eHealth - System Usability Improvement

Bridging the Gap Between Stakeholders and Nurses

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Abstract

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Electronic Health (eHealth) denotes the practice of information communication technology within healthcare. In the health care sector, eHealth has received countless criticizing from nurses, who constitute the largest group among healthcare providers. This is because it has had little involvement from nurses and continues to undermine the importance of user participation during planning, designing and maintenance of the system. Although it has been stated that the existing limitations of the system are not entirely technical, eHealth systems are not well designed to support nurses’ working processes. This is due to the cumbersome nature of the system which lead to multiple technical difficulties that are encountered while using them. This thesis therefore presents a general background on the current state of eHealth as well as reviews how the stakeholders such as managers and system administrators identify and handle nurses’ complaints during all stages of eHealth systems developing as well as overall software maintenance. In order to meet the objective, the criteria of data collection was through interviews with project managers and system administrators of the systems.

Findings
- Lacking communication among the stakeholders i.e project managers and system administrators as well as between the stakeholders and nurses
- Lack of involvement of nurses in system development and overall maintenance
- Inadequate nurses’ profiling and audience segmentation by project managers and system administrators
- Inadequate end user surveying
- Poor managerial decision making by nurses’ managers
- Lack of proper information technology training for nurses

Conclusion
Continual contact between stakeholders and nurses, proper information technology training, use of surveying approaches such as pre-deployment usability testing, collection of feedback and interaction design could be some of the essential approach in improving the current system in place. In addition, the use of user centered design which directly involves the end user in information system development would considerably narrow the gap between stakeholders and nurses.

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**Glossary**

**eHealth**: Refers to the use of information and communication technologies in healthcare

**ICT**: Stands for information communication technologies

**Cambio**: The vendor that develops Cosmic

**Cosmic**: The system used in healthcare in Region Uppsala

**EHR**: Refers to electronic health records; a systematic collection of patients medical records

**EPJ**: Digitization unit in Region Uppsala; Electronic Patient Journals

**IT-Coordinator**: The second line of system support for medical professions

**End-Users**: The people who use the system

**Nurses’ IT training**: Courses which equips the end-users with the necessary skills to use the system

**Innovation**: Creative system improvement ideas

**Commercialization**: The processes of managing a product for financial gain

**Prioritization**: Arranging system problem areas in order of importance

**Perspective**: A particular attitude towards a point of view

**User Centric Design (UCD)**: a broad term to describe design processes in which end-users influence how a design takes shape

**Interaction Design**: The collection and analysis of experiments both failures and successful system interaction
Introduction

Information plays a huge role in healthcare at all levels. Information collected from scientific sources, patients, colleagues, administrators, and personal experiences is all used in medical practice (Botha, 2016). The way this information is handled, stored and shared influences how effectively and efficiently it can be used. eHealth helps medical professionals with their decisions and actions and aims at improving patient outcomes by enabling clinicians to make better use of information (ibid). This is achieved by improving the ways patient data and medical knowledge are captured, communicated, presented and applied. Although eHealth has had a positive impact on healthcare in terms of fast sharing electronic information and improving patient interactions with medical professional among other things (ONC, 2018), most of these systems have cumbersome design and other technical problems. These problems, which are often compounded with inadequate system training have caused many difficulties for nurses and to all medical professionals at large (Joekong, 2016). Despite a significant body of research on the topic, the cause of the problem is still not solved. While there are many factors which contribute to this, the most common is poor communication and, lack of clarity and transparency within the different levels and organizations involved ().

The two main groups that have been investigated are (Watt, 2016):

- Those impacted by eHealth systems, such as nurses
- Those who are instrumental in shaping eHealth systems and can impact the project such as managers and system administrators

The latter is the focus of this paper since little research has been done. Identifying the perspective of stakeholders when designing or building eHealth systems is vital in order to fully understand the underlying factors that contribute to the unsuccessful implementation of eHealth in healthcare (Joekong, 2016). This is because it contributes to the gap between the stakeholders and the nurses (ibid). In order to identify the technical strain created by these systems, an in-depth analysis of the stakeholders’ strategies when designing systems is carried out.

So how can eHealth be improved and be embraced fully by nurses in daily care routines without complicating the process? This dissertation will investigate the perspective of managers and system administrators on the design of eHealth systems. The focus is on how managers and system administrators of eHealth systems Investigate, understand and prioritize nurse’s eHealth needs during the system processes such as planning, designing, maintenance, etc.
Since most of the existing literature on the design of ICT systems are primarily based on the nurses’ perspectives, this study will, therefore, contribute to filling the research gap of project managers and system administrators’ perspectives on nurse’s needs.

**Objectives**

- To provide an overview of the current state of the system and the relationship between stakeholders such as project managers and system administrators, and nurses in the health care sector in Region Uppsala. How do they resolve nurses system complains and error reports?

**Disposition**

This paper will be divided as follows:

Background section: Presents an overview of the current system difficulties and gives an introduction of some of the issues encountered by nurses when using eHealth. It is followed by a theory section based on managers and system administrators’ perspective when designing systems, how they perceive their nurses and the overall relationship between these two important parties.

