

The influence of the socio-organizational context of the nurse staff on multi-technology acceptance

A study on the acceptance of multiple technological applications among nurses at Radboud University medical center

Lisa Wekenborg (s4357094)
lisa.wekenborg@student.ru.nl

Nijmegen School of Management

Supervisor: dr. R.A.W. Kok
Second examiner: dr. A.A.J. Smits
Internship supervisor: Wouter van Wijhe, MSc

19-08-2018

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Abstract

Nurses are exposed to an increasing number of technological applications. Although these are aimed at for example reducing their workload or improving efficiency, the introduction of multiple new applications might also complicate the care process for nurses. Whereas existing studies mainly focus on singly technology adoption, our study examines how nurses deal with the simultaneous introduction of multiple technological applications in order to gain a deeper understanding of how nurses deal with these. This study was conducted at a university medical center and experiences of nurses on the joint usage of two applications were collected by means of a survey and interviews. Our findings show that the fact that multiple applications are introduced simultaneously does not seem to hinder the nurses to use either of the applications; they see them as separate entities. They are namely running on different systems and are introduced by different project teams with each their own communication strategy. Conditions in the socio-organizational environment that are found to facilitate multi-technology acceptance include a shared coaching role among nurses that ensures a smooth information flow within the nurse staff and having a group of nurses on board that might take on the role of a technology promotor. Moreover, a support system that serves as an accessible and immediate contact point for nurses who experience difficulties while working with the applications is found to motivate nurses to actually use a technological application as this support system might give them more confidence. Although future research is needed at other departments in other hospitals, our research point to the importance of taking into account the role of the nurse staff in technology adoption decisions and hope to trigger implementation managers to pay more attention to how the nurse staff could be of help when implementing new technologies. Based on our findings, one recommendation for the hospital of our focus is to appoint one or a few nurse(s) as specialized nurse in the field of pilots and new technologies to make sure the nurse staff always has someone to go to when they feel information is not flowing smoothly at the department.

1 Introduction

During the last decades, the Dutch health care industry has been subject to restructuring processes as a consequence of an increasing and changing demand for care (Nivel, 2009). In an attempt to deal with this, a wide range of new technologies has been implemented targeted at improving the quality, safety and efficiency of care. Moreover, new technologies are introduced to help to minimize complications, reduce the workload of nurses or improve health outcomes (De Veer et al., 2009; Varabyova, 2017). It is, however, widely acknowledged that introducing technology within complex organizations such as a health care organization is a dynamic and complicated process as the new technologies do not always fit the current systems the medical staff is working with (Cresswell & Sheikh, 2013; Rippen et al., 2013; Varabyova et al., 2017). A smoothly working technology is not the only requirement to realize the forecasted benefits of the implemented technology in for example quality or efficiency. Research demonstrates that the successful adoption of new technologies, when the technologies are integrated in current systems and actually used by targeted users, also depends on multiple factors beyond technical features of a technology (Varabyova et al., 2017; De Veer et al., 2011; Webster, 2002). One critical condition of a successful implementation of new technologies is whether they fit within the existing social structure and whether they can be translated into the everyday life of the users. Failure to implement new technologies in an organization is often due to difficulties in integrating the technologies in the users' daily activities (Webster, 2002). Moreover, as health care organizations include a wide range of functional departments which all have their own social and technical decision criteria and requirements which in a complex web of interrelated issues situated in a wider organizational environment, health care is rather slow to adopt new technologies compared to other industries (Cresswell & Sheikh, 2013; Varabyova et al., 2017).

Technology adoption can be seen as a process rather than something that happens at one moment in time (Rogers, 1995). When a person adopts a technology, this means that the technology is implemented in a person's daily activities (Van Biljon & Renaud, 2008). Acceptance can be seen as one of the stages of the adoption process, in which a person decides whether or not to use the application (Rogers, 1995). A wide range of models are introduced in an attempt to explain factors influencing the adoption process or on the acceptance stage of this process (Fishbein & Ajzen, 2011; Holden & Karsh, 2010; Rogers, 1995; Venkatesh et al., 2003). One widely used model used to explain a person's intention to use a certain technology, or acceptance, is the Technology Acceptance Model (TAM), which was originally developed by Davis (1989). This model suggests that, in order to adopt a technology, users should believe that the implementation of the new technology supports them to perform their job better, faster or more efficient than without the technology, a concept which is known as perceived usefulness. Second, users should

believe that the new technology can easily be integrated into their daily activities and that the benefits of using the technology outweigh the effort it takes to learn how to use it. This idea is captured in the concept of perceived ease of use (Davis, 1989). TAM is frequently applied in studies conducted in various industries as it provides simple but thorough explanation, although there is room for improvement when applying it to the health care industry (Holden & Karsh, 2010).

Because of its simplicity and wide use in previous studies, we will use the TAM as the basis for our research. Since the first introduction of the model, a wide range of additions or adaptations have been made in the model. Some of these are discussed in chapter 2 as well as other theories on technology adoption and acceptance next to TAM. In our research, we focus on the 'left' side and the 'right' side of the model. We want to adapt the original dependent variable on the 'right' side of the TAM as well as want to examine influences on perceived ease of use and perceived usefulness, on the 'left' side of the original TAM. Moreover, we want to adapt the right side of the original TAM as a considerable part of previous research is concerned with the adoption process of only a single technology such as in De Veer et al. (2011), Hatz et al. (2017), and Holden and Karsh (2010), little attention, however, has been paid to the adoption of multiple technologies simultaneously. One potential addition that therefore could be made to TAM is to take into account that an end user might adopt multiple technologies simultaneously, as in practice the nursing profession is subject to a wide range of changes regarding the role of technology in their job. Not only are the possibilities to implement technological advances into the nursing profession increasing, also the number of technologies available to nurses has increased (De Veer et al., 2009; De Veer et al., 2011; Zuzelo et al., 2008).

An academic hospital, the Radboud University medical center, based in the Netherlands, is currently constructing a new building. The hospital aims to implement a series of new technological applications into this building in the light of its new strategy "less bricks, more bytes, different behavior", among which some applications are targeted at reducing nurses' work load or to increase their job efficiency. In order to realize the forecasted benefits of implementing these technological applications, nurses should (learn how to) use them as intended. Whereas a considerable amount of research has been conducted on identifying factors beyond technical features impacting the adoption process, such as Rogers (1995), De Veer et al. (2011), and Varabyova (2017), in practice, new technology adoption processes remain expensive and time consuming in health care settings (Chaudoir et al., 2013). Therefore, more understanding is needed at "the left side of the TAM" and to more attention should be paid at the context in which a person forms an attitude towards the usefulness and ease of use of a technology (Holden & Karsh, 2010, p.14). This context consists of a wide range of interpersonal relationships, routines, work processes and behaviors for example. The influence of the team of which nurses are part of is often

neglected (Holleman et al., 2009). Large, academic health care organizations that provide specialist care, such as the Radboud University medical center, are characterized by a high level of decentralization. Rather than the organization as a whole, the socio-organizational context of the nursing staff might have a significant influence on a nurses' viewpoint on certain new technological applications. Certain team characteristics, such as how roles are divided, or strategies applied by the team, such as how results are monitored, might facilitate or hinder the implementation of innovations, but further research is needed to find out how the socio-organizational context of a team might influence an individual nurse to use a technology (Holleman et al., 2009).

We will study this in our research by focusing on the case of the Radboud University medical center. The aim of our research is to increase understanding of the role of the team in technology acceptance and thereby providing a starting point for future research on how the implementation of future applications into a medical organization success could be increased. This has led us to formulate the following research question:

How does the socio-organizational context of the nurse staff influence a nurse's decision to simultaneously use multiple technological applications at Radboud University medical center?

This question will be studied by means of a mixed method approach combining a survey and in-depth interviews. We focus on one department of the Radboud University medical center, namely CTS department, as this department currently is involved in a pilot with two new technological applications.

This research is particularly relevant from a practical point of view for the Radboud University medical center. As nurses who will move to the new building are faced with a wide range of technological applications that they are expected to learn how to work with in a short period of time, an understanding of how they learn using them is crucial because only if the applications are used as intended, the forecasted benefits can be realized. Besides, the nurse staff might provide a safe environment for nurses so an understanding how the socio-organizational context of nurse staff works might enhance the success rate of technology adoption in health care settings (Holleman et al., 2009).

From a scientific point of view, this research is relevant as it aims to contribute to the understanding of the socio-organizational context of the health care setting in which multi-technology acceptance might take place. While the majority of studies on technology adoption processes in the health care organizations focus on a single technology, in reality, health care organizations rely on a wide range of different technologies. Whereas Dorfman (1996) and Gomez and Vargas (2012) studied the adoption of multiple technologies in respectively the agricultural sector and the engineering sector, little research has been done

on this process in the health care industry. Moreover, this research aims to provide increased understanding of the context in which multi-technology acceptance might take place. As many quantitative studies were conducted on how TAM explains a person's intention to use a technology, there is a need for an in depth understanding of the socio-organizational context in order to assess its impact on intention to use, as this remains unclear in previous studies (Schepers & Wetzels, 2007). In the current study, we focus on the specific context at the level of the nurse staff.

The remainder of this study is structured as follows. In the next chapter (2), we will discuss various theories on (multi-)technology adoption intention and the preliminary conceptual model will be introduced. In chapter three on methodology, we explain the mixed method research approach we use for this research. In chapter four, we present the results of our analysis followed by a discussion of the results in chapter five. The study ends with a conclusion in chapter six.

2 Theoretical framework

This chapter starts with an outline of various theories on technology adoption and more specifically on technology acceptance (2.1.). This is followed by an overview of the current state of research on multi-technology adoption and to what extent it differs from single technology adoption (2.2). In section 2.3., we discuss perceived usefulness and perceived ease of use as widely used determinants of adoption intention. Finally, we zoom in on the socio-organizational context at the nurse staff level influencing nurses' decision to accept or even adopt a technology in section 2.4.

2.1. Adoption of technology

The topic of technology adoption has received increasing attention during the last decades, also in the health care industry (Holden & Karsh, 2010; Robert et al., 2010). Before explaining the concept of adoption, we first need to specify what we mean with the term 'technology' in the context of this research. Technology encompasses a wide range of applications, devices or systems. Previous studies on technologies in the medical sector are concerned with a wide range of technologies that differ in for example size, in targeted user group and in how much it changes the job of the medical professional. Three types of technologies that are implemented in a hospital setting can be distinguished: Technology that supports patients, technology that support care providers in their work or technology that aims at improving the process, such as IT solutions (De Veer & Francke, 2009). During the last few decades, a significant number of studies on technology adoption have paid significant attention to the third area, which is the area of health information technology. Since the introduction of information technology in health care five decades ago, it has gained widespread usage. A widely studied innovation in the field of information technology in health care is the electronic health record such as electronic health records (Creswell, Bates & Sheikh, 2013; Holden & Karsh, 2010; Venkatesh et al., 2003). These electronic health records allow health care providers to share information with all other clinicians involved in a patient's care which caused a major change in the work process of the medical staff (Ammenwerth, Iller & Mahler, 2006). A smaller number of researchers focus on one specific technology, rather than information technology as a whole, such as telecare in the case of Gagnon et al. (2012) or therapeutic and diagnostic equipment and specialized facilities which is studied by Varabyova et al. (2017). In this research, we look at two technological applications which include both IT components as well as a physical component, namely Track and Trace and Next Generation Nurse Call. In section 3.2.1., we go into more detail into what these applications entail.

Technology is reshaping health care practices, services and settings. This has implications for the way health care is organized and delivered. It is therefore not only important to look at the technology itself,

but also how they change the context in which health care transactions occur (Coyte & Holmes, 2007). In order to realize the forecasted benefits of the implemented technology, the target user group must actually use or comply with the technology. If the technological applications are not incorporated in the processes of the organization, the technological applications are of little value (Frambach & Schillewaert, 2002). In other words, the target user group must adopt the technological applications.

This research focuses on the intra-organizational adoption decision, or more specifically on the individual accepting or rejecting a technological application in the context of an organization (Frambach & Schillewaert, 2002). Whereas the terms of adoption and acceptance are sometimes used interchangeably in existing studies, in this research, we use the term adoption when referring to a process rather than something that happens at a certain moment in time (Rogers, 1995). The potential adopters go through a number of stages before adopting the technology. First, the potential adopters get to know the technology after which they form an attitude towards the technology. Then they decide whether to accept or reject the technology and to actually implement the technology into their daily lives. Finally, they seek confirmation of this decision (Rogers, 1995). In some of the models on technology acceptance or adoption, adoption is not only explained as the choice to accept a certain technology, but also takes into account the extent to which that technology is integrated into the targeted system or context (Straub, 2009). One characteristic of an adopter is that he or she wants the technology to be replaced if it would break down. Moreover, when the adopter becomes more familiar with the technology, he or she might find innovative uses for it. A final characteristic of an adopter is that when a technology is adopted and integrated into a person's daily activities, he or she cannot do his or her work properly without the technology anymore in the end (Van Biljon & Renaud, 2008). Acceptance, considered as a stage of the adoption process, refers to the attitude people have towards the technology. Acceptance, of a technology is a precondition for a user to adopt it. It is important to examine the acceptance of a technology among individuals because if there is no acceptance among the target group, the desired consequences cannot be realized (Van Biljon & Renaud, 2008). As already mentioned in the introduction chapter, we focus in this research on the acceptance stage of the adoption process using the TAM as our basis. This will be discussed in more detail in section 2.2.

The decision on whether or not an individual accepts a technology is often explained in relation to diffusion theory. This theory describes how a technology is spread through a group of people. Diffusion is defined by Rogers (1983) as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p.5). Diffusion can be seen as a social change. Social change occurs when new ideas are diffused and then adopted or reacted, which leads to certain consequences. These consequences include adaptation of the structure and function of a social

system. Factors such as time and social pressure are included in diffusion theory in order to explain the process of how a group of people adopt or reject a certain technology.

