



The success of a management information system in health care – A case study from Finland

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ABSTRACT

Purpose: The purpose of this article is to describe perspectives on information availability and information use among users of a management information system in one specialized health care organization. The management information system (MIS) is defined as the information system that provides management with information about financial and operational aspects of hospital management.

Methods: The material for this qualitative case study was gathered by semi-structured interviews. The interviewees were purposefully selected from one specialized health care organization. The organization has developed its management information system in recent years. Altogether 13 front-line, middle and top-level managers were interviewed. The two themes discussed were information availability and information use. The data were analyzed using inductive content analysis using ATLAS.ti computer program.

Results: The main category “usage of management information system” consisted of four sub-categories: (1) system quality, (2) information quality, (3) use and user satisfaction and (4) development of information culture.

Conclusions: There were many organizational and cultural aspects which influence the use of MIS in addition to factors concerning system usability and users. The connection between information culture and information use was recognized and the managers proposed numerous ways to increase the use of information in management work. The implementation and use of management information system did not seem to be planned as an essential tool in strategic information management in the health care organization studied.

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1. Introduction

Information systems are a perennially contentious subject of discussion in health care organizations but the number of studies focusing on management information systems is relatively small. The purpose of this article is to describe perspectives on information availability and information use

among users of a management information system in one specialized health care organization. In this study we define management information system (MIS) according to Naranjo-Gil and Hartman as the information system that provides management with information about financial and operational aspects of hospital management [1].

The use of information technology is obligatory and essential in terms of both clinical care and management function

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due to the information-intensive nature of the health care. In spite of growing investments in information technology, there are still many difficulties in the implementation, use and usability of health care information systems. Compared to other sectors, the internal IT capabilities in health care organizations are inadequate and lag behind in the effective development of information systems to meet the increasing demands for care, quality and efficiency [2,3]. Moreover, health care is a complex environment for information systems due to rapid changes in the operating context and characteristics such professional culture, complex organization structure and management system as well as tension between these and the information systems [2–7].

The emphasis in health care information systems development has been on clinical systems, especially electronic patient records rather than on developing management information systems [8–10]. In Finland, the development and implementation of clinical information systems have been emphasized in national policies and there are numerous diverse information systems. The information provided by these systems, however, is not sufficient for managerial needs. In addition, the strategies of Finnish health care organizations have pointed out the need to develop management function. Notwithstanding, the development of health management information systems has received less attention [4].

1.1. *The success of management information systems in the management of health care organizations*

The fundamental factor for the success of information systems may be the extent to which a health care organization considers its strategies in information management and understands the role of its information systems in achieving strategic objectives [10–12]. As evidenced in recent studies, strategic information management and information system implementation is a major challenge to health care organizations due to a lack of strategic thinking as evidenced in recent studies (e.g. Refs. [10,13–16]).

DeLone and McLean [17] in the field of management information systems and later van der Meijden et al. [18] in the field of patient care information systems, have presented six success dimensions of information systems: (1) system quality, (2) information quality, (3) usage, (4) user satisfaction, (5) individual impact and (6) organizational impact. The system quality dimension consists of the characteristics of the information system itself and is assessed in terms of attributes like system flexibility and accuracy, response time, ease of use, convenience of access and integration of systems. Information quality measures include information system output e.g. information accuracy, usefulness, reliability, currency, format and timelines. System quality and information quality influence each other, and together or separately these dimensions influence use and user satisfaction. This third category refers to the interaction of information products with the user, to system use, information use, or both. Examples of attributes are frequency and regularity of use, use or non-use, attitudes and motivation to use, and difference between the information needed and received. DeLone and McLean integrated use and user satisfaction because in cases of obligatory use user satisfaction is an alternative measure of system value.