The method section presents the method used to collect the data needed in this study. Which is a semi-structured interview with six people working closely with the system. It also contains data analysis and data limitations.

The result presents the findings and analysis of the interviews with different stakeholders. A discussion and conclusion part will then follow, which will attempt to answer most of the questions raised in this paper. Finally, the report contains ideas and suggestions for further research.
Background

eHealth systems have been defined as the use of information and communication technologies (ICT) in healthcare over the whole scope of capacities that influence well-being. One example of an eHealth system is the electronic health record (EHR), which has been used to digitize patient journals (Ma, 2016). Some of the aims of eHealth are to ease the interactions between medical professionals and patients and between healthcare practitioners. In addition, it should facilitate the recording, use, storage and overall security of patient information. ICT in the healthcare sector is used all over the world to improve efficiency and quality of service in health care (Panda and Thakur 2016). However, although it has been around for a few decades, the development of these systems has had little involvement from nurses, i.e. nurses continue to play a minor role in the design and development processes of the systems (Weckman and Janzen, 2019). This has caused unanticipated negative effects which stakeholders seem to have been oblivious to. In the health care sector, ICT has indeed been severely criticized by medical practitioners due to the multiple technical difficulties that they encounter while interacting with the systems. Nurses, who constitute one of the largest groups of healthcare providers, have been particularly affected by ICT-related issues.

The end-user involvement in all stages of the development process of the systems significantly contributes to the efficiency of eHealth. In health systems, most of the end-users among medical professionals who can be labeled the representatives of the entire group usually are nurses (Ma, 2016). It has been proven that the active involvement of the end users specifically the nurses in the health care system has had a positive impact on the innovation, commercialization, and transition of eHealth systems into the market (ibid). However, when deciding which group of medical professionals should be part of the project, nurses usually are not on the priority list. They belong to a group which is usually overshadowed by other medical professionals such as doctors. In order for stakeholders of eHealth systems to achieve success in their projects, they should prioritize nurses through comprehension of the nurse’s needs that are usually fostered by needs assessment approaches (Shah S. G, 2009). Most of the need assessment methods involve underscoring the specific needs of nurses to act as a guiding post for the end product. Yet the nurses' needs are often negated or misinterpreted as a result of the developer using intermediates such as IT departments and scouts that have a direct link between the two (ibid). From various reports, it has been noted that the intermediates accrued bias towards the needs of the nurse. To some extent, the nurses are left out of the development process making the use of the systems difficult. Therefore, to achieve success, managers and system administrators must invest in nurses’ participation. This can be done for example by creating better methods of collecting detailed information about the end-users needs during the planning process among other things.
Investigating The Perspective Of Different Stakeholders

Stakeholders have different relationships when handling projects. Usually, as stated above, these relationships are grouped into those who will be impacted by the project and those who can impact the project. As part of those who can impact the project, project managers and system administrators need to come up with strategic guidelines which facilitate the successful completion of the project (Michelson, 2019). It is vital to distinguish between these stakeholder groups here so as to understand their interconnected roles as background to this study.

Fig 1: Stakeholders-lack of end-user inclusion
Project Managers

Project management is an important task which is constantly performed by eHealth experts (Värri et al., 2019). In eHealth, strategies often require a proper understanding and knowledge of the background, organizations, and individuals involved since they can have an immense impact on the strategy (ibid). An effective strategic manager will invest in proper planning of the project which includes identifying end users early and naming them as contributors. For managers, it is important to identify what each contributor want or need and what influence they have over the project so that a successful strategy can be refined and implemented (ibid). In large projects such as eHealth, the project manager oversees and manages project team members who are assigned to specific project office and subject matter. There are certain characteristics of eHealth projects that add complexity and require special attention, such as minimizing service disruption, providing reliable support and providing proper system training (ibid).

Successful completion of the project within the time frame is always the perspective of all the parties involved especially manager. But there are many challenges that a manager involved in designing electronic-health systems needs to consider, some of these factors usually lead to system flaws or even project failure (Pan, Gary & J. Flynn, Donal 2003) e.g.

- Incomplete or unclear scope
- Failure to identify and involve end-users
- Communication problems
- Risk management problems

While all of these tasks are usually completed, the degree of execution varies hence the end product might not meet the needs of the intended end-users.

System Administrators

System administration duties vary from planning, configuring, installation, testing and overall maintenance of the systems. They are the driving force behind the existing systems. Their main objective is to ensure that the system is functioning well. It is therefore crucial that they understand, involve and continue to consult medical professionals in all the stages of the project (Lavin 2015). It has been reported that they tend to focus majorly on their own interests intentionally or unintentionally rather than the expected requirements of the system. Some of the aspects the stakeholders focus on are basically (Jenny, 2006):

- The quality software of the system
- Developing cost reduction initiatives
- Time or deadline of implementing the system or program
Even though the clients such as medical professionals are included in the planning of the project, it is the poor communication between the system administrators and the nurses that cause most of the errors (Lavin 2015). This usually happens when they fail to incorporate the nurses when considering variables such as user classification scheme, system’s scope as well as orientation, nature of process development and individual roles of design, as well as maintenance within the development cycle of the application (Almunawar, 2012).

