RIS/PACS implementation calls for changes in work processes and organizational structure

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Abstract

A Readiness for Change survey was conducted in a radiology department at large Danish University Hospital's in connection with the implementation of RIS/PACS in 2005. The survey was part of a research project concerning organizational factors in the implementation of RIS/PACS and aimed to evaluate the preparedness for the new system and obtain staff members' assessments of co-operation in and among professional groups.

A follow-up survey conducted in May 2014 shows that nine years after the RIS/PACS implementation, users continue to call for changes in system functionality and work processes, and point out organizational shortcomings. *Co-operation in and among professional groups was assessed at the same level as in 2005. The new survey corroborates the 2005 respondents' expectations for change in work processes and organizational structure in as far as their retrospective assessment of the significance of work processes and organizational structure when implementing RIS/PACS remain unchanged.*

It is concluded that the implementation of RIS/PACS involves not only technological issues but also affects tasks, actors and structure in the department, as predicted by Leavitt.

Keywords:

Organizational change, radiology information system, PACS (radiology), evaluation studies, Aalborg University

Introduction

When in 2004 Aalborg University Hospital implemented a radiology information system and picture archiving and communication system (RIS/PACS) a decision was taken to initiate an action research project concerning organizational factors in relation to the implementation of the system. As work progressed, the limited focus on RIS/PACS was abandoned for a more general orientation towards organizational development. The primary result of the research project was the formulation of a shared vision for the radiology department with an action plan listing 35 initiatives. The action plan targeted a wide range of improvements, such as better signposting and floor markings for traffic guidance and the preparation of guidelines for examinations. Efforts to establish a new culture in the department to help secure general respect and recognition of individuals and professions exemplify ideas of greater scope. Only five of the action plan initiatives were connected directly to the RIS/PACS implementation.

As a first step in the action research project, a Readiness for Change Survey (RCS) was conducted in early 2005 to assess the department's preparedness for the implementation of RIS/PACS. In May 2014, a follow-up survey was done to understand the extent and nature of changes over the nine years since the first RCS. A shorter version of the 2005 RCS questionnaire was used.

This paper reviews those aspects of the study that relate to RIS/PACS, partly by comparing responses from 2005 and 2014, partly by examining respondents' suggestions for changes.

Materials and methods

The questionnaire used for the 2005 RCS was an adapted version of the questionnaire for studying the implementation of electronic medical records described in Høstgaard and Nøhr [1], whose terms were substituted by terms relevant to radiology and RIS/PACS.

In 2014 an abbreviated version of the 2005 questionnaire was used, as items relating to staff expectations for the implementation were removed. Other questions were changed to introduce the retrospective perspective that would enable comparison with responses in 2005.

The quantitative analyses of the paper-based 2005 questionnaire were performed using Microsoft Excel statistical software. In 2014 SurveyXact software was used both for the electronic distribution of the questionnaire and the quantitative analysis. For the qualitative analysis, data were reduced via meaning condensation – in 2014 supported by the NVivo analysis software.

In both surveys the questionnaire was sent to all employees in the department. Responses were obtained from 47 % (90 of 191) and 45 % (91 of 202) in 2005 and 2014, respectively.

As shown in Table 1 the response rates for individual professional groups ranged from 35 % to 57 % in 2005 and from 29 to 51 % in 2014 (Table 2).

Table 1 – 2005. Staff numbers and response rates, by profession

Profession	n	%
Radiologists	39	36
Carers[1]	98	55
Secretaries	40	35
Various	14	57
Total	**191**	**47**

Table 2 – 2014. Staff numbers and response rates, by profession

Profession	n	%
Radiologists	52	29
Carers	110	51
Secretaries	40	50
Various[2]	0	0
Total	**202**	**45**

The relatively low response rates for radiologists is unsurprising as physicians' response rates are typically 10 percentage point below average for all professional groups, according to Bowling [2]. The secretaries' exceptionally low response rate in 2005 was understood to stem from their recent experience that survey responses were used to identify candidates for a subsequent round of layoffs.