The extent of use also has a positive or negative effect on user satisfaction. The influence of an information product on management work and manager's behavior such as quality of decisions constitutes the dimension of individual impact [19]. Organizational impact in turn refers to the effects of the system on organizational performance e.g. process quality, collaboration or costs. In addition, van der Meijden et al. argued that some attributes are related to organization culture such as control and decision-making, management support, professional values and communication. On the whole, success is a dynamic process in which different dimensions relate temporally and causally [17,18].

The development and use of a management information system or any other information system is part of information management in a health care organization. According to Choo, information management is the management of network processes that acquire, create, organize, distribute and use information and it involves policies, information resources and information technology. A continuous cycle of six closely related processes consists of (1) identification of information needs, (2) information acquisition, (3) information organization and storage, (4) development of information products and services, (5) information distribution and (6) information use [20,21]. Every action needs to be planned, organized, coordinated and controlled, especially when many different units and occupational groups are involved in information management in the health care organization.

Managers need information in decision-making regarding their daily work concerning e.g. planning, organizing, staffing, coordinating, reporting and budgeting as well as in clinical management. The information needs of managers working in different units (e.g. in-patient wards, human resource units, financial units) or different levels of organization (strategic, middle or operational level) differ in terms of MIS [20,21]. Furthermore, according to previous studies, the attitudes, skills and knowledge and background of managers influence the information needs and the use of information systems [4,11,22–24]. Among managers with predominantly clinical backgrounds systems that are not directly relevant to patient care are less easily accepted [18] and these managers focus more on non-financial information and prefer a more interactive style of using management information systems than managers with background in administration, who use MIS more for economic decision-making [11]. Furthermore, the studies reveal the need for education and training to enhance the use of information systems in health care [3,11,24].

Nevertheless, information systems are assumed to facilitate managers' work. In the study by Hedelin and Allwood [25] the properties of the information have been identified as follows: appropriate content, form, trust and accessibility to information. As found in recent studies, managers' information needs and the current management information systems, however, do not correspond sufficiently (e.g. Refs. [3,4,16,26]). For example, nurse managers' core information needs were identified in the areas of planning of performance, follow-up evaluation and for the planning and management of organizational changes and resource utilization [27]. However, it is difficult to exactly identify the information needed in decision-making and problem solving [25]. Management information systems improve the quality of decisions because

they enable more comprehensive use of information and promote proactive planning and management of practice [19]. This, however, requires more processed, analyzed and sophisticated information than raw data [26] and the system is expected to encompass both managerial and clinical information as well as information about finance and human resources of health care organization [3,4,22].

So far, only few studies have addressed the connection between information culture and information use. According to the study by Choo et al. [28], information culture was able to explain 30–50% of the variance in information use outcomes. The major reason for information system failure is failure to address and recognize the cultural gap between different stakeholders in a health care organization [5,18]. Information resources, technological tools and policy standards constitute the technical infrastructure of information management. Given this infrastructure, the generation and transformation of information in the organization are shaped by the organization's interpretation of its purpose and function and by its specification of rules, routines, and roles [20,21].

Information culture as a part of organizational culture can be defined as a culture in which the value and utility of information in achieving operational and strategic success is recognized. In such a culture, information forms the basis of organizational decision-making and information technology is an enabler for effective information management. Furthermore, information culture emphasizes communication flows, cross-organizational partnerships and internal environment of cooperativeness, openness and trust. Synthesis of information culture and organization culture is an integral part of the process of becoming a knowledge-based organization in which the availability and use of information are inherent in everyday activities [5,28]. Information systems and information management processes enable knowledge creation, sharing and use [29].

To sum up, the number of studies concerning management information systems in health care is small. However, the management function is strategically central to meeting the future challenges of effectiveness, increasing needs and demands of patients and decreasing availability of staff resources. Information technology plays an important role in information management to enhance information availability and use in the decision-making of health managers' daily work. From the literature it is known that many attributes concerning users, information system, information received and organization affect the usage of information systems. The development of management information systems in a health care environment requires a holistic approach in order to take account of all these aspects.