**Challenges of managers and system administrators**

There are many difficulties that managers and system administrators face when handling and developing eHealth systems projects. Typical challenges that these stakeholders encounter can be grouped into three categories (Pagliari, 2007):

- **Communication** - This problem arises when managers fail to ensure that all key contributor and middlemen have open and effective communication channels.
- **Technical** - With the constantly changing technology, today’s codes might not be useful tomorrow, therefore stakeholders must ensure that they are always ahead and can make a critical judgment on which technology is appropriate for both the system and the end-users.
- **Operational** - This encompasses the whole functionality of the processes in a project i.e. creative ideas, interviewing and surveying end-users with the help of questionnaires, observations, and interviews, constant communication with end-users as well as other stakeholders, managing conflicts and overall time management, etc.

**Stakeholders Perspective of Nurses’ needs**

Developing information systems requires united efforts from system administrators, managers, and medical professional, in this case, nurses (Jenny P, 2006). The two figures I.e Managers and system administrators make up the stakeholders in this study, while nurses are considered as the end-user. The figures’ common goal is to establish an information system. In this scenario, stakeholders and nurses tend to be the specific point of focus during the development of an information system. Stakeholders are supposed to identify nurses’ needs during the initial stages of the system development process, but more often, they fail to identify these requirements or rather recognize them late during the developing stages of eHealth systems (Jenny P, 2006). This can be due to the lack of recognition of nurses as key contributors, it can also be due to the presence of middlemen, I.e. the information received from nurses is simply not delivered to the vendor and vice versa. Most nurses are usually the last to know when system changes are made. Without proper and reliable background information, stakeholders focus primarily on aspects such as:
It has been reported that when stakeholders fail to identify the system users, the repercussion usually is that they fail to uncover the key challenges that might arise when the system end-users interact with the system, resulting in the development of incompetent systems (Jenny P, 2006). Therefore, the imbalance during system development leads to poor and incomprehensible malfunction of the system, an aspect that yields an automatic lack of confidence in the developed system. While this is the reality that nurses experience, most managers and system administrators are oblivious to the existence of this problem, hence it can be downplayed or classified as a minute problem.

**Considering nurses’ involvement during the design process**

![Diagram](https://via.placeholder.com/150)

*Fig 2: user satisfaction is only achieved through user involvement*

Considering the satisfaction of nurses’ needs are vital during the design process (Walker, 2016). Engaging nurses into the design process has numerous benefits such as enhanced system quality. This normally arises from receiving accurate requirements from the end user. However, nurses are not always considered during the design process. This is mainly because the stakeholders are
often entangled between the qualities of software, timeline and the fact that nurses are not on the priority list among medical professionals (Skinner (2014)). A clear illustration is provided in fig 3, where all medical professionals are grouped under medical professional which mostly is composed of doctors, administrators, and nurses’ representatives. Consequently, stakeholders miss out on vital information from a critical group which could be beneficial to their end product. For instance, users can be involved in the process in the following different levels (Tzortzopoulos, Fabricio & Caixeta, 2019):

- Informative - User provide and receive information
- Consultative - Users are invited to comment and give feedback about the predefined services
- Participative - User is fully involved and can influence decisions concerning the whole system

From the data analysis, several factors which hinder the process of identifying the end-user needs while configuring and overall maintenance of eHealth systems were identified. According to the researchers, some of these factors include (Alvarez, 2004):

- Failure to involve nurses (end-users)
- Communication problems
- Nurses’ IT training
- Time constraints
- Incomplete or unclear scope

Stakeholders such as project managers and system administrators, researchers and opinion leaders within the sector of Information Technology reckon eHealth has the potential to overcome the above-named factors (ibid). These factors are perceived by the stakeholders as some of the key contributors to the cumbersome nature of eHealth system. Consequently, limiting system accessibility, and causing system faults among other things. However, managers and system administrators believe that eHealth application is capable of being tailored in accordance with the attributes of the end-users such as nurses. According to the data, eHealth developers perceive that one of the most challenging aspects of their work is being able to proactively recruit nurses i.e. identifying and engaging the target candidates/end users of the system (Egbokhare, 2008). Additionally, they have the perception that, regardless of the potential benefits of eHealth, barriers to its implementation are numerous. These mainly comprise of limited system accessibility by nurses, and the level of technological literacy witnessed in nurses.
A significant number of sources pointed out that the stakeholders have the mandate of identifying nurses needs at the beginning of the development process (Sharp, 1999). Since nurses comprise the largest proportion among medical professionals, the departments responsible for system design improvements ought to classify nurses as an important group whose contributions can greatly assist in making the system more efficient. It is therefore vital to account and prioritize their system needs to ensure the creation of a smooth sustainable business model. Currently, the group is called medical professional and nurses are one of those who make up this group, although it sounds all inclusive, the process of segmenting and profiling this broad range of end users can be challenging. End-user segmentation, profiling and overall involvement within a nursing profession have been neglected (D.W, 2005). This is due to the fact that nurses are not on the priority list. As mentioned earlier, more often nurses representatives attend these meeting and not nurses. Usually, this is because of the lack of time due to the complex nature of their work, whereby they must attend to patients. In addition, the stakeholders mainly accentuate on uncovering determinants such as attitudes, conducts, and knowledge from a particular context i.e. the doctors and nurses’ representatives. When they do consider nurses, they mainly use contents from already existing research hence saving time and money.

