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Understanding healthcare practitioners' needs in the area of smart digital solutions for medical recording

A Case Study in Swedish private healthcare

Master's thesis in the Master Degree Program Quality and Operations Management

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SUMMARY

Improvement science in healthcare has gained traction in recent years, driven by the extensive challenges of resource scarcity and need for efficiency. While previous research has underscored the importance of patient-centeredness, there remains a gap in considering the perspective of the healthcare practitioners' role in creating patient centeredness care. The healthcare practitioners are in this thesis considered internal customers in healthcare organisations while patients are external customers. Research has previously focused on the service quality for patients, thus external service quality. Yet, ensuring internal service quality is vital to ensure patient-centred care as it enables healthcare practitioners' capabilities to provide qualitative service to patients. At the same time, healthcare is undergoing significant changes with digitalisation and upcoming initiatives with automation that potentially also could influence service quality.

The purpose of this thesis was to identify internal customers' needs and requirements in the development of an automated medical recording service. Furthermore, this study investigated potential barriers and enablers for implementing change and examined how modularity can be a means of providing high service quality during implementation of new digital services. The purpose was addressed through a case study with an IT company that sells digital solutions to private healthcare clinics. To thoroughly understand the internal customers' (in this case the healthcare practitioners') needs, the Kano model was applied. To generate quality attributes, interviews were held with medical practitioners and were then used as a basis for questions in a Kano survey.

The Kano survey revealed several critical attributes, where correct interpretation of words and grammar, speed of automation, and integration of referral systems were highlighted as important for satisfaction. Further, barriers and enablers to change among medical practitioners were uncovered. Doctors showed to be most ready for digitalisation and automation whereas medical scribes showed highest resistance. Quality and ethical aspects of automation, such as accuracy and accountability, were identified as crucial considerations.

A modular approach, tailored to the varying needs and readiness levels of different professional roles and types of healthcare clinics was proposed. This approach involves assessing readiness, creating a sense of urgency, involving stakeholders in the change process, and gradually implementing modular offerings to address specific needs and barriers. Overall, the findings underscore the importance of understanding internal customer perspectives, addressing potential barriers to change, and adopting a tailored, modular approach to implementing automated medical recording services in healthcare organisations.

Keywords: Healthcare, Kano, Digitalisation, Modularity, Change management, Internal Service Quality

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Annie Olsson & Sofia Stjepanovic, Gothenburg, May 2024

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1. Introduction

This chapter presents the background and objectives of this thesis, followed by three research questions that support the purpose of the study. It concludes with a discussion of the study's delimitations.

1.1 Background

The background of this study will introduce digitalisation and automation, internal service quality and change management, all in the context of Swedish healthcare.

1.1.1 Digitalisation in Swedish healthcare

Swedish healthcare is ranked at the top when it comes to quality and efficacy in medical outcomes compared to other countries with similar economies and stances (Jovic, 2018). However, when it comes to efficiency, Sweden is considered lacking as costs related to healthcare are rather high in comparison to other European countries (Jovic, 2018) and waiting times are perceived as high (Spak, 2022). To mitigate these issues, many initiatives focus on how digitalisation can be incorporated into ways of working to improve both efficiency and waiting times in Swedish healthcare (Spak, 2022).

In parallel with the establishment of digitalisation in healthcare, research on the usage of Artificial Intelligence (AI) has gained traction in recent years (Bergman & Schmidt, 2023). Potential benefits such as increased availability for patients and time utility for personnel have been presented. Aung et al. (2021) mention that an application area could be relieving administration for personnel, where an AI could e.g. summarise data, search for information or synthesise patient records. Finley et al. (2018) have presented automated AI-based medical scribes that use automatic speech recognition (ASR) and natural language processing (NLP) as a possible application. Automated medical scribes offer great benefits, but also imply challenges and affect stakeholders involved (Montenegro et al., 2023). Thus far, there are promising solutions presented, but none are yet tested in large-scale clinical settings (Montenegro et al., 2023; Falcetta et al., 2023; Finley et al., 2018). To access the opportunities that AI provides and ensure quality in service provision, there is a need for further understanding of stakeholder needs and interests. Stakeholders could be healthcare practitioners utilising such AI solutions.

1.1.2 Internal service quality in healthcare

As stated by Gremyr et al. (2020), one of the principles of quality management in organisations is customer and stakeholder focus, and is stated as the “importance of

fulfilling customer and stakeholder needs, which requires an organisation-wide focus on customers and stakeholders" (Gremyr et al., 2020, p.23). Srivastava and Prakash (2019b) state that quality in service is critical for the success of organisations, and that healthcare is a provision of services rather than physical goods. They further elaborate on service quality and highlight two perspectives, internal and external service quality. They present the two as "*[e]xternal service quality refers to customer's perception of what they value and what they are willing to pay for. Internal service quality relates to services provided by the employees within the organisation*" (Srivastava & Prakash, 2019b, p.295). Translated to a healthcare setting this means that external service quality refers to the patient's perception, while internal service quality refers to the healthcare practitioner's perception of what quality of service is.

Patient-centeredness is increasingly highlighted in healthcare as critical for improved quality (Bergman et al., 2014). This implies greater focus on the patient and aligns well with the statement of Srivastava and Prakash (2019b) that there is an increased focus on external service quality in healthcare. However, to succeed in delivering care that meets the expectations of the patients (external customers), healthcare practitioners, as the internal customers, have a critical role and they must be equipped with the necessary capabilities to provide service that meets the expectations of the patients (Lee & Lee, 2022; Srivastava & Prakash, 2019b; Harrison et al., 2021). Bergman et al. (2014) highlight the increased focus on patients as a revolution in healthcare, since when patients are better informed meaning that they can collaborate in the healthcare process, leading to improved quality of care. However, to ensure successful delivery of healthcare, ensuring internal service quality is a prerequisite, but research on this topic is limited (Srivastava & Prakash, 2019b; Lee & Lee, 2022). Thus, focusing on the perspective of healthcare practitioners and internal customer satisfaction is of importance for service quality in healthcare.

1.1.3 Sustaining quality improvement through change

By understanding the internal customers and involving them throughout the development of services and products, quality can be determined for various segments and assured (Lengnick-Hall, 1996). However, as Milella et al. (2021) state, when trying to implement something new in an organisation that requires change, barriers and resistance can occur, which need to be overcome to sustain implementations. Harrison et al. (2021) mean that change management models can work as a frame of reference to help organisations in healthcare to consider key elements that are necessary for ensuring and sustaining change. It is of importance to create a sense of urgency in the people who are affected by change, to generate a motivation to make the change happen from the start (Varkey & Antonio, 2010). Without realisation of why change is necessary, barriers are not easily overcome. Furthermore, Lv and Zhang (2017) indicate that barriers are subjective but that that training is essential to empower a change within

people, and that skills, behaviour and attitudes need to develop for a change to be possible.

With varying needs to be met among healthcare practitioners, and thus clinics, but with a need to standardise and make efficient, Miller and Elgård (1998) state that modularity can be a useful way to balance customisation and standardisation. In a healthcare setting, this means a modularity of services. Research on service modularity has had an increase in focus during recent years and Gremyr et al. (2019) describe that service modularisation improves efficiency by standardisation but enables customisation where service modules can be combined to create unique offerings in bundles. It can thus be said that the concept of modularity in products and in services has been established in research for some time. However, there is limited research on modularity as a change management tool for implementation, and furthermore in a healthcare setting during the development of new digital services.

1.2 Purpose

The purpose of this thesis is to identify critical needs of internal customers to address in the development of an automated medical record service. Further the purpose is to investigate potential barriers and enablers for implementing change related to automated medical recording and examine how modularity can be a means of achieving service quality during implementation of new automated medical record services.

- Which are the critical attributes to consider to ensure customer satisfaction in the automation of medical recording?
- What potential barriers and enablers influence customers in the change towards automating medical recording?
- How can modularity be supportive of an implementation of automated medical recording services?

1.3 Delimitations

This study will be delimited to Swedish healthcare and private clinics that are customers to the study's case company, implying that they use the IT systems provided by the case company. All clinics involved are located in Sweden and follow Swedish regulations. Furthermore, the study is delimited to the segments primary care and specialist care. These are the two major customer segments of the case company and were chosen based on potential to have the highest impact. The sample of the study is also delimited to the three roles (types of internal customers): doctors, nurses and medical scribes as these are the major roles handling medical records. Excluded customers are organisations in surgical care and occupational care. Surgical care is excluded due to little verbal patient-provider interaction during care, while occupational care is excluded due to different process flows when seeking medical care. Furthermore, there are delimitations

in the ability to reach a high number of respondents due to limited availability of the healthcare practitioners. Moreover, there are delimitations to the attributes chosen for inclusion in the Kano the study where only attributes that are connected to the scope of the study are included.

2. Theory

This chapter will first go through digitalisation and automation of healthcare as this study aims to understand customer needs in the context of healthcare undergoing digitalisation and automation. Thereafter, the chapter will present improvement science in healthcare, followed by a discussion on change management as a response to the rapid shifts in needs in the sector. Taking a historical outlook on quality management, it becomes evident that customer-centricity plays a pivotal role and that this focus has also reached the healthcare sector. However, little emphasis has been put on the internal customer in organisations and its role in enabling internal service quality. The role of the internal customer will, hence, be discussed further in this chapter. The chapter then introduces the Kano model as a method for thoroughly understanding the internal customers' needs and their influence on customer satisfaction. Finally, the conceptual framework applied in the study will be presented. The framework takes a stamp in the theory presented and will provide the structure for analysis of the result.

2.1 Digitalisation and Automatisation of Healthcare

As above mentioned, the context of the study will be presented in this part of the chapter by presenting the benefits as well as the challenges of smart digital solutions for administration tasks.

2.1.1 Utility of advanced digital technologies

Usak et al. (2020) state that technological advancements within internet-based healthcare services, such as IoT healthcare solutions, have the potential to improve effectiveness, minimise costs and improve performance. These digital solutions also have the potential to decrease stress in personnel and are described as vital to be able to meet the increased healthcare needs (Demaku & Pihlgren, 2021). Surveys presented by Svensson and Sandgren (2022) show that healthcare practitioners estimate that they would save up to 56 minutes per day if IT systems work. There is however a risk that digitalisation can lead to healthcare practitioners becoming overworked if they are not given enough time to learn the system correctly. At the same time, El Noaimi (2020) states that the burden of administration has increased for healthcare personnel since Electronic Healthcare Records, EHR, was introduced and is even a cause of burnout. Castillo (2021) presents that approximately 40% of practitioners' time goes to handling administrative work.

2.1.2 Digitalisation of administration tasks

A possible digital solution for administration issues is the usage of AI, where parts of administration are automated. Following the definition suggested by Falcetta et al.

(2023, p.14), these intelligent solutions include “systems that could detect speech and transcribe it in a natural and structured fashion simultaneously with the doctor-patient interaction”. The key components in these solutions are automatic speech recognition (ASR) and natural language processing (NLP) (Finley et al., 2018). Applications of ASR-NLP solutions are, among others, automated AI-based medical scribes (Finley et al., 2018).

Possible improvements from using ASR-NLP or AI include reducing the administrative burden on healthcare providers, leading to cost reductions and improved workflow (Montenegro et al., 2023) as well as improved productivity and time efficiency (Falcetta et al., 2023). This also allows physicians to spend more time with patients (Falcetta et al., 2023; Zhou et al., 2021), which not only may improve the quality of the patient-provider interaction, but also might prevent and reduce the burnout rates of physicians (Falcetta et al., 2023). A study done by Zuchowski and Göller (2022) details how time and error rates were decreased with speech recognition, with an average time difference of 3.79 minutes and an average error rate difference of 0.15 per line, thus indicating potential benefits. Automating documentation with AI-based tools moreover has the possibility to improve the overall quality of healthcare in its ability to learn from millions of datasets and richer documentation, which further may be customised, autonomously.

2.1.3 Technical challenges with smart digital tools for administration

At the same time, there are challenges raised with this application. There is a concern whether a system could understand and process human conversations and language with variations in accents and choice of words (Zhou et al., 2021; Falcetta et al., 2023). Furthermore, relevant but unspoken medical evaluation made by healthcare providers could also present a challenge when trying to implement such solutions (Willis & Jarrahi, 2019) as well as adjustment issues with workflow (Zhou et al., 2021). There is also a need for high-quality data, which might be difficult to achieve in settings of medical meetings with interruptions, more than one person in the room, and microphone uptaking (Montenegro et al., 2023; Falcetta et al., 2023). Zuchowski and Göller, (2022) also present that the perception of error rates was larger for speech recognition than typing among the respondents in their study. There were also comments from respondents “that their acceptance of speech recognition software would be improved if certain adjustments were made, such as the creation of a mobile speech recognition software application, a faster speech recognition learning system or a medical-specific vocabulary. “ (Zuchowski & Göller, 2022, s.34).

2.1.4 Ethical challenges with using smart digital tools in healthcare

There is also an aspect of ethical considerations when adopting artificial intelligence in healthcare. Gerke et al. (2020) present four major ethical challenges when using AI in

a healthcare setting. First, informed consent is a major aspect that healthcare clinics need to consider. The lack of knowledge among medical practitioners further makes the situation difficult, due to not understanding how much should be informed to patients.

Secondly, Gerke et al. (2020) explain how safety and transparency is an important consideration. Systems need to be reliable and give correct information, thus placing importance on reliable dataset. This aligns with the outline of Schönberger (2019) that to get the most out of smart systems, they need to be trained on data, but depending on the source, data sets can cause bias in the system which can be cause for discrimination. Gerke et al. (2020) also state that it is important to ensure that datasets are trained without bias to ensure safe usage in several demographics. Lastly, Gerke et al. (2020) discuss the importance of data privacy.

Patients and medical practitioners need to trust that their information is managed properly, otherwise the system would fail to be incorporated (Gerke et al., 2020). Furthermore, uncertainty regarding ownership of data generates fear. When managing large quantities of patient data, it is necessary to consider whose responsibility it is when an AI malfunctions. Schönberger (2019) mentions that doctors have legal responsibility for their actions, but developers of such technology as AI are not conformed to such. There is a question raised whether a clinician can be held accountable for a suggestion from an AI if they do not understand the output, as well as possible safety consequences if accountability cannot be determined.

2.2 Improvement Science in Healthcare

Improvement science in healthcare has gained traction in recent years (Portela et al., 2016; Bergman et al., 2014). Cribb (2018) describes improvement science in the context of healthcare as "research in healthcare quality improvement that is explicitly aimed at improving health services" (p.110), and this is the definition that will be followed in the study. One other definition of quality improvement in a healthcare context is "to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development" (Batalden & Davidoff, 2007, p.2). Hence, it is hardly surprising that meeting the challenges faced by healthcare today requires a focus on quality improvement (Bergman et al., 2014).

Quality improvement first started in the industrial sector, but reached the healthcare sector in the 1980's. As outlined by Girdler et al., (2016), taking a historical outlook on the movement of quality management and improvement, the origin of today's knowledge stems from three men and their work, namely Walter Shewhart, W. Edwards Deming, and Joseph M. Juran. Shewhart laid the foundation of statistical control and mounted the distinction between common cause and special cause of variation. Deming took on Shewhart's findings in the area of management practice and quality

improvement. Juran later on developed this knowledge further in his *Quality Control Handbook* in which he presents cross-functional practices and techniques for quality control (Girdler et al., 2016).

Dean and Bowen (1994) moreover add Philip Crosby as one important contributor to the principles of quality improvement. They further discuss the many variants of frameworks and principles proposed and how these have led to ambiguity in the quality improvement movement from the start. Moreover, Dean and Bowen (1994) undertook to gather the proposed frameworks into one, which they presented as three sets of principles, practices, and tools. Even today these principles remain, for instance in Gremyr et al. (2020). The principles presented by Dean and Bowen (1994) and later paraphrased by Gremyr et al. (2020) are presented in Table 1.

Table 1. Principles of Quality Management.

