Computerizing medical records in Japan

Hideo Yasunaga a,*, Tomoaki Imamura b, Shintaro Yamaki c, Hiroyoshi Endo d

a Department of Health Management and Policy, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan
b Department of Public Health, Health Management and Policy, Nara Medical University, 840 Shijo-cho, Kashihara-city, Nara 634-8521, Japan
c Human-Care Research Group, Mitsubishi Research Institute Inc., 2-3-6 Otemachi, Chiyoda-ku, Tokyo 100-8141, Japan
d National Institute of Public Health, 2-3-6 Minami, Wakoh City, Saitama 351-0197, Japan

Purpose: The present study reports the current status of computerizing medical records in Japan. In 2001, the Ministry of Health, Labour and Welfare formulated the Grand Design for the Development of Information Systems in the Healthcare and Medical Fields. The Grand Design stated a numerical target for “spreading the use of electronic medical records (EMR) in at least 60% of Japan's hospitals with 400 or more beds by 2006.” The objective of this study was to examine the extent to which EMR and order entry systems (OES) have been adopted as of February 2007 and to evaluate the Japanese government's policy regarding the computerization of medical records.

Methods: We conducted a postal survey targeting medical institutions throughout Japan. In February 2007, we mailed self-administered questionnaires to all 1574 hospitals with 300 or more beds, and to a random selection of 1000 hospitals with less than 300 beds in addition to 4000 clinics. Responses were received from 812 (51.6%), 504 (50.5%), and 1769 (44.8%), respectively. We asked questions concerning: (i) the extent to which EMR and OES had been introduced; (ii) the reasons why certain institutions had not introduced EMR and (iii) the subjective evaluation of the efficacy and cost-effectiveness of EMR.

Results: The percentage of institutions that had introduced EMR as of February 2007 was 10.0% for hospitals and 10.1% for clinics. Even the percentage for hospitals with 400 or more beds was just 31.2%, illustrating that the government’s target had not been reached. The most common reason given for not introducing EMR was: "The cost is high" which was observed in 82.0% of hospitals. It was considered that the introduction of EMR could improve ‘inter-hospital networks’, and ‘time efficiency for physicians’ by around 45% and 25% of hospitals, respectively.

Conclusion: Healthcare information computerization in Japan is behind schedule because the introductory costs are high. For the computerization of healthcare information to be further promoted, prices of EMR systems should be lowered to a level which individual hospitals can afford. Furthermore, the communication between EMR systems should be further standardized to secure functional and semantic interoperability in Japan.

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1. Introduction

Developing national infrastructures for health information has become a major political issue in many advanced nations. Since the beginning of the 21st century, rapid developments have been made in healthcare information technology (IT), especially in Europe and the US [1].

In his 2004 State of the Union address, the US President affirmed, “By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care.” (President George W. Bush, State of the Union Address, 20 January 2004). The Center for Information Technology Leadership estimated that the net savings for Healthcare Information Exchange and Interoperability (HIEI) would be $77.8 billion annually, or about 5% of the total annual US healthcare expenditure [2].

In Japan, the first significant developments using IT were achieved in the field of commerce. In January 2001, the Japanese government declared the e-Japan Strategy. The IT Strategic Headquarters, which had been established within the Japanese Cabinet, developed an information infrastructure for business and as a result, e-commerce and the computerization of the financial sector became widespread [3]. To promote the computerization of healthcare information in Japan, the Ministry of Health, Labour and Welfare (MHLW) in 2001 set up the Healthcare Information Systems Examination Committee. In 2002, very little progress had been made in the computerization of healthcare information in Japan, with the percentage of medical institutions that had introduced electronic medical records (EMR) being just 1.2% for hospitals and 2.6% for clinics. In addition, no more than 14.4% of hospitals had introduced order entry systems (OES) [4].

The Examination Committee established the Grand Design for the Development of Information Systems in the Healthcare and Medical Fields, and stated a numerical target for “spreading the use of EMR in at least 60% of hospitals with 400 or more beds across Japan by 2006” [5]. The Grand Design detailed the benefits that would result from the computerization of healthcare: (i) patients will find it easier to make choices between medical institutions; (ii) patients will have access to easy-to-understand medical information; (iii) patients’ waiting times will be shortened; (iv) physicians will be able to provide the best medical care based on the latest medical information; (v) referrals to specialists will become smoother; (vi) patients will be able to obtain more objective second opinions; and (vii) medical accidents will be prevented [6].