The stakeholders usually collect most of the information from different platforms on the internet that already include the nurses–reported outcomes, goals and clinical facets guided by the international regulations. It is only when they need more clarification, that they try to get information from nurses, the nurses are therefore the last group to be considered when it comes to the design, implementation and overall system improvement (Peters, 203-208). While the above considerations are in place, the developer’s dependability on the intermediaries translates to nurses being left out in the process and resulting in difficulties when using the eHealth systems since they had minimal input. For instance, nurses find it difficult to access the patient’s journals due to the complex nature of the systems or the too many clicks needed when switching between different functionalities of the system. This causes a lot of confusion; it is time-consuming and subsequently leads to many errors in the patients’ journals. It is evident that stakeholders do not proactively maintain contact with nurses. (Holzinger, 2005). Ideally, identification of audience segment is founded upon the assessment of a wide range of quantitative data and employing variables such as demographics, psychological, etc. Since there is little engagement in the design process and during maintenance between nurses and the stakeholder, key variables which could solve most of the system’s issues are not discovered (Ramanath, 2010).
End-user Surveying

Surveying is a research method of collecting information from a specified audience, which has been used to determine if a particular project is on the right track, to evaluate user interfaces among other things (A.W. (2005)). To carry out the process of surveying for the end users’ problems, needs, and wants, the stakeholders usually consider some vital approaches. These include a model based on the workflow analysis, pre-deployment usability testing and collection feedback coupled to training and program (A.W. (2005)). Prior to the deployment of the system to the users, the stakeholders should ideally be able to acknowledge that the users are capable of using such a system without any difficulty. In the absence of such an approach, the stakeholders will automatically create systems that do not meet user expectations, leaving the end users, in this case, nurses complaining about the system (Kujala, (2003)). The inclusion of nurses in the design development allows for communication exchange between the stakeholders and the end user. According to Lavin (2014), there is little communication mainly between the IT department personnel and nurses. This is because most IT departments fail to do a proper survey of nurse recommendations and most importantly report back to the vendors i.e. “they block the flow of information from nurses to vendors”. They also undermine nurses’ complaints and respond to complaints with reasons such as: “the system was not built that way” or “the software does not allow such change etc.” (Lavin M, 2014).

The Importance of Nurses’ Segmenting in Prioritizing Design Considerations

Profiling users during system development and design is entirely based on identifying and segmenting the end users of the system (Sedera,2004)). Failure to integrate the right end users into the design and development process makes it hard to formulate or create correct user profiles i.e. “a record of user-specific data that define the user's working environment” (Rouse 2007). When identifying the audience segments e.g. doctors, nurses, administrators, etc., the managers and system administrators do not focus on uncovering the difference in work duties, departments, and the level of interaction with the system (Keil, 2002). They also fail to consider other demographic variables which are important when defining user profiles (ibid). As a result, they experience difficulties when creating the users’ profile as well as when making changes to the eHealth system application in terms of configuring features.

Prioritization is an important part of any project, therefore it cannot be done in isolation. It requires the collaboration of all teams i.e. both stakeholders and end-users. Prioritizing on design consideration is mainly based on three facets ((B B. 2004). These include:

- The feasibility of considering the design
- The urgency of the design,
- The extent the design will improve the existing design collections within the institutions.

Some of the factors that most of the stakeholders might consider when prioritizing design include; use of the design, condition, and value of the design. In addition, design consideration is important when they are focused on the target population (B.B. 2004). However, when it comes to the end user group, all medical professionals fall under the same group. As a result, the number of nurses who get to be part of the project usually is low. According to Lavin (2014), “there were no nurses as the first author among the 35 citations dealing with medication administration recommendations, nor were there any citations from nursing journals “. This is the firsthand proof to show the lack of nurses’ involvement in IT projects.

The figure below shows the distribution of the different stakeholders and end-users during the planning stages of the system project.

