MEDINFO 2007
HISA Ltd Australia
© 2007 The authors. All rights reserved.

Projects Integrating Information Systems are Going Regional – A Systematic Review

Ricardo Cruz-Correia[a,b], Pedro Vieira-Marques[b,c], Ana Ferreira[b,c], Filipa Almeida[a,b], Jeremy Wyatt[d], Altamiro Costa-Pereira[a,b]

[a]*Department of Biostatistics and Medical Informatics, Faculty of Medicine, Univ. of Porto, Portugal*
[b]*Centre for Research in Health Technologies and Information Systems – CINTESIS, Faculty of Medicine, Univ. of Porto, Portugal*
[c]*Informatics Department, Faculty of Medicine, Univ. of Porto, Portugal*
[d]*Health Informatics Centre, Univ. of Dundee, Dundee, Scotland, UK*

Abstract and objective

Integrating Information Systems (IS) is essential to support shared care. Many different integration approaches have been implementation through the years. This paper summarises studies examining approaches to integrate patient data from different IS. The literature was systematically reviewed in the last decade (1995-2005) to identify articles that mention patient records, computers and data integration or sharing. Of 3124 articles, 84 were included describing 58 distinct projects. Most of the recent projects were regional. More recently significantly more IS are integrating referral letters and extending to primary care. We conclude that patient information is becoming more accessible as there are more integrated IS which are more likely to involve primary care and a wider range of patient level data.

Keywords:

computerized medical records systems,
systems integration

Introduction

A patient record is a set of documents containing clinical and administrative information regarding one particular patient, supporting communication and decision making in daily practice, and having different users and purposes. Today more data on patients is recorded than ever before [1]. In hospitals, information technologies tend to combine different modules or subsystems, resulting in a best-of-breed approach. Integration of healthcare Information Systems (IS) is essential to support shared care in hospitals, to provide proper care to mobile individuals and to make regional healthcare systems more efficient. However, to integrate clinical IS in a way that will improve communication and data use for healthcare delivery, research and management, many different issues must be addressed [2-4].

Consistently combining data from heterogeneous sources takes a great deal of effort because the individual feeder systems usually differ in several aspects, such as functionality, presentation, terminology, data representation and semantics [5]. Over the years different solutions to these problems have been proposed and some applied. Many of these solutions coexist in today's healthcare settings and are influenced by technology innovation and changes in healthcare delivery.

This review appraises studies examining the different approaches to integrating patient data from heterogeneous IS. Special attention is given to the type of integration engine and the type of integrated data. Articles published in the English literature with abstracts available were reviewed between 1995 and 2005. We aimed to specifically review the integration of patient data, and how systems are evolving in practice to meet patient, professional and organisational needs.

Methods

Only studies describing or evaluating IS implementation for integrating patient data from heterogeneous IS were selected.

The review team was composed of three Computer Scientists, namely Ana Margarida, Pedro Marques, and Ricardo Correia, one medical doctor Filipa Almeida advised by health informaticians experienced in systematic reviewing, Jeremy Wyatt and Altamiro Costa Pereira.

Studies were identified in the bibliographic databases from September to October 2005. Since there is no specific standardised MeSH term, we developed a search string that includes the concepts of patient record, computers and data integration or sharing. Only articles with an abstract in English were considered. Given the significant evolution in ICT in the last decade, only studies published after 1994 (the last ten years) were included.

Three distinct bibliographic databases were searched: Medline (via Pubmed - www.ncbi.nlm.nih.gov/entrez), IEEE (IEEE Xplore - ieeexplore.ieee.org) and ISI (ISI Web of Knowledge - isiknowledge.com). The query search string used in each database was ((medical or clinical or patient) and record*) and (comput* or digital or electronic*) and (integrat* or link* or sharing or share or shared).

This search method found 2443 articles in Pubmed, 961 in ISI and 414 in IEEE Xplore, a total of 3818 articles. After eliminating duplicate articles 3124 were selected.