Results

Use of PC

The recorded increase in computer/PC experience from 2005 to 2014 is unsurprising. The proportion of respondents in the department who assessed themselves as super users rose from 6 % to 11 % while the category of highly experienced increased from 34 % to 63 %. Thus, almost three fourths assessed themselves to be *Highly experienced* or *Super users*.

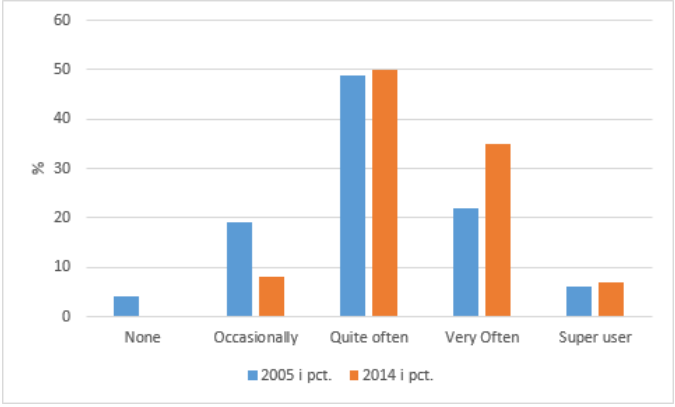

Figure 1 - Experience working with computer/PC

Perceived need for changes before/after RIS/PACS

The 2005 survey asked staff members to assess the need for changes in organizational structure and work processes in the forthcoming implementation of RIS/PACS. In 2014 those 64 % of the 2005 respondents who were still employed in the department were asked to assess the necessity of changes in structure and processes in connection with the implementation of RIS/PACS. Figure 2 below gives responses for organizational structure and work processes as perceived in 2005 and 2014, respectively.

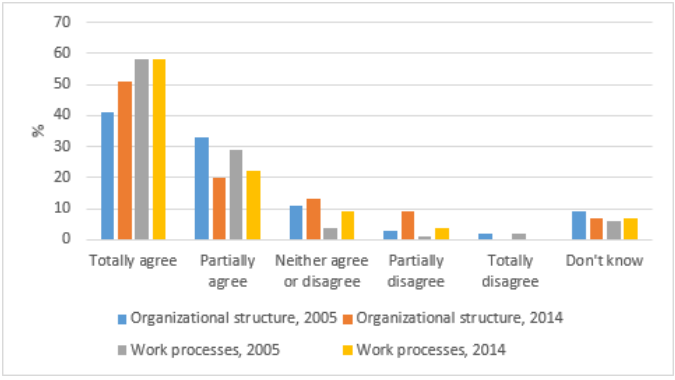

Figure 2 – Perceived need for changes in organizational structure and work processes assessed before/after RIS/PACS

The distribution of responses concerning the need for changes in organizational structure were slightly more dispersed in 2014, while the proportion of responses indicating total agreement rose from 41 % in 2005 to 51 % in 2014. Regarding work processes, the percentage of those who declare themselves in total agreement was unchanged, whereas the *Neither agree nor disagree* category went from 4 % to 9 % while the *Partially agree* category rose by 3 % to 4 %.

Improvement of RIS/PACS via changes in organizational structure and work processes

In 2014 57% of responses ticked either the *Agree* or *Partially agree* button to indicate their view that the use of RIS/PACS would gain from changes in organizational structure while 22 % offered concrete suggestions for helpful changes.

[1] Primarily radiographers and nurses.

[2] In 2014 part of the other tree professions.

