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ORIGINAL PAPER

A Roadmap to Pre-Implementation of Electronic Health Record: the Key Step to Success

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ABSTRACT

Introduction: Initial attempts are made to implement electronic health record (EHR) in Iran, the present study aim is developing a proper roadmap to EHR in pre-implementation phase by expert views on the matter. **Method:** An initial framework was developed for pre-implementation based on reviewing literature on EHR implementation and descriptive-comparative with qualitative approaches in five countries. A questionnaire was designed in several sections using 47 main topics associated with pre-implementation. Cronbach's alpha 0.89 confirmed the reliability of the data. Expert views were used to score each topic based on Likert scale and opinions were collected through Delphi. Then results analyzed using descriptive statistical analysis method. **Result:** Framework of EHR pre-implementation roadmap was presented in four phases: preliminaries, assessment, planning, and method of choosing system vendors. Priorities in each part were determined and reflected in the roadmap using expert views, analyses, and requirements of each phase. It seems strategic planning at different levels; assessment of needs; providing and managing financial resources, setting standards; examining the existing condition was determined as highest priorities in above phases. **Conclusion:** For successful implementation, developing national carefully-designed and well-documented EHR pre-implementing roadmap, Based on country situation, from strategic to operation level is necessary.

Keywords: Pre-Implementation; Electronic Health Record (EHR); Roadmap.

1. INTRODUCTION

Electronic health record (EHR) is not composed on one thing; rather it is a collection of interconnected systems which are based on a set of clinical and managerial tasks (1). As such, a roadmap should be developed for proper nationwide implementation of EHR based on such considerations as dynamicity and temporal and spatial requirements (2). Success in e-health depends on successful implementation of electronic health record (3). The pre-implementation is an important phase which focuses on activities that can facilitate success in the project (4). EHR roadmap is generally developed at national level. Different views propose that once the need for EHR is established, a minimum of essential elements must be included: Assessment, in particular readiness assessment (5, 6, 7, 8), proper planning for implementation (6, 9, 10), determining the need for EHR and selecting a vendor (10), implementation and considerations for related support procedures, final assessment of the system, optimization, maintenance, and EHR support (10).

There are three operational phases to EHR implementation: pre-implementation, implementation, and post-implementation (7, 11). There are the new wave

of EHR implementation In Iran it is defined as electronic health records system project (SEPAS), by Ministry of Health and Medical Education (12). Because of the importance structural, processes, performance aspects and uniformity systems of health care center for the health of the network connection (13), pre-implementation assessment for decreasing failure rate is necessary. The present study aim is developing a proper roadmap to EHR in pre-implementation phase by expert views on the matter in Iran

2. METHOD

An initial framework was developed for pre-implementation EHR based on reviewing literature in numerous library resources, relevant databases, interviews with Iranian experts and scholars, and descriptive-comparative with qualitative approaches in five selected countries, namely England, Denmark, Singapore, Canada, and the United States (Countries with substantial experience and systematic actions in the field of information technology and EHR systems, or with significant progress and changes in recent years). Then elements of the initial roadmap for pre-implementation of EHR were incorporated into

a questionnaire. Content validity, literature review, and advices provided by experts were used to confirm the validity of the data obtained in the comparative study. Moreover, the value, Cronbach's alpha 0.89 confirmed the reliability of the data. The components were designed along four dimensions (preliminaries, assessment, planning, and selection of the system) and evaluated by Delphi method. In this regard, first the initial framework, in the form of a questionnaire, was made available experts in Iran, including health information management experts, medical informatics experts and researchers in academic centers as well as Ministry of Health and Medical Educations with over three years' experience in this area. They were asked to identify appropriate components in each category and also to determine priorities and score these components for proper model of a roadmap in Iran, using a 1-7 Likert scale (1, highest value, and 7, lowest). Thirty questionnaires were confirmed through Delphi and using the average scores for values provided by experts, priorities were determined for designing a proper pre-implementation roadmap.