Definitions	*Principle 1*	*Principle 2*	*Principle 3*
Dean and Bowen (1994, p.305)	"The paramount importance of providing products and services that fulfil customer needs requires an organisation-wide focus on the customer" (Dean & Bowen, 1994, p.305)	"Consistent customer satisfaction can be attained only through the relentless improvement of processes that create products and services" (Dean & Bowen, 1994, p.305)	"Customer focus and continuous improvement are best achieved by collaboration throughout an organisation as well as with customers and suppliers" (Dean & Bowen, 1994, p.305)
Gremyr et al. (2020, p.23)	"Importance of fulfilling customer and stakeholder needs, which requires an organisation-wide focus on customers and stakeholders" (Gremyr et al., 2020, p.23)	"Continuous improvement for consistent customer and stakeholder satisfaction" (Gremyr et al., 2020, p.23)	"Collaboration internally cross functions and externally with customers and suppliers is a basis for improvement and customer and stakeholder focus." (Gremyr et al., 2020, p.23)

What is not shown in Table 1 is that each of the three principles are followed by a set of practices and tools. Evident, however, is that the core of the framework is customer and stakeholder focus. Continuous improvement is vital to ensure sustained focus on customers and stakeholders, and teamwork is essential to ensure sustained continuous improvement (Gremyr et al., 2020). Considering the rise of improvement science in

healthcare, which has implied greater focus on the customer and a view on healthcare as a process of service delivery (Bergman et al., 2014), the principles of Dean and Bowen (1994) with customer focus as a focal point is critical.

2.3 Change Management

This part of the chapter will present the need for change in healthcare organisations and critical considerations in implementing change.

2.3.1 Change in healthcare organisations

The speed of the need to change within healthcare has increased with new technology and medical advancements as well as with changing social and financial needs (Varkey & Antonio, 2010). To be able to manage healthcare in such a changing environment, quality improvement is seen as a vital part for healthcare practises to succeed. However, Milella et al. (2021) state that healthcare organisations are seen as professional bureaucracies where employees are responsible for operational tasks in a professional and specific way. This arrangement is seen as bottom up in a perspective and can be described as rigid, but resistant to change.

Furthermore, the concept of professional bureaucracies create barriers to innovation as stable and predictable processes are preferred and autonomy reduces possibilities of efficiency initiatives (Milella et al., 2021). Thus, it is necessary to define problems and actions to implement change on the level of the professionals and a way that is susceptible to them. This aligns with Varkey and Antonio (2010) who explain that for quality improvement to have an effect on change, a focus on people and relationships within the organisation is necessary. Lv and Zhang (2017) further state that training is essential to empower a change within people, and that skills, behaviour and attitudes need to develop for a change to be possible. There are several change management models to follow, such as Kotter's 8-step model and Lewis's 3-step process for change management that is widely used. Harrison et al. (2021) state that change management models work as a frame of reference that can help healthcare organisations to consider key elements that are necessary for ensuring and sustaining change.

2.3.2 Implementing change in healthcare organisations

When implementing change in an organisation, barriers are important to consider and overcome (Lv & Zhang, 2017). Lv and Zhang (2017) and Varkey and Antonio (2010) describe that fear of change and uncertainty of the future is seen as a common barrier when trying to implement changes. Lv and Zhang (2017) state that a second barrier is resistance, which can embody anger, anxiety, or bargaining. Limited resources and support also work as a barrier, since changes usually require more time, coaching, and

costs. Furthermore, lack of interest to change from leadership can work as a barrier as well.

Varkey and Antonio (2010) detail a framework in seven key steps to successfully implement a change in healthcare organisations influenced by the perspectives of various change management models. The framework first presents the need to assess readiness to change and then create a common sense of urgency and importance within the organisation. This step is similar to Kotter's first step where Lv and Zhang (2017) state that it is difficult to take action towards a goal without a sense of urgency, see Figure 1. Varkey and Antonio (2010) further explain that a steering team should include who will plan, coordinate and monitor the project. This collective leadership is also part of Kotter's second step for change, see Figure 1, which Lv and Zhang (2017) describe as helping establish a culture with engagement in all levels of the organisation. Varkey and Antonio (2010) then continue with the development of an implementation plan which is first tested as a pilot, and thus evaluated before moving on with dissemination of the change in the entire organisation. Lastly the changes of the project are anchored in the organisation and necessary actions are taken to sustain the change.

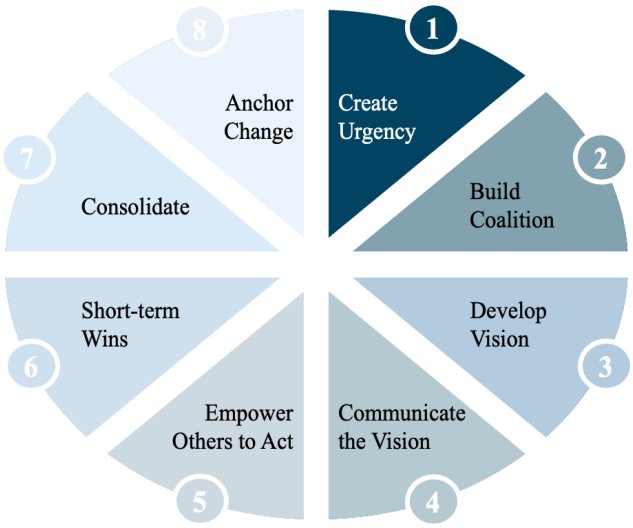

Figure 1. Kotter's 8-step model based on Lv and Zhang (2017)

2.4 The role of the internal customer

Following the principles of quality management abovementioned, the focus on the customers is vital to the success of any organisation (Gremyr et al., 2020). In this part of the chapter, the role of the internal customer and roles that customers can take on will be presented.

2.4.1 Internal service quality

Gremyr et al. (2020) present that customer focus and understanding of customers' expectations and needs are key to ensuring high perceived quality of customers, which

Grönroos (2015) describes as the interaction between customer expectations and experiences. Further, customers today have increased expectations of service delivery as the overall excellence of service has improved (Srivastava & Prakash, 2019b). Srivastava and Prakash (2019b) further argue that internal service quality is a prerequisite to enable service quality, which in turn makes internal service quality critical to the overall success of the healthcare organisation (Lee & Lee, 2022; Srivastava & Prakash, 2019b). Internal service quality is defined as the "perceived quality of service provided by distinctive organisational units or the people working in these units" (Srivastava and Prakash, 2019b, s.296).

To enhance internal service quality, internal customer empowerment, personal competence (Lee & Lee, 2022), and engagement (Harrison et al., 2021) is critical. The importance of the internal customer underlines the need to ensure internal customer satisfaction (Srivastava & Prakash, 2019b). For instance, Konttila et al. (2019) present that, in regards to digitalisation of medical records, previous experiences among medical practitioners had an impact on the attitude to implementation and a connection to feelings of dissatisfaction and negative outcomes. Lengnick-Hall (1996) further states that customers act as inspectors of offerings, thus determining quality and that their dissatisfaction could cause potential issues for firms. To ensure quality, it is suggested to view customers as more than end receivers and to work with them during the process of quality creation. From this realisation, five customer roles were identified: customer as resource, co-producer, buyer, user and product. In the following parts of this study, the customer will refer to the internal customer as presented by Srivastava & Prakash (2019b).

2.4.2 Customers as roles

Lengnick-Hall (1996) describes that customer as resource and co-producer mean that customers are adding value as input for the transformation process. The role of resource commonly involves customers acting as information providers, which helps the organisation by reducing rework and returns. Customers as co-producers instead require customers to enact self-leadership and self-management to contribute to quality, by taking over certain actions from the providers. Customers as buyer, user, and product mean that the value creation is an outcome from the transformation process and links perceived quality with a purchasing decision as well as linking perceived satisfaction with user experience.

The role of the buyer is thus connected to how they perceive that the offer meets their needs and that they receive a good return on their investment (Lengnick-Hall, 1996). For companies to generate purchases, they must work on the relationship with the buyer, as the buyer makes decisions based on factors such as image and reputation. Customers as users entail that customers determine the gap between expectation and experience of an offering which measures satisfaction. The indicator of quality is based

on how users feel that the offering meets or exceeds their expectations, which thus determines how much satisfaction the offering yields.

Moreover, Lengnick-Hall (1996) explains that the role of the customer as a product indicates that behaviour or needs from the customers have changed during the transformation process, which results in the customer experiencing both the transformation process and becoming the final step in the process. By understanding the various roles customers can have, quality can be enhanced. Hence, Srivastava and Prakash (2019b) state that healthcare organisations should prioritise understanding and response to the needs of the employees, the internal customers, in their effort to enhance internal service quality. One way to gain a thorough understanding of the needs of the customer is the Kano model (Gremyr et al., 2020).

2.5 Kano Model

Previously, customer satisfaction was seen as only proportional to the perceived quality of service so the higher the quality, the higher the satisfaction. With the development of Kano's model on customer satisfaction, more categories of customer needs that affect satisfaction in different ways were introduced. The aim of the model is "better understanding of how customers evolve, evaluate and perceive quality attributes and focused the attention on the attributes considered more important by customers in order to improve them." (Paraschivescu, 2012, s.117).

The Kano model has five categories of quality attributes that determine the level of satisfaction (Paraschivescu, 2012). Must-be attributes are a necessity for customers to even consider the service, they are usually not expressed by the customer since they are considered a basic criterion and a prerequisite (Matzler et al., 1996). One-dimensional attributes have a satisfaction that is proportional to the performance of the service, hence, the higher the level of fulfilment, the higher the satisfaction, and the opposite for dissatisfaction.

One-dimensional quality attributes are articulated, specified, and often measurable (Matzler et al., 1996), and are the attributes that companies compete with (Löfgren & Witell, 2005). Attractive attributes give a high level of satisfaction if present, but have no effect if not present. They surprise and delight, but are not normally expected by the customer. Fulfilling attractive quality attributes is a good opportunity for differentiation (Löfgren & Witell, 2005). Indifferent attributes do not contribute to either satisfaction or dissatisfaction. Lastly, reverse attributes yield dissatisfaction if fulfilled (the opposite of one-dimensional quality attribute), and is often a result of that different customers want different things (Löfgren & Witell, 2005).

By classifying customers' needs and requirements according to the Kano model, one can prioritise what to focus on in the development of new services as well as in

continuous improvements of a service. Moreover, product requirements can be better understood, and customer segments can be identified based on how they value each attribute. In Figure 2, the different categories of quality are represented showing how attributes categorised into the different quality categories affect customer satisfaction depending on the degree of achievement of each attribute (Matzler et al., 1996).

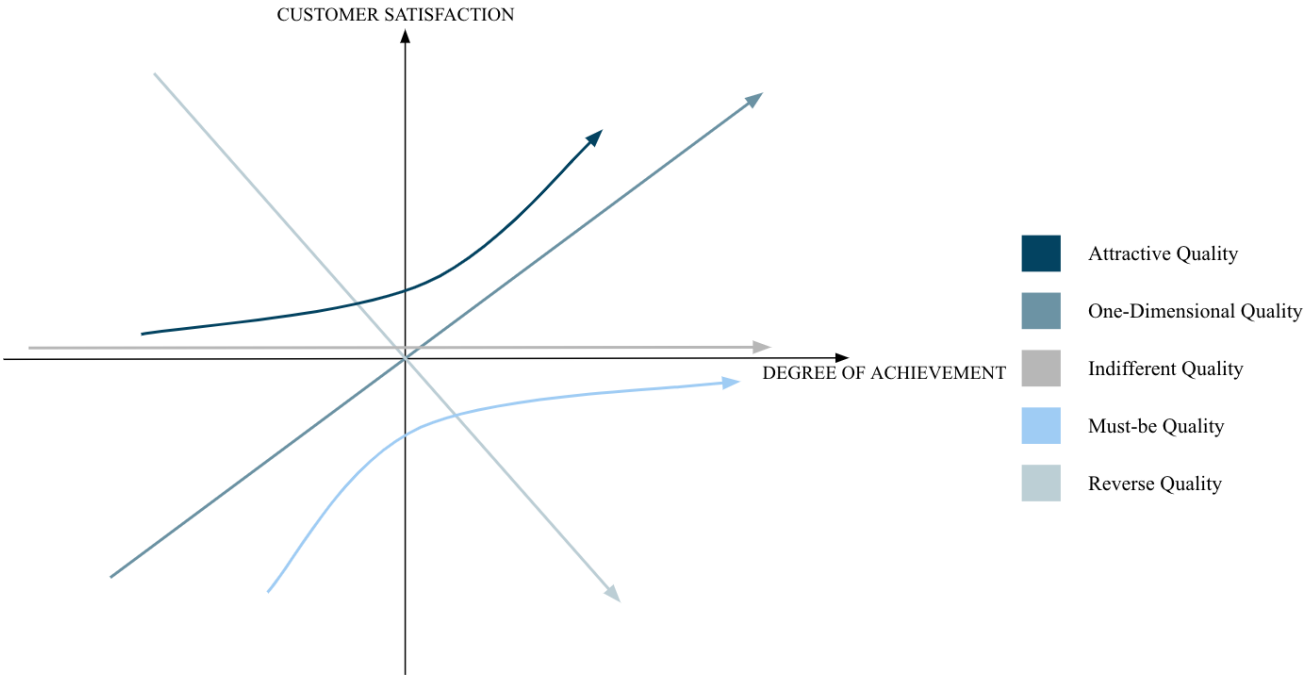

Figure 2. Kano Model

Löfgren and Witell (2005) add to the Kano theory that quality attributes are dynamic, and follow a life cycle of indifferent to attractive to one-dimensional to must-be quality, meaning that over time a satisfactory attribute might give dissatisfaction. When there is understanding of different needs among segments, offerings in the form of modules can be created that cater to the various customers (Gremyr et al., 2019).

2.6 Modularity in Healthcare

To fulfil patients' needs in healthcare, various combinations of standardised and customised care are essential (Srivastava & Prakash, 2019a). Mannion and Exworthy (2017) state that standardisation and customisation provide outcomes in vastly different ways, but it is difficult to only have one and not the other. Sinsky et al. (2021) describe that too much standardisation can decrease the quality of outcome as it is either unnecessary or insufficient in providing care, while too much customisation increases the workload for medical practitioners. It is thus important to achieve a balance between standardisation and customisation. Miller and Elgård (1998) explain that modularity can be viewed as a method to balance standardisation and customisation.

Modularity is described by Gershenson et al. (2003) as a concept where a component or a group of components are designed independently from each other, but function as an integrated entity when combined. Modularity in service has had an increase in focus during recent years and is defined as the division of services into standardised components that can be combined in various ways to meet customer needs (Gremyr et al., 2019). Benefits presented are cost reductions, customisation, simplifications of complex systems and standardisation of services. Gremyr et al. (2019) describe that service modularisation improves efficiency by standardisation but enables customisation where service modules can be combined to create unique offerings in bundles.

Pohjosenperä et al. (2019) argue that modularisation can be incorporated in healthcare to combine various care services to address individual patient needs. Furthermore, Srivastava and Prakash (2019a) show "that modularisation is applicable in treatment processes where several sequential mechanisms need to [be] incorporated." (s.106). Pohjosenperä et al. (2019) further argue that modularity can help with improvement opportunities in care processes and that care service can be modularised and packaged to address various patient needs, thus enabling customised care. Prakash (2022) means that there are many enablers for service modularity in healthcare, with technological versatility being one that has shown to have positive effects. Prakash (2022) further describes that "technology-driven approaches can increase the efficiency and effectiveness of modular service delivery" (Prakash, 2022, s.1457). Technology could allow better coordination within healthcare processes and better utilisation of resources, thus enabling better service delivery and timely delivery of care.

2.7 Conceptual Framework

This research is grounded in the concepts and theories presented in Chapter 2, which are improvement science, the role of the internal customer, the Kano Model, modularity, and digitalisation and automation, all in the context of healthcare. These concepts lay the foundation for the conceptual framework applied in the research, presented in Figure 3.