2. Methods

The data for this qualitative case study was gathered by semi-structured interviews. The interviewees were purposefully selected from one specialized health care organization in Finland. The organization has developed a management information system in recent years. Altogether 13 front-line, middle and top-level managers (nursing, medical, financial, human resources, IT) were interviewed in 2006. Informants

were selected from the list provided by the organization according to the two following criteria: (1) they were familiar with the management information system and (2) they were willing to share their views and participate in the study. All those managers who were selected on the basis of these criteria agreed to participate in this study.

Permission for the study was obtained from the health care organization according to their procedures. The subject of the study was quite sensitive and the managers had varying views and experiences of the management information system. For this reason the anonymity of both the interviewees and the organization was carefully ensured throughout the research process. Therefore, neither the organization nor the interviewees and their personal characteristics are described in detail.

The topics of the interviews were identified from the recent literature and they focused on information availability and information use. There were two researchers present during the interviews, one conducting the discussion and the other assisting and taking notes. The interviews were tape-recorded and transcribed verbatim. The credibility of the research was enhanced by researcher triangulation and peer debriefing. However, in qualitative research the researchers are not neutral toward their research subject [30].

The data were analyzed using inductive content analysis with an emphasis on the content of the discussion. The transcribed data was read through several times. The units of analysis were chosen according to the purpose of the study. A word or sentence was chosen as a unit of analysis. Similarities and differences were sought through which the data was organized. Expressions with the same meaning formed categories that were given a title describing their features. A computer program for qualitative analysis (ATLAS.ti) was used in the analysis. Although the analysis was inductive in nature the results aptly reflected the theoretical aspects introduced previously and thus validate the credibility of the study.

3. Results

The main category "usage of management information system" consisted of four sub-categories: (1) system quality, (2) information quality, (3) use and user satisfaction and (4) development of information culture. These categories emerged from the data.

3.1. System quality

The nature of comments concerning information technology was positive but the number of different information systems and the difficulties in integration and communication between systems was reported to seriously disrupt effective functions in the organization. The information systems in health care are incomplete and the usability is poor according to the informants. In comparison with these critical opinions, the managers' views on the usability of the management information system were quite positive. They found it relatively easy to learn and use although the number of clicks needed was high and the response time too slow causing experiences of frustration, extra work and inconvenience.

... it is that so many new information systems are coming all the time, it is tiredness that there are so many and that they are always in some way or other incomplete

About usability, such simple things as transmission time and the capacity of the server are essential problems.

I argue that there are managers who won't wait up to two minutes many times to notice that the wrong page was loaded.

The views of user education differed in concerning both content and quantity; some argued that there had been ample user education and that in particular technical support was exceptionally readily available, whereas others claimed that they had had no education in using the MIS and they did not even know if any had been organized. Some managers criticized the content of the education to being too technically oriented instead of focusing more on the quality of data and what kind of reports they could get from the system and how to interpret them. The knowledge and skills of managers vary considerably.

The education has been given very inclusively to all (managers) ... the meaning is that all, at least nearly all.

More education and training to use the MIS is surely needed for front-line managers, this kind of feeling I have.

I can go there (to MIS) and I can do some things, basic things, but more complex things I can't.

Convenience and access confused the managers. Basically and theoretically, as one strategic manager described it, MIS was open to all managers but this principle was not yet reality. A few front-line managers suspected that they were not allowed to use MIS even if the access code and password were on hand. There were even doubts that MIS would continue the previous culture of health care in which access to management information is strictly controlled and only open to few selected persons. There had been no discussions on access rights during the implementation of MIS and nobody knew who actually used the system according to informants.

I don't know how wide it (MIS) is allowed to use but I know that at least nurses in charge and their secretaries and I suppose medical directors can use it.

I don't believe that everybody uses (MIS) it but in theory it is available for all.

This (MIS) reproduces the exciting tradition and culture of health care organizations that there is some information and systems which are meant to be used only by certain selected persons.