Although the project seems correctly distributed, it is unclear who healthcare professionals are. Are all the different medical professionals represented? If so, how are they distributed?
User-centered Design

User-centered design is an interactive design process which dictates that users should be central in each phase of the development process (Hudson, 2019). It is an essential tool that should be used by eHealth developers to conduct observation, survey, and overall evaluation in order to determine the needs of the nurses. Most stakeholders commonly rely on a model-based workflow analysis, the analysis includes; pre-deployment usability testing, feedback collection and a possibility of training programs among other things (ibid). Although all these measures are taken into consideration, it is questionable why nurses face a myriad of challenges when using these systems (Segal, 2007). Somehow the designing workshops fail to involve the target users (nurses) who understand the context of the problem at hand. Most of the sources suggest that there is a lack of inclusion of nurses in the pre and post usability tests of the eHealth tools. This strategy, which is very important and has been emphasized by many scholars is still not properly implemented by both the managers and the system developers. As a result, a gap exists between the caregivers and the stakeholders. In order to successfully implement user-centered systems, the following key features must be used (Hudson, 2019):

- Direct involvement with nurses through
  - Evaluation
  - Observation
  - Surveying.
- Research on the context of use,
  - Who are the users
  - Experience level
  - The purpose of the system
  - The environment setting
  - What ideas or suggestions the target users they have
- Focus on all the users i.e culture and human value

This will help in understanding and identifying the design of the user interface (ibid).
The figure above shows the vital steps that are key to the successful implementation of user-centered design. If the flow of information is not followed or if stakeholders choose to pick one or a few, then the end product will not be satisfactory. For instance, it has been reported that the developer chose to focus more on evaluation rather than the entire process. As a result, the design will not meet nurses needs since there is no improvement in usability testing (Hudson, 2019). In the final stage of the process, system administrators continue the process by implementing the system without gathering adequate feedback from the real-world setting (Meso, 2005), hence causing many difficulties for the end-user.

**Communication Between Nurses and Stakeholders**

Communication with the nurses in all of the project stages and during maintenance of the system has been challenging. Nurses prefer direct contact with the manufacturer of the proposed system to eliminate recurring problems. According to a study conducted by Selimi Hani, this is important since nurses would have an opportunity to share their ideas and system complaints. It will also allow nurses to give credit or critic to the manufacturer's ideas and considerations of the design. Typical communication channels techniques are through distributors, government
agencies, different IT-departments, and representatives hence nurses are neither given a chance to voice their opinion nor to be a part of the process.

Electronic Health developing establishments often associate the non-inclusion of nurses due to location technicalities and therefore the distributors play a role in bridging the gap between the developer and the nurses. As a result, less cost is incurred when indirectly dealing with nurses (Torkzadeh, 2003). Figure 6 provides a detailed analysis of the gap that exists between the developers and the nurses (Akinnuvesi, Uzoka, Olabiysi, Omidiora, & Fiddi, 2013). It is a model that depicts the developer’s engagement and perception of the nurses hence explaining the findings of this research.

![Diagram: Nurses participation model: The gap between nurses and developers perception]
Research Settings and Methods

In order to gain an understanding of underlying reasons, a qualitative research method was used. This method provides insight into the problem as well as giving a deeper understanding of the underlying causes.

Research setting

Cambio Cosmic In Region Uppsala

Region Uppsala uses Cambio Cosmic in all of its hospitals and clinics. This system is developed by Cambio healthcare systems which were founded in 1993 (Cambio.se, 2019). Cambio Cosmic was launched in Sweden in 2005, it is defined as “a modern, safe and innovative healthcare information system that was originally designed both for and with the Nordic healthcare market” (ibid). In Region Uppsala, it is the electronic patient journal department (EPJ) that manages Cosmic. They are the digitalization unit in the region and “the middlemen” between Cambio and end-users. Therefore, they are responsible for the overall handling of operation such as:

- Performing installation and maintenance
- Monitor, troubleshoot and correct errors.
- Produce and maintain documentation.
- Minor configurations of the system
- Contact with end-users and vendors.

Cosmic contains 3000 templates and with each template having a specific purpose and more than 10000 users in Region Uppsala, with the main user group being nurses (Cambio.se, 2019). Since the system has been around for a long time, it is outdated and in need of constant configurations and integration with other systems such as orbit (a surgical planning system).

There are four different lines of support who are involved when it comes to handling system error. EPJ is one of them and therefore does not have direct contact with the nurses so they rely on IT-coordinators to receive, review and filter the problems raised by nurses and pass it on to them. The sequence of events from the time nurses send a complaint to the time EPJ receives it is described in the diagram below:
When a nurse encounters a problem or error, the first line of support is other nurses working in the same unit. If they cannot solve the problem, they send it to the second line of support. This is the IT-coordinators, who have some form of system training and experience since most of them have worked as nurses or administrator before. They help the end-user with simple tips on short-cut and fix minor system issues. In addition, they filter most system errors I.e. only the system errors that they view important would be grouped using a priority list and forwarded to EPJ. At this point, EPJ would further filter the system error, fix what they can by configuring the system or providing support for end-user and send what they deem relevant to Cambio.
Data Collection

The method of data collection was through an interview study. The interview study was achieved by contacting the administrators at the EPJ who later sent the contacts relevant for the thesis work. There were six interviewees, some of them work in the same department, while others are working at different levels. Those that participated in the interview are system administrators, project managers, and system support providers. They were specifically chosen because they are experts in their specific work areas. The literature study was obtained from different online articles and papers.