More than 6 years have passed since the Grand Design was announced. What has been the extent of progress in the computerization of healthcare information in Japan during this time?

In this study, we conducted a questionnaire survey in medical institutions throughout Japan and examined the current state of the computerization of healthcare information, as of February 2007. We also used the survey to clarify how healthcare providers in Japan evaluated the effectiveness and usefulness of computerization. We took an overview of the specific policies that the Japanese government had so far advanced to promote the computerization of healthcare information. We also examined the real factors impeding computerization.

2. Survey target and method

2.1. Questionnaire survey

The survey was conducted in all medical institutions in Japan (9026 hospitals and 97,442 clinics). All 1574 hospitals with 300 or more beds were chosen. One thousand hospitals with less than 300 beds and 4000 clinics were selected at random. In February 2007, we mailed self-administered questionnaires to 6574 medical institutions chosen as described above. Valid responses were received from a total of 3085 (46.9%) institutions, comprising 812 hospitals with 300 or more beds (51.6%), 504 hospitals with less than 300 beds (50.4%), and 1769 clinics (44.2%).

2.2. Survey categories

2.2.1. Computerization status

Medical institutions were asked if EMR and/or OES had been introduced as of February 2007.

2.2.2. Reasons for not having introduced EMR

The medical institutions that had not yet introduced EMR were asked to select from the following to describe their reasons for not introducing EMR (multiple responses were permitted): (1) The cost is high; (2) the workload of doctors would increase; (3) the workload of nursing staff would increase; (4) the workload of paramedical staff would increase; (5) we are used to the paper system, and it is easy to manage; and (6) there is not much benefit for patients.

2.2.3. Evaluation of the effects of EMR

Hospitals were asked to make a comparison between not having EMR and having EMR, and to rate the following items as either ‘improve’, ‘remain the same’, or ‘worsen’: (i) time efficiency of physicians; (ii) time efficiency of nurses; (iii) time efficiency of testing; (iv) time efficiency of pharmaceutical services; (v) information sharing between healthcare workers; (vi) inter-hospital networks; (vii) prevention of medical malpractice; (viii) space saving and (ix) use for medical research.

For each of the above items, we used the \( \chi^2 \)-test to compare the percentage of ‘improve’ responses between the group of hospitals with and without EMR.

2.2.4. Evaluation of the cost-effectiveness of EMR

Medical institutions were asked to use the following five options to evaluate whether EMR was cost-effective: strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree.

2.2.5. Need for the promotion of healthcare information computerization

Medical institutions were asked to use the following five options to evaluate the future necessity of promoting the computerization of healthcare information in Japan: strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree.
Table 1 – Introduction of electronic medical records and order entry systems by hospital bed numbers

<table>
<thead>
<tr>
<th>Population size (Ni)</th>
<th>Sample size (ni)</th>
<th>With EMR (ai)</th>
<th>With OES (bi)</th>
<th>A_i = a_i / n_i (%)</th>
<th>B_i = b_i / n_i (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 beds or more</td>
<td>485</td>
<td>273</td>
<td>100</td>
<td>225</td>
<td>36.6</td>
</tr>
<tr>
<td>400–499 beds</td>
<td>354</td>
<td>183</td>
<td>46</td>
<td>123</td>
<td>25.1</td>
</tr>
<tr>
<td>300–399 beds</td>
<td>764</td>
<td>356</td>
<td>59</td>
<td>202</td>
<td>16.6</td>
</tr>
<tr>
<td>200–299 beds</td>
<td>1149</td>
<td>99</td>
<td>8</td>
<td>34</td>
<td>8.1</td>
</tr>
<tr>
<td>100–199 beds</td>
<td>2716</td>
<td>185</td>
<td>12</td>
<td>38</td>
<td>6.5</td>
</tr>
<tr>
<td>Less than 100 beds</td>
<td>3558</td>
<td>220</td>
<td>15</td>
<td>26</td>
<td>6.8</td>
</tr>
</tbody>
</table>

EMR, electric medical record; OES, order entry system. EMR adoption rate adjusted for bed numbers = ΣA_iNi / ΣNi = 905/9026 = 10.0%. OES adoption rate adjusted for bed numbers = ΣB_iNi / ΣNi = 2441/9026 = 27.0%.