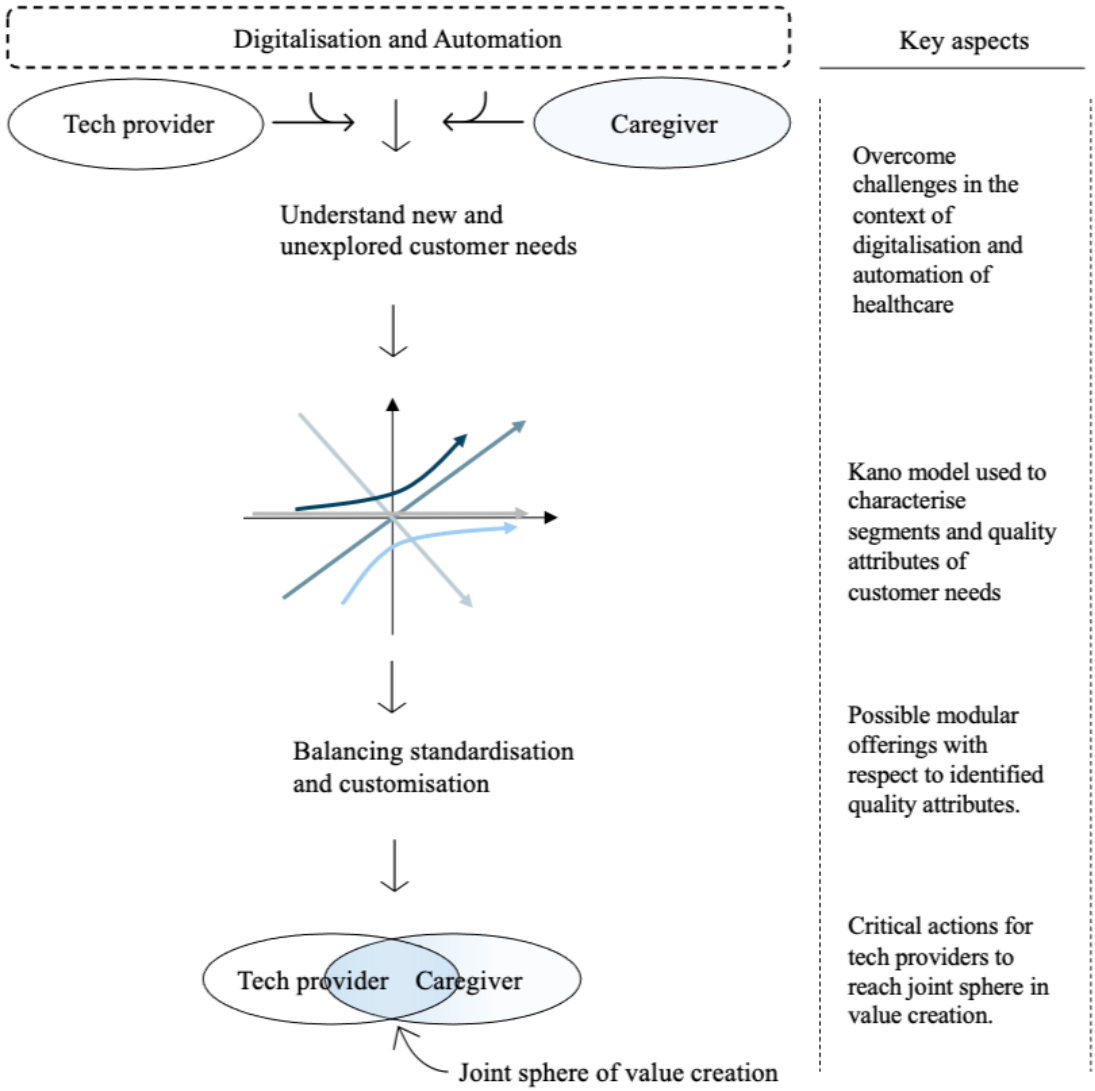

Figure 3. Conceptual Framework

In the conceptual framework (Figure 3) applied for this study, two spheres are illustrated, the tech provider sphere and the caregiver sphere. The goal of the study is to reach a joint sphere of value creation as presented by Grönroos (2015). Grönroos (2015) presents the shift from product-centred logic to service-centred logic in value creation, a logic that suggests that the customer is the creator of value, hence value can be defined as the customer is "being better off" (Grönroos, 2015, p.12). Thus, the value is determined by the customer and the provider can only support this value creation in

the joint sphere during the customer-provider interaction by providing value facilitating resources.

Digitalisation and automation of healthcare offer the potential of improved efficiency, reduced waiting times (Spak, 2022), increased availability for patients (Bergman & Schmidt, 2023), reduced administration burden for personnel (Aung et al., 2021), and improved patient-provider interaction (Falcetta et al., 2023). Hence, it is a critical step in the improvement of healthcare and yet these changes imply challenges affecting all stakeholders involved (Montenegro et al., 2023). As stated by Lee and Lee (2022), Srivastava and Prakash (2019b) and Harrison et al. (2021) medical practitioners, who can be viewed as internal customers in the context of healthcare services, have a critical role in delivering care of quality to patients. To understand and meet their needs in the face of change in the context of digitalisation of healthcare, and ensure internal service quality, is thus, critical.

To understand the needs of the stakeholders, the Kano Model, visualised as a graph in (Figure 2), can be used. By applying the Kano Model, different quality attributes can be identified from the various stakeholder segments. Thus, it enables a categorisation of quality attributes and a more nuanced understanding of what is needed to reach satisfaction among the stakeholder segments (Paraschivescu, 2012). The categorisation of quality elements can further provide a ground for customised offerings. Sinsky et al. (2021) highlight the need for balance between standardisation and customisation of offerings, and Miller and Elgård (1998) raise modularity as a means to find this balance.

At the bottom of the conceptual framework, the joint sphere of value creation presented by Grönroos (2015) is visualised. The identification and categorisation of customer needs by the use of the Kano model, clustered in modular offerings, can provide the tech provider with capabilities to support the value creation in the tech provider-caregiver interaction.

3. Method

In this chapter, the method applied throughout the study is presented and motivated.

3.1 Research Strategy

The research strategy of this study is a mix of quantitative and qualitative, and as Bell et al., (2019) suggest appropriate for such a strategy, an abductive approach has been adopted. The abductive approach is suggested to overcome the weaknesses of the inductive and deductive approaches, respectively, as it is a back-and-forth approach between the theory and the empirical world to build theories and create understanding (Bell et al., 2019). Meadows (2014) further argues that social understanding in real-world settings is best, if not only, evolved by "everyday reasoning" that is in nature abductive. Given that this study aims to understand stakeholder needs within their real-world setting, Meadow's argument aligns well with the purpose of this research.

The mixed method strategy has become increasingly popular in recent years as a further attempt to overcome the weaknesses that are suggested to be inherent in qualitative and quantitative research strategies (Creswell, 2009; Bell et al., 2019). Creswell (2009) highlights that the mixing of qualitative and quantitative methods enables expanded understanding and that problems in social and health science are so complex that neither the quantitative nor qualitative strategy alone can address these.

There are different types of mixed strategies, but the one adopted throughout this study is the exploratory sequential design shown in Figure 4. In the exploratory sequential design, qualitative data is first collected to provide hypotheses and data that are then to be quantitatively investigated and analysed (Creswell, 2009; Bell et al., 2019). Creswell (2009) presents several benefits of the exploratory sequential design. The quantitative phase enables improved interpretation of the qualitative data collected, for instance, the distribution of a phenomenon can be assessed. This design is particularly suitable in emerging fields since it allows for quantitative testing of data that is generated empirically. One of the main drawbacks presented by Creswell (2009) with the approach is that it requires much time considering the need for sequential time periods of data collection.

To illustrate how the research strategy supports the aim of the study, the research questions are mapped in Figure 4. The critical attributes to consider (RQ1) is to be found by first generating relevant attributes in the qualitative phase and then assess the criticality in the quantitative phase. The second and third research questions will be answered by analysing the result and current literature.

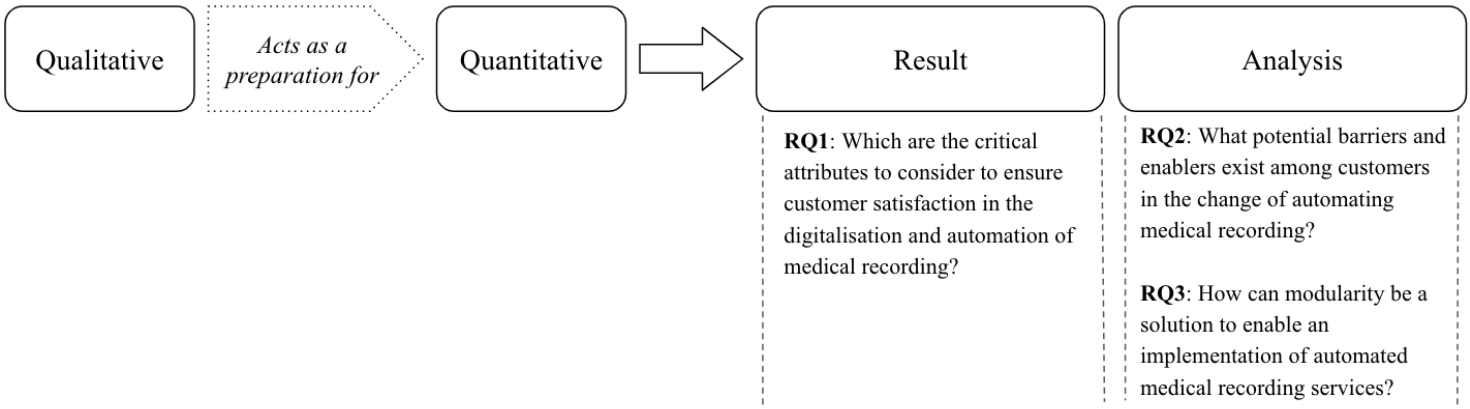

Figure 4. Exploratory Sequential Design

3.2 Research Design

This study is a case study. Case studies have been criticised for limited generalisability due to the limited context studied, however, they have in recent years gained popularity due to providing a thorough understanding of one phenomenon and its context (Dubois & Gadde, 2002). Further, the mixed-method strategy with an abductive approach is common and well-supported when using a case study design (Bell et al., 2019). The case study presented in this thesis is based on one organisation, an IT company supplying digital solutions and infrastructures to healthcare clinics, with focus on their new digital offering to clinics.

The process of the research is shown in Figure 5. The first phase focused on defining the scope of the study and involved iteratively reviewing literature along with information on the project provided by the case company. The second and third phases were preparation phases before the quantitative data collection in phase four. In the second phase, qualitative methods were used that were then to be analysed to generate attributes (phase three) relevant to the fourth quantitative data collection phase. The quantitative data collected was then analysed in phase five, and in phase six the conclusions from the study were presented. During phases two to five, the study applied the Kano survey to identify and analyse customer needs. A further explanation of the Kano Model is described in the theory of reference, and the Kano survey and its related data collection method is described in 3.3.

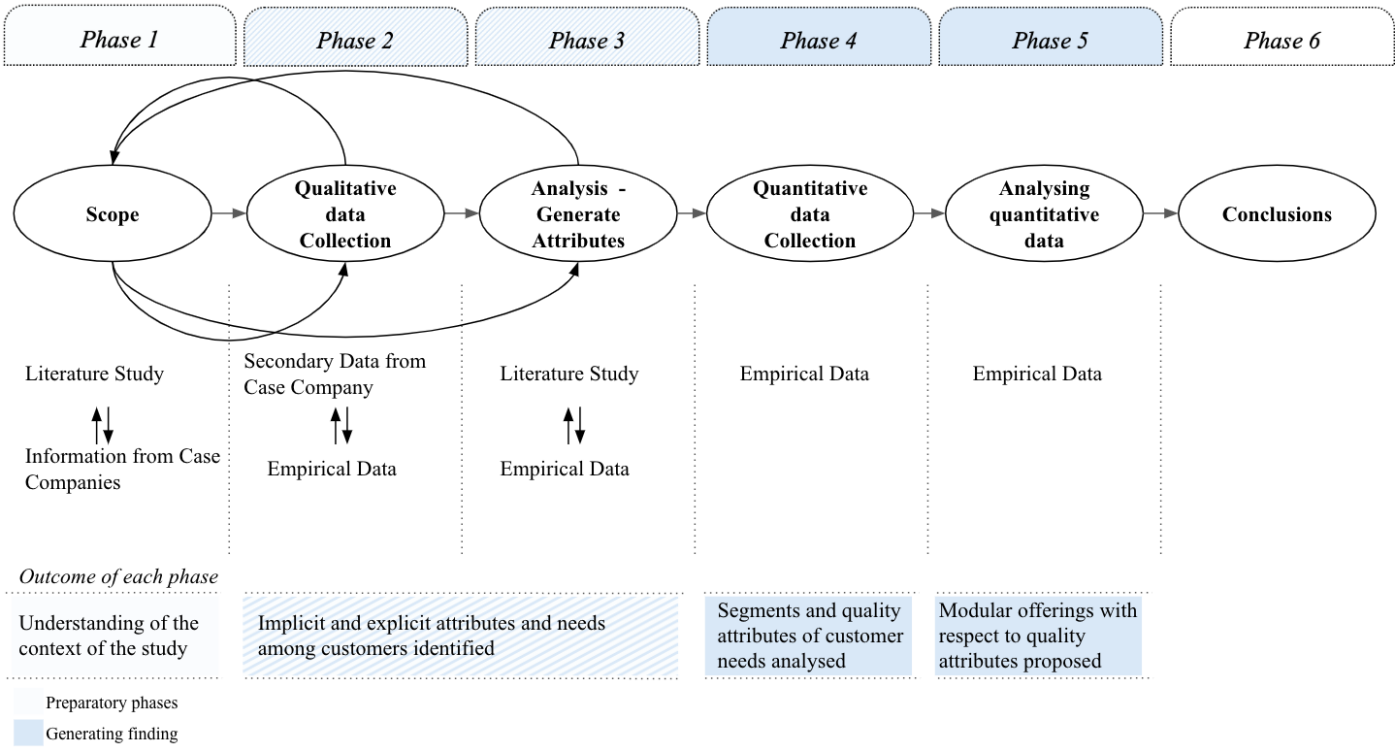

Figure 5. The research process

3.3 Data collection

The collection of data was done in two phases, one qualitative followed by one quantitative. In this part of the chapter, these two phases will be described.

3.3.1 Qualitative collection of data

The first data collection phase followed a qualitative approach with direct non-participating observations and semi-structured interviews. Ciesielska et al. (2018) state that observers of direct non-participating observations can access silent knowledge and work well in organisational studies. The observations were done in a specialised healthcare clinic for one full day. Two observations were done on physicians dictating medical records in the medical record system studied. During the observations, field notes were taken, focusing on gathering benefits and drawbacks of the process of medical recording.

Bell et al. (2019) explain that interviews in a qualitative setting focus on understanding the interviewee's perspective. Semi-structured interviews give flexibility in open-ended questions, but with a guideline of which topics will be covered. This gives benefits of understanding and addressing specific issues. The structure of the interviews followed Critical Incident Technique, where interviewees are asked to recite extreme memories

of incidents regarding a specific topic (Butterfield et al., 2005). The interviewer can then categorise data collected in a way "that summari[s]es and describes the data in a useful manner, while at the same time 'sacrificing as little as possible of their comprehensiveness, specificity, and validity" (Butterfield et al., 2005, s.479).

The interviews started with introductory questions about the interviewees to understand their role and responsibility within their organisation. The interview then followed with open questions about their experience of benefits and drawbacks with medical record documentation, as well as administration in general. Lastly, questions about their biggest wishes concerning medical recording were asked to better understand what their optimal situation would be. See Appendix 1 for the interview template.

A total of eight interviews were done, whereas four were done with doctors (below referred to as D1-D4), two with nurses (below referred to as N1) and four with medical scribes (below referred to as M1-M3). Two interviews were done in primary care clinics and six were done in various specialised clinics. A snowball sampling approach was utilised to identify relevant interviewees, as stated by Bell et al. (2019). The duration of each interview was about 30 minutes. No interview was recorded, instead one interviewer was responsible for taking notes whereas the other one conducted the interview. A list of attributes was generated from the interviews and observations by examining the answers and picking out words and sentences that were seen as customer needs. The needs picked out were organised in the categories of: technological, resource saving, work environment, organisational support and quality and control, and work methods. The attributes formed a basis for question formulation of the survey for the quantitative data collection phase. The attributes used for question formulation were coded to the question number they connected to in the survey.