3.2. Information quality

Not all interviewees had confidence in data accuracy and currency. Data saving is decentralized so that data is saved in the units where it is produced and thus the critical point for accuracy and timeliness is that data saving as documentation of actions is carried out on time, faultlessly and similarly in all units. Some managers assessed this phase as incomplete due to absence of detailed instructions and shared discussions and due to unclear process management. Comprehensive thinking including plain responsibilities and better co-operation

from information management, financial administration and clinical management units were expected. The interviewees considered comprehensive thinking a prerequisite for the maintenance and development of MIS as well as resourcing in order to meet the future needs of a more sophisticated management information system.

The informants were, however, pleased with the format and content of the basic reports (information) from MIS although they simultaneously doubted the accuracy and reliability of the reports because of the previously described unreliability problems concerning data saving (input). Furthermore, data updated with too much delay makes real time information unavailable and this delay in turn diminishes the usefulness of information in planning, decision-making and evaluation and causes haste in budgeting as well. For these reasons some managers also had backup systems (e.g. Excel) for their information management.

In my opinion the basic reports from MIS are quite good and you can get them quickly.

The quality assurance of MIS has not been done ... the managers should take care that the practices are standardized and the data saving is done in the same way in every unit.

You can get information some days, who knows, I have had to draw my conclusions on the basis of other information. This delay is inconceivable and if it is not corrected the groups will decline to use the system, they don't trust it.

We are using some old ways in information management (e.g. Excel) because we can't trust that the needed information is available through MIS.

A frequently articulated aspect of information quality was the need for more multifaceted information products. In addition to the existing basic reports the managers would like to have more analyzed, refined and detailed information from MIS in the formulated information products for different user groups. They thought that too much is left for the end user to mine and edit to meet the information needs and for this they above all lack the time to do. The available information did not support the daily processes and work sufficiently although it was quick to acquire if the database was updated. Again, co-operation and discussions with the financial administration were needed by clinical managers to better understand and take advantage of information in their work.

There are in MIS a huge number of figures, statistics, exact information which an operative manager like me can't take sufficient advantage of because there is too much of it and it is poorly analyzed.

3.3. Use and user satisfaction

The managers widely assessed MIS to be a management tool for top managers and executive groups in different domains of their organization. The marketing and information of MIS had created this notion and for this reason they also thought that members of those groups use MIS regularly. However, some managers stated plainly during the interviews that they did not use MIS at all or they only used the system required for budgeting. Consequently, the quantity and frequency of use

ranged from non-use to weekly use. In addition to direct use of MIS the managers mentioned indirect use in which secretaries used the MIS and printed reports for managers. This echoes the practice before the electronic management information system was implemented when secretaries gathered information, had statistics and graphs, printed and copied to get the necessary reports to the managers.

They have wanted to limit it (MIS) in some way and it has been marketed as a tool for executive groups

Well, I don't use it (MIS) unless I must, but in the planning of action in the near future I am ordered to use it.

It can be seen that some medical directors use MIS actively but some of them don't even touch it. They tell the secretaries to use the MIS and print the information reports.

The main reason for not using MIS, according to the managers, was negative attitudes toward information systems in general and lack of motivation to use the management information system. Moreover, the lack of motivation to learn was also considered to explain incompetence. The managers called for a change in attitudes among those managers who did not use the system. Other reasons for not using the MIS were prioritization of the use of patient information systems by medical and nurse managers and usability problems of MIS. The commitment of the strategic managers, for example, by using the MIS in meetings where middle and front-line managers attend was seen to be important in promoting the use of MIS.

Those who haven't used MIS at all ... it is not their knowledge and skills or that they would not learn but it is the attitude, something like "it is not my business"

I think it is important that we managers are committed and use this tool (MIS). For example we use it systemically in planning and evaluation meetings where chief physicians and head nurses are present, in these situations I open the system and we look at the information together and discuss it, so I get feedback as well.

