective of the Canadian Infostructure project [14], launched in 1999, is to create a unified network of electronic health records across the continuum of care.

In the UK, the National Health Services Information Authority proposed an information strategy that will allow lifelong electronic health records for every person in the country with round-the-clock online access to patient records for all NHS clinicians [15]. Similar efforts are being undertaken in the United States by the Department of Health and Human Services, which launched the National Health Information Infrastructure to provide access for individuals and authorized providers to lifelong health records [16]. In Australia, a health information network (HealthConnect) was established to collect health-related information about an individual in a standard, electronic format to be available for retrieval at any time [17].

Israel is a relatively small country and has several characteristics that can help in the implementation of integrated medical records. These are

- Every citizen has a unique identity number, so that he/she can be easily identified by every healthcare provider in the country.
- Only four health management organizations provide healthcare to the entire population, all of which use EMRs. The two largest HMOs use the same EMR system.
- All healthcare organizations and hospitals have to report to a single agent, the Ministry of Health, which can enforce the codes to be used in their reporting.
- Other issues driving towards integrated EMR systems are the relatively high mobility of citizens inside a small country and the possibility of changing from one HMO to another, assured by the National Health Insurance Law of 1994.

To our knowledge, no data have been published about the use of EMR systems in Israeli hospitals. The aims of this study were to map the use of EMR systems in Israel's major hospitals, to understand their patterns of use, and to address issues related to barriers impeding the use of EMR systems such as security issues. We expect that this study will help the move towards integrated EMR systems in Israel.

## Materials and Methods

Structured questionnaires were sent by mail in the summer of 2001 to 25 major general hospitals and one pediatric hospital in Israel. The questionnaires were sent to the hospitals' directors and directors of medical informatics units. Follow-up telephone calls

were made to all participants in order to explain the study and its goals and to reassure the participants of the anonymity of their institutions' data.

The questionnaire contained three major sections. The first consisted of check-off or yes/no questions about technical characteristics of the EMR system, such as operating system, manufacturer, database program on which the EMR system was based, and about the network environment. Additional questions inquired about connectivity to other database systems, e.g., demographic information, medical laboratories, imaging departments. The second section of the questionnaire consisted of checklist questions on functions present in the EMR systems and concerns about security and privacy. The third section consisted of a table with questions on the usage of the EMR system by various personnel in the hospital. Participants were asked to fill in which departments actually used the EMR, who were the users (physicians, nurses, secretaries or other personnel), and for which tasks (admissions, hospital discharges, clinical follow-up).

We used SPSS version 11 for statistical analysis. Spearman's correlation coefficient was calculated to test the association between ordinal variables. Chi-square test was performed to compare the categorical variables between different departments.

## Results

Of the 26 hospitals, 23 (88.4%) returned the questionnaire between November 2001 and February 2003. Of those, 21 hospitals (91.3%) used EMR systems. Hospital deputy directors or medical informatics' staff filled out the questionnaires. The size of the hospitals varied from 75 to 1,267 beds (median 500). Twenty-seven different EMR systems are in use in these hospitals. One EMR system is used in 11 hospitals, another two systems are used in 4 hospitals and four other systems are used in 3 hospitals. Nine of the hospitals use one EMR system in all hospital departments. Three hospitals use two EMR systems while the other hospitals use three to five different EMR systems. The average number of EMR systems in use within one hospital is 2.4. No correlation was found between hospital size and the number of EMR systems in use (Spearman  $r = 0.086$ ).

All hospitals except one use a Windows operating system, four also use DOS, and three use UNIX as well. The exception is a hospital with an open VMS operating system. All hospitals used a LAN network environment to run their EMR systems.

Regarding EMR connectivity to other systems and departments within the hospital, 90.5% of the EMR systems are connected to the central demographic repository and over 85.7% to laboratories. Fifty-two percent are connected to surgical units, blood bank and radiology department, and 50% are connected to the pathology department.

The respondents were asked about the presence of specific EMR system features and future plans to introduce them within the next 2 years. The results are summarized in Table 1. The most frequent function is retrieval of laboratory results and/or imaging studies, found in 85% of the hospitals. Some type of decision support system is present in 20% of the hospitals, and 55% did not plan to introduce it.

NHS = National Health Service  
HMO = health management organization

Regarding data security, 75% of the respondents were concerned about inappropriate access to patient records information by authorized users within the organization, 65% were concerned about violation of data security policies and practices, and 55% about access to patients' information by unauthorized users outside the organization. Thirty-five percent indicated inadequate standards for data security and limited data security functionality in vendor systems, and 20% claimed that there is inadequate data security protection on the Internet. All hospitals use a password as a security measure. Table 2 specifies the security guidelines, standards and features present in the hospitals.