3.3.2 Quantitative collection of data

The second phase was of a quantitative nature and data was collected with a survey. The sample for the survey was limited to the scope of the study, where the survey was only sent to primary care clinics and specialised clinics that are clients to the case company. The sample was further limited to entail doctors, nurses, and medical scribes from the two segments. Bell et al. (2019) describe that questionnaires must be easy to follow since those answering will have to make their own assumptions. The survey followed the pre-defined structure of the Kano survey, with questions in a pairwise format with a negative and positive formulation that asked how respondents would feel if they had or did not have a certain feature (Berger et al., 1993). There were five alternatives to choose from when answering each question and the survey followed a vertical format. All answers were anonymous but the respondents were asked to specify their role within their organisation, to ensure responses within the intended scope. A representative illustration of a pair of questions with the possible answer options following the Kano survey format is seen in Table 2.

Table 2. Representative Illustration of Kano Survey (Berger et al., 1993)

How would you feel if you were provided with [*the feature*]?	1. I like it that way 2. It must be that way 3. I am neutral 4. I can live with it that way 5. I dislike it that way
How would you feel if you were **not** provided with [*the feature*]?	1. I like it that way 2. It must be that way 3. I am neutral 4. I can live with it that way 5. I dislike it that way

The survey had an introduction to the purpose of the study as well as instructions for how to answer the questions. The survey had 15 pairs of closed questions with attributes that were generated from the qualitative data collection. All questions were in Swedish and the alternatives were translated from English to Swedish, using the translation for the alternatives applied by Löfgren and Witell (2005). For the full survey, see Appendix 2. The survey was sent out to a total of 9730 people, and 220 responses were recorded. Since the survey was sent out via the case company's lists of contacts, a further analysis of who did not respond and why was not possible. As there is no way of knowing the reason why some did not respond, the potential implications of bias need to be considered. The responses were sorted based on reported role, wherein 166 had roles included in the scope, which meant that they reported that they were doctor, nurse, or medical scribe. Roles reported that were considered outside scope were, among others, psychologist, physiotherapist, and dietician. The distribution among respondents based on type of clinic and role is presented in Table 3.

Table 3. Distribution of responses

	Specialist Clinic	Primary Care	*Total resp. per role*
Doctor	76	21	97
Nurse	20	13	33
Medical Scribe	26	10	36
Total per clinic type	*122*	*44*	

Once the relevant responses were sorted, each pair of questions was assigned a category of quality attributes, described in section 2.3. The categories were assigned by mapping each response according to Table 4. The mapping and analysis of responses was done

in excel and throughout the analysis of responses, the methodology described by Löfgren and Witell (2005) was followed.

Table 4. Classifications of quality attributes

		Dysfunctional				
		I like it	It must be	I am neutral	I can live with it	I dislike it
Functional	I like it	Q	A	A	A	O
	It must be	R	I	I	I	M
	I am neutral	R	I	I	I	M
	I can live with it	R	I	I	I	M
	I dislike it	R	R	R	R	Q

A = Attractive; O = One-dimensional; M = Must-be; I = Indifferent; R = Reverse; Q = Questionable

The mapping of each response resulted in a distribution of classifications for each of the questions. The next step of the analysis was then to assign one classification for each question. The classification of quality attributes followed the reasoning of Löfgren and Witell (2005) and Matzler et al. (1996), where the classification with highest frequency is chosen if it is not close to tie among classifications. If the distribution of classification is too close, the evaluation rule "M > O > A > I" is suggested by Löfgren and Witell (2005) and Matzler et al. (1996). The definition of "close to tied" was not predefined, hence, an estimation was made by looking at the distributions. A difference of < 5 percentage points was set as threshold for the use of the evaluation rule. Furthermore, since neither Löfgren and Witell (2005) nor Matzler et al. (1996) mention the classification R into the evaluation rule, the evaluation rule "M > R > O > A > I" was determined, since it aligns with the reasoning of Löfgren and Witell (2005) and Matzler et al. (1996) that it is most critical to ensure no dissatisfaction (hence to fulfil must-be and reverse quality attributes) before ensuring satisfaction (fulfilling one-dimensional and attractive quality attributes).

To further understand how each quality attribute affects satisfaction or dissatisfaction, a calculation of averages labelled "better" and "worse" were calculated, as suggested by Matzler et al. (1996):

Extent of satisfaction:

$$\frac{A + O}{(A + O + M + I)}$$

Extent of dissatisfaction:

$$\frac{O + M}{(A + O + M + I)(\times -1)}$$

The value for extent of satisfaction ranges from 0 to 1 and the higher the value, the higher the influence on satisfaction. The value for extent of dissatisfaction ranges from 0 to -1 and the lower the value, the higher the influence on dissatisfaction if not met (Matzler et al., 1996). In the calculations of extent of satisfaction and dissatisfaction the reverse quality was excluded. The criticality of reverse quality attributes is argued for above. However, since the reverse quality is of the opposite direction (see Figure 2) compared to the other classifications, which implies that the fulfilment of the attributes yields dissatisfaction whereas non-fulfilment yields satisfaction, these are evaluated separately.

To be able to analyse potential differences among customer segments, the steps for analysis above described were conducted over the total respondent group within scope, but also for each of the respondent groups specialist care (122 responses), primary care (44 responses), doctors (97 responses), nurses (33 responses), and medical scribes (36 responses). The result for each question was presented separately in tables to visualise the potential variation among respondent groups.

3.4 Quality of Research

In Table 5, quality criteria relevant to qualitative and quantitative research as presented and described by Bell et al. (2019) are presented. To ensure quality of research each of these criteria was considered throughout the study, with countermeasures presented in Table 5.

Table 5. Quality Criteria and Countermeasures

Qual./ Quant.	*Criteria*	*Description*	*Countermeasures*
Qual.	Dependability	Result is applicable at other times (Bell et al., 2019).	● Clear and standardised structure in interview and observation template (Bell et al., 2019). ● Documentation of the professional roles of the interviewees (Bell et al., 2019).

	Transferability	Result is applicable in other contexts (Bell et al., 2019).	*Limited due to case study* (Dubois & Gadde, 2002). ● Different professional roles were interviewed (Anney, 2014). ● Seeked breadth in respondents (roles and healthcare institutions) to gather many perspectives (Anney, 2014).
	Credibility	Results are believable (Creswell, 2009; Bell et al., 2019).	● Face-to-face interviews (Jensen et al., 2010) ● Describing the context in all interviews (Bell et al., 2019). ● Follow-up questions to ensure understanding during interviews (Bell et al., 2019). ● Using a standardised method in developing the interview template (Bell et al., 2019).
	Confirmability	Researchers have been objective in the study (Bell et al., 2019; Anney, 2014).	● Standardised and renowned methods during interviews. ● Peer reviewed interview template (Anney, 2014).
Quant.	Reliability	Results are repeatable (Bell et al., 2019; Creswell, 2009).	● Standardised method, Kano, categorising respondents as questionable (Bell et al., 2019; Creswell, 2009) ● Pilot test of survey (Creswell, 2009). ● Indication on reliability/questionability of answers by the categorisation of Kano (Löfgren & Witell, 2005)
	Replicability	The study is repeatable (Bell et al., 2019).	● Documentation of respondents (professional roles) (Bell et al., 2019). ● Documentation of survey structure (Bell et al., 2019). ● Detailed method (Bell et al., 2019).
	External validity	The results can be generalised beyond the specific context	*Limited due to case study* (Dubois & Gadde, 2002). ● Survey sent out to as many as possible (Bell et al., 2019)

		(Bell et al., 2019).	● Survey sent out to a large variety of professional roles (Bell et al., 2019).
	Internal validity	The findings are a causal result of the investigation (Bell et al., 2019).	*Most applicable to experimental designs, hence, limited applicability* (Creswell, 2009) ● Attributes in the Kano survey are created based on information from interviews with representatives from respondents to ensure correct and understandable context (Bell et al., 2019).
	Ecological validity	Results are applicable in real life settings (Bell et al., 2019).	● Survey sent out to caregivers in their real life setting (Bell et al., 2019) ● Attributes generated from real life setting (Bell et al., 2019)

1: Assessing credibility involves analysing movement, kinesic and linguistic properties of communication (Jensen et al., 2010)

The countermeasures presented in Table 5 are all defined based on definitions of each quality criteria (Bell et al., 2019; Creswell, 2009). Further, the research has involved triangulation of methods to increase confidence and comprehensiveness of the findings (Heale, 2013).

3.5 Ethical considerations

This study has been ethically guided by the four ethical concerns proposed by Bell et al. (2019), namely deception, invasion of privacy, harm to participants, and lack of informed consent. To prevent deception, the participants of the study were informed about the intent of the research and, hence, data collection that they were part of, whether it was through observations, interviews or surveys. This is also tightly linked to the concerns of informed consent, which was ensured by providing enough information about the study to all who are to be a part of it.

The concern of harm can be viewed from many perspectives, but aspects that are mentioned by Bell et al. (2019) and considered relevant to this study are stress and harm to future career paths and employment. Considering today's long waiting times in Swedish healthcare (Janlöv et al., 2023), there might already be stress put on the healthcare practitioners who are to be a part of this study. Therefore, as mentioned in the previous part of this chapter, the availability of the respondents was a consideration when choosing among participants. Regarding harm in terms of future employment, the research has intended to understand the stakeholder needs and concerns to meet these in the future, hence, it has been a red thread throughout the research process. Furthermore, as observations were done, seeing or hearing sensitive information has

been addressed as potential harm to patients. During the study, a confidentiality agreement had been signed with the case study company, stating:

> "[the students are to] *follow the same confidentiality and secrecy as required by law for personnel active within healthcare. Specifically, it means that no information about individual patients may in any way be forwarded to any other person, company, or authority, or in any way copied, altered, or moved*".

There were no interactions with patients in this study. Finally, the concern of privacy is an important one in Swedish healthcare, with heavily regulated patient data laws (SFS 2008:355). The regulations were complied with, and patient data was only to be read if it was made anonymous or if the patient had provided informed consent. However, this were never done during the study.

4. Result

In this section, findings from the interviews, observations, and Kano survey will be presented.

4.1. Caregiver Perception of Digital Medical Recording Tools

In this part of the chapter, answers and quotes are presented from the eight interviews conducted. First, answers about the system used by the caregivers and medical scribes are presented. This system is sold by the case company and is a medical record web application with various IT-services connected to the medical recording part. Then, traditional dictation methods are presented. Traditional dictation method means that a caregiver records information after a patient meeting, and then it is transcribed into the medical record by a medical scribe manually. Lastly, usage of speech recognition software is presented. Speech recognition software is an external service that is connected to the medical record system, where caregivers dictate into a microphone which immediately transcribes into the medical record.

4.1.1 The System

One of the first benefits mentioned is connected to the performance of the software system itself. D1 states that it is fast and user friendly compared to other products they have tried and that the application enables users to gain access from various systems such as “phone, computer and Ipad”. M1 also agrees with how the system is organised, stating that “it is easy to learn and very logical”. N1 also explains that the system is user friendly and fast to use with little computer freezes. However, D1 presents a drawback with the system regarding flexibility, stating that one “cannot have several windows open” and that one “cannot have two tabs open, which the public competitor can”, referring to the possibility to have two or more different tabs open in the web application. D1 also mentions that the signing button is a “top irritation moment, as it can be seen how much faster it could be done”.

During an observation where D3 showcases how a referral is done, there are approximately 15 clicks to open the referral window in the system. Furthermore, administrative information such as address needs to be added to the system and several clicks are made to access this information from the patient record. Referral management is only one example of various administrative tasks concerning medical record recording. D3 states that they need a medical scribe for these types of administrative tasks so that doctors can spend as much of their time as possible with patients and that medical scribes work as a control function. D2 expresses similarities, stating that one “must spend time on finding addresses [and] that these traditional secretary tasks take too much time”. Moreover, when observing D3 beginning to document the patient

visits, they first checked old notes about the patient and then checked the new notation taken during the visit. Then, the medical record template is opened for the new visit and the doctor starts dictating notes by using a microphone connected to the overall medical recording system.

N1 describes the benefits of how the system is structured and that "everything is in the same place: referrals, testing and surgery planning". D2 further explains that the system saves data and that statistics can readily be accessed which helps with "calculating and planning and is easier to set resources for future needs". D1 also mentions customisation based on patient symptoms when preparing for patient meetings, stating that "different templates have a varying degree of specification depending on patient visit". M1 mentions drawbacks with the system, stating that there "can be a little too many clicks to move forward". Decreased flexibility with templates for medical records has been mentioned, where D2 states that "one could wish to write something but it does not fit in [the template] and it can limit oneself and make it difficult to express oneself".

4.1.2 Use of Traditional Dictation Methods

M2 states that by transcribing dictates, words can be changed to less medicinal terminology, mentioning that "what is written must be understood by the patient, so a medical secretary should 'make it more Swedish'". M1 mentions that transcribing dictates works best when doctors speak clearly and articulate with a slower pace. M1 further explains that one of the best work environments to transcribe dictations are "when one can sit in peace and quiet and not become disturbed".

D2 states that by not using traditional dictation, less errors are made in the medical record, "since medical scribes can be sloppy". D4 describes that with traditional dictation, it can take a long time to receive the finished records and that it is preferable to do the medical recording themselves. D4 expresses other issues with traditional dictation, stating that "dictation usually implies long medical records, updates and 'babbel'[non-relevant, additional statements]". Issues with traditional dictation are mentioned by M2 as well, stating that it "can be blurry and bad sound recording and a lot of repetition. [Doctors] like to babble when dictating in an audio file compared to speech recognition software". M3 states that "it takes 2-3 times longer to transcribe and there is always surrounding work as well". M2 also describes the transcription process to take the double amount of time that the audio file is. D2 further states that using dictation would require investment in two medical scribes and that they do not have the resources, stating that they save 2MSEK a year not having medical scribes.

4.1.3 Use of Speech Recognition

The use of speech recognition for writing medical records varies in terms of how many people use it and in which cases it is most beneficial. D1 explains that for situations where large amounts of information need to be processed, e.g. when determining someone's ability to work, speech to text can be beneficial. N1 further details that speech recognition could work well in certain environments stating that "when working in an ambulance, this is a more difficult work environment and little time between calls to write medical records". D1 further states that "when it is predictable and structured, speech recognition is good", which refers to how patient meetings are organised. However, D1 states that "risk with speech recognition is that there is too much written. Speech recognition does not make people more clear in how they structure". D2 expresses issues with the amount of text in medical records, stating that "new doctors write too much and older people almost write too little. It creates an uncertainty as to how much writing is expected". Moreover, D1 mentions that speech recognition does not work in smaller meetings and that you "don't save anything in the margins and there is a large volume of these types of meetings".

D3 explains that a benefit of the speech recognition software currently in use is the function of macrons, where a few words can generate full sentences. This was seen during the observation of D3, where usage of short commands for standardised patient values was used. D2 also mentions the usage of macrons that are standardised. D4 finds writing in the medical record during patient meeting more efficient than dictation, stating that "there is risk to forget what was said during the conversation that can lead to awkwardness if one must contact the patient [later] to confirm", and also that one "can be disturbed when dictating after patient visit". At the same time, D3 mentions that with speech recognition, compared to traditional dictation, the dictation is done immediately, and patients can access their records instantly. However, D3 also describes that "with speech to text, there is no one that controls errors and no one who senses a plausibility in what is written". Moreover, when asked about using speech recognition software N1 states that "nurses and assistant nurses sit in the same room and that dictation would be troublesome then".

D1 states that the current speech recognition system successfully summarises and structures text with approximately 70% accuracy. Furthermore, D1 describes experience with speech recognition accuracy "Me as a doctor do not care about the cost, and an AI that has an error 3 out of 10 times is not [good] enough when a medical scribe does everything correct". D3 also states that there is " a lot of separation of words" and that there are difficulties in interpreting words that sound similar which could have an impact on outcome. This is shown during the observation of when D3 documents after a patient visit, where separated words are corrected manually. Furthermore, one word (shea butter) is not registered so this is also adjusted manually. Furthermore, there are grammatical errors such as tempus that are adjusted manually as well.

The current service requires manually pressing the mouse in each information window where the spoken documentation should be added as D3 shows during the observation. The last step of medical recording in the observation of D3 is entering action codes manually, which are connected to remuneration, and then an 'ok' button is pressed to sign the medical record. D3 then writes a note to the medical scribe to enter a telephone time for the patient. This is done to increase time for other tasks for the doctor, as D3 states that "before we had a medical scribe, everything took longer time. Not for speech recognition, but for other tasks around [medical recording]". D3 also expresses that "in reality things are forgotten and traditionally a medical secretary discovers this error [in transcription], but with speech recognition software it might not be discovered until months later when the patient reaches out".