The managers used MIS mostly in budgeting, planning and monitoring the functioning of their own units. Compared to their information needs in management work they were not very satisfied with the information received. The management information system is based on Balanced Scorecard thinking and therefore the managers pointed out the scarcity of information concerning personnel, clients and processes. Most information needs were presented for human resources management, for example, from training, employee appraisals, well-being at work and staffing because the information received emphasized "hard figures" like vacancies or work input. Automatically gathered patient satisfaction information and feedback information from internal processes to evaluate the quality of daily working were also suggested as a part of the MIS.

One problem is the shortage of information concerning human resources, what kind of information there should be available and how the concepts of human resources are understood, these we are wondering about.

The shortage of feedback information from patients is evident from the daily management point of view.

3.4. Development of information culture

The managers identified some features to further develop the information culture in their organization although many organization cultural features were already revealed in other sub-categories. The managers considered that there should be discussions on systematic information use in decision-making and management on what kind of information is important and essential for different groups of managers. This would also raise the common concepts and meaning so the information received from reports could be better used in the units. According to the managers the information should always be analyzed in units to integrate it into tacit knowledge as well as to promote an information and knowledge sharing culture between units by developing it systematically throughout the organization. Some managers were confused as to whether sharing was allowed or comparing of units acceptable.

... but the use of information is not reflected and it was not marketed in the organization ... it was not discussed together what kind of information is followed up

I do not think that all (knowledge) can be there in the information system but interaction is needed in the units and is important in leadership.

Openness concerning information sharing ... there maybe some hoarding of information in units, they are not giving it to the common database. This is barrier to rational development.

4. Discussion

4.1. Discussion on the results

The purpose of this article was to describe perspectives on information availability and information use among users of a management information system in one specialized health care organization. In addition to considerations of usability and users emphasized elsewhere, our findings revealed numerous aspects, cultural and organizational, affecting the use of MIS.

According to the results the implementation and use of the management information system did not seem to be planned as an essential tool in strategic information management in the health care organization. This emerged from descriptions that the information needs of managers working in different positions and units were not sufficiently identified and discussed and middle and front-line managers especially argued that MIS do not enhance their daily work and decision-making. Even though the managers were quite pleased with the content and format of basic reports from MIS they wanted more processed and sophisticated information and not only financial information but also the contents of human resource management and clinical management to achieve the strategic objectives of their organization. Lack of strategic thinking and inadequate catering for the information needs of

managers have appeared in many recent studies in health care [10,14–16].

A systematic way of identifying all user groups, their information requirements, examining their work and social settings in the organization is essential to meet the different information needs in the health care organization. According to Choo [20], inadequate identification of information needs of different groups is the most serious mistake in information management of organization.

The other factors evidencing the lack of strategic information management were the vagueness of access rights and user education, lack of guidance and general instructions and practice concerning the data saving and unclear process management. These factors and the marketing of MIS have given rise to views that MIS is a management tool for top managers only and among other than top managers especially there was lack of trust in the information received from MIS; some managers even had their own backup systems for their information management. According to Hedelin and Allwood, the properties of information are appropriate content, form, trust and accessibility to information and these did not fully come true in the health care organization studied [25].

The access to MIS also reflects some features that are typical for health care organizations. Firstly, the hierarchical structure of organization determines who has access to the system, not who needs the information in daily practice. Secondly, different professionals have different power resources in the organization and the openness of MIS could change this cultural feature and make their work, decision-making and control more transparent [19]. Thirdly, the non-use of MIS was not really a question of competence for any of the interviewees according to these results, contrary to what has been reported elsewhere [3,11,24]. Those who used the system commented that it was easy to use. In terms of attitudes the finding is more interesting. As a whole the physician managers did not express negative attitudes as such toward MIS, but they had negative attitudes toward management.