3. RESULTS

Elements of initial framework pre-implementation roadmap was developed for EHR based on reviewing literature and study countries includes:

a) Preliminaries phase includes: policymakers' call for EHR at national level (7, 11); strategic planning (at national level, and if required, at regional and local levels) (1, 12-13); setting national standards (12, 14) (technical, semantic, and information interoperability) (14); developing of a flexible timeline framework at national level (12, 15); Estimate of potential costs; preplanned meetings; general governance for implementation; establishment a strategic team at national level (14); forming workgroups at national level (16); providing initial solutions to EHR implementation (14); formation of advising teams; assessment of readiness for implementation (14).

b) Assessment of needs (needs and priorities for personnel and stakeholders (17), and patients as well as technical and non-technical needs and expectations including accessibility and high quality of patient-based information (18)) (1, 19); assessment of the existing conditions (19) including; assessment of primary business and clinical workflow within the organization (20), resources (15), types of communications (between patients and providers or among providers) (21), employees involvement (22), documentation (23), data collection and reporting, access to the internet (24), assessment existing problems, assessment data-flow (1), identification and analysis potential area, personnel's readiness in knowledge and skills (25), mapping of the existing workflow (26), state of IT (4, 25), proper and improper existing functions (27); assessment of the state of readiness for EHR implementation (4); assessment of the impacts of changes on productivity (13).

c) Planning for determining the extent of needs for EHR (11); determining uses of EHR in (primary-secondary) operational areas (28); financial management (12) and resources; determining a framework for timing of operational implementation (29); architecture for technical infrastructures including technologies, mapping of technologies and services for standards, focus on integration technologies like Point Of Care (20); setting work strategies and its changes (14); defining core elements of EHR (20); identification of key requirements (30, 31); developing a plan (14) and description of roles and responsibilities (27, 32, 33); determining existing workflow and the impact of changes in existing business workflow (14) including drawing, mapping and reengineering workflow, identifying gaps (20), changes in roles and responsibilities of employees as a result of EHR implementation, redistribution of roles and responsibilities, changes in data flow within and outside the organization (27); determining the approach to project management (one-time or progressive projects) (20); creating IDs for actors involved in healthcare (12); designing and creating databases (34, 35); forming a project team (20); determination system establishment model (34); defining data/information architecture including data/information model, data dictionary, data forms; standards and solutions which are related to EH, conceptual architecture of the system (20); service architecture including types of services, components of services, integrated services, and transfer of services; planning for preparation (planning for assessment of readiness) (20); determining business architecture in the form of key requirements (36) e.g. possibilities for sharing information among organizations and systems (37); defining and designing solutions to business implementation architecture (12) including methods of exchanging data, designing national health portal, messaging procedure, data repositories, and (38); designing a clinical informatics roadmap (22) including coordinating projects and the existing clinical documents, managing clinical items such as medicine, diagnosis, treatment, continuous care including access to record summaries, triage and referrals, referral tools and management, methods for using clinical data (39); planning for required changes in physical space (20); planning for support services (14).

d) Selecting the system and vendor include collecting initial information from organization (40) including identification of the existing conditions, identification of organizational goal, and clarifying the goals respectively (34); method for selecting vendor (7) (approved list or non (27)); assessment vendor and the system after selection (28, 34); making contract with vendor and approval by component authorities (30).

Delphi test based on identified elements indicates that all experts and scholars approved the above mentioned components. In preliminaries of the roadmap to EHR implementation, the average value

of scores assigned by the experts to the main components (1, highest value, and 7, lowest) ranges from 1.28 to 2.43. Seventy-five percent of these main components were assigned to the first quartile of the scoring range (1 and 2) by 75% of the respondents (i.e. “completely agree”). The highest percentage (86.7%) in the category “completely agree” was related to strategic planning at national level (average score = 1.28). This was followed by the “need for calling for EHR by policy makers at national level” and “forming a strategic team” (average scores of 1.34 and 1.68). Average scores ranging in Preliminaries elements are from 1.69 to 2.43. (Table 1).

In assessment phase (Table 2), average scores assigned to total components range from 1.72 to 2.46. Over 80% of experts assigned 1 and 2 (25% of top scores) for the three major components in assessment (assessment of needs, existing conditions and readiness) for EHR implementation in the roadmap. In the first quartile of scores, the highest percentage (86.3%) and largest average score (1.72) belong to assessment of needs while the lowest average score of 2.46 relates to assessment of the impact of changes on productivity.

