Using electronic health records to save money

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ABSTRACT

Objectives Health information technology, especially electronic health records (EHRs), can be used to improve the efficiency and effectiveness of healthcare providers. This study assessed the cost-savings of incorporating a list of preferred specialty care providers into the EHRs used by all primary care physicians (PCPs), accompanied by a comprehensive implementation plan.

Methods On January 1, 2005, all specialty clinic providers at the Israeli Defense Forces were divided into one of four financial classes based on their charges, class 1, the least expensive, being the most preferred, followed by classes 2–4. This list was incorporated into the EHRs used by all PCPs in primary care clinics. PCPs received comprehensive training. Target referral goals were determined for each class and measured for 4 years, together with the total cost of all specialists visits in the first year compared to the following years. Quality assessment (QA) scores were used as a measure of the program’s effect on the quality of patient care.

Results During 2005–2008, a marginally significant decline in referrals to class 1 was observed (r=−0.254, p=0.078), however a significant increase in referral rates to class 2 was observed (r=0.957, p=0.042), concurrent with a decrease in referral rates to classes 3 and 4 (r=−0.312, p=0.024). An inverse correlation was observed between year and total costs for all visits to specialists (2008 prices; r=−0.96, p=0.04), and between the mean cost of one specialist visit over the 4 years, indicating a significant reduction in real costs (2008 prices; r=−0.995, p=0.005). QA was not affected by these changes (r=0.94, p=0.016).

Conclusions From a policy perspective, our data suggest that EHR can facilitate effective utilization of healthcare providers and decrease costs.

INTRODUCTION

Rapidly rising healthcare costs over recent decades have prompted the application of cost-containment methods to medicine, with the goals of improving efficiency, reducing expenses, and increasing the quality of healthcare.1,2 Numerous cost-containment strategies have been proposed. Rigorous experimental studies of the effect of these options are scarce and estimates of their independent effects are not available.2 Health information technology (HIT) and especially electronic health records (EHRs) have the potential to improve the efficiency and effectiveness of healthcare providers.3–5 This concept can be found in the American Recovery and Reinvestment Act of 2009 (ARRA) with its US$19 billion program to promote the adoption and use of HIT and especially EHR.6 ARRA authorizes the Centers for Medicare & Medicaid Services (CMS) to provide reimbursement incentives for eligible professionals and hospitals that meet meaningful use criteria along the road to becoming ‘meaningful users’ of certified EHR technology. This includes using an EHR for functions that both improve and demonstrate the quality of care, such as e-prescribing, electronic exchange of health information, and submission of quality measures to CMS.7

Data on the costs and cost-effectiveness of implementing such systems are not always available,2,5,8 although all cost-benefit analyses predict substantial savings when using EHRs.6

Primary and secondary medical care in the Israeli Defense Forces (IDF) is provided through primary care clinics, military and civilian specialty clinics, and by hospitals. The annual budget is fixed and has to cover all primary and specialty care health needs of the military population aged 18–55 years, including hospitalization and rehabilitation (but not salaries). Some principles of managed care are used, such as pre-authorization for specific services including referrals to a specialist by a primary care physician (PCP).

Comprehensive EHRs developed for the medical branch of the IDF exist at all military primary care and specialty clinics with the capacity to store readily accessible data with high fidelity and to help translate it into context-specific information that can enable providers to work more efficiently (table 1).

On January 1, 2005, a list of specialty care providers was incorporated into the existing EHRs to help the PCPs choose which were preferred. The preference was determined by the actual cost of a specialist visit.

The aim of this study was to assess the effectiveness of using the EHR as a vehicle to promote cost-savings by incorporating a list of preferred specialist providers and fixing a set of referral goals, along with providing comprehensive training to physicians. The program was evaluated over a 4-year period.

METHODS

Study design

In January 2005, 40 specialty clinics that provide medical services to the IDF were categorized into one of four preferred provider classes based on cost criteria, class 1 being the least expensive and the most preferred, followed by classes 2, 3, and 4 (the most expensive). Pre-authorization was required for referral to a class 4 provider.

Classes 1–3 were integrated into the EHRs of 242 primary care clinics. When a PCP decided to refer a patient to a specialist, a list of providers and their classes appeared on a screen (figure 1). This enabled the physician to easily choose a specialist according to financial class and to provide the patient with all necessary documentation, printed from the EHR. This further streamlined the process, as no administrative staff assistance was
needed and the patient did not require approval for the referral. The new process did not impact patients financially, as members of the IDF are not required to pay co-payment fees.