Altogether, 299 clinical departments use EMR systems in all the hospitals surveyed. Physicians use the EMR system in over 98% of the departments. In about 29% of the departments, they are the only users and in 32% a secretary uses it as well. Table 3 details the use of EMR systems by the staff in all departments, specifically

**Table 2.** Security guidelines' standards or features

	Presently used (% of hospitals)	Neither used nor planned (% of hospitals)
Passwords	100.0	0
Data security procedures	80.0	5.0
Firewalls	65.0	15.0
Backup and recovery procedures	80.0	15.0
User access by role/class/action	35.0	45.0
Audit logs	60.0	10.0
Electronic signatures	35.0	5.0
Data encryption	5.0	70.0

**Table 3.** Percentage of users of the EMR in all departments surveyed, specifically internal, surgical and pediatric

	All departments (n=299)	Internal (n=71)	Surgical* (n=51)	Pediatric** (n=27)
Physician	29.1	31.0	35.3	29.6
Physician and nurse	9.7	11.3	3.9	22.2
Physician and secretary	32.1	38.0	31.4	25.9
Physician, nurse and secretary	21.4	14.1	21.6	14.8
Physician, nurse, secretary and other personnel	6.4	5.6	5.9	7.4
Nurse	0	0	0	0
Secretary	1.3	0	2.0	0

\* Surgical departments include: general surgery, vascular surgery, thoracic surgery and heart surgery.

\*\* Pediatric departments include: pediatric and pediatric surgery.

**Table 1.** Functions supported by the EMR\*

	EMR supports the function (% of hospitals)	Function neither supported by EMR nor planned (% of hospitals)
Requisition of past records and examinations	45.0	15.0
Retrieval of lab tests and/or imaging studies	85.0	5.0
Clinical data repository that supports texts and codes (CPT, ICD-9) for billing purposes	65.0	15.0
Data warehouse to support research and isolate outcomes for statistics research	55.0	25.0
Decision support	20.0	55.0
Storage of images (PACS)	35.0	35.0
Voice recognition	10.0	80.0
Single database in the hospital	50.0	5.0
Web-based EMR	10.0	75.0

\* Rows do not total 100%, since there are hospitals in which the EMR partially supports the function; therefore, respondents stated both that the function is present and that the function is planned. For example: in a hospital with different EMR systems, some of the systems may support the function while others do not.

**Table 4.** Percentage of tasks done with the help of the EMR in all departments surveyed, specifically internal, surgical and pediatric

	All departments (n=298)	Internal (n=71)	Surgical* (n=51)	Pedia- tric** (n=27)	P
Medical admission and discharge	94.3	98.6	98.0	96.3	NS
Nurse admission and discharge	38.9	35.2	37.0	48.1	NS
Medical daily follow- up	46.3	49.3	43.1	48.1	NS
Nurse daily follow-up	20.5	21.1	15.7	40.7	<0.03
Surgery reports	NA	NA	49.0	NA	NA

\* Surgical departments include: general surgery, vascular surgery, thoracic surgery and heart surgery.

\*\* Pediatric departments include pediatric and pediatric surgery.

NA = not applicable, NS = not significant.

internal medicine, surgical and pediatric. No significant difference in the use of EMR systems was found between the departments.

Table 4 summarizes the use of EMR systems in the clinical departments. Over 90% of the departments use the EMR system for admissions and discharge of patients. About 40% use the EMR system also for daily medical follow-up and for nursing admissions and discharges, and 20% use the system for daily nursing follow-up. Surgical procedures are documented in the EMR in almost 50% of the surgical departments. We found no significant differences in the pattern of use between the internal medicine and surgical departments, but nurses' use of the system for daily follow-up was greater in the pediatric department (40.7%) compared to the internal (21.1%) and surgical (15.7%) departments ( $P < 0.03$ ).

## Discussion

The vast majority of Israel's hospitals uses EMR systems. Many different systems are in use and most hospitals use more than one EMR system. This represents a barrier to data exchange between hospital departments. In a hospital setting, where patients are sometimes transferred or readmitted and can be treated in various

departments, the lack of data exchange diminishes the value of electronic records. The presence of several different EMR systems also causes difficulties in creating a single hospital network where the departments are connected to each other and to other hospital systems (e.g., laboratory), maximizing the amount of data available to the clinical staff.

The variety of systems seems to indicate that in many hospitals the introduction of EMR systems was a departmental initiative at a time when there were no plans for an integrated hospital system. In many cases, non-clinical systems, such as demographic systems for admission and discharge, were incorporated before EMR systems, representing legacy\* systems that must be integrated somehow with the new systems. Most hospitals seem to be trying to overcome this barrier by increasing the connectivity between EMR systems and other systems within the hospital. Several unifying measures are being planned, such as construction of a single central database in the hospital, connectivity to PACS (Picture Archive and Communication System), and to laboratory systems for requisition of tests as well as retrieval of past results.