While no respondent specifically indicated disagreement to the components incorporated in planning phase, the results presented in Table 3 showed that among the twenty five main components of planning, the range of average scores assigned by respondents (1.53-2.27) suggested that respondents “agree” or “totally agree” with the components (first quartile and upper portion of the second quartile) (Table 3).

In initial framework for selecting the system and vendor (Table 4) the average score for the main components range from 1.8 to 2.69, falling among the top 70% scores. 80% of respondents placed “collecting ini-

| | components | Average score |
|----|--|---------------|
| 1 | Policymaker’s call for EHR at national level | 1.34 |
| 2 | Strategic planning (at national level, and if required at regional and local levels) | 1.28 |
| 3 | Setting national standards | 1.69 |
| 4 | Developing a flexible timeline framework at national level | 1.93 |
| 5 | Estimation of potential costs | 1.90 |
| 6 | Preplanned meetings | 2.43 |
| 7 | General governance for implementation | 1.86 |
| 8 | Establishment of a strategic team at national level | 1.68 |
| 9 | Forming workgroups at national level | 1.86 |
| 10 | Providing initial solutions to EHR implementation | 1.93 |
| 11 | Formation of advising teams | 2.24 |
| 12 | Assessment of readiness for moving forward | 1.90 |

Table 1. Preliminaries of the roadmap to EHR pre-implementation

| | components | Average score |
|---|---|---------------|
| 1 | Assessment of needs | 1.72 |
| 2 | Assessment of the existing conditions | 1.83 |
| 3 | Assessment of readiness for EHR implementation | 1.90 |
| 4 | Assessment of the impact of changes on productivity of the system | 2.46 |

Table 2. Assessment phase in the roadmap to EHR pre-implementation

| | components | Average score |
|----|--|---------------|
| 1 | Determining the need for EHR | 2.27 |
| 2 | determining uses of EHR into (primary-secondary) operational areas | 2.13 |
| 3 | Providing and managing financial resources | 1.53 |
| 4 | determining a framework for timing of operational implementation | 1.87 |
| 5 | setting work strategies and its changes | 1.73 |
| 6 | defining core elements of EHR | 1.70 |
| 7 | identification of key requirements | 1.53 |
| 8 | Preparing a plan and defining roles and responsibilities | 1.76 |
| 9 | determining existing workflow and the impact of changes on the existing workflow | 1.87 |
| 10 | determining the approach to project management | 1.93 |
| 11 | creating IDs for actors involved in healthcare | 1.93 |
| 12 | designing and creating databases | 1.80 |
| 13 | forming an executive project team | 1.87 |
| 14 | identifying system establishment model (e.g. client/server, web-based, etc) | 1.80 |
| 15 | defining an architecture for technical infrastructures | 1.57 |
| 16 | determining business architecture in the form of key requirements | 1.90 |
| 17 | conceptual architecture of the system | 1.60 |
| 18 | Defining service architecture including types of services, components of services, integrated services, and transfer of services | 1.70 |
| 19 | Defining data/information architecture | 1.60 |
| 20 | Defining and designing solutions to business implementation architecture | 1.93 |
| 21 | planning for preparation (planning for assessment of readiness) | 1.77 |
| 22 | Defining EHR-related standards and solutions | 1.60 |
| 23 | designing a roadmap to clinical informatics | 1.97 |
| 24 | determining and planning for required changes in physical space | 2.07 |
| 25 | Planning for support services | 2.10 |

Table 3. Planning phase in the roadmap to EHR pre-implementation

tial information for proper selection of the system” in the score 1 or 2 that indicate the highest scores. The components of this phase also have the highest pri-

| | components | Average score |
|---|---|---------------|
| 1 | Collecting initial information from organization | 1.80 |
| 2 | Method for selecting the vendor | |
| | Selecting a vendor from an approved list | 2.38 |
| | Selecting a non-listed vendor | 2.69 |
| 4 | Assessment of vendor and the system after selection | 1.90 |
| 5 | Making contract with vendor | 2.30 |
| 6 | Approval by competent authorities | 2.31 |

Table 4. *Initial framework for selecting system and vendor for Electronic Health Record pre-implementation*

orities based on their scores. Availability of an approved list of vendors in national level has lower average score, and therefore higher priority, compared to non-listed vendor. A huge majority of respondents placed assessment of vendors and the systems in the first and the second scoring level (46.7% assigned 1 and 33.3% assigned 2 as the score for this type of assessment) (Table 4).