Physician training sessions were held before implementing the change to emphasize the importance of selecting providers from classes 1 and 2 in preference to those in classes 3 and 4. Class 3 providers appeared in the computerized list. For providers in class 4, a pre-authorization process was required. The referral request was approved under specific circumstances, such as to maintain continuity of care. To ensure quality of care, recommended medical and financial criteria were published to help PCPs choose a specialty provider (table 2). The guidelines also allowed medical administrators to measure the integration of the new concept into each clinic quantitatively (table 2). The results were published and distributed to all PCPs and to administrative personnel. If the wait for an appointment was more than 2–3 weeks, the PCP could refer to a class 2 physician. A report about waiting times was transmitted online to the PCP every 2 weeks. Every 2 months each primary care clinic administrator received a report extracted from the EHRs that included the number of referrals to the various providers compared to the target goals. Physicians were also given the incentive that part of the money saved would be returned to the command/unit for improving medical services. No personal financial incentives were given to any PCP.

We reviewed data from the ongoing quality assessment (QA) project of the Medical Corps to determine if the changes made in the system affected healthcare quality. Several teams of two experienced physicians, with at least one of them a board certified family physician, conduct the QA process. The teams use a detailed, established QA protocol. The QA program includes several aspects of secondary healthcare characteristics.

Table 2  Explicit criteria for primary care physician referrals to specialists

<table>
<thead>
<tr>
<th></th>
<th>Medical</th>
<th>Economic</th>
</tr>
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<tbody>
<tr>
<td>Continuity of care</td>
<td>No more than a 2–3-week wait for a class 1 preferred provider</td>
<td></td>
</tr>
<tr>
<td>Geographic proximity</td>
<td></td>
<td>Increase referrals to class 2 by 25% (up to 95% of all referrals to classes 1 and 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less than 5% of all referrals to class 3 and 4 physicians</td>
</tr>
</tbody>
</table>

Data collection

From 2005 through 2008, data collected from the EHRs included number of visits to primary care clinics, total number of referrals to specialists, and number of referrals to specialists in each financial class. This information was compared to the recommended objectives and goals for every primary care clinic. Total costs for every specialist and costs for a single specialist visit were calculated from financial systems and compared year by year. Cost of living increases were factored in using 2008 rates.

The cost to the IDF Medical Corps of incorporating the list of preferred specialist providers into the EHR was also calculated. As no new providers entered the system during the study, the cost was minimal. The annual QA scores from 2005–2008 were extracted from the computerized system and compared year by year.
Statistical analysis
Data analysis was carried out using SPSS V11.0 statistical analysis software (SPSS Inc., Chicago, Illinois, USA). Distributions of continuous variables were assessed for normality using the Kolmogorov–Smirnov test (cut-off at p<0.01). Because continuous variables had distributions significantly deviating from normal, they are described as median (min–max) in addition to mean±SD. Results were compared simultaneously across clinics using the Kruskal–Wallis test and post hoc pair-wise comparisons were made using the Mann–Whitney U test. The χ² test was used to assess associations between categorical variables. The association between cost and time was described by calculating Spearman’s correlation coefficients. All tests were two-sided and considered significant at p<0.05.

RESULTS
From 2005 through 2008, a mean of 1 363 323 visits (range 1 272 845–1 401 190) to primary care clinics were counted annually. Of these, 363 325 patients (26.6%) were referred to a specialist annually. No significant change in either the number of primary care visits (p=0.99) or referral rates to a specialist (p=0.99) were observed over this time.

The number of referrals to class 1 specialists decreased each year and was marginally significant (r=−0.254, p=0.078). However, a significant increase in referral rates to class 2 physicians was observed over the 4-year follow-up period (r=0.957, p=0.042; table 3). A significant decrease in referral rates to class 3 and 4 specialists was observed over the 4-year follow-up period (r=−0.312, p=0.024; table 3).

Changes in referral patterns to class 1 and 2 providers differed according to command centers and forces. Although the different situations of the various divisions, the nature of their operations, and geographic location relative to the providers affected referral patterns, all areas increased referrals to classes 1 and 2.

A significant inverse correlation was observed between year and total costs for all specialist visits (2008 prices; r=−0.96, p=0.04). A significant inverse association was observed between the average cost of a single specialist visit, indicating a significant reduction in real prices (2008 prices; r=−0.995, p=0.005), and reflecting a reduction in mean cost for a single specialist visit over time. Specifically, costs in 2008 prices declined by 4.08% from 2005 to 2006, by 4.96% from 2006 to 2007, and by 2.99% from 2007 to 2008. The cost of developing the application in the already existing EHRs was only 6.1% of the return from using an electronic medical record system. From 2005 through 2008, a significant reduction in total and mean single specialist costs was observed. Because the computerized list of preferred providers was incorporated into the existing EHR system, its implementation cost was low and it was proven cost effective. In addition, referring patients to preferred providers from classes 1–3 was achieved without administrative staff aid. This also increased efficiency by redirecting the administrative manpower engaged in this task to other goals.

Before implementation of the preferred provider program into the EHRs, written administrative guidelines were delivered to PCPs. This method of delivering information was inefficient as the PCPs and the administrative staff did not always receive it, it was difficult to remember the changes, and it did not succeed in creating a preference for one provider over another. We can assume that without incorporating the list into the EHRs, where it would be readily available, and organizing it according to financial classes, the process of achieving recommended referral rates to preferred specialty providers could not have been accomplished as effectively as it was.