Having shortly described the technology adoption theory and diffusion theory by Rogers (1983), three theories other theories will be shortly discussed in this section as they have an important role the literature on technology adoption and they are most relevant in the context of the current research compared to other existing studies (Gücin & Sertel Berk, 2015). These include the Theory of Reasoned Action, the Technology Acceptance Model, and the Unified Theory of Acceptance and Use.

One theory frequently mentioned in studies on technology adoption is the Theory of Reasoned Action by Fishbein and Ajzen (2011). Thirty year after their first book in 1975, *Understanding Attitudes and Predicting Social Behavior*, the researchers recently published a new book describing the current status of their theoretical approach to the prediction and change of human behavior (Fishbein & Ajzen, 2011). Their theory assumes that human social behavior is a result of the information or beliefs people possess about the behavior of interest. People differ in the beliefs they hold as these beliefs are influenced by for example background, demographic characteristics and personal experiences. Figure 1 in Appendix 1 shows the three beliefs a person possesses: Behavioral beliefs, normative beliefs and control beliefs. These beliefs guide people in the behavior they do or do not perform. Each person assigns a different weight to each of the three beliefs and one's intention to perform a certain behavior is based on a particular combination of these three beliefs. Whereas one might do something because one has a positive attitude toward this behavior, another might perform a certain behavior because of the social pressure he or she perceives. A person's intention to behave in a certain way is significant indicator that the behavior will actually be carried out, as long as the person has control over the behavior such as relevant skills and abilities (Ajzen & Fishbein, 2011).

Davis (1989) suggests that perceived usefulness and perceived ease of use are important drivers and these should thus be taken into account when studying what drives an individual to adopt a new technology. These two factors constitute people's attitudes toward using technology and affect technology behavior. In Figure 2 in Appendix 1, we can see that perceived usefulness and perceived ease of use together form one's attitude towards the technology. This attitude influences then whether or not one accepts the technology and actually uses it in the end. In other words, if one accepts the technology and uses it, one can say that the technology is adopted by this person. Since the first publication of the Technology Acceptance Model (TAM) in 1989, many researchers have revised, adapted or added additional factors to the model in order to broaden the explanation of technology adoption (Holden & Karsh, 2010). The TAM

forms the basis of our conceptual model (see Figure 4 at the end of section 2.2.) with intention to use (“acceptance”) as the dependent variable. In section 2.2., we will further elaborate on this model.

A more recent model compared to the one of Davis (1989) is the Unified Theory of Acceptance and Use of technology proposed by Venkatesh et al. (2003) which aims to integrate various theories on technology behavior. This model proposes four factors that influence individual’s acceptance and usage of the new technology. These factors are performance expectancy, effort expectancy, social influence and facilitating conditions. First, the performance expectancy is the expected increase of performance. This concept incorporates the concept of Perceived usefulness from the TAM. The effort expectancy refers to the ease of use related with the accepted technology, in which the concept of Perceived ease of use from the TAM is included (Holden & Karsh, 2010; Venkatesh et al., 2003). Social influence is the perception of self-reflected by people who are important for the individual. Facilitating conditions are beliefs about the existence of personal or institutional support encouraging technology acceptance (Venkatesh et al., 2003). Figure 3 in Appendix 1 shows the relationships between these variables and behavioral intention and use behavior.

Having discussed various theories on technology acceptance and adoption, we can conclude that many theories focus on a person’s attitude which influences his or her decision to adopt a technology. This attitude is according to the theories discussed above by user’s characteristics, but also by influenced by the context the individual operates (Frambach & Schillewaert, 2002). This contextual influence is subject to change. Organizational members are not only recipients of new technological applications; they actively interact with them by experimenting with, evaluating, gain experience with or complain about the new technology (Greengalgh et al., 2017). In section 2.4., we discuss these influences of the socio-organizational context in more detail.

2.2. Multi-technology acceptance

The amount of technological applications introduced in health care aimed at for example reducing nurses’ workload or increasing efficiency of care has significantly grown (De Veer et al., 2011). These new applications need to be integrated into current work processes, which might cause a disruption of routines and an increase in the complexity of the nurse job (Zuzelo et al., 2008). However, little research has so far been conducted on the effects of implementing multiple technological applications simultaneously, especially not in health care (Cho & McCardle, 2009; Gomez & Vargas, 2012). The majority of previous studies namely on focuses on the adoption of a single innovation at one moment in time, including the models discussed in section 2.1.

In their research on organizations' adoption decision of four new process technologies in manufacturing, Gomez and Vargas (2012) argue that adopting one technology might have consequences for other technologies that are to be implemented because of their potential complementarities. Although there is a weak relationship between the complementarities of technologies and an organization's adoption intention, these complementarities might influence the organization's decision in adopting relating technologies when it already adopted a certain technology (Gomez & Vargas, 2012). In line with this, Stoneman and Kwon (1994) found that the greater the complementarity between technologies is, the more likely it is that technologies are adopted simultaneously and the earlier the adoptions take place.

Besides studies on complementarities among technologies, other studies on multi-technology acceptance focus on for example the economic dependence between technologies, such as Cho & McCardle (2009) who mention that economies of scale can be achieved when implementing multiple technologies simultaneously, or what combinations of technologies would yield the best results (Dorfman, 1996). Finally, Gomez & Vargas (2012) looked at how competitive advantage might arise from creating complex systems of multiple process technologies in manufacturing firms.

In this research, we are mainly interested in the decision to accept multiple technological applications rather than their technological features. We use the definition of Dorfman (1996) who describes the concept of intention to use multiple technological applications as the interactions between decisions to adopt or not adopt several technologies. Many technologies in health care are becoming increasingly interdependent and integrated. As Rosenberg (1979) states, "technologies depend upon one another and interact with one another in ways which are not apparent to the casual observer (...)". It is important to take into account the possibility that technologies may complement, substitute or conflict with each other as this might have consequences for the adoption decision. This assumption is generally not taken into account in research that considers the adoption of multiple technologies as independent choices (Dorfman, 1996).

Having discussed some of the few existing theories on multi-technology acceptance, we might conclude that there is a lack of research on this topic at the level of the individual adoption decision. We now turn to introducing our preliminary conceptual model (See figure 4 on page 17). As already discussed in the introduction chapter, the TAM (Davis, 1989) serves as the basis of our conceptual model as this is a widely applied model and provides a simple but thorough explanation.

The dependent variable in our model is Intention to use multiple technologies. This is adapted from the variable in the original TAM, which was Behavioral intention to use technology (or 'acceptance'). Rather

than looking at only one technology, this research studies the intention to use multiple technologies. The original dependent variable of TAM, actual use, is left out of this model as the technologies of interest in this research will only be implemented in a few years. In line with TAM, we argue that a person's intention to use multiple technologies is determined by his or her attitude towards the technologies. This attitude is considered to be a mediator between the influence of a person's perception of the usefulness of the technology and the perception of the ease of use of the technologies. This will be discussed in more detail in section 2.3.

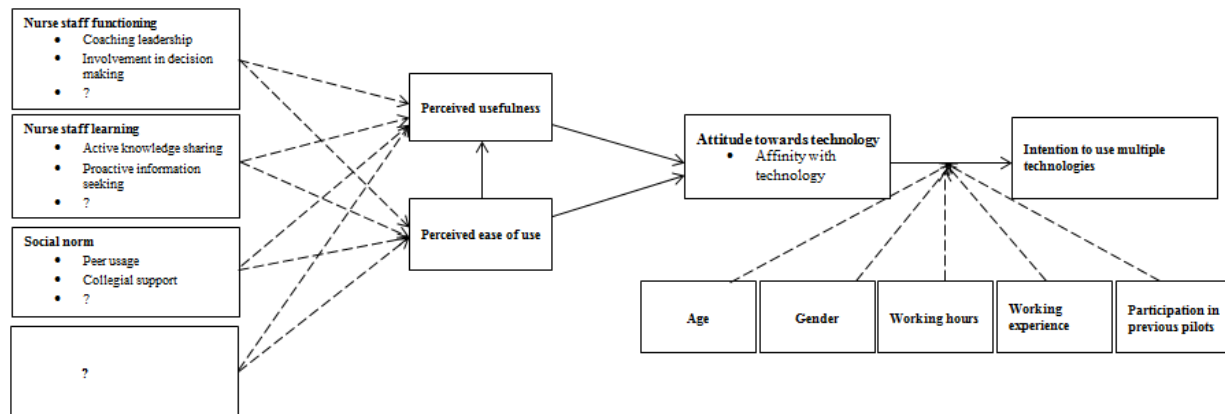


Figure 4. Preliminary conceptual model.

As this research looks at the influence of the socio-organizational context on a nurse's intention to use multiple technologies, a relationship which is mediated by one's attitude towards technology, we identify three aspects of the socio-organization environment on which we will focus in order to structure our study. These include Nurse staff functioning, Nurse staff learning and Social influence. This list of factors is neither exclusive nor exhaustive. Therefore, we left room open for new factors to emerge, not only within the constructs of Nurse staff functioning, Nurses staff learning and Social influence, but potentially beyond these. These will be discussed in more detail in section 2.4.

2.3. Attitude and perceptions

Having discussed the dependent variable of our preliminary conceptual model, we now introduce variables which are found in the literature to have an influence on Intention to use multiple technologies. The 'right part' of the model will not only be examined by means of interviews, but also by a survey. This will be discussed in more detail in Chapter 3. The relationships that are tested by the survey are indicated with a bold arrow in Figure 5 in Appendix 1. In the following, we will discuss the constructs of Attitude and the Perceptions of Ease of use and Usefulness.

As is shown in Figure 4, Attitude towards technology is thought to mediate the influence of external variables on a person's technology acceptance (Frambach & Schillewaert, 2002). In this study, we use the definition of Edison et al. (2003) who describe attitude as the "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p.140). Previous studies have shown that having a positive attitude towards a technology highly influences whether someone intends to use the technology (Davis, 1989; Edison et al., 2003; Frambach & Schillewaert, 2002).

In his research on predicting user acceptance of computers, Davis (1989) argues that two constructs are found to be particularly important determinants of the actual use of a system, namely how the target user perceives the usefulness and the ease of use of the system. Perceived usefulness is defined as the "degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). If people consider the system as being useful in the context in which they work, they are highly likely to actually use it (Davis, 1989). Perceived ease of use is defined as 'the degree to which a person believes that using a particular system would be free of effort' (Davis, 1989, p.320). The idea behind this is that people are more likely to use a system when it is easy to learn how to use it. Our third hypothesis is then:

Finally, the effect of the control variables Age, Gender, Working hours, Working experience and Participation in previous pilots will be tested on the relationship between attitude and intention to use, as well as their direct effects on Perceived usefulness and Perceived ease of Use on Intention to use multiple technologies. Their potential effects will be discussed in more detail in section 3.3.1. on the operationalization of measures.

Having discussed our proposed alteration at the 'right' part of TAM as shown in Figure 4, we now turn to the left side of the model. This part will be examined in the case study. Attitudes can namely be influenced and can change (Frambach & Schillewaert, 2002). A significant amount of literature on technology adoption is concerned with identifying factors that influence the adoption of new technologies by individuals. A number of researchers take a broad perspective and try to establish a framework of a wide range of factors influencing the adoption process. Varabyova et al. (2017) for example propose to look at the adoption process of a new technology from four perspectives: the organizational, individual, environmental, and innovation-related perspectives in order to understand how the technology should be implemented. Another research studies the adoption process at various levels of a health care organization, including the organizational-level factor, the provider-level factor, the innovation-level factor, and the patient-level factor (Chaudoir et al.,2013). Yet other authors suggest taking a broader perspective as a range of technical, social and organizational considerations need to be taken into account to make sure that

technological innovations fit both individuals as well as the organization (Cresswell & Sheikh, 2013). Finally, De Veer et al. (2011) suggest that four innovation determinants need to be taken into account when studying how new technologies are disseminated, adopted, implemented and continued in an organization. These include ‘characteristics of the innovation’, ‘characteristics of the adopting person (user)’, ‘characteristics of the organization’ and ‘characteristics of the socio-political context’. An understanding of each of them is crucial for successful adoption of new technologies according to De Veer et al. (2011). In this research, we focus on the socio-organizational contextual factors influencing technology adoption, which is discussed in more detail in the next section.

2.4. Socio-organizational factors influencing technology adoption

Whereas dominating theories on technology adoption discussed in section 2.1. mainly focus on for example the individual attributes of the user, such as intrinsic motivation and attitudes, or on the characteristics of the technologies, there is a lack of attention to attributes of the direct social environment of the medical professionals (Ammenwerth, Iller & Mahler, 2006; Holleman et al., 2009). Nurses do not work in isolation but they are part of an organization. The organization is in turn part of a larger environment (De Veer et al., 2011).

In this research, we take a more focused view on the influence of the socio-organizational context on a person’s technology adoption intention and behavior. The socio-organizational context is studied at the level of the nurse staff. Whereas in previous research the term ‘nurse team’ is used instead of the nurse staff by for example Holleman et al. (2009) and Timmermans et al. (2012), we do not use this term in this research as in our view their definition of a team does not fit in the context the Radboud University medical center. Holleman et al. (2009) for example describe teams as “two or more people working together on a specific goal through interrelated activities” in which all individual team members contribute specific knowledge, skills and abilities to the group (p.1257). As the nurse staff at CTS consists of 51 nurses, some of them might not have worked with colleagues due to a difference in preferences for a shift. Therefore, we use the term nurse staff to indicate the total group of nurses working at CTS. In section 3.2.1., we elaborate into more detail on the composition of the nurse staff at Radboud University medical center.

In order to study the socio-organizational context of the nurses, we focus on three influences that might have an impact on nurses’ adoption decision: Nursing staff functioning, nursing staff learning activities and social influence. These factors are based on suggestions from previous studies and help us structure our research, but this list is neither exhaustive nor excluding. The propositions that are formulated in this section will be tested using interview and observations.