Interviews

Most of the interviewees are working at the department of the electronic patient journal (EPJ) at Akademiska Hospital. They handle IT-related issues which arises from the existing eHealth systems as well as the introduction of new system configurations. I interviewed six employees who work with four different workgroups in the two departments.

The interviewees included:

- A project manager who works with resolving reported EHR system errors, configuring the system as well as collecting ideas from end-users
- Four of the interviewees are working as support i.e. testing different parts of the system e.g. the patient forms, different modules in cosmic, handling system error reports, solving minor system errors and sending the most challenging ones to Cambio
- An IT coordinator who works as the second-line support for all medical professionals, Here they help solve simple system questions and error, giving tips to the end-users on how to optimize and use the system efficiently and lastly they forward most system complaints to the third line of support (EPJ)

A semi-structured interview with open-ended questions was chosen intentionally. The strategy was to help create a little more discussion-oriented interview where the interviewees could come up with their own inputs and views on aspects they deemed important, which will, in turn, allow me to go outside the interview design and discuss questions that were not among the list of questions prepared. These interviews were carried out at the EPJ offices and Akademiska hospital IT-administration section. The respondents were both women and men between the ages of 20 and 60 years. The interviews took 30 - 60 minutes.
The following table gives an overview of the interviewees’ respective departments and job title. The interviewees were chosen since all of them are involved in the introduction of new features, the configuration of the existing system and overall maintenance.

<table>
<thead>
<tr>
<th>Interviewee 1</th>
<th>Position</th>
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<tbody>
<tr>
<td>Interviewee 2</td>
<td>Support</td>
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<tr>
<td>Interviewee 3</td>
<td>Support</td>
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<tr>
<td>Interviewee 4</td>
<td>Support</td>
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<tr>
<td>Interviewee 5</td>
<td>IT-coordinator</td>
</tr>
<tr>
<td>Interviewee 6</td>
<td>Support</td>
</tr>
</tbody>
</table>

*Table 1: People who participated in the interview.*

The interview questions were designed in a way so as to avoid leading or influencing the interviewees' response. The aim was to obtain an accurate picture of the current relationship between the developers and nurses, how they resolve nurses system complains and error reports and where their priority lies when deciding on software changes or introduction.
Interview Questions

Interviewees introduction

Job title:

Duties:

Cambio Cosmic Background and the IT-line of support Involved

What is Cambio Cosmic and when was it introduced?
What type of services does your department provide?
What does this department strive to achieve?
What is this department main Purpose?
How many lines of support are involved?
How is the collaboration between them?
Are you satisfied with the current channel of communication and flow of information between the different line of support?

System Questions

What causes software malfunction? Is it the users’ or poorly designed software?
How do you deal with system error and complaints?

End-User Questions

How do you perceive the systems’ end users?
How do you learn about those needs?
How to do you group medical professionals as the end users?
Which methods do you use to identify nurse’s needs?
How do you take nurses’ needs into account when configuring and improving the system?
How do you decide what design considerations to prioritize?
Data Analysis

The data from the interview was analyzed and compiled. The data gave a picture of how systems complaints are dealt with by the different IT-line of support involved, it also gave an understanding of how the current situation looks within these different levels. The relevant findings were classified according to the description of the research anchored to the objectives of this study. The data addressed nurses’ IT know-how, nurse’s segmentation, profiling, and involvement in all of the system processes, user-centered design, and Nurses-inclusion.

The data received from the interviews were compiled to be able to find out:

- How these different administrations collaborate and work individually
- How they investigate nurses' needs
- How they decide on what design considerations to prioritize when configuring and updating the system.

The results from the interviews are presented below with the help of figures to give a vivid picture of the overall findings of the review.

Results

The data collected and presented here is from the interviews. In total there were 6 interviewees working in EPJ and Akademiska hospital who have been working with the system in place for a long time, hence their experience assisted in identifying the core factors which contribute to system complaints.

Interviews

Below are the themes identified from the interviews:

- The Notion that nurses are involved in all the systems development processes
- Communication problems
  - Lack of proper channels of communication between the different levels and between stakeholders and nurses
  - Many levels involved in the process and also in decision making
- Inadequate IT-training for nurses
Lack of proper and continual end-user (nurses) surveying (due to time constraints)

The Notion that nurses are involved in all systems development processes

The stakeholders that were interviewed all agreed that the system functionalities are in a good state for the most part. They also have the notion that they do involve nurses when it comes to all system improvement and maintenance. All of which is based on the error reporting system. In their view, nurses are involved in the process since they have access to the error reporting system and can also contact the stakeholders when they have any queries. It is therefore apparent that it has nothing to do with continuous collaboration between them—which can be used to innovate before, during and after the system design. In addition, most of the interviewees have the perception that nurses poorly interact with the eHealth system and cannot handle basic system functionalities which in their view leads to many system errors.