4. DISCUSSION

The relevant components in the roadmap to pre-implementation of EHR were reviewed and approved by the experts in four phases. Priorities were identified by scholars and experts. In preliminaries phase of EHR pre-implementation, the components were ranked from the highest to the lowest priorities (P1-P9) in the last column in the Table 1.

In addition to the above mentioned items, based on views determined by the experts with regard to assessment this assessment was divided into two main parts: designing nationwide tests to examine the level of preparation in terms of facilities, equipment, infrastructure and testing the model through a national plan and issuing certificates (14), as the first priority, and evaluation of success in terms of quality, security, and productivity (41), as the second priority. Although identified as the fifth priority, implementation governance, were considered of great importance by experts. Providing financial and human resources (20); requiring adequate participation from stakeholders (12); information governance including frameworks for privacy policy, access to information, and defining frameworks for confidentiality (26, 28) and best practice in EHR implementation; requiring involvement from clinical and managerial sectors in developing and identifying success factors (12); making clear decisions and commitment to strategic goals (1) were identified as the five top priorities in implementation governance.

A study carried out in 2010 on successful implementation of EHR, showed that after careful analysis, it is necessary to design a path to move forward, estimate project expenses, and identify IT solutions to clinical businesses (42).

Esterle and Kourobali (2010) believe government support for implementation, participation by stake-

holders, emphasis on leadership, governance, vision and information governance (e.g. privacy policy), and having national and international standards for health are all needed to develop a coherent information and communication system (19).

Kotter (1996) stresses need for establishment of a system by identifying main opportunities, building a powerful team to direct changes, developing an vision and a strategic plan, linking different strategies, new prospects, removing obstacles, planning for planning, making required changes for improvement including policies that have not been anticipated in the prospect, and creating new approaches in the process (43). McGowan and Cusack (2008) emphasized the need for developing standards for technology and formative assessment of EHR (44). These findings are all in line with the findings of the present study.

As far as assessment is concerned, priorities (P1-P4) in this regard can be proposed in Table 2.

With regard to the first priority, scholars emphasize identification of needs and priorities for personnel and stakeholders, and patients as well as technical and non-technical requirements.

In assessment of the existing conditions, ranking by experts was assigned assessment of primary business and clinical processes within the organization, resources, state of IT, personnel's readiness in terms of knowledge and skills, mapping of the existing procedures, types of communications, proper existing activities, access to the internet, employees involvement, documentation, data collection, and reporting.

Bernstein et al. (2005) proposed comprehensive clinical assessment, analysis of readiness for change, evaluation of clinical performance and analysis of the existing workflows(5). Ajami et al (2011) stated that assessment of readiness, as a part of assessment of EHR implementation, should be considered in the early stages of assessment. Main areas of readiness for EHR implementation include organizational culture, management and leadership, and operational and technical readiness (45). All these findings are consistent with this research.

In planning phase of the roadmap to pre-implementation EHR, priorities were identified and proposed by experts (P1-P9) in Table 3.

Once implementation plan is approved, an executive team is required to operationalize the implementation process. Considerable emphasis has been put on the presence of leaders (CEO, CIO, CFO), clinical core groups (physicians or CMO), and project managers with average scores ranging from 1.79 to 2.33 as well as on the involvement of other persons like IT experts, HIT, clinical staffs, or other staffs (reprehensive of staffs and specialists), general and operational managers, training professionals, and business professionals.