2.4.1. Team functioning

One characteristic of the socio-organizational context on which we zoom in is the functioning of the nurse staff as research suggests that the success of attempts to change behavior of nurses are likely to be dependent of how for example communication or role division within a team (Holleman et al., 2009; De Veer et al., 2009). In their literature review on how certain team characteristics and how team functioning can be influenced through team directed interventions, Holleman et al. (2009) point out, despite weak evidence, several of these which are found to have an influence on one's attitude towards change, or more specifically towards the implementation of technologies. Characteristics that might contribute to a successful implementation of innovations include for example having a climate of trust, team stability, leadership and open communication. Moreover, as the implementation of new technologies is likely to cause potential users to change their current behaviors, certain team directed strategies can be applied. Examples include coached leadership, feedback, use of peer leaders and discussion meetings (Holleman et al. 2009).

To structure our research, we will focus on three aspects of team functioning, namely leadership and involvement in decision making. To begin with, a team leader might create a safe environment for members to communicate with the ongoing changes through motivation and coaching, thereby reducing potential resistance towards the implementation of technologies among members (Holleman et al., 2009; Timmermans et al., 2012). However, although team functioning is considered to have an important influence, its exact relationship with adoption intention still needs further research. Next to coaching leadership, involvement of the nursing staff in decision making processes is also cited by nurses in previous studies to be a factor that significantly influences the decision of whether or not to adopt a technology. Decisions made to introduce a technology without consulting the nurses what their actual needs and wishes are have found to be factor that might reduce the likelihood of the technology being adopted by the nurses (De Veer et al., 2011).

The first proposition is therefore: *Nurse staff functioning influences nurses' attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that a coaching leader stimulates nurses using new technological applications or when they are involved in the decision making process on technological applications.*

2.4.2. Team learning

Besides the influence of team functioning on the adoption of technology, the learning process through which nurses go when new technologies are introduced is also found to have an influence on their adoption decision in previous studies (Edmondson, Bohmer & Pisano, 2001; Timmermans et al., 2012).

The implementation of an innovation, such as a new application, is likely to be followed by a learning process through which new behaviors and routines are developed. Existing cognitive, social and organizational aspects might need to be revised. When this is done properly, the new routines that emerge with the implementation of the new technologies will then become the new standard meaning that these technologies are successfully adopted by the target users (Edmondson, Bohmer & Pisano, 2001). Little research has been conducted so far on how this learning process evolves in the nursing profession. Some researchers suggest that training and coaching are mentioned by nurses as being the main strategies applied to learn how to deal with the new technologies (Schepers & Wetzels, 2007; De Veer et al., 2011). However, only training and coaching appears not be enough: Also support systems and the ability to share experiences in a team are mentioned are desired tools by nurses and which might positively influence technology adoption. Although there is not always receive enough attention paid to these factors in daily practice of the nurse due to a lack of time or support, it is important to not only focus on individual learning, but also on how the team as a whole might learn.

To establish new routines, people need to communicate and coordinate as they are their roles might need to be redefined. It is not the individual alone that needs to change; implementing new technological applications might involves a collective learning process. Some of the few studies on the learning process of nurses regarding new technological applications suggest that teams that use certain team learning activities are found to more easy accept the new technological applications and the changes in routines that comes along with them (Edmondson, Bohmer & Pisano, 2001; Timmermans et al., 2012). Moreover, teams that perform these learning activities were characterized by a higher level of motivation, a higher average level of psychological safety among the nurses and a willingness to develop new behaviors (Edmondson, Bohmer & Pisano, 2001). In this research, we use the definition of team learning as defined by Edmondson, Bohmer and Pisano (2001) who describe team learning as a construct embracing the learning activities that team members exploit to gather and processes information, which allows the team to develop and perform. Team learning include gathering information from external sources, giving and taking feedback, forming shared mental models over the effects of the new technology, and sharing knowledge on new developments (Timmermans et al., 2012).

Three team learning activities could be distinguished. First, information acquisition encompasses the process by which the environment is scanned to obtain information. It assesses the extent to which team members bring in information that is collected outside the team. Second, team information processing focuses on how team deals with the distribution of information among the team members. Team members may have different mental models and might process the information in different ways. In order to create a common understanding of the information, members might collectively interpret and make sense of the

information through dialogue and feedback for example. Finally, information storage and retrieval refers to how information is put on paper or added to a database so that it can be easily used in the future (Van Woerkom & Croon, 2009).

In order to structure our examination of the collective learning process of nurses, we focus in our data collection on two factors, namely active participation in trainings and sharing knowledge with colleagues. As little is known on how nurses learn how to deal with new technological applications that are introduced at their department, we will try to gain insight into this by means of interviews. We will particularly focus on their involvement or participation to examine whether they are rather active or passive in seeking for information. Moreover, we will examine whether nurses take responsibility for the collective learning process by sharing their knowledge with colleagues or rather keep it for themselves. This brings us to the second proposition: *Nurse staff learning influences nurses' attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that nurses proactively seek information by for example participate in trainings and actively share knowledge with their colleagues.*

2.4.3. Social norm

In addition to team functioning and team learning, a third characteristic of the socio-organizational context we shed light on in this research is the influence of the behavior of a person's peers (Frambach & Schillewaert, 2002). In their study on what influences users' acceptance of information systems at work, Aggelidis and Chatzoglou (2009) find that using a new information system was approved more easily as hospital staff saw colleagues took advantage of better working conditions as a result of using the new system (Aggelidis & Chatzoglou, 2009). Whereas this specific research looks at the adoption of an information system, social influence might also influence the adoption of technological applications as the acceptance of an application by people that have significant influence on an individual's life might motivate the individual to imitate his or her behavior and to also use the applications.

In the discussion on the influence of a person's peers on the technology adoption decision, the term of social norms or subjective norms are frequently mentioned (Fishbein & Ajzen, 2011; Thompson, Higgins & Howell, 1991; Venkatesh & Davis, 2000). Both constructs encompasses the idea of an individual's behavior being influenced by the way they think people who are important to them will view them as a result of using a certain technology (Venkatesh et al., 2003). In our study we follow Fishbein and Ajzen (2011) who define social norms as 'a person's perception that most people who are important think that he should or should not perform the behavior in question' (p. 20).

One explanation for this is that an individual wants to keep up with his or her peers, such as his or her superiors or colleagues. People are likely to have a more positive attitude towards a new technology when many people in their social environment already make use of that technology. The perception that many people make use of a certain technology might even outweigh the effort he or she needs to invest into learning how to work with the new technology (Frambach and Schillewaert, 2002). This led us to formulate the final proposition is: *The social norm within the nurse staff influences nurses' attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that nurses copy colleagues' behavior, they motivate colleagues to use an application or even take on the role of promotor of an application.*

In the next chapter, we will explain the mixed method research approach used for this research and discuss the methods for data collection in analysis in detail.

3 Methodology

In this section, we first explain the mixed method research design chosen for the purpose of this study (3.1.). After that, we outline the case of the Radboud University medical center and we describe how cases are selected (3.2.). The main concepts are operationalized in section 3.3. This is followed by an outline of the techniques used to analyze the quantitative and the qualitative data in section 3.4. The final section of this chapter (3.5.) consists of a reflection on the research approach.

3.1. Research design

The unit of analysis in this research consisted of the nurse staff and the nutrition assistants at the cardiothoracic surgery department of the Radboud University medical center. This research took a real time and future perspective as we conduct this study while the pilots of Nurse Call and Track & Trace are running at Radboud University medical center. During the surveys and interviews we asked the respondents and informants to share their experiences with the applications during the pilots and whether they intend to use these in the future. Based on the findings we obtain during these pilots, we made recommendations for the future, thereby integrating the real time and future perspectives.

	Quantitative research method	Qualitative research method
Goal	<ul style="list-style-type: none"> - Get an overview of the general stance towards technology (and the Track & Trace and Nurse Call applications) among respondents - Help selecting relevant cases 	Gain in depth insight into what factors might influence whether informants accept or reject a technological application.
Means	Survey	Interviews, observations and document analysis
Number of respondents /informants	30 respondents (nurses at CTS)	25 informants, including: <ul style="list-style-type: none"> - 12 nurses at CTS - 3 nutrition assistants - 10 other informants not working as a nurse at CTS
Case selection	All nurses working at CTS are potential respondents. The surveys were distributed via e-mail and on paper.	Informants were selected and contacted via the survey, snowball sampling and direct approaching during their work.

Table 1. Overview of the features of the qualitative and quantitative research approaches.

The research method used in this research was a mixed method approach as we combine a quantitative method, a survey, with qualitative methods, namely field observations and interviews. The qualitative research approach was dominant in this research, but the quantitative approach was added in order to increase the breadth and depth of understanding of the issue under study (Johnson, Onwuegbuzie & Turner, 2007; Swanborn, 2010). Table 1 summarizes aspects of the quantitative and qualitative research

methods. The mixed method approach was suitable in this research as it provided complementary views about the phenomenon under study, which will be discussed in depth in the following.

3.1.1. Case study

A case study was considered to be the most appropriate research strategy to dominate this research compared to surveys and experiments as this research focuses on descriptive and exploratory purposes rather than hypothesis testing or explanatory purposes (Babbie, 2012). Moreover, a case study is appropriate because it allows us to study the behaviors, motives and experiences of the organizational members of our interest and their interactions. Next to that, by means of a case study, we can increase our knowledge on the phenomenon under study since that is still absent today (Swanborn, 2010). Finally, a case study fits the purpose of this study as the phenomenon under study is complex and dependent on people's interpretations which requires in depth examination in order to increase understanding about the social process under study (Almutairi, Gardner & McCarthy, 2014; Swanborn, 2010).

3.1.1.1. Interviews

Semi-structured interviews were conducted since this interviewing method was considered to fit the purpose of this research, namely to increase understanding on what drives nurses to accept certain technological applications. According to Justesen and Mik-Meyer (2010) a "semi-structured interview is defined by the interviewer working from a guide in which the themes and a number of key issues are defined in advance" (p.53). Accordingly, a list of questions was formulated (See Appendix 8) to guide the interviewer, but it also left room for the interviewee's own input. This question list was used as a basis for both the orientation interviews as well as for the interviews with the nurses and nutrition assistants but for each interview this list was slightly adapted to the specific context of each of the informants.

3.1.1.2. Observations and document analysis

Although not used as a primary data source, observations were done and one document was analyzed to complement the data retrieved from the interviews. While collecting data, we frequently visited CTS department and we were able to attend various meetings of the project team as well as the meetings of the nurse staff. Our observations helped us to gain insights into the daily operations at Radboud University medical center. Appendix 10 provides a logbook of our notes made during or after our observations. In addition to the observations, one document was analyzed which provided us additional information on the short study that was conducted prior to the introduction of Track & Trace. This document can be found in Appendix 11.

3.1.2. Survey

Simultaneously to the collection of qualitative data, the survey was distributed. The goal of the survey was threefold: First, it helped us gaining insights into whether the respondents participated in (one of) the pilot and what their general stance towards technology is. Second, based on the survey, we aimed to select both interviewees who are positive towards technology and interviewees who are less positive towards technology. Third, ten questions regarding Track & Trace and ten questions on Next Generation Nurse Call that are included in the survey are created by the project leaders of the respective pilots. These concern survey questions 4.1. till 4.10. on Track & Trace and survey questions 7.1. till 7.10. (See Appendices 6 and 7 for the complete survey). These are both based on the System Usability Scale, a means for measuring and comparing usability of a system across a range of contexts (Brooke, 1986). As the results on these questions are only used by the project leaders and are not included in this survey, we do not discuss these questions in more detail.

3.2. Case description and selection

In this section, we provided a short description of the current situation at the Radboud University medical center as background information of the current research. This is followed by the description of the selection of the survey respondents as well as the selection of interviewees.

3.2.1. New strategy at Radboud University medical center

Before explaining how cases were selected and data was collected, we will first elaborate on the case of the organization that is the leading case in the present study. The Radboud University medical center aims to decide by the end of 2018 on a number of technological applications that will be implemented in the new building 'S' by 2020. This is part of the new strategy of the Radboud University medical center: Less bricks, more bytes and different behavior. This means that the number of square meters of the Radboud University medical center will be reduced, while the most advanced, integrated technological applications will be implemented. This strategy requires a shift in behavior for employees and patients of the organization: They have to learn how to use the new technological applications in order to increase the efficiency and accuracy of personal care (Radboudumc, 2017).

Technological applications and pilots

The applications that are potential candidates to be implemented in the new building include Experimental wayfinding, Alarm Notification Platform, Track and Trace, and Next Generation Nurse Call applications. TechTeam Innovation assesses the possibilities of implementing these applications and this team consists of employees from many different parts of the organization, including nurse representatives, technical engineers and implementation managers. TechTeam Innovation is split up in several project groups for

each of the candidate applications to assess their feasibility in the context of the Radboud University medical center.

The applications of our focus in this research are Track & Trace and Next Generation Nurse Call as these are already in the pilot phase. This allows us to immediately assess the experiences and the behavior of the nurses during the pilot phase. The Track & Trace application enables nurses to find materials and devices quickly by chipping them so that their exact location can be tracked via Wifi. This application can only be used by nurses. Already a few weeks before the pilot started at CTS, the leader of the project group presented the technology and informed all the nurses at the department how to deal with it.

The Next Generation Nurse Call application will enable patients to target his or her question very specific to a medical professional who is best able to answer that question. This means that if patients want a glass of water, they can call the nutrition assistants rather than the nurse. The goal of this application is to reduce the burden on the nurses as they do not have to respond to all the demands of the patients anymore. The pilot of this application was aimed at both nurses and nutrition assistants. However, not all nurses and nutrition assistants of the CTS department were involved in the pilot: application was implemented in four rooms and the nurses who would have a shift in those rooms were informed about the pilot shortly before it started. The nutrition assistants do not belong to a specific department, but have their shifts across various departments of the hospital. Those that used the technology were randomly chosen by the leader of the project group.

CTS department

At the moment of writing, 51 nurses have a permanent contract at the CTS department of the Radboud University medical center. This number excludes flex workers, who do not have a fixed contract at this specific department. The nutrition assistants, in contrast, are not contracted by Radboud University medical center but they are employees of Food for Care. Moreover, they are not associated to a specific department of the Radboud University medical center, but they might have shifts at various departments of the hospital. Although some nutrition assistants work more frequently at CTS than at other departments, it is difficult to determine the exact number of nutrition assistants who ‘frequently’ have shifts at this department.