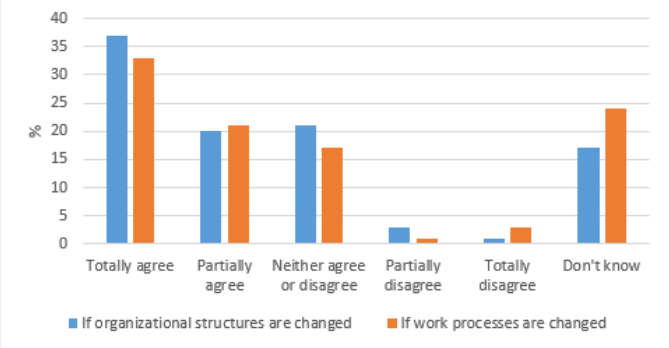

Figure 3 – The outcome from using RIS/PACS could be improved if organizational structures and work processes were changed

With regard to changes in work processes, 54 % of responses indicated either *Total agreement* or *Partial agreement* with statements concerning changes, with 21 % offering concrete suggestions for change. The distribution of responses appears from Figure 3.

The concrete suggestions for change generated by the above questions may be categorized under four headings: functionality, organization and management, training, and support. The suggestions for each of the four categories are discussed below.

Systems functionality:

- shortcut keys needed to avoid excessive clicking of computer mouse
- improved functionality for secretaries' hanging protocol task (image displays)
- improved integration with other systems and modalities, e.g. by:
    - removing the need for simultaneous operation of up to five IT systems
    - securing earlier appearance of referral documents from general practitioners
    - securing automatic transferral of to do lists to all modalities
- integration of systems for digital dictation, speech recognition, and spelling control
- improved overview of patients' previous examinations and the information communicated to them
- modernized/improved user interface and customization options
- optimized examination coding function

Organization and management:

- ensuring correct referrals of patients to examinations and rooms
- proper work stations in adequate numbers
- discontinuation of autonomy and individual rules
- avoiding process duplication in RIS/PACS
- improved management insight into staff members' job tasks

Training:

- time for RIS/PACS user-training
- training to avoid process duplication

Support:

- improved access to IT support as the department depends on RIS/PACS for essential functions such as examination reporting

Co-operation in and among professional groups

In 2005 as well as in 2014, respondents assessed co-operation in their own professional group as better than among professional groups in the department. The assessment of intragroup co-operation increased marginally over the years whereas inter-group co-operation was rated slight lower in 2014. Nevertheless, 90 % and 91 % stated that *co-operation is good* in 2005 and 2014, respectively. Figure 4 also shows than only a very small percentage regarded co-operation as *poor*.

A large majority of respondents indicated, however, that internal co-operation in their professional group offered room for improvement (76 % in 2005 against 88 % in 2014), 39% of those also offered comments or concrete suggestions. A similar picture emerges for co-operation among professional groups, with 92 % in 2014 indicating that co-operation might be improved (77 % in 2005). Comments or concrete suggestions were given by 32 %.

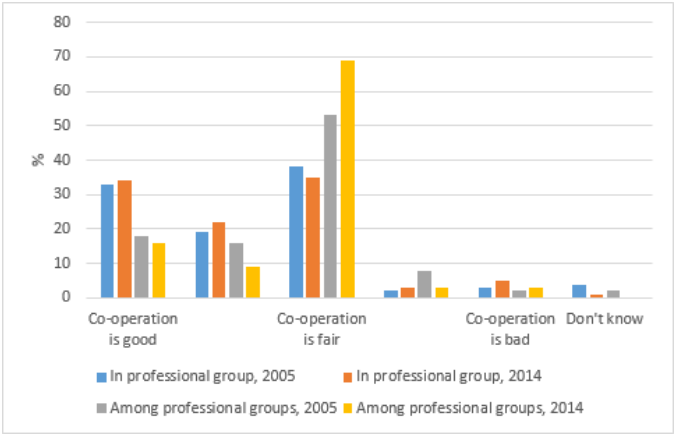

Figure 4 - Co-operation in and among professional groups

Figure 5 shows the relative distribution of all comments concerning co-operation in and among professional groups. Between 2005 and 2014 the greatest increase is seen for *Organization* and *Management*, while issues concerning *Meetings* and *Respect* attracted fewer comments in 2014. Comments on *Communication/information* and *Education* saw little change.