4.2 Identifying and classifying attributes

This section presents the identified quality attributes from the Kano survey. Each Table represents the answers to each question, where the *sample* indicates the two customer segments and the three various roles. The *classification* states the quality attribute that was identified for each segment and role. *Classification agreement* refers to the share of answers in percentage that the identified attribute generated. The asterisks present at some of the classification agreements indicate that the attribute chosen followed the evaluation rule for quality attributes, which is described in 3.3. *Better* indicates how much customer satisfaction will increase if the quality attribute is provided, whereas *worse* indicates how much customer satisfaction will decrease if the quality attribute is not provided. Table 6.1-6.15 show the result from each question.

Table 6.1. Kano Survey Result Q1

Q1: Standardised structure of medical record at clinic					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Indifferent	40,4%	0,36	-0,31
Type of clinic	Spec. Clinic	Indifferent	40,2%	0,38	-0,31
	Primary Care	Indifferent	40,9%	0,29	-0,29
Professional roles	Doctors	Indifferent	43,3%	0,33	-0,30
	Nurses	Indifferent	39,4%	0,38	-0,44
	Medical Scribes	Attractive	30,6%*	0,41	-0,21

The proposal of a standardised structure of medical record at clinics was based on interviews where issues with variations in medical records writing were mentioned. Results from question 1, seen in Table 6.1, show that the majority find a standardised structure of medical record as an indifferent quality, except for medical scribes who find it attractive based on evaluation criteria. 22,7% of respondents in primary care find

this attribute as a must-be which is shown in Appendix 3, indicating that this is more important for them.

Table 6.2. Kano Survey Result Q2

Q2: Predetermined medical record structure for per type of visit					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Indifferent	32,5%	0,47	-0,36
Type of clinic	Spec. Clinic	Attractive	28,7%*	0,52	-0,36
	Primary Care	Indifferent	40,9%	0,33	-0,36
Professional roles	Doctors	Indifferent	37,1%	0,46	-0,33
	Nurses	-	-	0,48	-0,48
	Medical Scribes	Attractive	27,8%*	0,50	-0,34

The suggestion of predetermined medical record structure per patient type of visit was based on interviews where, as in question 1, variation in how medical records are written were mentioned as well as more patient-specific templates. As seen in Table 6.2, on average, the attribute asked about in question 2 is classified as indifferent, but for specialised clinics and medical scribes, it is attractive based on the evaluation criteria. Nurses have a classification agreement of 24,7% for three quality classifications, as shown in Appendix 3, indicating that further investigation is necessary.

Table 6.3. Kano Survey Result Q3

Q3: Structure of medical record can be individually designed					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	28,3%*	0,60	-0,37
Type of clinic	Spec. Clinic	One-dimensional	32,0%	0,64	-0,40
	Primary Care	Indifferent	43,2%	0,46	-0,26
Professional roles	Doctors	One-dimensional	33,0%	0,60	-0,44
	Nurses	Indifferent	39,4%	0,55	-0,24
	Medical Scribes	Attractive	36,1%	0,64	-0,27

The proposal of having a structure of medical records that can be individually designed was based on interviews where caregivers wanted to have more flexibility in medical record templates, as well as more patient-specific templates. As shown in Table 6.3, there is a variation in classification among specialised clinics and primary care clinics and among the roles. On average the result classifies as one-dimensional based on evaluation criteria. The role of doctor showcases a higher importance for this attribute than other roles. This could imply, as mentioned in 4.1.2, that it would be beneficial to create patient specific templates.

Table 6.4. Kano Survey Result Q4

Q4: Referral function integrated in the medical record					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Attractive	43,4%	0,67	-0,26
Type of clinic	Spec. Clinic	Attractive	40,2%	0,63	-0,25
	Primary Care	Attractive	52,3%	0,77	-0,27
Professional roles	Doctors	Attractive	40,2%	0,66	-0,28
	Nurses	Attractive	45,5%	0,67	-0,24
	Medical Scribes	Attractive	50,0%	0,68	-0,21

The suggestion to have a referral function integrated in the medical record was based on interviews where tasks such as referral management and administrative management were wished to be integrated into the medical record. Table 6.4 shows that the attribute of referral function is seen as attractive for both segments and all roles, with a higher percentage for primary care than specialised clinics and more importance for medical scribes compared to the other roles. This could be due to the commonality of medical scribes handling referrals more often, as can be described in 4.1.1.

Table 6.5. Kano Survey Result Q5

Q5: Action suggestion function integrated in medical record					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Attractive	39,2%	0,58	-0,18
Type of clinic	Spec. Clinic	Attractive	37,7%	0,58	-0,18
	Primary Care	Attractive	43,2%	0,60	-0,19
Professional roles	Doctors	Attractive	33,0%	0,53	-0,20
	Nurses	Indifferent	45,5%	0,55	-0,18
	Medical Scribes	Attractive	58,3%	0,74	-0,14

The proposal of having an action suggestion function integrated in the medical record was based on interviews where there were wishes to be able to monitor follow ups and referral status as well as ensuring that referrals are sent correctly. The attribute in Table 6.5 is seen as attractive for all but nurses, where the classification is indifferent. The classification agreement is highest for medical scribes. This can also be correlated to what is stated in 4.1.1 that medical scribes handle more administrative tasks in the medical record.

Table 6.6. Kano Survey Result Q6

Q6: Human review/check of medical record					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Indifferent	42,2%	0,36	-0,31
Type of clinic	Spec. Clinic	Indifferent	42,6%	0,34	-0,31
	Primary Care	Indifferent	40,9%	0,42	-0,31
Professional roles	Doctors	Indifferent	37,1%	0,41	-0,29
	Nurses	Indifferent	51,5%	0,19	-0,27
	Medical Scribes	Indifferent	47,2%	0,37	-0,37

The proposal of having a human review/check of the medical record was based on interviewees stating that there is a need for a control function of the medical record before signing. Table 6.6 shows how the attribute is indifferent across the segments and roles. There is however a percentage of doctors and nurses who find this attribute to be a reverse quality as can be seen in Appendix 3. This can be correlated to what is stated in 4.1.2 where the review can increase waiting time to sign the medical record for doctors.

Table 6.7. Kano Survey Result Q7

Q7: Automatic review/check of medical record by system					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Indifferent	45,8%	0,46	-0,12
Type of clinic	Spec. Clinic	Indifferent	43,4%	0,48	-0,14
	Primary Care	Indifferent	52,3%	0,43	-0,08
Professional roles	Doctors	Indifferent	43,3%	0,49	-0,16
	Nurses	Indifferent	57,6%	0,41	-0,13
	Medical Scribes	Indifferent	41,7%	0,44	0,00

The suggestion for having an automatic review/check of the medical record was based on interviews where the need for control function and review of reasonableness of the medical record was mentioned. As seen in Table 6.7, the attribute is an indifferent quality for the respondents, but attractive for all groups as a second order classification as can be seen in Appendix 3.

Table 6.8. Kano Survey Result Q8

Q8: Dictation function with automatic generation of medical record					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Attractive	34,3%*	0,54	-0,16
Type of clinic	Spec. Clinic	Attractive	33,6%*	0,53	-0,15
	Primary Care	Attractive	36,4%	0,57	-0,19
Professional roles	Doctors	Attractive	32%*	0,55	-0,20
	Nurses	Attractive	42,4%	0,53	-0,13
	Medical Scribes	Reverse	30,6%*	0,52	-0,04

The proposal of a dictation function with automatic generation of medical record was based on interviewees stating that time on administrative tasks needs to be reduced, free up medical scribes for other administrative tasks and having efficient and fast medical recording. The attribute in Table 6.8 is seen as an attractive classification based on evaluation criteria for average, specialised clinics and doctors. For medical scribes, this is seen as a reverse quality based on the evaluation criteria. As this attribute might question the future role of medical scribes, this result is expected.

Table 6.9. Kano Survey Result Q9

Q9: Dictation with automatic generation of medical record faster than manual writing					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	39,2%	0,63	-0,50
Type of clinic	Spec. Clinic	One-dimensional	38,5%	0,63	-0,49
	Primary Care	One-dimensional	40,9%	0,61	-0,52
Professional roles	Doctors	One-dimensional	48,5%	0,69	-0,59
	Nurses	One-dimensional	33,3%	0,52	-0,45
	Medical Scribes	Indifferent	33,3%	0,53	-0,27

The proposal of a dictation function with automatic generation of medical record that is faster than manual writing was based on interviews where dictation is faster than manual writing and reduced lead times between patient appointments and completed medical record were mentioned. The attribute in Table 6.9 is seen as one-dimensional across segments and roles except for medical scribes, with the highest consensus for doctors with 48,5%. There are 16,7% of medical scribes who see this attribute as reverse, as can be seen in Appendix 3, which is expected as the function itself undermines their ability to work.

Table 6.10. Kano Survey Result Q10

Q10: Use of short-cuts for medical recording					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	27,1%*	0,58	-0,41
Type of clinic	Spec. Clinic	One-dimensional	26,2%*	0,56	-0,39
	Primary Care	One-dimensional	29,5%*	0,65	-0,44
Professional roles	Doctors	One-dimensional	25,8%*	0,55	-0,40
	Nurses	One-dimensional	30,3%*	0,66	-0,41
	Medical Scribes	One-dimensional	27,8%*	0,60	-0,43

The suggestion of using short-cuts for medical recording was based on interviews mentioning usage of macrons and key word functions where a few words generate full sentences. As shown in Table 6.10, this attribute is seen as one-dimensional for all categories with the evaluation rules. There is however a high percentage for the classification of attractive as well as indifferent as shown in Appendix 3, so it would be beneficial to investigate this question further.

Table 6.11. Kano Survey Result Q11

Q11: Dictation function in environments with disturbing noise					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	31,3%	0,56	-0,49
Type of clinic	Spec. Clinic	One-dimensional	31,1%	0,56	-0,46
	Primary Care	One-dimensional	31,8%	0,53	-0,58
Professional roles	Doctors	One-dimensional	35,1%	0,59	-0,53
	Nurses	One-dimensional	27,3%*	0,56	-0,41
	Medical Scribes	Indifferent	30,6%	0,47	-0,47

The proposal of dictation function in environments with disturbing noise was based on mentions in interviews of calm working environments and good sound recording of dictations. Table 6.11 shows that the attribute for question 11 is seen as one-dimensional except for medical scribes where it is indifferent. However, as shown in Appendix 3, there is only a 5,6% difference between the classification of indifferent and one-dimensional, so with a looser implementation of the evaluation rule, this classification could be one-dimensional. For primary care, this attribute is seen as a must-be for 25% of responses, indicating that this could be an important attribute for certain groups.

Table 6.12. Kano Survey Result Q12

Q12: Automatic generation of medical record from recorded patient meeting					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Reverse	36,7%	0,57	-0,16
Type of clinic	Spec. Clinic	Reverse	40,2%	0,59	-0,15
	Primary Care	Reverse	27,3%*	0,53	-0,19
Professional roles	Doctors	Reverse	33,0%	0,65	-0,22
	Nurses	Indifferent	36,4%	0,43	-0,09
	Medical Scribes	Reverse	52,8%	0,47	-0,06

The proposal of automatic generation of medical records from recorded patient meetings was based on interviews where the ability to finish medical records in a short amount of time , and reduction of time for administrative tasks were mentioned. The attribute in Table 6.12 is seen as a reverse quality for all but nurses who are indifferent. However, the classification agreement for reverse is at 30,3%, as can be seen in Appendix 3, indicating that this is an attribute that could create dissatisfaction for nurses as well. Based on this result, it can be said that the roles and segments are not satisfied with being recorded.

Table 6.13. Kano Survey Result Q13

Q13: Automatic generation of medical record from recorded patient meeting faster than dictation function					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		Indifferent	27,1%	0,50	-0,36
Type of clinic	Spec. Clinic	Indifferent	27,9%	0,51	-0,31
	Primary Care	One-dimensional	27,3%	0,50	-0,48
Professional roles	Doctors	One-dimensional	27,8%	0,59	-0,45
	Nurses	Indifferent	42,4%	0,43	-0,27
	Medical Scribes	Reverse	30,6%*	0,32	-0,16

The suggestion if automatic generation of medical records from recorded patient meetings is faster than dictation function was based on interviews where the ability to have faster medical recording and reduction of administrative tasks were discussed. There is a variation among segments regarding the attribute of question 13, as is shown in Table 6.13 and can especially create dissatisfaction for medical scribes if present. This is likely based on the understanding that the need for their role would decrease.

Table 6.14. Kano Survey Result Q14

Q14: Interpretation of words in automatically generated medical records					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	33,7%	0,59	-0,53
Type of clinic	Spec. Clinic	One-dimensional	35,2%	0,59	-0,54
	Primary Care	One-dimensional	29,5%*	0,60	-0,51
Professional roles	Doctors	One-dimensional	37,1%	0,66	-0,54
	Nurses	One-dimensional	27,3%*	0,56	-0,47
	Medical Scribes	One-dimensional	30,6%	0,46	-0,57

The proposal of interpretation of words in automatically generated medical records was based on interviews where needs and wishes regarding ability to interpret words, language precision and ensuring a correct medical record were mentioned. Table 6.14 shows that the attribute of question 14 is seen as one-dimensional across segments and roles, but there is high prevalence for it to be a must-be classification, especially in primary care and medical scribes as can be seen in Appendix 3.

Table 6.15. Kano Survey Result Q15

Q15: Grammar in automatically generated medical records					
Sample		*Classification*	*Classification agreement*	*Better*	*Worse*
Average		One-dimensional	42,2%	0,61	-0,63
Type of clinic	Spec. Clinic	One-dimensional	44,3%	0,62	-0,66
	Primary Care	One-dimensional	36,4%	0,59	-0,55
Professional roles	Doctors	One-dimensional	43,3%	0,68	-0,63
	Nurses	One-dimensional	36,4%	0,48	-0,58
	Medical Scribes	One-dimensional	44,4%	0,56	-0,67

The suggestion of grammar in automatically generated medical records was based on interviewees mentioning no grammatical errors in medical records, ensuring correct medical record and a presentable medical record for patient viewing. The attribute of question 15 is classified as one-dimensional, as is seen in Table 6.15 but it can also be stated that some nurses and medical scribes see this as a must-be attribute, see Appendix 3, with over 20% for both roles.

In Figure 6, all attributes that were classified as reversed, one-dimensional and attractive are summarised per role. Since no must-be attributes were reported, these are not in the figure.

	Doctors	Nurses	Medical Scribes
Reversed	• Automated medical record from recorded patient-doctor meeting		• Automated medical record from dictation • Automated medical record from recorded patient-doctor meeting
One-dimensional	• Structure of record individually designed • Use of short-cuts • Ability to work in disturbing noise • Grammar • Interpretation of words • Speed in automated solutions	• Use of short-cuts • Grammar • Interpretation of words • Speed in automated solutions	• Use of short-cuts • Grammar • Interpretation of words
Attractive	• Integrated referrals function • Integration action suggestions • Automed medical record from dictation	• Integrated referrals function • Automed medical record from dictation	• Standardised structure of record per clinic • Predetermined structure per type of visit • Structure of record individually designed • Integrated referrals function • Integrated action suggestions

Figure 6.1. Summary of quality attributes per role

5. Analysis

In this chapter, the result of the study will be analysed. The analysis will follow the structure of the three research questions for the study.

5.1. Critical attributes for healthcare administration

In this part of the analysis the first research question of the study is to be analysed, namely: *Which are the critical attributes to consider to ensure customer satisfaction in the digitalisation and automation of medical recording?*. The analysis will be grounded in the Tables 6.1-6.15 presented in the previous chapter and the better-worse diagrams in Figures 6.1-6.6, presented below.

Figures 6.1-6.6 present better-worse diagrams, illustrating the impact on satisfaction/dissatisfaction for each question and respondent segment, as satisfaction approaches 1, the impact on satisfaction if the attribute is fulfilled increases, and as dissatisfaction approaches -1, the impact on dissatisfaction if the attribute is not fulfilled increases. Consistent with the Kano model's classification of quality, the attractive quality attributes are placed in the upper left corner, the one-dimensional in the upper right, the indifferent in the lower left, and the must-be attributes in the lower right corner.