According to the experts in the field of support programs, the highest priority should be given to assessment pre and post implementation followed by creating a integrity framework e.g. tools and instruc-

tions, architecture of clinical knowledge, training at different levels, preparing instructions for communication and information exchange, designing a plan to quality assurance of data/information and accreditation of data quality strategies and designing innovation programs (16) all of which fall in "agree" or "totally agree" category.

An important point noted by the experts was focus on standards. With regard to standard setting, the components can be ranked in terms of priorities assigned by the experts: Terminology standard (46), communications standards (20), privacy policy standard, security and confidentiality (20, 47), defining important guidelines for EHR (12), data/information model standard (20), data dictionary, data classification standard (47), defining conceptual and operational archetype, documentation standards (48), database standards (46), instructions and manuals, registration standard (20), data authentication standards (49), special standards such as reporting and performance measurement standards (47).

Aarts et al. (2004) and Dion et al. (2004) suggest that initial planning increase the possibility of successful implementation (50, 51). Lorenz (2004) notes that in EHR implementation, an organization needs to analyze the state of readiness by identifying core values, understanding overall organizational area of activity, identifying concerns of stakeholders and needs of end users, creating a vision, and identifying basic requirements in order to be able to accept the new system (52).

Hartley et al. (2005) emphasized cost evaluation, team building, defining timeline and framework, implementation, planning for the existing conditions, and training and related activities (29) while Andrews and Smith (2003) stressed planning for technical infrastructure and space optimization (53). Esterle and Kourobali (2010) stressed planning for time, personnel status, stakeholder awareness, implementation approaches, change management, focus on required processes, commitment, complete realization of advantages, and involvement by researchers (19), the latter being consistent with the findings of the present study. With regard to Selecting the system and vendor, priorities (P1-P5) were given by experts to proposed in the last column Table 4.

HRET & CHIME suggested that the first step in selecting a system for an EHR vendor should be evaluation of IT capabilities, identification of infrastructures in the organization, and preparing a list of requirements. Different types of users should also be considered in determining the type of products and clinical requirements. Available hardware and what is operationally needed by clinical staff should be carefully examined (42). These suggestions are in line with the findings of the present study.

5. CONCLUSION

EHR implementation is a complex and multifaceted process which is carried out in several stages

over time. A comprehensive roadmap, particularly in pre-implementation stage, is necessary. Diffused activities in this area seem to create obstacles in EHR implementation and to lead the process to failure in its very early stages in any country. Therefore, it is important to have a clear and well-defined roadmap characterized based on opinions put forward by experts in the same country. In this study with Developing framework for a pre-implementation roadmap is defined as the first step within four fundamental phases: preliminaries with 12 components and 9 defined priorities, assessment with 4 components and 4 defined priorities, planning with 25 components and 16 defined priorities, and finally selecting proper vendor and system with 6 components and 5 defined priorities. It is suggested to implementing EHR in every country, competent authorities, like Ministry of Health, should appoint or establish an EHR agency and develop carefully-designed and well-documented strategic plans and roadmaps at provincial levels for complete successful.

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REFERENCES

1. Amatayakul M. Electronic health records: apractical guide or professionals and organizations. Chicago: american health information management association, 2004.
2. The evolution of the Electronic Health Record: A roadmap for realizing the vision. McKesson Corporation; 2005.
3. Braa J, Monteiro E, Sahay S. Networks of action: sustainable health information systems across developing countries. *Mis Quarterly*. 2004; 28(3): 337-362.
4. Li J, Pek Wee Land L, Ray P, hattopadhyaya S. E-Health readiness framework from Electronic Health Records perspective. *International Journal of Internet and Enterprise Management*. 2010; 6(4): 326-348.
5. Bernstein K, Bruun-Rasmussen M, Vingtoft S, Andersen SK, Nøhr C. Modelling and implementing electronic health records in Denmark. *International Journal of Medical Informatics*. 2005; 74(2-4): 213-220.
6. Carr M. Serving Physician Information Needs, A model for the transition to Electronic Medical Record. *Journal of Health Information Management*. 1999; 13(3): 73-84.
7. Syed-Mohamad SM, Mohd H, Marzuki Z. Pre-implementation Framework for Electronic Medical Record Project.
8. Kucukyazici B, Keshavjee K, Bosomworth J. Best practice for implementing EHR and information systems. Human, social, and organizational aspects of health information systems. New York: Medical Information Science Reference; 2008: 120-39.
9. Electronic Health Record in Iran. Tehran: The Ministry of 2012 [updated 5 Feb 2013; cited 2012 september]; Health and Medical Education:[Available from: <http://it.behdasht.gov.ir/index.aspx?siteid=101&pageid=44723>].
10. Moraveji S. Productivity EHR services in pilots Tehran: ICT news2009 12 september Contract No.: 1088.
11. American Hospital Association. The Road to Meaningful Use: What it Takes to Implement Electronic Health Record