3.2.2. Case selection

The unit of analysis in this research is formed by the nurse staff and nutrition assistants working at the CTS department. This department was chosen as the department of our focus as it is the only one at which the pilots of the two technological applications of our focus are running simultaneously.

3.2.2.1. Selection of survey respondents

The target respondents for the survey were all nurses working at department CTS. The surveys were distributed via e-mail with the help of the project leader of Next Generation Nurse Call and the nurse team leader. Two weeks after the first e-mail was sent to the nurses, a reminder e-mail was sent by the project leader of Next Generation Nurse Call, specifically to those nurses who worked at least one shift at room 8, 9, 10 or 11, the rooms where the Next Generation Nurse Call technology was installed for the pilot, and to those the project leader thought would be willing to fill in the survey or to be interviewed. Next to the online distribution of surveys, we also distributed 35 surveys on paper. We distributed the survey at the nurse post and at the coffee corner. Table 5 in Appendix 2 shows an overview of the distribution moments.

3.2.2.2. Selection of informants

The informants were contacted and selected in various ways. Table 6 in Appendix 3 shows the list of informants, their functions and the way they were contacted. The first group of informants, a group of nurses of CTS who indicated in the survey to be willing to do an interview, was invited via an e-mail for an interview. This resulted in four interviews. To increase the number of informants, we passed by the nursing post to present our research and received help from the care coordinator to plan interviews. As she had access to the schedules of the nurses who had a shift in one of the rooms where the Nurse Call application was installed, she asked the nurses right away whether they were willing to be interviewed. The care assistant helped us to plan five interviews right away. A third method we applied to select informants was to accost nurses at the hallway whether they were available for an interview. With three nurses we contacted this way, we could plan a meeting for an interview. The second group of informants consisted of nutrition assistants. Two nutrition assistant were contacted via the survey we distributed among nutrition assistants. The contact details of the third nutrition assistant were retrieved via the team coordinator of the nutrition assistants. Finally, the third group of informants consisted of project leaders or members, a doctor-researcher, implementation managers, chair of Nursing Advisory board and a REshape fellow. Those were contacted via our internship coach or by means of snowball sampling where informants of earlier interviews referred us to new informants.

3.3. Operationalization

This paragraph discusses the operationalization of the main concepts in this research. First, we will operationalize the measures included in the survey. In section 3.3.1. we will discuss how the questions obtained from the existing literature were translated for the purpose of this research. Section 3.3.2. discusses the operationalization of the constructs included in the interviews.

3.3.1. Operationalization of measures

Only a selection of the variables indicated in our preliminary conceptual model are included in the survey, namely Intention to use (dependent variable), Perceived usefulness and Perceived ease of use (both independent variables, and Attitude towards technology (mediating variable) (See Figure 5 in Appendix 1). Nurse staff functioning, Nurse staff learning and Social influence were examined by means of interviews. In order to increase the validity of the survey items, the project leaders of both Track & Trace and Next Generation Nurse Call revised the draft of the survey several times before it was distributed. Table 7 in Appendix 4 provides an overview of the measures and the measures found in the literature on which they are based.

Dependent variable

The dependent variable in this research is Intention to use. In order to measure the respondent's intention to use the technology, we used one of the items proposed by Chrismar and Wiley-Patton (2002), though we had to adapt it in order to make it fit for the context of our research as after revision of our initial set up of the survey, the project leaders of Track & Trace and Nurse Call indicated that the initial items suggest that the applications would actually be implemented in the future, which is not necessarily the case. We therefore adapted the question to "Consider that the application would be implemented on your department in the future and you would have the choice whether or not you would use the application, do you think you will use the application often?" As this only considers the intention to use one technology (either Track & Trace or Next Generation Nurse Call), while our dependent variable includes the joint acceptance of multiple technological applications, we ask in the interviews about the interviewee's intention to adopt more than one technology. This will be discussed into more detail in section 3.3.2.

Independent variable

The items used to measure Perceived usefulness are based on the study by Chrismar and Wiley-Patton (2002) and so are the items used to measure Perceived ease of use. Chrismar and Wiley-Patton (2002) measure both constructs with four items. We decided, however, to leave out one item that measures Perceived ease of use, namely "My interaction with the application will be clear and understandable", as this question does not apply to the application of focus in this research. The Nurse Call and Track & Trace applications namely do not allow for 'interaction' with the technology as it is more a tool sending information.

Mediating variable

Affinity with technology is measured by using the scale proposed by Edison & Geissler (2003). While the original scale contains ten items, we chose to include seven in our survey because including all the ten

items would make the survey unnecessarily long. Moreover, several items were not considered as relevant in the context of this research, such as “I relate well to technology and machines” and “Solving a technological problem seems like a fun challenge”, and are therefore left out. Appendix 3 shows the complete overview of the original items and which were left out.

Control variables

We included five control variables as moderators in our model in order to control for potential effects of demographic factors on our model. The choice for including these control variables was based on the Unified Theory of Acceptance and Use of Technology which suggests that the influence on behavioral intention is moderated by gender, age, voluntariness and experience (Venkatesh et al., 2003). This theory was described in detail in Chapter 2. In our research, voluntariness of use is not included as a control variable, as this does not apply to the technological applications we focus on. When Next Generation Nurse Call and Track & Trace will be implemented into the new ‘S’ building, nurses are expected to work with them; they don’t have a choice in using them or not. The control variables age, gender and experienced are shortly discussed in the following.

First, age was included as a control variable as attitudes of younger people toward using new technological applications are found to be mores salient then those of older people (Morris & Venkatesh, 2000; Venkatesh et al., 2003). Respondents could fill in their age in the survey by typing their age in numbers. Later, five age categories were made to make this variable of ordinal measurement level (See Table 7 in Appendix 4). Second, gender was included as a control variable as gender differences might influence a person’s perceived usefulness and perceived ease of use as determinants of technology acceptance and usage behavior (Venkatesh & Morris, 2000). Respondents could indicate their gender by typing it into a text block in the survey. This option was chosen as it allows people who don’t feel that they belong to the ‘male’ or ‘female’ category to indicate another category themselves. For analysis purposes, two gender categories were created, making this variable of binary measurement level. Finally, we included working hours, participation in previous pilots and work experience as control variables. These are all based on the concept of ‘experience’ included in the Unified Theory of Acceptance and Use of Technology. First, working hours was included as a control variable because the number of hours you spend at work during the week might influence how much you are exposed to a technology and how fast you learn using it. Again, the respondents could indicate the number of hours they work per week according to their contract by typing the number into a text block in the survey. This provided us with a variable of ratio measurement level, but later we made categories to make the variable of ordinal measurement level. Second, work experience in years at Radboud University medical center was included as a control variable as the number of years you are working for the organization might influence your

view on technological applications that are implemented into the organization. Respondents typed the number of years they worked for the Radboud University medical center in numbers into a text block. This leaves us with a variable of ratio measurement level. For data analysis purposes, this variable was converted to a variable of ordinal measurement level. Third, the variable Participation in previous pilots was included as a control variable, as the fact that participating in many pilots might lead to pilot fatigue. Respondents could indicate either a 'yes' or a 'no'. The resulting variable Participation in previous pilot is therefore of binary measurement level. In case the respondents answered with 'yes', they were asked with a follow up question in what pilot they participated and when the pilot took place. They responded by typing this into a text block.

3.3.2. Operationalization of constructs

The concepts included as measures in the survey are also touched upon in the interviews. In addition to these, three constructs were included in the interviews, namely Nurse staff functioning, Nurse staff learning and Social influence. Table 8 in Appendix 5 provides an overview of the constructs included in the interviews and how they are measured during the interviews. Next to these constructs, four more constructs are tested during the interviews which belong to a research conducted parallel to our research. These are shortly explained in section 3.3.2.6. as the results of these variables are taken into account in the analysis of the data.

Multi-technology acceptance intention

The dependent variable in this research is Intention to use multiple technological applications. As explained in section 3.3.1.1., we were only able to measure intention to use a single technology by means of the survey, but in the interview we asked the interviewees what they thought of using multiple new applications in case they used both the Nurse Call and Track & Trace applications. In case the informant used only one of the applications, we asked a hypothetical question about how they would feel using multiple new applications simultaneously. As we did not only want to gain insight whether the informant intends to use the applications in case they would be actually implemented in the future, we also asked the informant what would trigger them to use them. Moreover, we asked whether other applications, such as EPIC, play a role in whether nurses intend to use the Nurse Call and or the Track & Trace application. Finally, we asked whether nurses see a relationship between the applications that were introduced as Vargas and Gomez (2012) suggested that complementarities between technologies might have an influence on a person's acceptance decision. This latter variable is described in more detail in section 3.3.2.6., as the complementarity between variables is included in the question list as a separate topic and belongs to the research conducted parallel to our study.

Attitude, Perceived ease of use and Perceived usefulness

The operationalization of the constructs Attitude, Perceived ease of use and Perceived usefulness were already discussed in section 3.2.1. We used the survey questions on these constructs as the basis for the interview questions. In order to find out what a nurse's attitude towards technology was by asking whether they are interested in technologies and whether they see are positive towards using technologies in their profession. In order to find out what might influence nurses' attitudes we asked an open question to what it is that they have a certain attitude towards technology in a follow up question. For both the nurses' perceptions of the ease of use and usefulness of the applications, we asked how nurses experience using Nurse Call and Track & Trace and whether they would use it if the applications would actually be implemented.

Nurse staff functioning

In order to gain insight into the functioning of the nurse staff under study, we build on suggestions by Holleman et al. (2009) to focus our attention to how leadership is expressed in the nurse staff. As the care coordinators are in charge of the daily management of the staff as appeared in the orientation interviews, we specifically ask about the role of the care coordinator in stimulating nurses to use the new technological applications.

In addition to that, we examine if and how nurses are involved in decision making processes on new developments at the department where the nurses work as this might also have an influence on the acceptance decision by nurse (Holleman et al., 2009). We ask to what extent nurses feel involved and to what extent their level of involvement influences their intention to use. The concept of involvement is also addressed as a separate factor in the question list and one of the key variables of the study that is conducted parallel to this study. Therefore, the involvement of nurses is explained in more detail in section 3.3.2.6.

Nurse staff learning

In order to gain insight into the learning process through which nurses might go when being faced with new technical applications, we take the findings of Timmermans et al. (2012) as a starting point. We ask the nurses how they learn using the applications, what information or instructions they received, from whom they received information or instructions and how they were taught to bring this into practice. In addition to that, we asked the nurses to compare the learning process of these particular applications with the learning process of EPIC. Although EPIC is an application that caused a major organization in work processes of nurses compared to the applications of our focus in this research, but we included this question to gain insight into what practices or activities work best according to nurses. Finally, we ask the

nurses if and how they think the learning process influences their attitude towards the application(s) and their intention to actually use them.

Social norm

In order to examine this aspect of the social norm, the findings of Aggelidis and Chatzoglou (2009) and Frambach and Schillewaert (2002) form the basis of our interview questions on this topic. The informants might not be conscious about the influence social norms might have on their behavior. We therefore first openly ask nurses what would motivate them to use the applications after which we focus on the role of their staff members, care coordinators and project leaders in this. Whereas we examine the role of the care coordinator in 3.3.2.3. more from a leadership perspective, we here want to examine how his or her behavior could influence a nurses' attitude towards the applications and on their perceptions of the usefulness and ease of use of the applications.

Other variables included in interview question list

The variables studied in the research that was conducted alongside our research include Involvement of potential users, External pressure, Complementarities of technologies, and Order of entrance. Although these constructs are not particularly focused on in this research, we need to shortly explain these constructs as they are integrated in the interview question list and the answers on these questions might be related to the questions on the key constructs of our study.

First, Involvement of potential users is concerned with if and how nurses are involved in the introduction of the applications on the department and whether their involvement lead to a more positive attitude towards the application. It also includes the question whether nurses feel heard by those who are in charge of introducing the applications. The construct of Involvement of potential users is also partly covered in our key construct Nurse staff functioning (see section 3.3.2.3.). Second, the construct of External pressure examines the potential increase in work pressure nurses might experience when multiple technological applications are introduced simultaneously rather than a single application. Third, the findings on the influence of the construct of Complementarities of technologies on the acceptance decision as the complementary among technologies might motivate potential users to adopt a second related technology when they adopted a certain technology (see also section 3.3.2.1.). This construct is examined by asking nurses if and to what extent they perceive the technological applications as being related to each other and how this might influence their acceptance decision. Finally, Order of entrance concerns questions on how the nurses find the speed with which the technological applications are introduced after each other.

3.4. Data analysis

In this paragraph, we will discuss the techniques used to analyze the quantitative data (3.4.1) as well as those used to analyze qualitative data (3.4.2).

3.4.1. Quantitative analysis methods

Data were analyzed by creating frequency tables and crosstabs. In order to prepare the data for the data analysis we used summated scores to integrate multiple items that make up a measure. There are no assumptions that should be met before making crosstabs, though, we created new categories within our variables so that the resulting tables are more easily readable. Table 5 in Appendix 2 provides an overview of the original categories of the variables included in the quantitative data analysis and the new categories that are created for lay out purposes.

As our data set is small (N=30), we need to use the Likelihood Ratio to compute whether there are relationships between the variables of our focus. We were not able to use the Pearson chi-square as in all crosstabs the expected frequencies in each cell was below five (Field, 2013).

3.4.1.1. Missing data

In total 39 out of 51 nurses at CTS filled in the survey. 30 valid responses were recorded. Three surveys on paper needed to be excluded as they were not filled in completely. Six more unfinished responses were recorded by Qualtrics.

3.4.1.2. Reliability analysis

Reliability was examined by using the Cronbach's Alpha values. As shown in Table 4 in Appendix 2, all values were above the .70 acceptance range (Field, 2013).

3.4.2. Qualitative data analysis

The pattern matching approach proposed by Yin (2009) was applied to analyze the data. This technique is applicable in this study since it allows us to bring diverse data types retrieved from interviews and observation together (Almutairi, Gardner & McCarthy, 2014). This technique helps us to enhance the internal validity of the study if the patterns derived from theory match the patterns found in the data (Almutairi, Gardner & McCarthy, 2014; Swanborn, 2010).