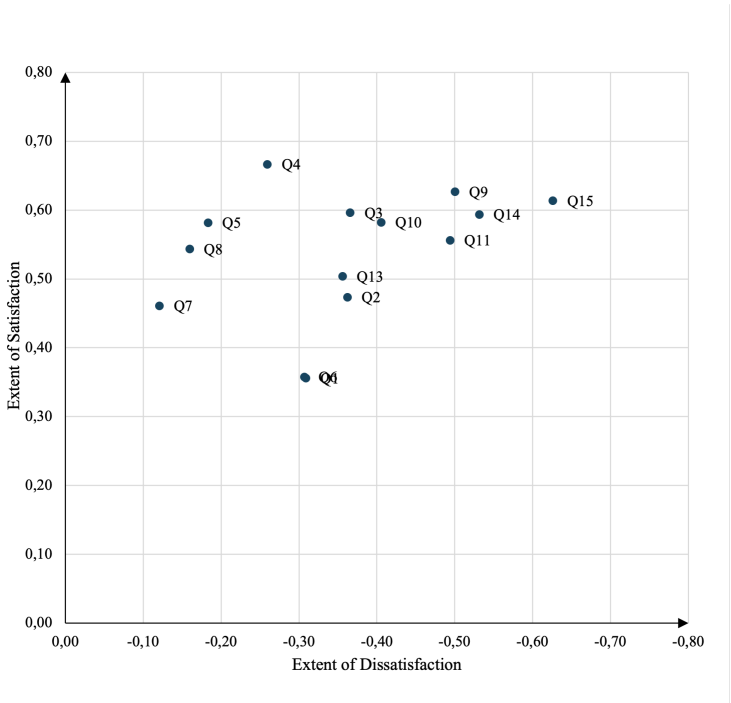

Figure 7.1. Better-Worse Diagram for all respondents

Figure 7.1 depicts the Better-Worse diagram for all segments compiled together. Overall, the high prevalence of indifferent and attractive attributes, and the absence of

must-be attributes, reveals that the offering asked for is still in early stages of adoption, following the dynamic nature of Kano (Löfgren & Witell, 2005).

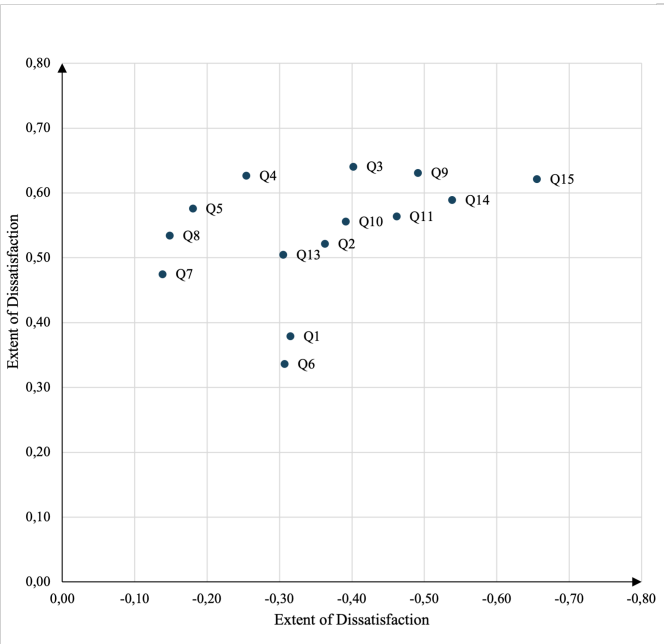

Figure 7.2. Better-Worse Diagram for Specialist Clinics

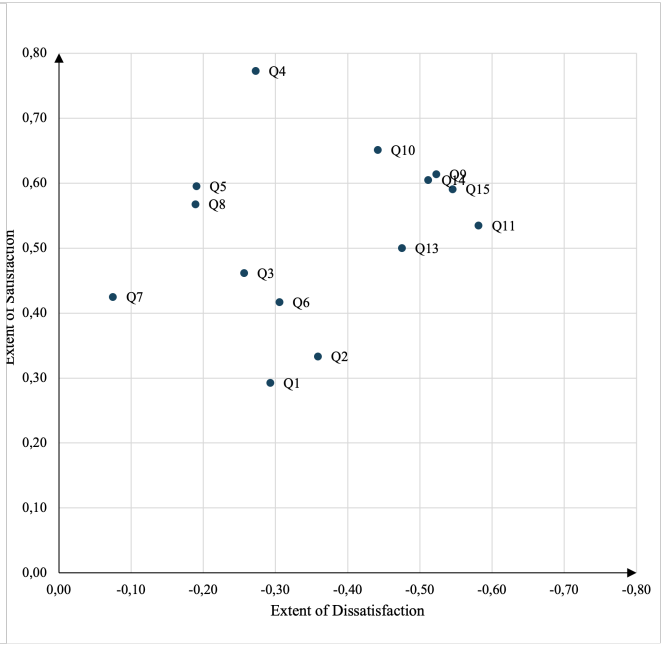

Figure 7.3. Better-Worse Diagram for Primary Care

Figure 7.2 and Figure 7.3 visualise the Better-Worse diagrams divided per type of clinic. The diagrams show coherence in the majority of the attributes; however, two differences stand out. First, specialist clinics appear to value the ability to customise the structure of the medical record more than primary care, since Q2 and Q3 are stated as one-dimensional and attractive qualities respectively, placed high up in Figure 7.2, while both these attributes are stated as indifferent for primary care. Second, specialist clinics report higher resistance to being recorded during patient meeting, as indicated primarily by Q12 but also by Q13. Q12 is stated as reverse quality for both segments, and is, thus, not depicted in the Better-Worse diagrams. From Table 6.12, one can however read that the consensus on reverse quality is higher for specialist clinics than primary care. A further analysis on the resistance to being recorded is presented below in the present chapter.

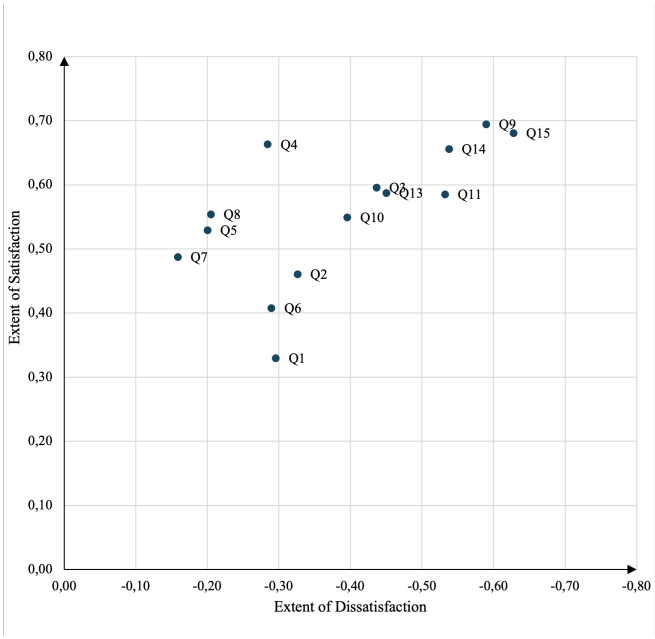

Figure 7.4. Better-Worse Diagram for Doctors

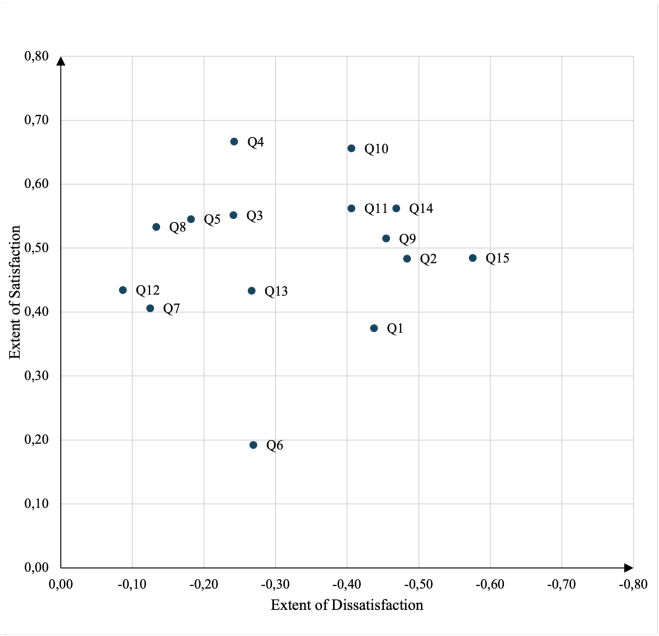

Figure 7.5. Better-Worse Diagram for Nurses

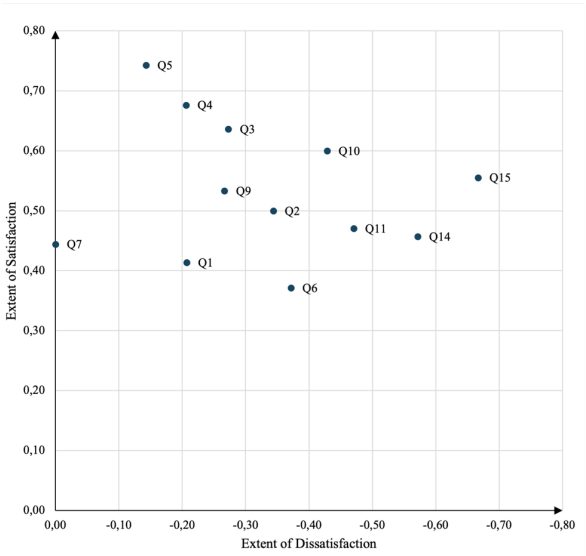

Figure 7.6. Better-Worse Diagram for Medical Scribes

Looking at the Figure 7.3-7.6, comparing the Better-Worse diagrams among customer roles, some differences are revealed among respondents. Doctors stand out in the highest prevalence of one-dimensional attributes, indicating doctors are most ready for the change of automation and digitalisation. Medical scribes stand out in highest prevalence of reverse attributes, indicating highest resistance to the change, which might not be surprising considering it concerns automating tasks that traditionally has been their expertise (Aung et al., 2021; Finley et al., 2018).

The diagrams in Figure 7.1-7.6 and Tables 6.1-6.15 show that correct interpretation of words (Q14) and grammar (Q15) are one-dimensional attributes with comparably significant impact on satisfaction when fulfilled and dissatisfaction when not. Despite concerns raised by Zuchowski and Göller (2022) regarding the accuracy of automatically generated records, the relatively positive attitude indicates a slightly more positive attitude than suggested by existing literature.

The ability to use shortcuts in medical recording (Q10) is yet another attribute expected and articulated for all respondent segments. Many caregivers use short-cuts today as a means to speed up the medical recording by minimising the need for repetition when writing or dictating. The classification of this attribute as one-dimensional thus indicates that this is an attribute to compete with as it is expected and explicitly wanted.

Integration of a referral function in the medical record (Q4) is attractive with high impact on satisfaction and low impact on dissatisfaction for all respondent segments, and all except nurses state the same for integration of action suggestion system in the medical record (Q5). This consensus provides a clear indication for enthusiasm for digital solutions that streamline processes and enhance workflow efficiency, aligning with the reasoning of Montenegro et al. (2023) and Falcetta et al. (2023).

The presence of a review system, whether it is performed by human (Q6) or by an automatic system function (Q7) has rather low impact on both satisfaction and dissatisfaction for all respondents, however the diagrams in Figure 7.1-7.6 show somewhat higher satisfaction impact on automatic review and somewhat higher dissatisfaction impact on human review. The low impact of automated review systems is interesting, since voices during interviews clearly stated the important control function of the medical scribe in reviewing the medical records. This opens up for automating the control function and could hence be a suggested initiative to reduce the administrative burden. However, automating the control raises ethical concerns of trusting the data, accountability of data (Gerke et al., 2020), and potential bias if data is trained to make decisions (Schönberg, 2019).

Automatic generation of medical records through dictation (Q8) is a delighter, placed in the upper-left corner of the better-worse diagrams (Figures 7.1-7.6), for all except for medical scribes who instead perceive it as a reverse quality, and as stated in the result this might possibly reflect concerns about the future of their roles. Conversely, automatic generation of medical records from recorded patient meeting (Q12) is stated as a reversed quality for all respondent segments, except for nurses for whom it has little impact. There is, thus, a willingness for automation of the medical recording but resistance towards being recorded during patient meeting. This aligns well with the concerns raised by the literature such as how to ensure that unspoken medical evaluation made by the healthcare practitioner is not missed while medically irrelevant

conversation during patient meeting is correctly sorted out from the medical record (Willis & Jarrahi, 2019), and may be part of the explanation to the result.

Questions comparing the speed of automatic record generation to manual writing (Q9, Q13) highlight the importance of speed in automation solutions. The majority of segments perceive these attributes as one-dimensional, but medical scribes stand out with indifference (Q9) and resistance (Q13) which may stem from a broader concern about automation's impact on their roles. For the other segments, speed seems to be an important part of solutions to automate the recording. At the same time, literature stresses the need for reduced resource utilisation and increased time with patients (Bergman & Schmidt, 2023; Aung et al., 2021), thus digital solutions should consistently ensure and emphasise speed.

The requirements in terms of degree of standardisation and customisation in different segments (Q1, Q2, Q3) varies. Although the ability to individually design the structure of medical records generally yields somewhat higher satisfaction, differences among professional roles and related attributes (Q1, Q2, Q3) result in no clear consensus on preference. Specialist clinics show a slightly stronger impact on satisfaction with customised offerings compared to primary care, suggesting that the need for a more customised structure is higher in more specialised healthcare practices.

As stated by Löfgren and Witell (2005), when providing a service it is most critical to ensure no dissatisfaction before aiming for satisfaction, hence the prioritisation of fulfilling attributes in the order of must-be → reverse → one-dimensional → attractive. There is a general positive attitude towards automation, but to which degree is not as clear. Following the priority rule of Kano (Löfgren & Witell, 2005), it is most critical to consider the resistance towards being recorded. Next priority is to ensure quality in terms of grammar and interpretation of words, the implication on speed and efficiency of each solution, and the feature of being able to use short-cuts, as these all are one-dimensional to most segments. Integrating functions, such as referral systems, to ensure efficient systems, would be the final priority.

5.2 Potential barriers to change among customers

This part of the chapter will analyse the second research question of the study. *What potential barriers exist among customers in the change of automating medical recording?*

5.2.1 Barriers with standardisation and customisation

Looking at attributes that contribute to standardisation and customisation of medical recording, opinions differ among the various professions. Medical scribes find the proposed ways to standardise and customise medical record templates as attractive,

indicating that they have little to no resistance to this change. This could be due to their way of working, where their job of transcribing medical records becomes easier if the templates are more structured. Even though doctors find Q1 and Q2 to be indifferent, some barriers could be present since they are the profession with the highest level of authority. The lack of interest is presented as a barrier by Varkey and Antonio (2010), and the possible increase among resources such as time and money that are required for a change can cause a resistance among employees. However, the positive attitude among doctors to create their individual medical record templates would indicate lower barriers. This could be due to their autonomy where they are professionally responsible and specifically responsible and are open to work in a more efficient way that facilitates them (Milella et al., 2021). Nurses are indifferent to Q1 and Q3, but since they do not write medical records to the extent that doctors do, as mentioned during the interviews, this could be an indication that they do not have a specific barrier but rather that they do not utilise the feature enough to care.

5.2.2 Low barriers for integration functions

Attributes that are connected to making the system more integrated and thus more effective are met with general positivity. Barriers to the function of referrals are therefore smaller as satisfaction would increase if this function was implemented. Doctors and medical scribes both feel positive for an action suggestion function, while nurses are to a higher degree indifferent. This could mean that implementation would be smooth, but if it requires nurses to work differently, resistance could occur as mentioned by Varkey and Antonio (2010) and Lv and Zhang (2017). Other attributes that contribute to more efficient work is the usage of shortcuts and macrons. All roles find this to be an important attribute as seen in the results, which indicates lower barriers and less resistance. Based on the interviews, this attribute is already in use by some people and clinics, which could be a beneficial benchmark for implementations in scenarios where it has yet to be utilised.