- Systems in Hospitals. Trendwatch: American Hospital Association, 2010.
12. Hendriks J. Realizing the Goal of Electronic Health Records in the United States- Lessons Learned from Canada Sierra Systems; 2009: 9.
 13. National IT strategies – Denmark, England and Canada - National Information Structure Strategic Planning 2009: Available from: www.socialstyrelsen.se
 14. NHSCfH. The National Programme for IT Implementation Guide/Guidance to support trusts that form Local Health Communities in implementing National Programme products and services. Leeds.; NHSCfH; 2007: p. 83.
 15. Deutsch E, Duftschmid G, Dorda W. Critical areas of national electronic health record programs - Is our focus correct? *International Journal of Medical Informatics*. 2010; 79(3): 211-222.
 16. NHSCfH. The National Programme for IT Implementation Guide/Guidance to support trusts that form Local Health Communities in implementing National Programme products and services. In: team IG, editor.: *National Health Services*; 2005: p. 72.
 17. Kaye R, Kokia E, Shalev V, Idar D, Chinitz D. Barriers and success factors in health information technology: A practitioner's perspective. *Journal of Management & Marketing in Healthcare*. 2010; 3(2): 163-175.
 18. AMA. The Road to Meaningful Use: What it Takes to Implement Electronic Health Record Systems in Hospitals. Trendwatch: American Hospital Association; 2010.
 19. Esterle L, Kouroubali A. political and organisational factors influencing large scale implementation of electronic health records. report: Executive agency for health and consumers, 2010.
 20. Canada Health Infoway. EHRS Blueprint/an Interoperable EHR framework. Canada Health Infoway Inc.; 2006: p. 390.
 21. Brown SA, Chervany NL, Reinicke BA. What matters when introducing new information technology. *Communications of the ACM*. 2007; 50(9): 91-96.
 22. California Community Clinics EHR Assessment and Readiness/Starter Assessment. California: California Health Care Foundation; 2010 [cited 2011]; Available from: http://www.nachc.com/client/EHR_Starter_Assessment_final.
 23. Ogrod E. Report of the council on medical service 2000 Contract No.: CMS Report 10 - A-00.
 24. How to Implement EHRs/Step 1: Assess Your Practice Readiness. 2012 [cited 2012 30 september]; Available from: <http://www.healthit.gov/providers-professionals/ehr-implementation-steps/step-1-assess-your-practice-readiness>.
 25. Ahlstrom J. Electronic Health Records (EHR) - Assessing Organizational Readiness. Wipfli LLP; 2010 [cited 2011 November]; Available from: <http://www.wipfli.com/resources/images/11935.pdf>.
 26. A Prescription for Meeting Minnesota's 2015 Interoperable Electronic Health Record Mandate A Statewide Implementation Plan. In: Committee MDoHatMe-HIA, editor.: Minnesota Department of Health and the Minnesota e-Health Initiative Advisory Committee; 2008. p. 103.
 27. Primary Health Care Transition Fund. The EMR Toolkit. In: Canada PHCTFH, editor. Ottawa, Ontario The authority of the Minister of Health /Health Canada; 2006.
 28. Carter JH. Electronic health records: A guide for clinicians and administrators: ACP Press, 2008.
 29. Hartley PC, Jones DJ. EHR implementation. A step by step guide for medical practice: American Medical Association, 2005.
 30. Electronic Health Record in Canada/an overview of federal and provincial audit report. Ottawa, Ontario, 2010.
 31. Wallhouse R, Burns A. WP5 - National reports of EHR implementation. "United Kingdom": Public Health 31.3. 2008. Report No.: EHR-I-National-Report-ABC Contract No.: D11-National-Report-UK.