Each interview was transcribed into an electronic text document. By means of coding, the raw data was raised to a conceptual level. Conceptualizing data not only reduced the amount of data, but it also provided a language for talking about the data (Corbin & Strauss, 2008). The coding process was conducted using Atlas.ti.

By using methods such as constant comparison and asking questions, data was closely examined and labels were attached to groups of words (Corbin & Strauss, 2008). Examples of the resulting codes from the open coding stages are *diffuse information*, *information provision*, *need for feedback*, *disrupting routines*, *added value*, *sharing information*. The results of the open coding were reanalyzed in order to identify the core concepts in this study (Babbie, 2010). The open codes were combined and regrouped to identify which categories are important and how they are linked (Boeije, 2014). Examples of these axial codes are *openness in nurse team*, *usefulness as condition for ease of use*, *need for immediate support*, *need for clear instructions via a single medium*, *fit with routines*, and *influence of time*. In order to identify the central code(s) to which all other codes are related, we integrated the connections between the categories that resulted from the axial coding phase (Boeije, 2014). To find these connections, the axial codes that were considered relevant for this research were compared with each other. Table 13 in Appendix 12 shows the comparison between theory and the codes retrieved from theory. The resulting selective codes were *shared coaching role*, *collective learning*, *collegial behavior as a measure*.

3.5. Reflection on research approach

The interviewees received full information about the purpose of the study prior to the interview. After the interviews were transcribed, they were sent to the interviewees to give them the possibility to read the text for approval. The interviewees were ensured that their results would not be used for any other purpose than this research.

Having discussed how data was collected, we now turn to the results section in which our findings are presented.

4. Results

This chapter first discusses the results of the quantitative data analysis. In section 4.1.1., the descriptive statistics are discussed after which the correlations are presented (4.1.2.). In the second part of this chapter, we will discuss the results of the qualitative data analysis (4.2.). The findings of the qualitative data analysis are discussed along the three propositions introduced in section 2.4.

4.1. Results of quantitative data analysis

In order to analyze the quantitative data, descriptive statistics and frequency tables are provided and crosstabs are made. We start by discussing the descriptive statistics and frequency tables (4.1.1.), after which we discuss our findings on the general stance of nurses towards technological applications (4.1.2.). Finally, we discuss the results of the crosstabs (4.1.3.).

4.1.1. Descriptive statistics and frequencies

In total, valid 30 responses were registered. Table 2 shows that 22 out of the 30 respondents used Track & Trace. Of those 22 respondents, 13 respondents used Track & Trace in combination with Nurse Call, while the other nine only used Track & Trace. Moreover, 14 respondents used Next Generation Nurse Call, of which only one respondent did thus not use Nurse Call in combination with Track & Trace.

Number of respondents that only used T&T	Number of respondents that only used Nurse Call	Number of respondents that used both applications	Number of respondents that used none of the applications	Total number of respondents
9	1	13	7	30
30%	3,33%	43,33%	23,33%	100%

Table 2. Overview of how many respondents of the survey used both applications.

The CTS department is generally known as being a department with relatively young nurses and this is in line with the high number of young respondents in the survey. Only six respondents reported to be 35 years or older. This means that, considering their age, the major part of the nurses at this department is likely to be familiar with using technology in their daily lives. This could imply that they also would not experience many difficulties with using technologies in their profession.

When looking at the work experience at Radboud University medical center, we observe that 30% of the respondents of the survey are relatively new on the department: They report that they work one year or less at CTS. This might imply that some of them still need to get used to the work processes and routines specific for the Radboud University medical center. What this means for their acceptance of new

applications is that they might not immediately see how they can benefit from using it, as they are still finding out what work routine works best for them for instance.

Next to that, the data shows that on average, the respondents work between 16 and 36 hours per week. 24 out of the 30 respondents indicate that they work 32 hours or more per week. This means that it is likely that most respondents were sufficiently exposed to the two new applications in order to assess their usefulness and ease of use. Finally, only nine out of 30 respondents reported that they participated in previous pilots that were running on their department. These include pilots of new technological applications, such as the electronic patient files, but also non-technological pilots, such as a pilot with new infusion pumps.

Appendix 9.2. provides the frequencies and descriptive statistics of the age, gender, work experience in years, working hours per week and participation in previous pilots.

4.1.2. Attitude towards technology

Before we turn to describing the relationships between variables that were found using crosstabs, we first discuss how nurses feel about using technologies in their profession. The results show that most of the respondents who used the Nurse Call application are rather positive towards the statement whether they would use this application as well when it would actually be implemented. Though, three out of 14 also report that they will not (See Table 9 in Appendix 9.1.). In contrast, none of the respondents who used Track & Trace were negative towards the statement whether they will use Track & Trace in the future in case it would actually be implemented (See Table 10 in Appendix 9.1.).

Next to the respondents' stance towards each application, the results of the survey also provide insight into their stance toward technologies in the nursing profession in general. Only five respondents filled in the survey of which one disagrees with the statement whether he or she in general is positive towards the use of technologies in their job (See Table 11 in Appendix 9.1.).

4.1.2. Crosstabs

By means of crosstabs, we examined whether there is a relation between the variables under study. As the expected count of cells that would be less than 5 exceeds the critical point of 20% in all crosstabs, we need to look at the Likelihood Ratios rather than the Pearson Chi Square. Table 12 in Appendix 9.3. provides an overview of the in total 36 relationships of which crosstabs were provided. Only five relationships appear to be significant (See Appendix 9.3.) First, the relationship between Perceived usefulness of Nurse Call and Affinity was significant with a Likelihood Ratio of 8.711 which implies that respondents who see the added value of Nurse Call appear to have a positive attitude towards this application. The same was true

for the Track & Trace application. This might imply that when nurses think the application adds value to their care delivery, for example in terms of patient benefits or efficiency of work, they have a positive attitude towards the applications and might be eventually more inclined to actually use the applications.

What is remarkable is that Perceived ease of use of both applications seems to be unrelated to the respondents' attitude towards the applications as the Likelihood ratios for these relationships are not significant. This implies that respondents do not let their decision to like an application or not depend on their perception of how hard it is to use the application. One potential explanation for this is that the respondents might already think that the applications must be useful in some way as a whole project team is concerned with studying nurses' experiences on using these applications.

Next to the relationships between Perceived ease of use and Perceived usefulness with nurses' attitude, our findings show that none of the control variables (Age, Gender, Work experience, Working hours and Participation in previous pilots) were significantly associated with either Perceived ease of use of Track and Trace, Perceived usefulness of Track & Trace, Perceived ease of use of Nurse Call or Perceived usefulness of Nurse Call. This implies that the Perceived ease of use of Perceived usefulness of an application are not influenced by personal characteristics of the respondents. Neither do they influence respondents' intention to use either Nurse Call or Track & Trace.

Finally, the crosstabs of Perceived usefulness Track & Trace and Intention to use this technology show that these variables are associated. Remarkable is that, in contrast to Perceived usefulness, Perceived ease of use of this technology and Intention to use it are not associated. Also Perceived usefulness of Nurse Call and Intention to use this technology appear to be associated. Unlike Track & Trace, the Perceived ease of use of Nurse Call appears to be associated with Intention to use the technology as the relationship is significant.

To conclude, our findings show that none of respondents disagree with the statement whether they would use Track & Trace when it would actually be implemented, while some disagree with the same statement on Nurse Call. The crosstabs show that especially the perceived usefulness of both applications is important for the respondents in their decision whether they use the application or not.

4.2.1. Results of the qualitative data analysis

This section summarizes the results of the analysis of the interviews and observations in order to answer the research question: *How does the socio-organizational context of the nurse staff influence a nurse's decision to use multiple technological applications at Radboud University medical center?* The main finding of this study is that, although the simultaneous introduction of the two applications of our focus

are not seen as a hindrance, collegial support appears to be the most important condition for nurses to be able to deal with the increasing role of technological applications at the CTS department of colleagues are seen as the main source of information available for nurses. Our findings show that the socio-organizational context in which nurses operate has an influence on their intention to adopt technological applications and in various ways. This is explained in detail in section 4.2.2.

To gain insight into socio-contextual factors that influence a nurse's intention to adopt technological applications, we take three factors found in the literature as a starting point for discussing the findings our research, including nurse staff functioning, nurse staff learning and social influence. Data retrieved from observations and interviews provide in-depth insights into these influences in the context of the Radboud University medical center. Appendix 12 provides an overview of the constructs derived from theory and how these relate to the data retrieved from the interviews and observations. As discussed in the methodology chapter, the results are structured along the propositions introduced in section 2.4. The discussion of the results is illustrated with quotes. Table 6 in Appendix 3 provides an overview of the informants and in what transcript the quote was found.

4.2.2. Experiences of nurses on using both applications simultaneously

Our findings show that the simultaneous introduction of the applications of our focus in this study is not considered to hinder nurses from adopting the applications. Of course, in presenting our findings we need to take into account that the technological applications of our focus are introduced as pilots and attitudes might change when these technologies will actually be implemented. However, overall, these two technological applications of our focus seem to have little impact on the existing work processes and routines of nurses and require little training prior to using them. Moreover, our findings show that nurses treated the applications of our focus as independent entities and as a result made two separate acceptance decisions. The decision of our informants to use one of the applications seems to be unrelated to the decision using the other. As the two applications run on different systems, the applications were seen as two independent ones from a technological point of view. Whereas the Nurse Call application is installed on the nurse bleeper, Track & Trace is only accessible via a desktop, either in the nurse post or a computer on wheels. Moreover, also from an organizational point of view the applications were seen as separate entities as they were introduced by two different project groups using their own communication and training strategies.

[1] *“Yes, the fact that they are both here at the same time is nothing new, so that doesn't really matter for me. So if it is good and handy, than it is only of added value for me.”* – Informant 14, nurse at CTS.

[2] *“For me it is not a problem to work with both simultaneously (...). We have frequently pilots here. No, those are separate things.”* – Informant 16, nurse at CTS.

It is not the first time that nurses at this department are encountered with multiple new technological applications that are introduced simultaneously. Most nurses considered technology as being an integrative part of nursing and the increasing role of technology in nursing is thought to be inevitable with an eye on the future as is shown by quotes 3 and 4. Thus, the fact that both applications were introduced simultaneously was not reported by nurses as a hindrance to use either of these applications. However, if they would have the choice, some nurses reported they would prefer that new applications are introduced after each other so that they have time to learn how to use it and to integrate them into their existing routines and work processes.

[3] *“There are simply not enough people to take care for elderly, so innovation and technology must be used to improve that. And if you just talk with people, just in an open conversation, then they will understand that as well.”* – Informant 11, nurse and management position

[4] *“Well, the whole world is technology, right? It is very odd if you still need to do something on paper, so yeah ...”* – Informant 23, nurse at CTS.

[5] *“For me, it doesn’t matter so much. As long as it is clear and fast, then I think it is fine. But if [the application] is more comprehensive and if you need to collect more information for it, then it might be annoying that two are introduced at the same time. And I notice among the older colleagues who are not used using technologies and then it can be very difficult.”* – Informant 14, nurse at CTS

Multiple pilots running simultaneously causes frustration

One factor related to the discussion on multi-technology acceptance that seems to cause some frustration for some nurses is that there are frequently many pilots running on their department, as is illustrated by quote 6. These pilots include not only pilots on new technological applications, but also new devices for patients for example. One reason for why there are many pilots appears to be that CTS is a department where nurse students are trained. The nurses are therefore frequently asked to participate in studies. Our findings indicated that this frustration was mainly reported by older nurses, but as we only interviewed a few nurses older than 35 years, further research is necessary to find out whether age actually has a significant influence.

[6] *“(…) I also tol dit the new senior nurse that they accept too many new things. Too many pilots at the department. That needs to change. But, Track & Trace, that’s something I really like, because that has*

added value. You know? Then you have some sort of reward. It increases your efficiency. And then I don't mind to take the effort to learn using it." – Informant 15, nurse at CTS.

[7] *"We are a training department and therefore we get a lot of researchers of students, students who graduate at our department and then also conduct interviews or research here (...). I don't mind that, because I am a coach here at the department, but among other nurses, but sometimes you notice, well, school is over... more rest, no researchers anymore... (...). So, it is not always what the hospital wants and what our team leaders want, but beyond that, we participate in many other researchers. So then it is a lot. [There sometimes is resistance] because they have to do something, again. It is the 'have to' part [that is causing frustration]."* – Informant 23, nurse at CTS.

[8] *"It's not that these two specific pilots are the problem. It is more that it is one of the many pilots. And yes, that's how human beings work, if you don't see the added value of it, then you easily blame the application, it frustrates you and you get apathy towards it. Then you will... well, to boycott it, that maybe not, but you definitely won't invest your time and effort in it [Nurse Call application] while that Track & Trace... Well that is useful. You know? You want to put extra energy into that. You also get it back then."* – Informant 15, nurse at CTS.

Perceived ease of use and perceived usefulness

Having discussed nurses' experiences with the introduction of multiple applications and the fact that multiple pilots are running simultaneously, we now turn to the conditions that are found to be required for nurses to accept one or multiple technological applications. We found that perceived ease of use and perceived usefulness influence a nurse's intention to use an application. Perceived usefulness seems thereby to be a condition for the perception of ease of use for nurses: When an application is not useful, either for the patient or for themselves, then nurses are not likely to actually use the application. The gains in time or in quality for patient (perceived usefulness) must balance out the effort that nurses should invest into learning to use the applications (perceived ease of use) as shown by the quotes below. If it takes too much time to figure out how an application works, nurses tend to find another way to reach their goal. Quotes 9, 10, 11 and 12 show how perceived usefulness is related to perceived ease of use according to patients. These quotes also illustrates that time appears to be an important factor.

[9] *"We of course want the best for our patients. Look, then it is also the question to what extent it is useful. Look, if we have to put a lot of effort into it [Nurse Call application] to make it a little bit better for the patient... (...). If you put a lot of time into it you and benefit from it and you save a lot of time with it later... But that wasn't the case so far".* – Informant 21, nurse at CTS.