Table 2 – EMR/OES adoption rate by type of medical institution

<table>
<thead>
<tr>
<th>Sample size</th>
<th>EMR adoption rate (%)</th>
<th>OES adoption rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University hospitals</td>
<td>57</td>
<td>50.9</td>
</tr>
<tr>
<td>Public hospitals</td>
<td>458</td>
<td>22.7</td>
</tr>
<tr>
<td>Private hospitals</td>
<td>919</td>
<td>12.9</td>
</tr>
<tr>
<td>Clinics</td>
<td>1725</td>
<td>10.1</td>
</tr>
</tbody>
</table>

EMR, electric medical record; OES, order entry system.

3. Results

3.1. Introduction of electronic medical records and order entry systems

Table 1 shows the number of hospitals by bed numbers, as well as the adoption of EMR and OES for each group. There was a strong tendency for institutions with a greater number of beds to have higher EMR and OES adoption rates. The nationwide EMR and OES adoption rates adjusted for bed numbers were estimated to be 10.0% and 27.0%, respectively.

Table 2 details the introduction of EMR and OES by medical institution type. University hospitals had a higher rate of adoption, and the rate was lower for private hospitals. The adoption rates at clinics were 10.1% for EMR and 7.7% for OES.

3.2. Reasons why institutions have not introduced electronic medical records

For hospitals that had not yet introduced EMR (n = 1067), reasons given included: “the cost is high” in 82.0%, and “the workload of doctors will increase” in 47.4%. Of the clinics that had not yet introduced EMR (n = 1524), 51.3% stated that “the cost is high”, and 58.4% stated that “the workload of doctors will increase” (Fig. 1).

3.3. Evaluation of the effectiveness of electronic medical records

In terms of the effectiveness of EMR in hospitals, the most common response was “information sharing between healthcare workers” (86.8%), followed by “time efficiency of pharmaceutical services” (63.2%) and “time efficiency of testing” (60.8%). Most notably, “time efficiency of physicians” and “inter-hospital networks” scores were relatively low, at 25.2% and 49.3%, respectively.

For “time efficiency of physicians” and “inter-hospital networks”, the rates for “improve” responses were not significantly different between the hospitals with and without EMR (Table 3).

3.4. Evaluation of the cost-effectiveness of electronic medical records

With regard to the cost-effectiveness of EMR, just 32.1% of institutions gave responses of either “strongly agree” or “somewhat agree.” With regard to the necessity of promot-

![Fig. 1 – Reasons for not introducing electronic medical records. Hospitals: n = 1067, clinics: n = 1524.](image-url)
ing computerization of healthcare information in Japan in the future, the combined responses of “strongly agree” and “somewhat agree” amounted to 49.3%.

4. Considerations

4.1. Policies for the development of healthcare information technology in Japan

In 2002, the rate of institutions that had introduced EMR was just 1.2% for hospitals and 2.6% for clinics [4]. Our survey has revealed that, in 2007, these rates had increased to 10.0% for hospitals and 10.1% for clinics. The rate of hospitals with 400 or more beds which had introduced EMR was higher at 31.2%. However, this figure is far short of the target of at least 60% stated in the Grand Design.

The Grand Design did not state numerical targets for smaller hospitals with less than 400 beds, which make up more than 90% of Japan’s hospitals. Thus, Japan’s policy for the computerization of healthcare information was initially only targeted at larger hospitals.

Most hospitals with 400 or more beds are either university or public hospitals. These hospitals are supported by public money, and had introduced EMR without considering cost-effectiveness. In 2002 and 2003, immediately after the establishment of the Grand Design, the government implemented the Program for the Development of Facilities through the Introduction of Electronic Medical Records, and it subsequently distributed subsidies to 249 hospitals to assist with the introduction of EMR. Almost all recipients of these subsidies were large hospitals. In 2004, these subsidies were discontinued. Therefore, even if private hospitals were to try to implement EMR, at present, publicly funded support is unavailable.

Why is the Japanese government hesitant in securing a budget for the dissemination of EMR to smaller hospitals? In the authors’ opinion, the foremost reason is that there are too many hospitals in Japan. In 2005, the number of hospitals in the US was 5,756, and the number of beds was 947,000 [7]. Japan has about half the population and one twenty-fifth of the land area of the US, and yet there are 9,000 hospitals with 1,800,000 beds [8]. The idea of injecting massive public funds for the purpose of introducing EMR into all of these hospitals has not gained, and is unlikely to gain, public consensus in Japan.

Under Japan’s public insurance system, the adoption of EMR creates almost no gains in revenue for clinics and small hospitals. From 2006, the MHLW made only the slightest of increases in the remuneration of medical treatment paid to medical institutions that have introduced IT. Specifically, public insurance will provide medical institutions with 30 yen (about 25 cents) per patient, in addition to the charge of 2,700 yen for their first consultation. Presumably, this low remuneration provides medical institutions with little incentive to adopt new IT systems.