We also assumed that due to the almost full capacity of class 1 and the recommendation to PCPs that patients should not wait more than 2–3 weeks for an appointment with a class 1 provider, the target of 70% or more of total referrals could not be reached. The goal of increasing referrals to class 2 providers was achieved, and the mean referral rate to classes 1 and 2 combined was between 89.7% and 90.1% in the years 2006–2008. In contrast, there was a significant decline in referrals to the highest cost providers. This decreased from almost 30% utilization in 2005 to 10.3%, 8.7%, and 9.9% in 2006, 2007, and 2008, respectively. It is possible that the decrease in referral rates to class 4 might have occurred with another process, such as the pre-authorization process, but the increase noted in referrals to class 2 resulted specifically because the program made it easy for PCPs to refer patients to these specialists. From a policy perspective, the system could be improved and made more efficient by adding more providers to class 1.

Setting recommended referral goals for each class for the PCP was an essential complementary step in effectively implementing a computerized list of preferred providers. We chose to set high goals rather than goals that might have been more easily achieved in order to increase referrals to the preferred providers, and we think that this was a reasonable administrative decision based on the outcomes. Still, we were careful to maintain physician autonomy and quality of care, as the choice of specialist was based on medical criteria that superseded financial criteria. PCPs responded well to the changes when the electronic list was implemented, as it clarified the list of specialty physicians, eased appointment setting, decreased paperwork and administrative costs, and streamlined the referral process as all the documentation was easily accessible from the computer. Although no personal financial incentive was given to any PCP involved in the project, we cannot totally exclude the

### Table 3

<table>
<thead>
<tr>
<th>Class</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>p Value</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st class</td>
<td>56.84</td>
<td>58.17</td>
<td>53.47</td>
<td>47.76</td>
<td>0.078</td>
<td>−0.254</td>
</tr>
<tr>
<td>2nd class</td>
<td>15.77</td>
<td>31.56</td>
<td>37.33</td>
<td>42.33</td>
<td>0.042</td>
<td>0.957</td>
</tr>
<tr>
<td>1st and 2nd classes</td>
<td>72.61</td>
<td>89.73</td>
<td>91.3</td>
<td>90.09</td>
<td>&lt;0.0001</td>
<td>0.595</td>
</tr>
<tr>
<td>3rd and 4th classes</td>
<td>27.39</td>
<td>10.27</td>
<td>8.7</td>
<td>9.91</td>
<td>0.024</td>
<td>−0.312</td>
</tr>
<tr>
<td>Quality assessment*</td>
<td>8.35</td>
<td>8.72</td>
<td>8.98</td>
<td>9.14</td>
<td>0.016</td>
<td>0.94</td>
</tr>
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*On a scale of 1–10.
possibility that the program incentives had some impact on the results. However, we assumed that any potential impact would have been minor because incentives were work related and not personal.

A QA project in primary care clinics was implemented in the Medical Corps in 2000. It measures the quality of healthcare in primary care clinics using various criteria. We used the QA scores from the years 2005–2008 as an indirect measure of whether our system influenced the quality of healthcare. Based on the data collected, we did not observe any negative or positive effects attributable to the changes we made in the prioritization of specialty care providers.

Although not specifically measured, it is likely that reduced waiting times and decreased paper work may have a positive impact on patient satisfaction.

Due to the success of this project, all medical services were classified according to financial considerations and were incorporated in the EHR beginning in 2009.

Another outcome of the project was that providers in class 4 experienced a decline in income during the 4 years. Although at first the providers did not accept the new program, in the end they agreed to the process and consequently lowered their prices, and new contract agreements were signed in 2009.

There are several limitations to our report. This was a prospective, uncontrolled, and non-randomized study. It would have been better if there was a control group, but as no other major changes were implemented during the study period, we can associate the trends that occurred to the different steps undertaken in implementing the specialist referral program. Although we did not measure patient satisfaction with the changes, healthcare QA measures did not decline during the process, but rather a non-significant rise was noted, probably attributed to the measurement of quality by itself.

In conclusion, cost-savings programs exist, but computerization, which allows them to be implemented in a highly effective manner, is an excellent platform for economic efficiency. This was assumed in the past and was evaluated in this study. Our data suggest that using EHRs to direct referrals to preferred specialty care physicians, accompanied by a comprehensive physician education program, can play a significant role in facilitating effective utilization of healthcare providers and in lowering costs.

Contributors YB-D: conceived of the idea and wrote the manuscript; HS: data processing; MB: statistical analysis; YM: data processing; TS: operation concept; IH: YB-D: conceived of the idea and wrote the manuscript; HS: data processing; and OB: operation concept and data processing.

Competition of interests None.

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Data sharing statement The manuscript includes all the data.

REFERENCES