Although most respondents stated that Web-based systems are not planned in their institutions, we believe that this answer may not be final. The rapid changes in information technology and solutions for integration of diverse systems over the Web, like XML-based solutions, make Web-based systems good candidates for future development of EMR systems.

Voice recognition and decision support systems are present in only a few hospitals and are not included in the future plans of most hospitals. Voice recognition does not appear to be essential at this stage, since we found that the percentage of Israeli physicians typing data directly into EMR systems is much higher than in other countries.

Respondents did not show much concern about security on the Internet because their systems are not presently Web-based. Their basic concern is inappropriate access to patient record information by authorized users within the organization. It is important to note that although this concern is very common and was also reported in a survey by the Medical Records Institute [11], it exists also with paper records. Electronic records with passwords and logs are probably better protected from unauthorized access by persons within the organization than paper records.

Physicians are the principal users of EMR systems in Israel. This fact is extremely important, because during data entry into the system physicians can be supported by other tools linked to the system such as decision support systems. Nurses use EMR systems much less than physicians. However, although the percentage of physicians who use EMR systems is high, they use it only for certain tasks. In other words, usability can be improved as the system is not used to its full potential. Most of the data entry is for medical admission and discharge, while the medical follow-up drops to less than 50%, and nurse's follow-up to about 20%. Similar results were found in a survey of the use of EMR systems by physicians in

Finland's hospitals. Physicians reported using EMR systems for far fewer tasks than the system supported [18].

We did not survey the type of data entered. We assume, however, that most data are entered in an unstructured form since the tasks of admission and discharge generally rely on free text. This means that the data presently entered to the EMR system are not structured. Although entry of structured data reduces usability [19], it is best suited for retrieval and facilitates the exchange of data between systems.

Interestingly, there are almost no differences in the distribution of EMR systems' users and in the pattern of usage among the different clinical departments. We thus conclude that the difficulties impeding more extensive use of the EMR system are the same across the different departments.

We sent the questionnaires to hospital directors and directors of medical informatics units and not to the end-users, as our aim was to investigate the institution's policies and general characteristics of the systems in use. It would be interesting to continue this study by addressing the systems' end-users directly.

## Conclusions

Electronic medical records systems have become an integral part of patient records and patient care in Israel. Physicians are the principal users of EMR systems, which is an important factor in the potential use of decision support systems. However, the use of EMR systems is still limited to certain tasks and therefore not all the clinical data are entered into the systems. Efforts should be made to develop systems that are better adjusted to the clinical setting, and healthcare personnel should receive the necessary training and assistance in order to use EMR systems more extensively.

The variety of systems used across the country is challenging in terms of integrating patients' information, both within each organization and among different organizations.

To the best of our knowledge, this is the first study to cover all the major hospitals in the country. We believe that a network of nationally integrated EMR systems is feasible in Israel, being a relatively small country with only four HMOs providing healthcare to the entire population. Existing facilitators can overcome the barriers to achieve this aim. As in other countries, the government should play a central role in this process.

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\* An older computer system or application program that is no longer efficient or compatible with new technology but has not been replaced or modified because of the expense or difficulty.

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*It will be years – not in my time – before a woman will become prime minister*

*Margaret Thatcher's definitive statement, 1974. Mrs. Thatcher represented the Conservative Party in the British Parliament for more than two decades and in 1979 was elected prime minister. She is the only British prime minister who was elected three times in a row, and she served for an unusually long period, 11 years*

## Capsule

### HIV and HCV co-infection

Rockstroh et al. addressed the problem of HIV and hepatitis C virus (HCV) co-infection. Since the decline in HIV-related morbidity and mortality after introduction of highly active antiretroviral therapy (HAART) in 1996, liver disease caused by chronic infection with HCV has become an increasingly important cause of morbidity and mortality among HIV-infected patients infected parenterally with HCV in more developed countries. A third of HIV-infected individuals in Europe and the USA have HCV co-infection. HIV accelerates HCV liver disease especially when HIV-associated immunodeficiency progresses. With the introduction of pegylated interferon in combination with ribavirin, greatly improved treatment options for patients with HIV and HCV co-

infection have become available and have led to sustained virologic response rates of up to 40%. Furthermore, recent cohort analyses have shown that immune reconstitution induced by HAART can improve the course of hepatitis C leading to a decline in liver-related mortality. However, patients with HCV co-infection are at increased risk of hepatotoxicity from HAART. Owing to the high rates of HIV and HCV co-infection worldwide, new improved treatment strategies and guidelines for the management of co-infection remain a major future goal.

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E. Israeli