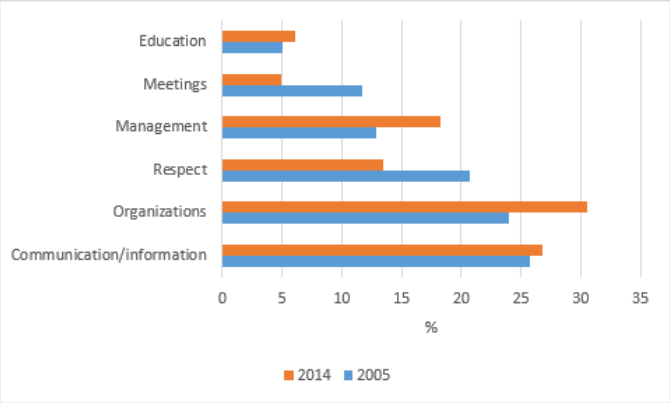

Figure 5 - Comments on co-operation

With respect to comments of relevance to RIS/PACS, several respondents mentioned the working environment, lack of team spirit, and the department's stressful work atmosphere. A shortfall of staff caused by recruiting problems for vacant consultant positions leaves little energy for helping others and scarce opportunity for concentration. Another typical comment concerned the wish for changes in work routines and the department's social culture. There seems to be an understanding that the stressful workday in combination with apprehensions about changes prevents this. Other comments concerned management, for example in calls for a stronger contribution to the formulation of clear guidelines for work in the department.

Discussion

The decision taken in 2004 to implement RIS/PACS at North Jutland hospitals – including the radiology department at Aalborg University Hospital – may be seen as a paradigmatic shift in that paper and film were replaced by the digital RIS/PACS system. In addition to using IT for patient-related information, the department now employs advanced technology for radiological examinations. It follows naturally that today's respondents assess themselves as considerably more experienced computer users. The fact that three fourths of current respondents categorize themselves as *Highly experienced* or *Super users* only serves to emphasize that production and work routines in the department are based on the use of advanced information technology.

The initiation of an action research project focusing on organizational issues (among others: structure, work flow, cooperation, communication, and culture) reflected the recognition that apart from being an IT project, the implementation of RIS/PACS was also a question of adapting organizational conditions and work processes, as pointed out by several authors at the time. [3-7]

A high-profile speaker at a 1998 conference on computer-based patient records, Reed Gardner, is quoted as saying:

"…the success of a project is perhaps 80 percent dependent on the development of the social and political interaction skills of the developer and 20 percent or less on the implementation of the hardware and software technology!" [4, 7, 8]

The controversial statement on the distribution of organizational and technological issues in successful instances of IT system implementations was often cited in the field.

A comparison of responses concerning the need for changes in organizational structure and work processes shows the foresight of the early respondents' assessment of the need for changes. The gain since 2005 in the perceived need for changes in organizational structure may indicate that while many at the time saw a change of work processes as required, they were less inclined to see the importance of changes in organizational structure. The course of events has affirmed this need. Further indication is evident from the responses to the question concerning improvements in the future use of RIS/PACS. Such a need is not only acknowledged – in fact, respondents in 2014 prioritized changes in organizational structure over changes in work processes.

The system model developed by Leavitt clearly shows that when changes are implemented in one realm of an organization, whether they involve technology, tasks, actors, or structure, the other three realms are bound to be affected [9, 10]. The high scores for perceived need of changes in organizational structure and work processes provide support for the aforementioned 80/20 rule (in figure 2 and figure 3). Also Lorenzi and Riley [5, 6] and Berg [7] have focused on organizational factors in the implementation of IT systems in healthcare.