4.2. Delays in standardization

Our results indicated that only 45% of hospitals considered that introduction of EMR could improve ‘inter-hospital networks’.

Unified terminology and codes to enable the exchange of information among medical institutions, master files of diagnoses, surgical procedures, clinical laboratory tests, pharmaceuticals and medical materials were already standardized and coded in Japan in 2001 [6]. Nonetheless, standardization of communication between EMR systems is behind schedule. There have been no incentives for vendors to build interoperability into their products because their customers are not asking for it. For this reason, very few networks have been built between medical institutions.

4.3. Financial burden of EMR systems in hospitals

This study found that many medical institutions in Japan complained of the high costs of EMR. In fact, the prices of individual EMR systems are considered too expensive in Japan.

The cost for a hospital to introduce EMR is purportedly $10,000–20,000 per bed, and the annual upkeep is 10% of the initial introductory cost (unpublished data). According to the 2005 Medical Economics Survey, the annual revenue of small hospitals with less than 400 beds is $110,000–$130,000 per bed [9]. Hospital management clearly lacks the courage or incentive to incur the costs of EMR with this low level of revenue.

Our results show that healthcare workers in Japan were doubtful if an IT system could save on medical costs and recover the exorbitant setup costs. There is a gap between the cost-effectiveness of EMR which is highlighted by health policy makers, and the cost-effectiveness that in reality is felt by the staff who are at the forefront of medical practice in hospitals and clinics.

For the computerization of healthcare information to be further promoted, it is imperative that the initial cost of introducing EMR be lowered.
4.4. Benefits of computerizing medical records

Probably, the greatest hope that medical institutions have for computerized systems is improvements in the quality of healthcare, especially healthcare safety. In fact, previous studies have revealed that computerization was effective on safety aspects such as the prevention of medication errors [11,12]. The results of our study show that medical institutions that had already introduced EMR evaluated the benefits of EMR comparatively high. It was thought that the use of EMR would lead to greater convenience and hence to a more favorable evaluation.

On the other hand, only 25% of hospitals considered that the introduction of EMR could improve ‘time efficiency for physicians’. In fact, previous reports have revealed that introducing EMR would not result in any dramatic improvement in the time efficiency of physicians [10].

4.5. A critical review of the Grand Design

The current status of computerizing medical records in Japan has fallen short of what the Grand Design envisaged and the goal has not been achieved. In fact, in 2002 the Grand Design mainly encouraged the initial spread of EMR and OES to each hospital. The decisions made were the only ones possible at that time. The Design regarded the communication between EMR systems as a necessary second step but did not mention the detailed models or implementation plans for interoperability and compliance with national standards. It is possible that the failed introduction of the proposed information technology innovations to healthcare systems resulted from such limited decision-making.

5. Conclusion

The overall EMR adoption rate has increased to 10.0% in hospitals in Japan, and hospitals with 400 or more beds have an EMR adoption rate of 31.2%. However, these figures are far short of the target stated in the Grand Design. For the computerization of healthcare information to be further promoted, prices of EMR systems should be lowered to a level which individual hospitals can afford. Furthermore, the communication between EMR systems should be further standardized to secure functional and semantic interoperability in Japan.

Conflict of interest

The authors declare that they have no conflict of interest.

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Authors’ contributions: HY, TI, SY and HE jointly conceived the idea for the study. HY analyzed the data and all authors interpreted the results. HY drafted the manuscript. All authors revised the paper and approved the final version. The authors take responsibility for the content of the manuscript.

Summary points

What was known before the study?

- Healthcare information technology is generally thought to assist in avoiding dangerous medical mistakes, reducing costs, and improving care.
- In 2001, the Japanese Health Ministry formulated the Grand Design for developing healthcare IT systems in Japan, stating a numerical target of at least 60% for the introduction of EMR in larger hospitals.

What this study added to our knowledge?

- Our survey clearly demonstrated that the current status of computerizing medical records in Japan has fallen short of what the Grand Design envisaged. The goal has not been achieved.
- Many medical institutions hesitate to introduce EMR because of high costs and doubts regarding effectiveness for saving costs or improving care.
- Although the Grand Design regarded the standardization of communication between EMR systems as a necessary second step, it did not clearly present detailed models or implementation plans for interoperability and compliance with national standards. The decision with limited forward thinking might have caused Japanese healthcare IT systems to remain immature.

References