5.2.3 Existing barriers to automate medical recording

Continuing with attributes regarding automation of medical recording, one can see that several people among doctors and nurses are positive towards new implementations, indicating that barriers are lower for e.g. dictation function and even more so if it is faster than manual writing. This would indicate that respondents feel a sense of urgency as presented by Varkey and Antonio (2010), probably due to the reported increase in administrative burden (El Noaimi, 2020). There are however 14.4% of doctors that are not as positive to a change to automation of medical recording, which can be seen in Appendix 3. For this group, there are higher barriers that need to be overcome. The resistance could be due to fear of change, where Milella et al. (2021) mention that professionals in healthcare are more rigid in their way of working, which also causes a resistance to change. If they perceive that they would need to increase their workload

in any way or that the skills needed to learn take too much time for the intervention to work, this could lead to resistance as Lv and Zhang (2017) present.

In parallel, a dictation function where patient-doctor meeting is recorded and simultaneously generates a medical record notation is met with more resistance. This could be due to the concept of professional bureaucracy, as mentioned by Milella et al. (2021), where doctors are fully responsible for operational tasks in the organisation. By having everything recorded, it could leave a feeling of not being in control as well as moving outside of a stable and predictable procedure, which Milella et al. (2021) state as important for this profession. At the same time, medical scribes are resistant to attributes and functions that increase automation, which could be due to the reasoning that their roles would disappear. This fear of losing their jobs, or ability to work with tasks that they have an education in, is presented by Varkey and Antonio (2010) and Lv and Zhang (2017) as a common barrier. However, when asked if the patient-doctor recording is faster than the current dictation system, the responses become one-dimensional, which indicates that if it increases efficiency and thus works better than the status quo it is seen as beneficial.

5.2.4 Quality and ethical aspects with automated medical recording

Quality aspects connected to automation for medical recording are vital to consider to minimise barriers to change. As results indicate that interpretation and grammar of words are expected to be of high quality, not meeting this criterion could lead to great dissatisfaction that in turn leads to resistance. This is due to greater need of resources, and if there are extra steps such as adjusting words and sentences manually, this could cause employees to expel such efforts (Varkey & Antonio, 2010; Lv & Zhang, 2017). Zuchowski and Göller (2022) further state that perception of errors are more common for automated systems, even if that perception is false, which further presses on the importance of having the employee's collaboration. The lack of trust in the automated systems also demonstrate the ethical barriers that can be present. Doctors who feel that they do not understand how the technology works could risk misinforming patients, as Gerke et al. (2020) mentions. Moreover, with uncertainty as to who is accountable for consequences of such smart systems, as Schönberger (2019) mentions, many might feel fear that leads to resistance to change.

As the professional roles have various opinions about attributes, as well as various opinions within the roles, barriers are present to a varying degree. Attributes that would cause dissatisfaction if present are more prone to have higher and more barriers than attributes that are perceived as needed and wanted. Attributes that are welcomed by some are resented by others, indicating that preparatory work is needed before any changes can be achieved. There are several ways to achieve change as presented by Varkey and Antonio (2010), but with such fragmentation between the roles, a more modular approach could be applicable.

5.3. Implementation of change with modularity

In this part of the chapter, the third research question will be analysed. The research question follows: *How can modularity be supportive of an implementation of automated medical recording services?*.

5.3.1 Assessing readiness and creating a sense of urgency

When implementing changes to an organisation, it is important to start with assessing the readiness to change within the organisation (Varkey & Antonio, 2010). First after such an analysis, work can be done to achieve an implementation. Castillo (2021) states that 40% of doctors' time is spent on various administrative tasks, and results from the Kano survey suggest that there is willingness to change to new practices if it increases efficiency. However, medical scribes are rather resistant to changes that involve automation of medical recording, indicating that they might not be ready for implementation. This logic also applies for the group of doctors who present resistance to automation, as presented in Appendix 3. Differences in preference and opinion indicate that to enable a change, different offerings should be presented to the various roles and groups within the roles. A modular approach to automation solutions in medical recording could thus be applicable, as Gremyr et al. (2019) describe that service modules can be combined to create unique offerings.

For the role of medical scribes and the more hesitant groups of doctors, creating a sense of urgency is a first step to overcoming the barrier of resistance as presented by Varkey and Antonio (2010) and Lv and Zhang (2017). For doctors, this could be done by pressing on the benefits as well as drawbacks if not changing their way of working and the future consequences of their work. For example, Demaku and Pihlgren (2021) present that digital solutions can decrease stress, but also that the change is necessary to meet an increase in healthcare demand. To overcome the resistance among medical scribes it is critical to create a sense of urgency, but since the resistance may derive from fear of their roles becoming obsolete, other approaches should be considered for this segment.

5.3.2 Involving the people to create change

As presented in the results, medical scribes are still a necessity in the organisation, and more focus could be placed in educating and helping find new tasks for medical scribes. One doctor stated that they would not have survived without their medical scribe, as the person managed several other aspects of administration. There should thus be a focus on creating a plan for medical scribes and how their role will and can change with the new implementation, rather than excluding them altogether. This can be done with training and education, to help teach new tasks and what the role would imply. Moreover, there is resistance within both medical scribes and doctors regarding the

automation of medical recording where the doctor- patient meeting is recorded. The results show that at least doctors are positive about this method if it is more efficient than other dictation functions. If it is in fact a better option, further analysis and better understanding about the resistance is necessary to consider an implementation.

For the roles and groups that are positive towards an implementation of automation aspects for medical records, it is important to ensure that no resistance occurs during the process of implementation. As this group has likely already established a sense of urgency, it is instead important to create a steering team that will plan, coordinate and monitor the project and will create engagement through all levels of the organisation (Varkey & Antonio, 2010; Lv & Zhang, 2017). When creating an implementation plan, education and training offerings of the new service should be considered, as Svensson and Sandgren (2022) state: not providing enough time to learn the system can leave employees overworked. Doctors, and potentially nurses, will be lead users of this new service so they should be involved as much as possible, as Lv and Zhang (2017) state that the development of new skills, attitudes and behaviour are essential to succeed with changes.

5.3.3 Modular offering to implement change

By providing modular offerings for the different roles within organisations, the case company has the ability to achieve an implementation of their service as well as working with their customers to further generate satisfaction. Moreover, to sustain an acceptance to the changes that come with the new service and system, the case company should utilise their customer even more in the development process. As mentioned by Lengnick-Hall (1996), customers act as inspectors and determine the quality of offerings, so by involving them throughout the process greater value can be achieved. Doctors, and potentially nurses are direct users of the new service, but could also act as resources, as stated by Lengnick-Hall (1996), where they provide valuable information in the transformation process. The view on how customers and providers can come together aligns with Grönroos' (2015) presentation of the joint sphere, where the value is determined by the customer, and the provider can only support this value creation in the joint sphere during the customer-provider interaction and by providing value-facilitating resources.

Another aspect of modularity is in how it can be utilised to implement changes sequentially. Based on the results, it can be said that mutual trends exist among the roles, which to a varying degree present urgency in a change to automated medical recording. By using the prioritisation rule of Löfgren and Witell (2005), where counteracting dissatisfaction has highest priority, modules can be sold and customised to clinics in ways that optimises the chances of sustaining change. The offerings could be presented in bundles that is then implemented in sequence so that the implementation occurs in ways that benefit the clinics.

6. Discussion

In this chapter, the theoretical and managerial implications of the study will be presented. The purpose of this thesis was to identify critical needs of internal customers to address in the development of an automated medical record service. Further the purpose was to investigate potential barriers and enablers for implementing change related to automated medical recording and examine how modularity can be a means of achieving service quality during implementation of new automated medical record services.

To address the purpose of the study, a conceptual framework, presented in 2.7, has been applied. The key aspects highlighted in the conceptual framework will guide the theoretical implications of the study. Thereafter, managerial implications provide a more hands-on perspective on actions to take for organisations taking on to automate medical record services.

6.1 Theoretical Implications

Previous research points out the growing focus on patient-centred care and that various developments should aim to cater to patients' needs (Bergman et al., 2014). However, Srivastava and Prakash (2019b) suggest that to achieve high service quality, focus on the internal customers, the employees, is a prerequisite. In a healthcare setting, service quality is perceived as efficient healthcare and short waiting times, which Spak (2022) states are current challenges in Swedish healthcare. The use of AI to mitigate challenges has gained traction with benefits such as relief of administrative burden (Spak, 2022).

However, Svensson and Sandgren (2022) state that the increased focus on digitalisation can lead to overworked healthcare practitioners if they are not given enough time to learn the new systems correctly. Moreover, Zhou et al. (2021) and Falcetta et al. (2023) detail concerns on whether a system could understand and process human conversations and language variations. This study has confirmed that healthcare practitioners have concerns regarding the ability of an automated medical recording service and how well it could be incorporated in their organisations. The findings of this study further confirm the importance of high data quality for a functioning service (Montenegro et al., 2023; Falcetta et al. 2023).

The Kano model shows to be a useful method to identify and categorise critical attributes and needs. Paraschivescu (2012) states that the responses enable a categorisation of quality attributes and a more nuanced understanding of what is needed to reach satisfaction among various stakeholder segments. The analysis of this study's Kano survey result confirmed that the roles of doctors, nurses, and medical scribes differed in opinions and needs – differences that could be analysed and elaborated on through the results.

By applying the results from the Kano model and survey in a healthcare setting, the various professions have been able to communicate with each other about attributes that affect them in different ways and to different degrees. Through the results from interviews and Kano survey, segments were identified whose needs can be bundled into modules, enabling improved efficiency by standardisation while at the same time enabling customisation (Gremyr et al., 2019). Literature has highlighted modularity as an approach to create offerings that cater to the various needs of the roles, but commonly in terms of products and services as finite solutions (Gershenson et. al, 2003; Gremyr et al., 2019). However, in terms of implementing modular solutions, previous research has not considered any aspect of time and potential importance of stepwise product and service introduction. On the other hand, change management literature highlights the importance of stepwise implementation in change (Varkey & Antonio, 2010; Lv & Zhang, 2017), hence higher focus on time dimensions. This study suggests a new perspective to modular service offerings, in which modular offerings follow the logic of stepwise implementation, thus, incorporating the time dimension from change management literature. The modular approach to the sequential roll-out of modules are illustrated in Figure 7.

By combining modularity and change management, tech providers of smart digital services can offer differentiated solutions in regard to implementation. Modular implementation offers a flexible approach as it offers various modular service bundles to clinics depending on their needs, while at the same time offers modular implementation bundles to facilitate a successful change. The two perspectives are vital in healthcare, due to its professional structure that commonly is seen as a hinder to change (Milella et al., 2021).

In the interaction between tech provider and healthcare practitioner, tech provider offers value facilitating resources by applying modular implementation. The belief is, thus, that the healthcare practitioner is well equipped for value creation in the joint sphere as presented by Grönroos (2015). In line with the service-centred logic of value creation, it is by definition satisfaction of customers that create value (Grönroos, 2015). When the healthcare practitioner's satisfaction is ensured by consistent customer focus and thorough understanding of their needs, internal service quality is achieved (Srivastava & Prakash, 2019b).

6.2 Managerial Implications

The study reveals differences in needs and readiness for digitalisation and automation of medical recording processes, hence, for companies taking on to automate medical recording services it is critical moving forward to understand these differences and approach the segments accordingly. Doctors and specialist clinics indicate being ready for the adoption of automating medical recording processes, and these segments are recommended as lead users for the adoption of automating solutions.

Medical scribes show the highest resistance towards automation of medical recording. As healthcare organisations today are faced with recourse scarcity and need for increased efficiency, automating administration might threaten the role of medical scribes. Yet, medical scribes still play an important role within healthcare organisations. In many healthcare clinics today, they are critical for the efficiency of the clinic and in these clinics, their acceptance of the solution is vital. It is important to seek to understand which types of organisaitons that need medical scribes and what role the medical scribes have today to ensure automation solutions that increases the efficiency and facilitates the work for the medical scribes rather than substitute them.

In the implementation of automated medical recording services, a modular approach is suggested. Furthermore, the approach has two categories of activities: marketing and education, and technical and function. In Figure 8, the suggested implementation is visualised.

	Technical quality and speed	**Structure per clinic**			**Integration functions**
	1	**2**	**3**	**4**	**5**
		Identify lead user clinics		**Identify resistance to recording**	
Focus	Focus on quality in grammar and interpretation of words.	Start implementation in small scale. Start with specialist clinics.	Identify required level of standardisation versus customisation of structure of record per clinic.	Understand reason for resistance to automation, and being recorded in particular at clinics.	Implement functions for an efficient and integrated medical record system.
Marketing and Education		Seek lead user clinics within specialist care.		Direct marketing and education to overcome resistance.	Educate close to clinic to ensure understanding of use.
Technical Quality and Functions	Focus on technical quality in terms of grammar and interpretation of words.	Test pilots at clinics to verify accepted error rate in grammar and interpretation of words.			1. Offer short-cuts in medical recording 2. Referral management system 3. Action suggestion function

Figure 8. Development and implementation plan

Correct grammar and interpretation of words has a high impact on both satisfaction and dissatisfaction, hence this should be of high priority (phase 1 in Figure 8). Yet, the threshold for what is considered sufficient is not defined, hence, it is recommended to start implementation on a small scale although the solution has not reached zero in error

rate in grammar and word interpretation. Along with this focus, the focus of speed and efficiency of solutions is critical.

The implementation of automating solutions is recommended to not only be modular in terms of offerings, but gradual in expansion. It is recommended to start with a small scope of clinics within specialist care and work closely with these to be able to identify pain points and ensure clear understanding (phase 2 in Figure 8). One further reason for working close to the clinics is the variation shown in need for standardisation versus customisation of structure of the medical record. It is recommended to follow up with each clinic in regard to what degree of structure is required per clinic (phase 3 in Figure 8).

Next suggested step is to further investigate the resistance to automation in general and recording in particular (phase 4 in Figure 8). It is critical to understand the reason for resistance and address it with the right marketing and education.

The fifth focus phase presented in Figure 8 is of more technical nature. The ability to use short-cuts is one function that is explicitly asked for and is hence recommended as a first priority function in this step. Thereafter companies taking on to automate medical recording services should integrate as much of the functions that are related to medical recording as possible to the medical record process, to streamline the process and minimise the amounts of administrative tasks outside the medical record. Two suggested functions are integration of referral management system and automated actions suggestion functions.

The development and implementation plan presented in Figure 8 is suggested as first steps in the development and implementation of automated medical recording systems. Following the suggested steps should help companies in setting the direction for implementation. Whereas Figure 8 visualises the first phases of implementation in small scale, the intention is that this recommendation will provide good preconditions for further expansions in functions and users.

Moreover, the potential resistance from medical scribes needs to be addressed in the implementation. As they are seen as important, their involvement in the process of change should be considered. By including them in the change process, where their role might be redefined, and allowing them to be part of the redefinition, resistance can be overcome. This will include initiatives to help train and educate the role in new directions.

7. Limitations and Future Research

This study has provided new insights into the importance of understanding customer needs when developing new digital services and how modularity can be used in implementation of change, but there are also limitations. This study is a single case study of a tech company developing digital services to private healthcare clinics, indicating limitations in general applicability. The interviewees and respondents from the Kano survey are users of the system that is sold by the case company, meaning that answers might have a positive bias towards the system. Furthermore, as the survey was sent out through the company's list of contacts, there are limitations in knowing who did not respond and why they did not respond. To get a broader view of customers' needs in general, it would be beneficial to include other medical recording systems that are in use in Sweden, but also compare how automated medical recordings services work in other countries that are operating in a similar fashion as in Sweden.

Moreover, this study is limited to analysing three roles within clinics and also limited to the type of clinics included. For future research, it would be relevant to expand the role definition to understand all types of needs in a healthcare setting, as well as include other factors such as age, previous experience of digital tools, and size of clinic. The types of clinics included are private primary care clinics and specialised clinics, thus excluding public owned clinics. It is therefore of interest to study the public owned healthcare sectors as well, due to the usual increase in size and complexity in terms of the organisation. Furthermore, this study examined how automated medical recording systems could work in a planned care setting, where patients have an appointment, but it would also be of interest to investigate how opinions, needs, and requirements could differ in an emergency care setting where predictability is inferior. Eventually, if and when implemented, the perceptions of patients to the digital service could be further researched.