 32. Moghaddasi H, Sheikhtaheri A. CEO is a Vision of the Future Role and Position of CIO in Healthcare Organizations. *Journal of Medical System*. 2010; 34(4): 1121-1128.
 33. EMR Success Factors. Canada Health Infoway; 2011 [cited 2011]; Available from: <https://www.infoway-inforoute.ca/working-with-ehr/health-care-providers/emrs/success-factors#collaborative>.
 34. Adler KG. How to select an electronic health record system. *Family practice management*. 2005; 12(2): 55.
 35. Prutti D, Sandhu N. National strategies for Health Informatics in Canada, United Kingdom and Denmark. In: Hejlesen O, Nøhr C, editors. *Health Informatics Journal*; Aalborg University: SAGE Publications, 2007: 62-63.
 36. Canada Health Infoway. EHRS Blueprint/an Interoperable EHR framework. Canada Health Infoway Inc.; 2003: p. 218.
 37. EMR Champion Guide. In: Health Do, editor. Saskatchewan: Saskatchewan Ministry of Health, Saskatchewan Medical Association; 2010: p. 18.
 38. McKinnon S. National Electronic Health Record Procurement. MOH Holding Pte Ltd, 2009.
 39. Muttitt S. Is Sustainability of Healthcare Possible without eHealth? The Singapore Experience. eHealth Conference Barcelona: MOH Holding Pte Ltd; 2010.
 40. Solution provider and system support selection. Canada Health Infoway; 2011 [cited 2012 february]; Available from: <https://www.infoway-inforoute.ca/working-with-ehr/health-care-providers/emrs/pre-implementation-guide?start=3>.
 41. Muttitt C, Sarah Singapore's National Electronic Health Record, The Roadmap to 2010. In: Ltd MP, editor.: MOH Holdings Pte Ltd; 2009.
 42. HRET&CHIME. Health Care Leader Action Guide on Implementation of Electronic Health Records Health Research & Educational Trust and College of Healthcare Information Management Executives, 2010.
 43. Kotter JP. Leading change: Why transformation efforts fail: Harvard Business School Publication Corp., 1995.
 44. McGowan JJ, Cusack CM, Poon EG. Formative evaluation: A critical component in Ehr implementation. *Journal of the American Medical Informatics Association*. 2008; 15(3): 297.
 45. Ajami S, Ketabi S, Isfahani SS, Heidari A. Readiness Assessment of Electronic Health Records Implementation. *Acta Inform Med*. 2011; 19(4): 224-227.
 46. Giokas D. Standards at Infoway Overview for HITSP Canada Health Infoway Inc., 2006.
 47. Steen EB, Detmer DE. The Computer-Based Patient Record: An Essential Technology for Health Care, 1996.
 48. MOH Holding Pte Ltd. 2010 [cited 2012 jan 14]; Available from: <http://www.mohh.com.sg/>.
 49. Elgar S. Developments in confidentiality and consent functions to support wider sharing of electronic health records in the UK 2011.
 50. Aarts J, Berg M. A tale of two hospitals: a sociotechnical appraisal of the introduction of computerized physician order entry in two Dutch hospitals. *Medinfo*. 2004; 11(Pt 2): 999-1002.
 51. Poon EG, Blumenthal D, Jaggi T, Honour MM, Bates DW, Kaushal R. Overcoming barriers to adopting and implementing computerized physician order entry systems in US hospitals. *Health Affairs*. 2004; 23(4): 184-190.
 52. Lorenzi NM, Riley RT. Managing technological change: organizational aspects of health informatics: Springer Verlag, 2004.
 53. Andrews S, Smith DM. The pitfall and benefits of electronic medical records (Enhancing your practice), Patient Care 2003: Available from: <http://business.highbeam.com/436950/article-1G1-99811962/pitfallsand-benefits-electronic-medical-records>.