Communication Problems

Communication is vital especially when many levels and chain of commands are involved. Currently, there seems to be a communication breakdown between different levels and between the stakeholders and nurses. Nurses usually are the last to be informed, more often this happens later than the scheduled time. One of the contributing factors is that information is passed through many organizations and levels. There are two ways nurses can be informed, through their managers; which is often used and online. While it is possible for nurses to read information online, most of them do not because of the time constraints. Therefore, they usually depend on their managers consequently causing the delay/loss of information. This is because, as stated by the interviewees, nurses’ managers are not reliable; they sometimes withhold information/feedback which in their view is important. In addition, it is reported that the managers do not take full responsibility for their actions, this is because they reckon that nurses have the responsibility of searching and reading information online.
The figure above shows an overview of the channels of communication. Most of the interviewees believe that having numerous levels owned by different Organization is a contributing factor to the many problems. Examples of these problems are:

- The availability of different criteria when sorting system complaints. “Sometimes we have different views when sorting since what one views important might not be for the next person”.
- It takes time to go through all the communication channels
- There is a high chance of miscommunication or loss of information along the way which can create confusion and conflicts.
- Increased/Unnecessary bureaucracy i.e. many decision-making barriers which can lead to a complicated administrative procedure
Some of them suggested that it would be better if the levels involved were under the same structure i.e. centrally. This would in-turn help them communicate effectively by having a simple channel of communication, fewer managers and meetings on a regular basis.

Looking at figure 4, one of the obstacles stakeholders experience is clear. That is the fact that many IT support levels are involved, consequently being one of the root causes of the existing gap between nurses and vendor. Each level receives error reports and has the duty to process them as they see fit. These levels use different criteria to review and filter the complaints. They send only what they deem needs to be fixed and vital to the next level. Since the system complaints or error are already filtered before it reaches EPJ, they, therefore, are not aware of the full extent of the system problems encountered by nurses. When EPJ receive complaints, they too have a criterion for sorting the error report i.e. using a priority list to further filter and sort the errors. The list is divided as follows:

**P1**: a shut-down, can have a huge impact on the work process, system inaccessible. It must be fixed as soon as possible

**P2**: Severe defect but it is functional, it must also be fixed as soon as possible e.g. log-in problems

**P3**: Undesirable, some functionalities are not available

**P4**: Not a major problem, system function well

The figure below shows how they sort different system errors using a priority list, where P1 the most urgent problem in their view is attended to first.
By the time the complaints reach the vendors, a significant amount of the original complaints has been taken out. This process is repeated in all the levels involved. As stated by one of the interviewees “Each level has their own strategy and procedure when handling system errors, since we need to collaborate efficiently we need to respect each other’s rules and regulations”.

**Inadequate IT-training for nurses**

Information technology training for nurses seems to be one of the factors that contribute to poor system usability. The interviewees criticized medical professional for lacking system know-how even though the training is offered. It is also a contributing factor why nurse cannot articulate their system experiences and system errors properly. According to the stakeholders, it has been brought to their attention that most system complaints are due to the lack of proper system training. Upon further investigation, it was discovered that although training in information technology is provided for nurses, there are other issues which prevent nurses from attending these lessons. For example, nurse managers who do not prioritize IT training for nurses, most of the time fail to book IT training for them due to the shortage of staff. Consequently, they end up using nurses who have already attended the training to teach and recruit new nurses. This causes many problems since most of these “experienced” nurses are not able to teach because:

- They cannot fully interact with the system themselves
- They lack the expertise i.e. expert information technology skills
As a result, new nurses are deprived of vital training by IT professionals. An example which most interviewees mentioned is that many nurses use wrong techniques to access different parts of the system, which consequently contributes to several daily system complaints. For instance, the use of many unnecessary clicks instead of the efficient shortcuts provided, and the use of the same wrong technique recurring among many nurses. This recurring problem exists because it is taught by unqualified personnel. As stated by one of the interviewees, approximately 40% of all system error report daily are due to lack of proper basic system know-how. The stakeholders all stressed on the importance of nurses’ IT training, they reckon that it will not only help them interact better with the system but also, they will be able to describe the system errors better when sending an error report.

Lack of end-user surveying

Learning about the nurse’s needs is an important aspect of the whole process since it facilitates the building of a successful and satisfactory end product. This can be done through interviews; where they can have a conversation with nurses. They can make site visits and observing the nurses and run a usability test. Unfortunately, this is not carried out properly and frequently. According to the interviewees, the follow-ups are conducted now and then. As a result, they do not know what problems nurses are experiencing. One of the reasons why do not frequently do research on end-user needs is because they simply do not have time to do it. However, they acknowledged that it is important since it would not only help them better understand nurses’ problem areas but also be able to correctly diagnose and solve the system problems.
Discussion and Conclusion

Technology offers infinite opportunities for electronic-health services in healthcare. Observations indicate that electronic health will be a strong tool in modernizing the health care sector. The use of e-health solutions can produce enormous improvement for patients and medical professionals from saving money to ease maintaining patient records and much more. To develop an established health material exchange platform, the key factor is to recognize end-users in the early stages of the project. This is because it is important to understand what they want or need and what influence they have over the electronic-health systems. It is therefore essential to segregate and prioritize the end users’ needs, giving the stakeholders a candid view and ultimately being able to meet the functionalities demand of a certain system. A design which primarily focuses on the needs of its end users is vital. Although it costs time, money and effort, involving end-users like nurses can determine the success or failure of eHealth system. It is thus important to understand how stakeholders such as project managers and system administrators can involve nurses right from the initial stages of a software development process, i.e. planning and design, through to implementation and acceptance. This will help the stakeholders have a clear picture of how to design and implement functionalities needed in a particular software.