8. Conclusions

The purpose of this thesis was to identify critical needs of internal customers to address in the development of an automated medical record service. Further the purpose was to investigate potential barriers and enablers for implementing change related to automated medical recording and examine how modularity can be a means of achieving service quality during implementation of new automated medical record services.

Several critical attributes of automated medical recording addressing internal customer's needs have been identified. First, correct grammar and interpretation of words are explicitly demanded by users, and speed and efficiency of the automation solution is further explicitly wanted. Second, to offer integrated medical record solutions, in which administrative tasks such as referral management systems and automated action suggestion functions are integrated in the medical recording, are attributes that are attractive and can thus be means of differentiation for the case company. Third, while the majority finds automation of medical recording attractive, there is a resistance towards being recorded during doctor-patient meeting, which calls for action in terms of marketing and education before implementing such an offering.

Barriers and enablers to change and implementation of automated medical record services vary among roles and within roles. Several of the suggested changes are met with positivity, enabling possibilities for implementation. All roles are in consensus of the need to integrate the system better, but with various degrees of impact on the respective roles. The suggestion of customisation and standardisation functions of medical records are further met with little resistance, meaning that such changes will have little effect in the implementation. In terms of automation of medical recording, doctors and nurses, who are the lead users of automation functions are in general curious and accepting of changes that make their work more efficient, while the same automation function suggestions act as high barriers to medical scribes.

Medical scribes show rather high resistance to implementations that indicate change to the applicability of their role due to fear. There are doctors who also oppose such implementations, potentially due to the profession's rigid structure and autonomy where doctors are used to having autonomy to work in a way they enjoy and in a way they are accustomed to. Moreover, there are important barriers to consider in terms of ethical aspects. The need for trust in the system is vital to enable any changes and implementations of such automated systems. If medical practitioners feel that the system does not deliver the safety and precision required to facilitate their administrative work, implementations will fail.

By breaking down the implementation into distinct modules, addressing both marketing and technical aspects separately, modularity enables implementation of automated medical recording services. Initially, emphasis should be put on ensuring accurate

grammar and interpretation of words, though the company should prioritise incremental improvements over perfection. Beginning with a small-scale implementation allows for identifying and addressing issues efficiently. Moreover, modular expansion enables a tailored approach, meeting the needs for standardisation versus customisation for each clinic. Understanding and mitigating the resistance to being recorded is critical and should be met with education of users and clinics. From a technical perspective, the case company should focus on streamlining the process and enhancing efficiency, by integrating administrative tasks such as a referral management system and an automated action suggestion function. The modular approach, as depicted in Figure 8, serves as a roadmap for implementation, laying the ground for future improvement and scalability.

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Appendix

Appendix 1: Interview Template

Notes: These interviews were held in Swedish, hence, this is a translation of the original interview templates. To ensure anonymity of respondents and the studied company, the name of the system has been replaced by [system].

Introductory questions:

- Tell us about your role in the organisation.
- Tell us about who is responsible for administrative tasks, specifically medical record keeping, in your organisation.
- Describe the process from patient meeting to the record being signed.
- For how long have you been working as you do today with medical recording?

Medical Records

- Do you use speech-to-text or do you write medical records manually?
- *[If applicable]*: In what situations does speech-to-text work best?
    - Can you provide an example of a specific situation?
- *[If applicable]*: In what situations does speech-to-text work worst?
    - Can you provide an example of a specific situation?

- *[If above was not applicable]*: In what situations does the process you use today for medical record keeping work best?
    - Can you provide an example of a specific situation?
- *[If above was not applicable]*: In what situations does the process you use today for medical record keeping work worst?
    - Can you provide an example of a specific situation?

- Do you have any concerns when it comes to medical records keeping today?

Administration

- How do you use [*system*] for administration today?
- In what situations does the administrative tasks you perform work best?
    - Can you provide an example of a specific situation?
- In what situations does the administrative tasks you perform work worst?
    - Can you provide an example of a specific situation?

- Do you have any wishes/thoughts on how the process of medical records keeping could function at best?

Appendix 2: Kano Survey

Intro

Hello,

We are two students from Chalmers University of Technology writing our thesis in collaboration with [the case company] and [the system]. We are exploring the user perspective in the development of new digital tools designed to simplify medical record-keeping and reduce the hassle of administrative tasks.

The questions will concern medical record-keeping, primarily focusing on dictation. You can answer the questions regardless of whether you use dictation today or not, and regardless of your role in healthcare.

The questions are structured according to a specific template where each question is posed with both a positive and a negative emphasis. We understand that the questions might seem oddly phrased, but please try to answer to the best of your ability. There are five options to choose from.

The survey will take 7 minutes to complete.

Your responses would be very valuable to us and will be used as a basis for further development of [the system].

Thank you!

Survey

- Where do you work?
    - Specialist clinic
    - Primary care center
- What role do you have?
    - Doctor
    - Nurse
    - Medical Secretary
    - Other:

1. How would you feel if the structure of the medical records were standardised at the clinic you work at?
    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

How would you feel if the structure of the medical records was **not** standardised at the clinic you work at?

- I like it that way
- It must be that way
- I am neutral
- I can live with it that way
- I dislike it that way

2. How would you feel if the medical record had a predetermined structure for each type of visit?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if the medical record did **not** have a predetermined structure for each type of visit?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

3. How would you feel if you could design the structure of your medical records exactly as you wished?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if you could **not** design the structure of your medical records exactly as you wished?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Imagine a process where referral management is handled as part of the medical record-keeping (before signing). At the end of the record, there is a "create referral" button. Patient information is automatically filled in. You need to select the referral recipient from a list.

4. How would you feel if this function existed?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if this function did **not** exist?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Imagine that [the system] has system support that suggests actions (e.g., send referral) from medical notes and automatically reminds you if an action has not been taken.

5. How would you feel if such a function existed in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if such a function did **not** exist in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

6. How would you feel if a human review/check of the medical record's content was performed before a doctor signed it?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

How would you feel if a human review/check of the medical record's content was **not** performed before a doctor signed it?

- I like it that way
- It must be that way
- I am neutral
- I can live with it that way
- I dislike it that way

7. How would you feel if the content of the medical record was automatically checked by system support in [the system] before a doctor signed it?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if the content of the medical record was **not** automatically checked by system support in [the system] before a doctor signed it?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

8. How would you feel if you had a service where you dictate and it automatically generates a suggestion for a complete medical note in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if you did **not** have a service where you dictate and it automatically generates a suggestion for a complete medical note in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral

- I can live with it that way
- I dislike it that way

9. How would you feel if a dictation function with automatic medical recording was faster than manual writing?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if a dictation function with automatic medical recording was **not** faster than manual writing?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Imagine using a dictation function with automatic medical recording.

10. How would you feel if there was an option to create shortcuts, i.e., expressions or words that generated a predetermined sentence in the medical note?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    How would you feel if there was **not** an option to create shortcuts, i.e., expressions or words that generated a predetermined sentence in the medical note?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

11. How would you feel if the dictation function could be used in an environment with disturbing noise?

    - I like it that way
    - It must be that way

- I am neutral
- I can live with it that way
- I dislike it that way

How would you feel if the dictation function could **not** be used in an environment with disturbing noise?

- I like it that way
- It must be that way
- I am neutral
- I can live with it that way
- I dislike it that way

12. How would you feel if you had a function where the patient meeting is recorded and automatically generates a suggestion for a complete medical record note in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    What would you think if you did **not** have a feature where the patient meeting is recorded and automatically generates a suggestion for a complete medical record note in [the system]?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Imagine a feature where the patient meeting is recorded and a suggestion for a complete medical record note is automatically generated in [the system].

13. What would you think if this feature was faster than the dictation function with automatic medical record keeping?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    What would you think if this feature was **not** faster than the dictation function with automatic medical record keeping?

- I like it that way
- It must be that way
- I am neutral
- I can live with it that way
- I dislike it that way

Suppose you have an automatically generated medical record note, generated either from dictation or by recording the patient meeting. You proofread this before signing.

14. What would you think if all words were correctly interpreted in the medical record note?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    What would you think if **not** all words were correctly interpreted in the medical record note?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Suppose you have an automatically generated medical record note, generated either from dictation or by recording the patient meeting. You proofread this before signing.

15. What would you think if the medical record note was completely grammatically correct?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

    What would you think if the medical record note was **not** completely grammatically correct?

    - I like it that way
    - It must be that way
    - I am neutral
    - I can live with it that way
    - I dislike it that way

Appendix 3: Kano Survey Result

Q1	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,6%	0,0%	2,3%	0,0%	3,0%	0,0%
A	21,1%	20,5%	22,7%	20,6%	12,1%	30,6%
O	10,8%	13,1%	4,5%	9,3%	24,2%	2,8%
I	40,4%	40,2%	40,9%	43,3%	39,4%	33,3%
R	10,2%	11,5%	6,8%	9,3%	3,0%	19,4%
M	16,9%	14,8%	22,7%	17,5%	18,2%	13,9%
	Indifferent	Indifferent	Indifferent	Indifferent	Indifferent	Attractive

Q2	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,6%	0,8%	0,0%	0,0%	0,0%	2,8%
A	25,3%	28,7%	15,9%	24,7%	24,2%	27,8%
O	18,1%	19,7%	13,6%	17,5%	21,2%	16,7%
I	32,5%	29,5%	40,9%	37,1%	24,2%	27,8%
R	8,4%	7,4%	11,4%	8,2%	6,1%	11,1%
M	15,1%	13,9%	18,2%	12,4%	24,2%	13,9%
	Indifferent	Attractive	Indifferent	Indifferent	-	Attractive

Q3	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
A	27,7%	29,5%	22,7%	24,7%	27,3%	36,1%
O	28,3%	32,0%	18,2%	33,0%	21,2%	22,2%
I	31,9%	27,9%	43,2%	29,9%	39,4%	30,6%
R	6,0%	4,1%	11,4%	3,1%	12,1%	8,3%
M	6,0%	6,6%	4,5%	9,3%	0,0%	2,8%
	One-dimensional	One-dimensional	Indifferent	One-dimensional	Indifferent	Attractive

Q4	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	6,0%	6,6%	4,5%	8,2%	3,0%	2,8%
A	43,4%	40,2%	52,3%	40,2%	45,5%	50,0%
O	21,7%	20,5%	25,0%	24,7%	21,2%	13,9%
I	22,9%	25,4%	15,9%	21,6%	27,3%	22,2%
R	2,4%	3,3%	0,0%	2,1%	0,0%	5,6%
M	3,6%	4,1%	2,3%	3,1%	3,0%	5,6%
	Attractive	Attractive	Attractive	Attractive	Attractive	Attractive

Q5	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	7,8%	9,8%	2,3%	11,3%	0,0%	5,6%
A	39,2%	37,7%	43,2%	33,0%	36,4%	58,3%
O	14,5%	14,8%	13,6%	13,4%	18,2%	13,9%
I	28,3%	27,0%	31,8%	25,8%	45,5%	19,4%
R	7,8%	9,0%	4,5%	12,4%	0,0%	2,8%
M	2,4%	1,6%	4,5%	4,1%	0,0%	0,0%
	Attractive	Attractive	Attractive	Attractive	Indifferent	Attractive

Q6	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,6%	0,8%	0,0%	1,0%	0,0%	0,0%
A	14,5%	13,9%	15,9%	17,5%	6,1%	13,9%
O	15,1%	13,9%	18,2%	14,4%	9,1%	22,2%
I	42,2%	42,6%	40,9%	37,1%	51,5%	47,2%
R	17,5%	17,2%	18,2%	21,6%	21,2%	2,8%
M	10,2%	11,5%	6,8%	8,2%	12,1%	13,9%
	Indifferent	Indifferent	Indifferent	Indifferent	Indifferent	Indifferent

Q7	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
A	28,9%	27,9%	31,8%	27,8%	27,3%	33,3%
O	10,2%	11,5%	6,8%	13,4%	12,1%	0,0%
I	45,8%	43,4%	52,3%	43,3%	57,6%	41,7%
R	15,1%	17,2%	9,1%	15,5%	3,0%	25,0%
M	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	Indifferent	Indifferent	Indifferent	Indifferent	Indifferent	Indifferent

Q8	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	1,8%	1,6%	2,3%	2,1%	0,0%	2,8%
A	34,3%	33,6%	36,4%	32,0%	42,4%	33,3%
O	10,8%	10,7%	11,4%	15,5%	6,1%	2,8%
I	33,7%	35,2%	29,5%	34,0%	36,4%	30,6%
R	16,9%	17,2%	15,9%	14,4%	9,1%	30,6%
M	2,4%	1,6%	4,5%	2,1%	6,1%	0,0%
	Attractive	Attractive	Attractive	Attractive	Attractive	Reverse

Q9	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	3,0%	0,8%	9,1%	2,1%	6,1%	2,8%
A	20,5%	20,5%	20,5%	19,6%	18,2%	25,0%
O	39,2%	38,5%	40,9%	48,5%	33,3%	19,4%
I	24,1%	26,2%	18,2%	18,6%	30,3%	33,3%
R	4,8%	6,6%	0,0%	2,1%	0,0%	16,7%
M	8,4%	7,4%	11,4%	9,3%	12,1%	2,8%
	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional	Indifferent

Q10	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	1,2%	0,8%	2,3%	2,1%	0,0%	0,0%
A	28,3%	26,2%	34,1%	25,8%	33,3%	30,6%
O	27,1%	26,2%	29,5%	25,8%	30,3%	27,8%
I	27,1%	30,3%	18,2%	28,9%	24,2%	25,0%
R	4,8%	5,7%	2,3%	6,2%	3,0%	2,8%
M	11,4%	10,7%	13,6%	11,3%	9,1%	13,9%
	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional

Q11	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
A	22,3%	23,0%	20,5%	21,6%	27,3%	19,4%
O	31,3%	31,1%	31,8%	35,1%	27,3%	25,0%
I	26,5%	28,7%	20,5%	23,7%	30,3%	30,6%
R	3,6%	4,1%	2,3%	3,1%	3,0%	5,6%
M	16,3%	13,1%	25,0%	16,5%	12,1%	19,4%
	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional	Indifferent

Q12	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	1,8%	1,6%	2,3%	1,0%	3,0%	2,8%
A	26,5%	26,2%	27,3%	29,9%	24,2%	19,4%
O	9,6%	9,0%	11,4%	13,4%	6,1%	2,8%
I	24,7%	23,0%	29,5%	21,6%	36,4%	22,2%
R	36,7%	40,2%	27,3%	33,0%	30,3%	52,8%
M	0,6%	0,0%	2,3%	1,0%	0,0%	0,0%
	Reverse	Reverse	Reverse	Reverse	Indifferent	Reverse

Q13	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	6,0%	6,6%	4,5%	5,2%	6,1%	8,3%
A	19,3%	19,7%	18,2%	20,6%	18,2%	16,7%
O	21,7%	19,7%	27,3%	27,8%	21,2%	5,6%
I	27,1%	27,9%	25,0%	19,6%	42,4%	33,3%
R	18,7%	22,1%	9,1%	17,5%	9,1%	30,6%
M	7,2%	4,1%	15,9%	9,3%	3,0%	5,6%
	Indifferent	Indifferent	One-dimensional	One-dimensional	Indifferent	Reverse

Q14	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	4,8%	5,7%	2,3%	7,2%	0,0%	2,8%
A	23,5%	21,3%	29,5%	25,8%	27,3%	13,9%
O	33,7%	35,2%	29,5%	37,1%	27,3%	30,6%
I	16,9%	17,2%	15,9%	11,3%	24,2%	25,0%
R	3,6%	4,1%	2,3%	4,1%	3,0%	2,8%
M	17,5%	16,4%	20,5%	14,4%	18,2%	25,0%
	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional

Q15	Average	Spec. Clinic	Primary Care	Doctors	Nurses	Medical Scribes
Q	2,4%	2,5%	2,3%	2,1%	3,0%	2,8%
A	18,1%	16,4%	22,7%	22,7%	12,1%	11,1%
O	42,2%	44,3%	36,4%	43,3%	36,4%	44,4%
I	16,3%	14,8%	20,5%	11,3%	27,3%	19,4%
R	1,8%	2,5%	0,0%	3,1%	0,0%	0,0%
M	19,3%	19,7%	18,2%	17,5%	21,2%	22,2%
	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional	One-dimensional

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