[10] “(...) *It is already very busy. So at the moment that you are going to try something out [an application for example] and it costs you even more time, then you rather spend that on the patient than on using an application. So I think if it will cost a lot of time, then you tend to just leave things as they were.*” – Informant 16, nurse at CTS.

[11] “*Of course we do everything for the patient, but if we need to search an hour for a bladder scan... well, then I just leave it, we'll do it next time then.*” – Informant 13, nurse at CTS.

[12] “(...) *For example, one thing, the score of the pain a patient experiences. In fact, we need to ask the patient to rate his pain every shift and if a patient is in pain, then we need to ask to give a score every hour. If you manage to visit the patient every hour, that's already an achievement. And if you also need to register all that... Yes, that happens a lot. Often, you ask it only a few times during your shift and if the pain is acceptable than you don't register it. You ask it, but don't register it [in the system]. If only the patient that could do that on his own by pushing one button for example...*” – Informant 21, nurse at CTS.

The insight of the importance of the perceived time that needs to be invested into learning how to use an application is also relevant for project leaders as our findings show that instructions of applications must be clear. This will be discussed in more detail in section 4.2.3.2.

Misfit with routines

Next to perceived time, the fit with existing routines is also found to be important, in particular for nutrition assistants in the case Nurse Call. For nurses, the Nurse Call and Track & Trace applications have, apart from some technical flaws that influence nurses perceptions of the ease of use of the applications, on which we won't go into much detail as that is beyond the boundaries of our research, little impact on their work processes and require little training. For nutrition assistants, though, the Nurse Call application appears to have a big impact on their job. As they work in a tight schedule in which they have limited time to do their tasks, an additional request of a patient for which they have to break through their routines, cost them a lot of effort. As a result, they sometimes ignored the signals of the patients. This led to frustration between nurses and nutrition assistants, rather than that they help each other.

[13] “*I arrived at the department and then it [the pilot of Nurse Call] was shortly mentioned. But maybe colleagues got an explanation, but well yeah, there is not much to explain, because it is just a bleeper that is there and we know: If that room number calls, then we need to go there. Well, I worked with the bleeper during a very busy evening and a patient called and I didn't answer because I couldn't at that moment. Then the nurses came to me to ask why I didn't answer the bleeper, whether I didn't hear it. And I*

honestly told them that I did hear it but I didn't had time for answering it. Because so many guests where there at the department that evening on top of all the patients.” – Informant 22, nutrition assistant.

[14] *“I think that they [the Nurse Call project team] haven't involved the kitchen sufficiently because immediately we had to tell nutrition assistants ‘Your bleeper is bleeping and if you don't answer, we [nurses] get the signal.’ ‘Yes, I'm too busy and I won't answer that stupid bleeper.’ [was the answer of the nutrition assistant]. So, then they haven't involved the kitchen enough I think. I don't know how they did that. Maybe they [the Nurse Call project team] just said [to the nutrition assistants] ‘Hi, we are going to this, full stop.’ While the kitchen also sometimes suffers from high work load, how they experience it thus.” – Informant 5, nurse at CTS.*

Perceived shortage or diffusion of information

So far, we have seen that using the applications of our focus is not considered to be a hindrance for nurses to accept them. As long as the applications are perceived as useful and easy to use, nurses tend to accept them easily, although some conditions need to be fulfilled. We have already seen that time and fit within routines also play an important role. This latter is especially important for nutrition assistants. Our findings show two additional factors that are also found to influence on the acceptance decisions on new technological applications by nurses. First, information about the applications is of significant importance. Especially colleagues seem to have a crucial role in the information dissemination.

[15] *“It's of course simple, very simple how it [Nurse Call] works. It's more about how it reaches everyone, the information, you know. So, what I said, if a couple of colleagues get clear instructions and get the task to spread the information, then in the end it will reach everyone I think. It is not so much that it isn't explained well, but... you hardly reach everyone.” – Informant 15, nurse at CTS.*

As is illustrated by quote 15, not everyone might feel to be at the same page when it comes to information about developments on their department. Our findings show that in particular, the nurse's colleagues appear to have an important role in information dissemination, rather than staff management for example. This will be discussed in more detail as well in section 4.2.3.1. One explanation for why collegial support is important for nurses is according to our findings that the information provision about new technological applications at the department is rather diffuse. Again, it should be taken into account that we base our findings on experiences of nurses with the technological applications in a pilot, but quotes 16 and 17 illustrate that not everyone feels to be on the same page when it comes to new developments at the department.

[16]“(…) It [Nurse Call application] was introduced at a certain day and those that work that day got the information and after that it disappeared somewhat. (…) So I think that if you implement it, then the explanation is particularly important. That is what I missed.” – Informant 16, nurse at CTS.

[17]“One time, (…) I was so mad, I considered to remove it [the Nurse Call application] and to replace it for the normal nurse call system because I didn't know what to do with it, it wasn't useful for anyone, it only caused frustration. And I, again..., I heard something in the hallway from colleagues but I never got an explanation about the [Nurse Call] application myself. Now, it is always a problem to introduce new things because (…) not everyone is there at that moment. And, another important thing is that there are already so many projects. And look, Track & Trace, that is useful for us, at least, I thought it was useful so I want to invest time and effort into it, but it creates extra workload on an already high workload, let me put it that way.” – Informant 15, nurse at CTS.

Possibilities to provide feedback

Next to a perceived shortage or diffusion of information, our findings show that there also seem to be little possibilities to provide feedback on the applications nurses try out and use. In particular, there seemed to be some confusion about the Nurse Call application. This was the case for both patients, who did not always receive information from the nurses on how to use the application, and for nurses and nutrition assistants, who often received ‘false alarms’ due to a technical flaw in the application. The informants had the feeling that these struggles do not always reach the project members concerned with these applications as is illustrated by the following quotes.

[18]“I think it is important in a pilot that you will try it out and that they listen to your experiences of using it. That something happens with your feedback. If not, there's no point in trying it out (...). [The fact that the bleeper of the Nurse Call application doesn't always work smoothly] is communicated [to the project leader]. I think it is also communicated with those people that were doing the measurements and observations of the system itself, so to say, and they would pass it on to the technical staff. But that did not happen I think. I don't know much more about that.” – Informant 16, nurse at CTS.

[19]“Not too long ago they were here to evaluate and to ask what wasn't clear about the system [Nurse Call application]. Then she also asked ‘What do you like to change in the application so that it is more useful and clear for you.’ Then many questions we had were answered. You could do that again for a smaller group of nurses. Repeat is when the system is adapted to our wishes.” – Informant 12, nurse at CTS.

The importance of giving nurses the opportunity to provide feedback is also recognized by the implementation manager of Groningen University medical center, as shown by the quote below. Although he indicates that it is important to ask nurses for feedback and arrange a meeting for that we think that, as a project leader, being present at the department and to ask nurses to provide feedback while they are actually working with it, is more effective. As discussed earlier, nurses do not want to spend too much time on learning how to use the applications and arranging a feedback meeting might feel like another thing on their to do list. Moreover, whereas the implementation manager at Groningen University medical center initially plans meetings with nurse staff leaders, we think it is particularly important to ask the nurse ‘on the floor’, because they report to not always feel heard.

[20] *“We want to have a dialogue with the departments. We will join the nurse meetings. Of course we cannot join every meeting. In the first place, we will focus on the meetings of the staff leaders. This is the meeting between all senior nurses of all departments. In particular, we want to start the dialogue with them. Dialogue is important. In any case, we try to good in good contact with the departments. And not only with the nurses, but also with facility workers. That’s how we discover things where we wouldn’t have thought of at first.”* – Informant 3, implementation manager at Groningen University medical center.

To, conclude, nurses at CTS who were involved in one or both of the pilots appear to not experience hindrances from the fact that two new applications were introduced simultaneously as they report to be used to being exposed to many new technologies in their profession. When it does not too much time to learn how to use an application and when it fits in existing work processes, nurses are open to accept the applications. The Nurse Call and Track & Trace applications appear to have little impact on the existing work processes and routines for nurses (it has for nutrition assistants, though). Though, the fact that there are many pilots running at CTS causes frustration according to a few informants. The main reason for this seems to be that not everyone is on the same page regarding information on new developments at the department. Nurses also report that possibilities to provide feedback are still lacking. In particular colleagues seem to have a role in bridging this potential information gap among nurses. In the following, we examine three components of the socio-organizational context, namely nurse staff functioning, nurse staff learning and social influence and focus on how colleagues have a role in these.

4.2.3. Influence of socio-organizational context

In the following, we will refer to our propositions made in section 2.4. and review how the findings of our study relate to the theories discussed in our literature review.

4.2.3.1. Nurse staff functioning

When looking at how nurse staff functioning might influence nurses' decisions to accept technologies, we focused at several aspects, namely leadership and involvement of nurses.

Caching leadership

The findings of the interviews and observations show that there are several members of the nurse staff are considered to have an important role in the diffusion of information about new development at the department and stimulating the staff members to participate in the pilot for example. There is not one single person who is seen as a 'leader' when it comes to stimulating nurses to use new applications, rather, nurses mentioned various persons who take a leadership role, all in a different aspect of the care process. These include the care coordinator, the senior nurse and the nurse staff leaders. The care coordinator role, which is shared by a number of nurses who are care coordinator for about four days a month, is concerned with the logistics of the beds and patients. Their role in regarding the new technological applications that are introduced at the department is mainly to remind nurses to try it out, rather than to support nurses in using it.

[21] *"He [care coordinator] starts in the morning the 8 o'clock meeting with 'Are there things that need particular attention today', 'Are there conversations' and he shortly introduces those things [new technological applications]. (...) Like 'Remember to fill in the survey'. 'We currently work with a new Nurse Call application as part of the pilot.' But (...) the 8 o'clock meeting is usually already quite long. Then it [Explanation about the new applications] is sometimes skipped to save time."* – Informant 13, nurse at CTS.

As becomes clear in this quote, care coordinators do not have an explicit role in coaching nurses. When it comes to new developments on their department, care coordinators are mainly passing through the information from management or external parties. In addition to this, in the interviews it became clear that the senior nurse is the nurse with the most experience during a specific shift. He or she supports colleagues in issues regarding patient care, but does not have a role in coaching colleagues on other issues such as learning how to use new technological applications. Finally, the nurse staff leaders are more concerned with managerial and administrative tasks rather than patient care. Quotes 22 and 23 illustrate how nurses are motivated to use the application and whether one person in particular takes the lead in this.

[22] *"No not specifically. We have [redacted] and [redacted] (...) [nurse staff leaders]. Those are more for specialistic matters like, I want you to do this or that. Because they do expect quite a lot from us. And that's also more because we need so from the department [leaders]. And among colleagues, I think we*

stimulate each other to keep using it, if anybody asks or older colleagues, that you stimulate each other (...).” – Informant 12, nurse at CTS.

[23]“*An example, we have in our nurse station, I don’t know whether you noticed that, in the back, a door to the secretary. The door is made of glass. And if we looked through it, then we could see the hallway and some patient rooms. Now one of the managers came up with the idea that information posters needed to hang on that door and now we cannot longer see through the door. So today, we were sitting in our nurse station and we don’t see those rooms anymore. Those managers are not working at the floor. So today I said to her ‘Well, that’s not so handy’. We already removed those posters. I said ‘Well, you first need to consult us, nurses, before you do something like that’. She said ‘Yes, but I am a nurse myself so...’ I was like ‘You haven’t worked at the floor for over a year.’ So, you need to keep feeling with the department, that’s what I wanted to say.*” – Informant 23, nurse at CTS.

As might become clear, there is not a specific role assigned to a staff member as being a coach in the field of adoption of technological applications. Rather than formal leaders, such as care coordinators or senior nurses, it appears that informal leaders are most important in motivating nurses on using the new applications. Our findings show that nurses coach each other and this appears to happen rather spontaneously on the hallway. This is also illustrated by quotes 24, 25 and 26. Being coached by and being able to ask questions to colleagues appear to be the most important features in the learning process for nurses. This will be discussed in more detail in section 4.2.3.2.

[24]“*Well, if I think... when I notice that colleagues are looking for a blatter scan, then you need to fix that together, if you are more experienced with the system [Track & Trace] then you try to anticipate on that.*” – Informant 17, nurse at CTS.

[25]“*I was planned at those rooms [where the Nurse Call application was installed] and then I received a different kind of signal and I thought like okay...? Then I went to my colleagues [and asked] ‘The patient called me with an exclamation mark, what do I need to do now?’ ‘Yes, you need to push on the device of the patient.’ [as one colleague responded] Well, that appeared not be what I needed to do (...). So that was just... I didn’t really received instructions or something. Well and that colleague didn’t know it either.*” – Informant 14, nurse at CTS.

[26]“*I think indeed that others also casually stimulate each other to use it (...). On the floor indeed, I think, otherwise it might slip your mind.*” – Informant 16, nurse at CTS.

Thus, rather than one 'leader' who is in charge of coaching nurses or stimulating them to use the applications, all nurses appear to take leadership for their own functioning. This is what is already recognized by other parties at Radboud University medical center. According to Jacqueline de Leeuw, Chief Nurse Information Officer, the hospital will start soon to challenge the medical staff, not only the nurse staff but everyone working on the floor with the patient, by setting up leadership programs. Everyone needs to take responsibility for his own learning process and for that of others, as is shown by the following quote.

[27] *"Everyone needs to be a leader in his profession, at any level (...). Important is that those nurses at the floor, with whom you also did an interview, that they also realize, hey, you are experiencing difficulties with the electronic patient files. That you then ask like 'Can I help you?' (...). That is in fact what we want all employees to have, from the transporter of the beds to the professor (...)"*. – Informant 24, nurse and management position.