All four reviewers from the review team were involved in study selection. Six combinations of reviewer pairs were defined, due to the large number of articles found. The first selection was based on the study title. Each pair of reviewers read 512 titles.

A total of 923 of 3124 articles were selected in this first selection on title alone.

The second phase of the study selection was based on abstracts. Again, six combinations of reviewer pairs were defined. Each pair of reviewers read 154 abstracts.

To maximize specificity, only selection by both reviewers was considered adequate. In cases of disagreement (n=215) a third reviewer was called to decide. A total of 159 out of 923 articles were selected.

The variables examined in this paper are related to these stages and intend to describe the context where the integration takes place (country, date, area covered, institutions involved, type of final users).

To analyse time trends, we divided the total period up into three shorter periods because of the small overall number of projects identified. The first period includes projects with their last publication 1994-1999, the second period last publication 2000-2002 and the last period 2003-2005.

The statistical analysis was performed with SPSS® version 14. P values were calculated using linear-by-linear association chi-square test with significance level of 0.05.

Results

Countries with the most published projects were the USA (15), Germany (8), Greece (6), Denmark (5) and China (4). 60% of the IS covered only a region, while 28% covered a hospital, 9% a department and 4% a whole country. There was a downward trend in publications related to projects that cover a hospital from 57% until 1999, 35% in 2000-02 and 17% in 2003-05 (p=0.022). The number of projects covering a region has increased over the years, and currently represents 73% (p=0,005).

Most of the integrated information comes from hospital IS (68%), with departmental (40%) and primary care (34%) IS representing the next two most frequent institution types. Four projects (9%) integrated information from health portals; all were published in the most recent period, 2003-05.

As expected, all information systems provided access to health professionals. Two recent projects were the first to claim giving data access to patients.

Currently there are more projects carrying out regional integration, especially between hospitals and primary care. Referral letters are mentioned in 8 of the 31 projects described in articles published 2003-05. It is also clear that patients are also becoming active participants because they appear for the first time as a user group in more recent projects.

Conclusion

Our results show an increasing number of publications describing projects which integrate data from multiple IS. This is in agreement with our initial assumption about the interest in improving the communication of health related data to support person-centred healthcare. As the number of heterogeneous health IS grows, their integration becomes a priority. Moreover, we may be witnessing an increasing interest in regional integration between heterogeneous healthcare information systems across different institutions, to help communication between the different stake holders (primary and secondary care doctors, nurses and patients). This is also supported by the increasing communication of referral letters.

Currently people have more mobility, longer lives and health care is more shared than ever before. It is clear that Information Systems are evolving to meet people's needs by implementing regional networks, allowing patient access and integration of ever more items of patient data.

One key omission from the literature reviewed is that most of the project publications failed to mention any type of error detection. We feel that is mandatory to verify the quality of integrated data, so that instead of propagating data errors, alerts regarding data quality can be triggered and correction processes can take place [6].

Note: Due to the lack of space it was not included in this article the references of the studies considered in this review. A full description can be asked to the first author. A full paper of this review is expected to be published in the near future.

References

[1] Wyatt JC. Clinical data systems, Part 1: Data and medical records. Lancet. 1994 Dec;344(8936):1543-7.

[2] Heathfield H, Pitty D, Hanka R. Evaluating information technology in health care: barriers and challenges. BMJ. 1998;316:1959-61.

[3] Berg M. Implementing information systems in health care organizations: myths and challenges. Int J Med Inf. 2001;64(2-3):143-56.
[4] Littlejohns P, Wyatt JC, Garvican L. Evaluating computerised health information systems: hard lessons still to be learnt. BMJ. 2003 Apr;326:860-3.
[5] Lenz R, Kuhn KA. Integration of Heterogeneous and Autonomous Systems in Hospitals. Business Briefing: Data management & Storage Technology. 2002.
[6] Cruz-Correia R, Vieira-Marques P, Ferreira A, Oliveira-Palhares E, Costa P, Costa-Pereira A. Monitoring the integration of hospital information systems: how it may ensure and improve the quality of data. Stud Health Technol Inform. 2006;121:176-82.