The results of this study provide indication that there is a need for more nurse participation in the development process of information system software and suggests that the nurses are to some extent alienated during all of the stages of the systems development life cycle, i.e. planning, design, implementation, and maintenance (Chiemeke, 2003). Interestingly, the results also indicate that project managers and system administrators have the perception that the nurses are given time and participate in all these processes, although this is far from nurses’ reality. In the managers’ and administrators’ view, the fact that nurses can contact them now and then via the error reporting system or by phone is a form of involvement. Due to this misconception, nothing is being done to come up with creative methods that would increase nurses’ involvement in eHealth development processes. In addition, the stakeholders are oblivious to the daily challenges and system functionality difficulties faced by nurses, pointing to a gap i.e a disconnection between managers and system administrators and nurses.

Many System administrators view nurses’ skill in information technology as an important factor that can influence their involvement during information system development processes. Consequently, the lack of IT skills limits the impact on the successful implementation of these systems (Damodaran, 1996). The findings indicate that stakeholders try to address this potential issue by providing both eLearning courses through the internet and also lessons which are taught in classes to nurses and other healthcare professionals on a wide range of topics on the existing
eHealth system. The end-users, women, and men of different ages appear to be capable of learning when using both methods.

The interviewees unanimously agreed that the root cause of training problem is nurses’ managers in the majority of the different hospital units. According to the stakeholders, managerial decision making affects the training of the nurses. The project managers and system administrators claim that the respective nurses’ managers do not consider nurses’ IT training to be vital to their work. “We have no mandate over the nurses’ managers, we cannot force them to send the nurses to IT training classes”. It was suggested by the interviewees that some of the factors that contribute to this problem are the shortage of nurses and the long demanding working hours of nurses. All the managers’ priority lies with patients; therefore, all other factors are secondary issues which can be set aside. Despite the stakeholders calling for institution managers to avail more IT training for nurses, a few of them are sent for training. The end game here being, the persons sent for the training are the ones who will in-turn provide training to their colleagues. As a result. nurses learn from an inexperienced person who is not qualified to teach. Often, mistakes are repeated, and the wrong commando is used when accessing different files in the system. This leads to several system faults and means that it also takes a considerable amount of time to maneuver the system.

As stated before, a user-centered approach one wherein the end-user is central to all the design processes. The need to think from the users' perspective is very important since it is key to successful design, i.e. creating systems that are efficient and easy for the end-user to use. Oftentimes, systems are designed with a market goal focus which in the long run substitutes the target audience. Although there are many factors that contribute to the system difficulties nurses encounter; from the perspective of managers and system administrators, the following are the contributing factors

- Lack of proper nurses’ involvement in system improvements plan
- Poor communication between all the levels involved
  - Communication between the stakeholders, the different departments within health care and with the nurse is vital during all the development processes of eHealth systems. According to the stakeholders, there is an information breakdown between the different levels involved and between the stakeholders and nurses.
  - The managers at different nurses’ unit do not rely on vital information about the system to nurses
- Poor information technology literacy among nurses
- Lack of proper and continual end-user (nurses) surveying
- The Incapability of the nurses to express their concerns appropriately and in a proper language understood by the developers
Whereas the developers have the preference of communicating in terms of the structure of data, nurses highly prefer communicating regarding the information system in terms of applications, behavior, and functionality of the information system.

Limitations

This paper’s contributors and interviewees are people who work at the digitalization unit in Region Uppsala and not from Cambio., involving Cambio would have provided a fuller picture. In addition, there were some limitations in using a literature study as a methodology to investigate the research problem. During the identification of the relevant materials, most of the existing literature concentrated on the nurses' perspective when dealing with eHealth software. There were a few articles that discussed the stakeholder’s perspective such as project managers, system administrators, and policymakers. Other sources were not specific to the intended target; therefore they did not provide an analysis of project managers and system administrators perspective on eHealth tools in reference to nurses’ feedback. The literature materials did not comprehensively provide information on how these stakeholders decide on the design considerations as dictated by the nurses.

Future Work

This research paper provides insight into the world of stakeholders such as project managers and system administrators vs nurses. The findings managed to scratch the surface of the many underlying problems brought about by eHealth, and, there is a need to further investigate and explore this topic. The contents of this paper can be used both for an in-depth analysis and as a reference point for future development. Some of my suggestions are:

- Investigate the need for middlemen i.e the different levels involved
- Further research to be done on how developers understand nurses needs
- Examine the gender factor, what role does it play in the healthcare sector? Is it the cause of the current disconnect?


**Pictures**