Respondents' assessment that changes in organizational structure and work processes can improve the use of RIS/PACS may be taken either as an expression that the department still has some way to go before its goals are met or that its staff recognize that the implementation and subsequent application of RIS/PACS is a continuing process.

Considering that the questionnaire items concerned organizational structure and work processes, it seems surprising that a relatively large proportion of suggestions for improvements related to functionality instead. A possible explanation may be that respondents equate the concrete functions in RIS/PACS with work processes, or that they took the survey as an opportunity to communicate their demands for improvements in functionality. It is easy to see how functionality and work processes can be confused as the former is intended to support the latter, but it cannot be ruled out that functionality is a limiting factor for the development and adaptation of work processes in RIS/PACS. Alternatively, work processes may have changed without subsequent adjustment of RIS/PACS functionality.

Apart from ideas for changes in functionality, respondents suggested several concrete changes that would immediately facilitate their use of the system. They mentioned more time for training, better support, and adequate access to proper work stations. Improvements in these areas would support the

department's execution of routine tasks which is strongly dependent on the proper functioning of RIS/PACS. However, all of these suggestions would incur immediate costs.

Other suggestions could be implemented without immediate costs; for example that management become more involved in staff members' responsibilities and work processes. Such issues concerned e.g. process duplication in RIS/PACS, the quality of referrals, and putting an end to certain colleagues' adherence to own rules and procedures.

Generally speaking, the majority of suggestions from respondents, for example in relation to functionality, organization, and management, and to training and support would be considered as management responsibilities as far as their implementation is a question of resource allocation. But a number of responses seem to reflect that the department is pressed for resources and understaffed as a result of a lack of qualified applicants for vacant positions. This impression is furthermore supported by the fact that many comments concerning co-operation, whether inside or among professional groups, appear to indicate working conditions in which staff are struggling to keep up.

Discussion of method

In the nine years that have elapsed between the two surveys the health sector has seen numerous changes. A few are listed below:

- The Municipal Reform of 1 January 2007 in which 14 counties were abolished to make way for five regions. In the reform a number of municipalities were merged, diminishing their number from 271 to 98, and changing the distribution of responsibilities between local government tiers [11]. For example, the municipalities were charged with several new healthcare tasks, calling for increased collaboration among them.
- Implementation of the cancer packages guaranteeing patients an effective examination and treatment programme. The majority of cancer diagnoses require radiology departments to perform at least one examination.
- The entitlement to early diagnostic examination, implemented in September 2013, requiring that referred patients be examined within 30 days, places a heavy load on diagnostic departments.
- Increased focus on quality in healthcare. The health service quality and accreditation institute IKAS (Institut for Kvalitet og Akkreditering i Sundhedsvæsenet) was established in 2005 and the first version of the Danish quality model DDKM (Den Danske Kvalitetsmodel) for hospitals was ready in 2009. Today, the accreditation procedure follows the second version of DKKM.
- Regions (supported by the governmental grants) have decided to build new acute hospitals (erroneously referred to as super hospitals by the media) [12].

Conclusion

Overall, a comparison of the results of the 2005 and 2014 readiness for change surveys reveals only minor differences. The evidence supports Leavitt's model of change predicting that technological change will spark the reconsideration and adjustment of tasks, actors and structures in the organization. The 2014 respondents offered many suggestions for change of functionality, but several of them are judged to concern the adjustment of organizational structure and work processes in the department. While the present study did not intend to determine whether the case provides an example of the mentioned 80/20 distribution between organizational and technical conditions, it clearly indicates that the implementation of RIS/PACS involves many other factors apart from technological ones.

Almost a decade after RIS/PACS was introduced in Aalborg University Hospital's radiology department, the 2014 survey offers an occasion for taking stock. It should be encouraging that respondents continue to offer constructive suggestions for optimizing the everyday use of RIS/PACS. On the other hand, their responses also give evidence that their struggle to cope with day-to day responsibilities may in part be the very source of their creativity.

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