Nurse involvement in decision-making

Next to coaching leadership, we looked at the involvement of nurses in the decision making process on what and how to introduce new applications. It appeared that nurses were not involved in the decision making process, but to some extent they were involved in the design process prior to the introduction of the applications, as illustrated by quotes 28, 29 and 30. It appears that information and involvement of nurses in the Nurse Call pilot was very limited but in the case of Track & Trace, the nurses were involved in the design of the application as they were asked what they would like to trace with Track & Trace. The document in Appendix 11 created by the project leader of Track & Trace, provides an overview of the results. A frequently mentioned device is the 'blatter scan' and, as we have seen, this device is actually included in the pilot on the recommendations of the nurses themselves.

[28] *"I think we were not really asked whether we actually needed these applications. It was more like, well, we will organize this, so you can participate. It is not that it was... Well, maybe with others ... the team leaders. But not within the team itself I think (...). But that is the case with most pilots here, that you are not really involved. That is invented by the team leaders."* – Informant 16, nurse at CTS.

[29] *"Prior to the introduction, we were informed on where they want to focus on and we had the opportunity to say like 'Well, is this [medical device] included [in the Track & Trace application]. Because, initially, I think, the blatter scan was not supposed to be included, but we indicated that including it would help us. So, in that respect, we brain stormed a little bit on how the application would look like prior to actually starting the pilot."* – Informant 12, nurse at CTS.

[30] “[The fact that the pilots of Track & Trace and Next Generation Nurse Call were running] was mentioned during the staff meeting (...). As a result, you felt more involved. It is the case that if, in the future, we want to expand the vision we have for the new building also to the existing buildings, like this one. The announcement was present and in the end, the best way to experience the application is to actually work with it. And that is fine. In my opinion, future applications should be introduced in the same way and as quickly as these applications were introduced.” – Informant 9, nurse at CTS.

In addition to the diverging experiences reported by nurses with regard to their involvement in the design of or decision making on the technological applications, our findings also show that all informants think nurses should be involved or want to be involved as is illustrated by quote 31. Quote 32 illustrates that some nurses do not really care whether they are involved in the pilot of Nurse Call or not as they trust their colleagues on their judgement whether the application is useful for them or not. In contrast, quote 33 again illustrates why a project leader, in this case of the project on continuous monitoring, might want to involve nurses.

[31] “Then you get the discussion of... do you need to give people something to choose. If you want to get something done, then you shouldn’t always give people a choice. You should say: ‘This is how we are going to do it.’ Of course there are people who need to think this through. But then I think that is more a tasks for those that bear the responsibility for this slash management slash the back up. What is then the reason to implement a new application while other new applications are introduced not too long ago. Because, I think, if you give nurses the choice, nothing will change upcoming year.” – Informant 19, nurse at CTS.

[32] “(...) I don’t really care in fact. If other colleagues try it out, I think we’ll be fine as they also know what we as nurses want and what works for us.” – Informant 8, nurse at CTS.

[33] “(...) If this would change the whole work process and if you get a different kind of bleepers, which provides way more information than the one we have now does, then you really need to think that through and talk about this with nurses and that is especially what we try to do by letting nurses participate in that kind of committees, because they know how it really works.” – Informant 18, nurse and management position.

Feeling of safety

In addition to coaching and involvement, our findings show that other attributes of nurse staff functioning might have an influence on the acceptance of technological applications. For example, some nurses report

that they feel safe in the team to ask for help when they need it. This safe environment is created by the nurse staff members themselves. The following quotes might give an example of how perceived safety might play a role in the adoption of technological applications among nurses at CTS.

[34] *“I noticed that... younger nurses easily coach the older ones in that... There is not only a role in this for the care coordinator. I also notice that I sometimes struggle finding something and then I just ask someone else. The team is very open towards each other to help each other in that. So that is broader than only the care coordinators (...). We are a very open team towards each other. We collaborate in a pleasant way. I think that it helps to show your vulnerability if you don't know something. You can only learn from that (...). I feel comfortable in the team (...). I happen to be the organizer of a theme party for tomorrow. So tomorrow we are going to do something fun with the whole team, we will have a barbecue.”*
– Informant 23, Nurse at CTS.

To summarize, informal leadership, rather than formal leadership, appears to be important in the technology acceptance decisions of nurses. This role is tied to one person; rather, nurses have a shared coaching role when it comes to the use of new technological applications. Next to that, involvement in the tailoring of the applications to the needs of the department is desired by some nurses, while others rely on the judgment of their team leaders or colleagues. Finally, a third finding that emerged from our data is that the nurse staff at CTS is characterized as having a high level of openness and this creates an environment in which nurses feel safe to ask for help to colleagues.

Based on these findings, we alter the proposition on the influence of nurse staff function on technology acceptance which was introduced in section 2.4. to the following: *Nurse staff functioning influences nurses' attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that nurses coach each other on using new technological applications, when they feel safe within their staff or whether nurses feel they (or their colleagues) are involved in the design of the application.*

4.2.3.2. Nurse staff learning

Although our findings show that the applications of our focus in this study did not have a major impact on nurses routines and work processes, introducing these applications requires nurses to learn how to work with them. In order to structure our examination of nurses' learning process, we look at how proactive they are in information seeking and whether they share their knowledge with colleagues

Learn by doing

To begin with, the interviews reveal that nurses in general mainly ‘learn by doing’: They are used to learn how to work with new technological applications on the job, by figuring it out by themselves. Some examples are illustrated by quotes 35, 36, 37 and 38.

[35] *“Yes, I am a type of person that I actually want to work with it, then I learn better how to use it. Just let me figure it out myself. In the end, I’ll rather do it myself, otherwise I get distracted and... I really need to work with something first before I can decide whether I think it is useful.”* – Informant 23, nurse at CTS.

[36] *“That [a training] is unnecessary I think, because then you ask people to invest extra time in it, while i think, yeah, you can also ask it quickly to your colleagues.”* – Informant 17, nurse at CTS.

[37] *“The target group for which it is implemented consists of nurses and they have a very practical mindset. That’s why they choose this profession. Nurses rather do something than thinking about doing something. When you look at the different types of learning defined by Kortehaags, nurses are ‘doers’. And they are characterized by the fact that they learn things by doing. They learn things by experiencing it. You also have a certain type of people who are more thinkers and talk everything through before doing something. Some nurses are like that. But in my opinion it is fine that they implemented these applications the way they did.”* – Informant 9, nurse at CTS.

[38] *“Research shows that if you need to learn something, 10% of what you need to learn, you can learn by passively being taught in a class room. 20% of what you need to learn, you can learn by studying something yourself for example via e-learning or by reading a book. Well, you wouldn’t be surprised that, in a profession like nursing, 70% of what you need to learn, you will learn on the job.”* – Informant 24, nurse and management position.

Importance of instructions

Learning on the job appears thus to work best. However, when being asked how the nurses learned to use the Nurse Call and the Track & Trace applications, some reported they missed clear instructions, especially in the case of Nurse Call. Especially some of the nutrition assistants felt that the Nurse Call application was suddenly there as is illustrated by quotes 41 and 41. Those that participated in trainings thus appeared to be more inclined to accept the applications as they felt they possess the right information to use the applications in a correct manner as is illustrated by quote 43.

[39] *“On Track & Trace, multiple presentations were given. During our daily nurse meeting (...) at half past one. And those presentations are still being organized. So I think in the meantime all my colleagues saw the presentation at least once. So in that respect, the application was explained quite well. With regard to the Nurse Call application, I noticed we got far less explanation about that and many people initially did not understand what it was and how it worked and some still don't know. So if you compare that, it should for the Nurse Call application be more like Track & Trace. There is a difference (...). I think at the moment that you don't understand it, then you might think, well, I am already very busy, well then it cost you more time to learn using it than you save by using the application. And if you do understand how it works you can actually benefit from using it.”* – Informant 16, nurse at CTS.

[40] *“From experience I know that that [to get a clinical class on the new application during the 2 o'clock meeting] is useful. Then you actually see it and hear about it. Because an email, you often read that quite quickly. During a clinical class, you hear about it. And you see where it is about. That really has an added value.”* – Informant 14, nurse at CTS.

[41] *“Only the first time I worked with it [Nurse Call application] they told me like ‘Oh yeah, you need to take that bleeper with you. And I was like ‘Bleeper? What bleeper?’”* – Informant 26, nutrition assistant.

[42] *“In fact, we only got an e-mail about ‘We will start with a pilot’. We already noticed some people sitting at the hallway with a tablet observing how many times we entered the patient rooms. Eventually we discovered why they were there. But after that we thought like, oh, we are going to start with the pilot and only after we got some explanation on what was about to happen.”* – Informant 7, nutrition assistant.

[43] *“I suddenly received the phone with the app... because that girl [the project leader Track & Trace] asked me whether I wanted to do it [to try out the Track & Trace on a smartphone] and I said ‘Fine.’ But she did explain me how it works and together we went through the app. So the information was good. And we also received an e-mail about the pilots, so... the information was sufficient.”* – Informant 8, nurse at CTS.

We compare the findings on how nurses prefer to learn with the actual learning process of the Nurse Call and Track & Trace applications. In the case of Track & Trace, the project leader did a short presentation. We attended one presentation and from our observations it appeared that not everyone heard about the new application yet, although the pilot was already running for three weeks at that time. The application was explained by the project leader by explaining the procedure while the nurses could immediately do it themselves on their computers. The first step was to log in into a new system but that did not work as smoothly on all computers. One nurse who was more proficient with using computers helped his

colleagues out. This presentation was pre announced. Not many people showed up. Those who were attending the training thought Track & Trace was very useful. They are proactively looking for information. (See notes of the observation in Appendix 9.5.).

Knowledge sharing

From the previous section we might conclude that a precondition for start figuring out how a new application works is that nurses know where to find clear instructions. If that is the case, nurses don't need to attend the training themselves as they are likely to ask their colleagues, who did attend the training or clinical class, to help them using the application. This is also illustrated by quote 44. As is already shortly discussed in section 4.2.3.2., the influence of colleagues is important in stimulating a nurse to use the applications. There appears to be also an important role for colleagues in learning how to use the applications. For applications like these, which do not cause any major changes in the work process of the nurses, training is namely not always provided, as was the case for the Nurse Call application. Getting instructions from colleagues, rather than following a training, is even considered to be a very effective way of learning in nursing as quotes 45, 46 and 47 illustrate. Nurse thus actively share their knowledge with colleagues. Those that have more affinity with technologies, the younger nurses in general, often help those that experience troubles, like the older nurses.

[44] *“On Track & Trace, so many presentations were organised that, if you wanted to attend one, you definitely have had the possibility I think. It frequently happens that one or more classes are provided and then you are then expected to inform your colleagues. This was thus not necessary for Track & Trace. But it was for the Nurse Call applications. You really needed to ask your colleagues how it worked because there were no classes provided on it.”* – Informant 16, nurse at CTS.

[45] *“In my experience, peer to peer works best. Either doctor to doctor or patient to patient, that works best, especially for people (...) who might struggle with changes. They accept something easier from colleagues than from an external party. Then they think, yeah, what do you know about it. And that might give people an excuse for not doing it. But if your direct colleagues do it and benefit from that, well yeah, then many excuses are not grounded anymore. And then they are more likely to do it (...). Look for those people who are the early adapters or who have the energy for it and make sure that you create facilitating conditions for them and educate them. And also give them the task to involve their team.”* – Informant 11, nurse and management position.

[46] *“If there are a few colleagues who are educated by those who introduce the pilots. And if they get the task to spread the word among their colleagues, I think that will work (...). For Track & Trace, it happened this way. I explained the application to a number of colleagues.”* – Informant 15, nurse at CTS.

[47] *“I think it happens automatically. This is teamwork, I think, at least at our department. I think teamwork is necessary for that. What is easy to grasp for one, can be very difficult for another. We solve that ourselves.”* – Informant 12, nurse at CTS.

Although coaching of colleague is considered as a good alternative for or addition to collective trainings, our findings show that the coaching role is filled in differently among nurses as it is not formalized how nurses should give colleagues instructions. Quote 48 shows that, in contrast to quote 46 for example, who considers it not being her task to share information among nurses. Moreover, due to time pressure, nurses might forget to share the information on the new applications with colleagues as illustrated by quote 49.

In some interviews, though, it appeared that there is attempted to structure and formalize the coaching role of a nurse. Some nurses are namely appointed as a specialist in some kind of field. The term they use for this is ‘aandachtvelder’. Being a specialist in some kind of field, such as for EPIC or ‘quality of care’, means that the nurse gets compensation in time to expand his or her knowledge in this field and to share that knowledge with colleagues. In this way, colleagues know where to go to with questions related to the field of the specialized nurse or ‘aandachtvelder’. This is however not yet the case in the field of new technologies, new developments or pilots at CTS, although our findings show that there is a need for this.

[48] *“That is mainly the task of the care coordinator [providing an explanation about the new applications to colleagues] and what is more (...) if I work at the rooms next door and I see a colleague of who I think, well, he or she might not have heard about it, then I won’t go to him or her to explain it. But when someone asks ‘Hey, do we have a new Nurse Call system?’ [Then I will reply with:] ‘Oh yeah, haven’t you seen it yet?’”* – Informant 14, nurse at CTS.

[49] *“For instance, my colleagues couldn’t attend a meeting today. That is annoying, because you cannot attend everything. Usually, we pass on this information during the transference of shifts, but due to the high workload it is... Yeah. You will miss some information again. Well, maybe it is more clear via e-mail.”* – Informant 14, nurse at CTS.

To conclude, it appears that nurses learn by doing, Training appears to be considered unnecessary; only short instructions will be sufficient for this type of technological applications. Though, having actually seen how the application works might stimulate nurses to actually use them as we have seen after the

clinical classes on Track & Trace. Another way to learn, which is seen by some nurses as an alternative for training but for others as an addition to training, is being coached by colleagues. Nurses who actively share the information about the new applications are likely to also have a positive attitude towards using them. Moreover, sharing this information with colleagues stimulate these colleagues to accept the applications more easily as they can try it out right away under supervision of their colleague. It should be, however, noted that this coaching role is not formalized and nurse fill in this role in different ways. External parties who want to share information with nurses and want them to spread the message with colleagues cannot always rely on that the information actually reaches everyone. As also pointed out in section 4.2.2., there is a need for some sort of support system, for instance in the form of specialized nurse ('aandachtvelder'). This led us to alter the proposition on nurse staff learning introduced in section 2.4.: *Nurse staff learning influences nurses' attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that nurses proactively seek information on the application as long as they know where to get it and they actively share knowledge with their colleagues and when a support system is present.*

4.2.3.3. Social norm

In addition to nurse staff functioning and nurse staff learning, we examined what the role of the social norm is on how nurses might behave with respect to the technological applications. In order to structure our examination of the influence of the social norm, we look at how nurses might be influenced because they want to keep up with their colleagues or if they are inclined to use the application when they see colleagues are benefitting from using it.