According to Choo et al., information culture explains up to half of the information use [28]. Likewise here the managers mentioned many subjects which are essential in developing the information culture in their organization in order to increase the use of information in management work. First of all discussions of systematic information use in decision-making and in other management functions as well as the quality of information used are necessary so that information forms the basis of organizational decision-making. This study confirms previous findings that sufficient information flows, co-operation and openness demand constant attention in health care organizations [5,15,25].

The need to integrate tacit knowledge (connect the meaning, interpret) to information and thus create new knowledge was considered important both at unit and organizational level. Middle managers' role in the design, implementation and use of the management information system and in developing co-operation should be emphasized [1,19]. They could communicate information needs to IT personnel and connect the meaning into information received from MIS and interpret it in practice, thus promoting collective sense making. Similarly, they could enhance the mutual understanding of the impact of MIS on work-load and daily work processes,

which in earlier studies has been found problematic along with usability [1,3,24].

Information systems and information processes are enabling conditions for knowledge creation, sharing and use [29]. There is an increasing amount of information in health care information systems but only some of it is used in management and leadership. In conclusion, the information culture of this health care organization is still developing. Implementing a management information system in a health care organization is demanding, not least because among managers with a predominantly clinical background, and systems that are not directly relevant to patient care are less easily accepted. To achieve the strategic goals of productivity, effectiveness and quality of care information based management is required and the implementation of the management information system as a part of strategic information management should be planned and coordinated as a whole including every phase of the information management process as well as information culture development.

4.2. Limitations

Interviews were carried out in the informants' offices or in other private places in the organization. The atmosphere of the interviews was relaxed and confidential after the interviewees had been assured that neither they nor their organization would be recognizable in the study. Consequently the data gathered was rich, consisting of comprehensive descriptions of managers' views and experiences of management information system in their organization although the interviewees were purposefully selected.

This study reported the results of one specialized health care organization in Finland and thus its transferability is limited except to similar contexts in Finland, although earlier studies do indeed concur with some of the findings of this study. The health care organization actively developed the MIS and therefore the managers were aware of MIS issues. Furthermore, participation in this study was based on interviewees' own willingness. This may enable those who are very critical and those who are very enthusiastic to express their opinions in interviews. However, the study reflects the perspectives of managers with different professional backgrounds and positions.

4.3. Suggestions for further studies

These results point to the need and raise some ideas for further research. It would be necessary to study in detail the use of information in the work of health care managers, especially what kind of information is used and where and how the information is acquired (e.g. information sources). Even though the integration and usability problems of information systems in health care are evident and essential for users, future studies could focus more on the perspective of the community, information culture and strategic information management. Furthermore, we need to know more about the information needs of health care management in the future, since the information systems are specifically designed to meet future information needs. However, it seems that one of the problems relating to MIS is due to this discrepancy between past

Summary points

What was already known about the topic?

- There are still many integration and usability problems with information systems in health care organizations.
- Attitudes, skills and knowledge and background of managers affect the information needs and the use of information systems.
- Managers' information needs and the current management information systems do not match well enough.

What this study added to our knowledge?

- The management information system does not offer valid, accurate and especially more sophisticated information for managers working in different units or levels in specialized health care organization.
- Instead of the problems of health care managers' attitudes, knowledge and skills the shared discussions of the information needed and used in management work is fundamental to improving the use of the information system.
- The connection between information culture and information use was recognized and the managers mentioned many subjects which are essential in developing information culture.
- The implementation and use of the management information system did not seem to be planned as an essential tool in strategic information management in the health care organization studied.

and future, therefore the development of information systems is forward looking and simultaneously the information culture is deeply rooted in history.

Authors' contributions

TK and JL drafted the article, designed the study and analyzed and interpreted the data together. The data was gathered as a part of the larger research project "Managing the Innovations of Human Resources in Health Care". TK was a coordinating researcher on the research project.

Conflict of interest

Researchers have no financial or personal conflict of interest concerning the studied topic.

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