Copy peer behavior

First, nurses seem to be aware of the influence of their colleagues' behavior regarding the use of new applications as their colleagues are an important source of information for them. On the question how staff members influence nurses to use the technology, one nurse mentions that nurses imitate each other: When they see or hear that a colleague benefits from using a certain technology, they are likely to be motivated to use it themselves as well as is illustrated by quote 50. Moreover, it appears that several groups of nurses can be distinguished and that these groups might copy each other's behavior as is illustrated by quote 51.

[50] *"Because of the openness in the team and how you communicate, then other people see it. then they easily copy you (...). And by saying like 'Track & Trace is useful because then I can find that (...) blatter scan quickly. [That also motivates] to use it, right."* – Informant 23, nurse at CTS.

[51]“(…)There is always that person who waits until the others act, one who says ‘Come on, I organize it for you, join that and that training, you are going to do this and this.’ Those people are there, the easy ones, to put it like that. There are people who are proactive and say like ‘Oh, I don’t like this, I will do that training, then I will learn how to deal with it.’ And then you have the ‘middle men’, who copy the proactive persons. Those people would say ‘Oh, everyone is joining that course, then I’ll join as well. I don’t think it is necessary for me now, but I might get something out of it.’ And those groups are present also at the work floor. And like I said, we have between fifty and sixty colleagues here. Well, then all groups are represented here.” – Informant 19, nurse at CTS.

Thus, some nurses seem to be motivated to want to keep up with their peers and therefore copy their behavior. It was suggested that implementation managers, or other parties who want to introduce new technological applications at the department, could take advantage of this. When targeting those nurses that are interested in technologies and feel motivated to share the information with colleagues, it is suggested that others will follow by copying their behavior as is illustrated by quote 52.

[52]“(…) I think that if you educate a few people at the department on how the application works, then, yeah, the message will be spread (...). At a certain moment, it will be embedded [into daily practices].” – Informant 17, nurse at CTS.

Peer support

Next to examining if and how nurses would copy each other’s behavior and the influence of that on their decision to accept a technology, we also look at the influence of peer support in using the applications. Our findings show that enthusiasm of a colleague about a certain application, because he or she benefits from using it, is likely to influence a nurse’s attitude towards this application and might eventually trigger him or her to actually use it. One nurse for example reports that he explained to colleagues how to use the new applications as he was very enthusiastic about this application. This is illustrated by quote 53. He also noticed that some of the colleagues actually tried out the application after his explanation.

[53]“(…) I for example explained to colleagues the Track & Trace application because I (...) was enthusiastic about it myself. (...) But, the other way around, when talking about the other application, none of my colleagues asked me: ‘Shall I explain it how it works?’, no one was really enthusiastic about that. I could have been the case, though. If only some people would have been more enthusiastic (...) then I would also go to a colleague like ‘Well, you can explain it to me, please do so.’ That is even the best way I think. (...)” – Informant 15, nurse at CTS.

Thus, in addition to coaching or supporting colleagues in using the new applications, some nurses take on the role of promoter of an application they are enthusiastic about and they want their colleagues to benefit from the application as well. The importance of having these people on board on your project is also recognized by Inge Schouten, as shown by quote 54. Although people might not always be aware of the social norm guiding their behavior, our findings show that nurses frequently share their experiences with colleagues. This is also the case when someone has a negative attitude towards the application. Quote 55 illustrates that nurses also share their frustrations with each other.

[54] *“If you just make sure that you assemble a team of, we usually call it, ‘dedicated nurses’. So nurses who (...) want to be more involved with innovations and who also are able to spread the message. There you can already make a profit because (...), well yeah, if you have colleagues who can explain it well to others and convince others by saying ‘This is why it is useful’ and to make sure the others of the team get on board as well. When that is not the case, the innovation will fail.”* – Informant 18, nurse and management position.

[55] *“It [Next Generation Nurse Call application] really frustrates me. And not only me.”* – Informant 15, nurse at CTS.

To conclude, various nurses report that they are motivated to use the applications when they notice their colleagues use it and benefit from it. Peer usage as an aspect of social norm therefore remains unchanged in the conceptual model. Furthermore, it appears that it is not only stimulating when colleagues provide support to nurses in the form of instructions or coaching, some nurses might even function as a promoter for the application. We therefore add a third aspect to the social norm, namely the technology promotor. It appears that it is important for project leaders to identify those promoters and to get them on board in their projects in order to be able to eventually get the whole staff on board. This led us to adapt the proposition on the social norm that was introduced in section 2.4. which resulted in the following:

The social norm within the nurse staff influences nurses’ attitude towards the technological applications and eventually leads to actually usage of the technological applications in a way that nurses copy colleagues’ behavior, they motivate colleagues to use an application or even take on the role of promotor of an application.

4.2.3. Resulting conceptual model

Having discussed our findings on multi-technology acceptance, nurse staff functioning, nurse staff learning and social norm, we now show how our findings alter or add to our preliminary conceptual model introduced in section 2.4. Figure 6 shows the proposed alterations to the preliminary conceptual model.

Our findings on nurse staff functioning show that, rather than one leader who support nurses in accepting new technologies, this role is rather shared among nurses. Therefore, we add the term ‘shared’ to coaching leadership in our resulting conceptual model. Next to that, we found that being involved in the decision making on the introduction of an application is not a significant influencer whether or not nurses will use the application as most of them report to rely on the judgment of colleagues or team leaders whether it is beneficial for nurses to implement it. Rather, some nurses reported that they want to be more involved into the design process of the application so that they can make sure the new application actually has added value for them and fits in their work processes. Therefore, we changed ‘Involvement in decision making’ into ‘Involvement in the design’ in the resulting conceptual model. Finally, in addition to shared coaching leadership and the feeling of involvement, nurses report that a feeling of safety, stimulated by informal activities for example, adds to the team cohesion and makes it for nurses easier to ask for help when they need it.

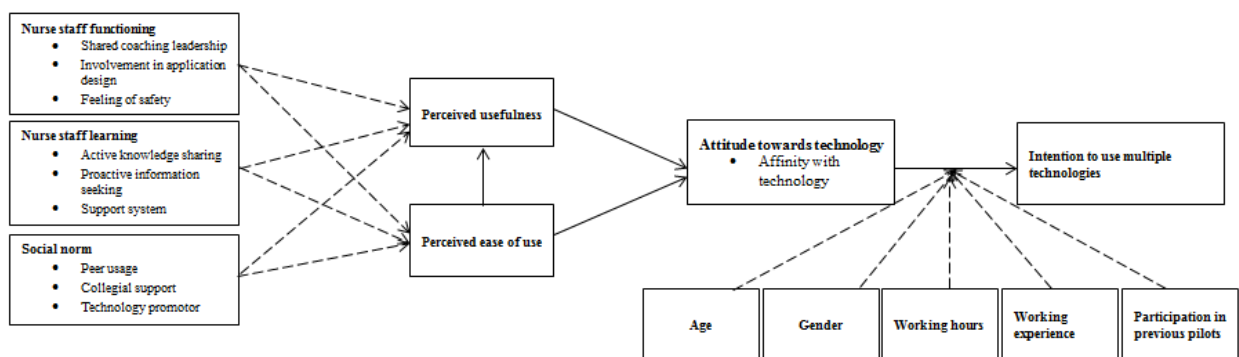


Figure 6. Resulting conceptual model including findings.

Second, our findings on nurse staff learning show that most nurses ‘learn by doing’ how a new technology works rather than first being taught how to use is through training for example. This way, nurses can be seen as proactive in seeking for information about new technologies. A precondition for this appears to be that clear but short instructions must be provided during a clinical class for example. Secondly, our findings show that the learning process of nurses that follows the introduction of new technologies is usually a collective activity: Colleagues appear to be an important source of information for nurses when clear instructions are lacking. Our informants report that sharing information with colleagues that could not attend an instruction meeting appears to be a frequently applied communication strategy by for example the team leaders about new developments. Receiving instructions by colleagues on the hallway how to use a technology, while actually using it, appears to be an effective way of learning. There is a risk, however, that nurses might forget sharing the information because of a lack of time for all the information nurses need to share during the transference of shifts for example. In addition to this, some

nurses report that they sometimes do not know to what colleague to go to with their questions. There appears to be a need for some sort of support system to back up potential information gaps between nurses. It must be clear for them where to get the information and it must be quickly to find it, otherwise some nurses tend to find another solution for reaching their goal without using the application. Therefore, support system was added as a third component of the construct nurse staff learning in the conceptual model.

Third, as expected, peer usage and collegial support influence technology acceptance in a way that nurses appear to be motivated using the technology if they see their colleagues are benefitting from using it or if their colleagues take on the role of promotor of a technology and actively share their experiences with using the technology. A reason for why nurses might copy each other's behavior as they do not want to be behind compared to their colleagues in terms of information. To overcome this perceived information gap, nurses might 'do what others do' such as subscribing for a training colleagues will follow. Our findings also show that some nurses might take up the role of technology promoting and actively try to convince colleagues to follow their behavior. Based on these findings of our research, the aspect of 'technology promotor' was added to the construct of the social norm.

Finally, now new categories beyond nurse staff functioning, nurse staff learning and social norm emerged from our data. Therefore, the box that was left blank in the preliminary conceptual model that was introduced in section 2.4. was removed.

Having summarized our findings and introduced the resulting conceptual model, we now turn to the discussion of our findings contribute to the existing knowledge on technology acceptance.

5 Discussion

Nurses are frequently faced with the introduction of new technologies aimed at increasing the quality of care or reducing nurses' workload (Zuzelo et al., 2008). So is the nurse staff at CTS: During the month June 2018, the pilots of Track & Trace and Next Generation Nurse Call were running simultaneously, among other projects. Although these applications are introduced to assist nurses in their work, research suggests that implementing multiple new technologies might also mean that the complexity of the nursing profession increases as they need to be integrated into existing work processes and routines (Edmondson, Bohmer & Pisano, 2001; Zuzelo et al., 2008). Moreover, the introduction of multiple new technologies requires that the nurses invest time and effort into learning using it for which they not always receive compensation in terms of time or financial rewards (Zuzelo et al., 2008).

In line with the TAM (Davis, 1989), the findings of our survey showed that if the nurse perceives the application as being useful, for example in terms of time savings or benefits for the patient, than he or she is likely to have a positive attitude towards a technology and might be willing to put extra effort in the application to learn how to use it. This was true for both the Track & Trace and the Nurse Call application.

Our findings from the interviews with nurses show that the fact that multiple applications were introduced at more or less the same time was not a major problem for most of the informants, as technologies are seen as an inherent part of the nursing profession. The two applications of our focus in this study seem to have little impact on the existing work processes and routines of nurses and require little training prior to using them. Some nurses reported to be more confident when they were introduced sequentially but we could only ask them that in hypothetical situation since the applications were not actually introduced (yet).

Although Gomez and Vargas (2009) argue that the adoption of one technology might stimulate target users to adopt other related technologies, our findings show that nurses treated the applications of our focus as independent entities and as a result made two separate acceptance decisions. Since the Nurse Call application is installed on the nurse bleeper and Track & Trace is only accessible via a desktop, our findings show that nurses did not see many linkages between them. In this case, the decision process on accepting one application was not dependent on the other application: While some nurses might even act as a promotor for one application, they might boycott the other.

Although nurses are used to working with a wide range of technologies and are frequently exposed to the introduction of new applications, some nurses reported that they feel overwhelmed by the many pilots running on their department. For some informants, this was a source of frustration. One explanation for this seems to be, according to our findings, that not everyone at the department feels to be on the same

page with their colleagues regarding new developments at the department. Collective instruction moments are difficult to organize due to the fact that nurses work in shifts. Although e-mail and the team website are actively used communication channels, the information not always reaches all nurses at the department. Another reason why nurses might feel that they lack the right information to use the new applications could be that they have less affinity with technology than colleagues, because they want to stick to routines or because they miss the information.

This points to a key finding of our study: The socio-organizational context in which nurses work appears to a significant influence on nurses' decisions on accepting new technological applications since the nurse staff appears to be the main source of information and support for nurses. In particular, the role of colleagues, appears to be important for nurses, rather than for example the nurse staff leader. Colleagues are namely the ones nurses will go to when they have difficulties using an application or when they need more instructions how to use it. Our study on the influence of the socio-organizational context was guided by suggestions from previous studies on what aspects of the socio-organizational context we focused. These include nurse staff functioning, nurse staff learning and the social norm. This list is neither exclusive nor exhaustive: As we saw in section 4, the aspects might be interrelated. Moreover, there might be more aspects that we have not discussed in this research. Though, we will discuss our findings using this structure.

Nurse staff functioning

To begin with the nurse staff functioning, Holleman et al. (2009) suggested that attempts to change behavior are likely to be dependent of the functioning of a nurse staff. When new technological applications are introduced that change work routines and require nurses to modify their behavior, the role of the nurse staff in changing this behavior should be taking into account. Some components of nurse staff functioning are found to have a potential influence, such as leadership and involvement in decision making (Holleman et al., 2009; de Veer et al., 2011). Our findings show that rather than one leader who support nurses in accepting new technologies, this role is shared among nurses. Coaching colleagues appears to be an integrative part of the nursing profession as all members of the staff share the responsibility of making sure everyone is at the same page when it comes to information regarding new developments at the department.

Next to that, De Veer et al. (2011) pointed to the importance of involving nurses in the decision making process on what applications to introduce at their department. Our findings show, however, that being involved in the decision making on the introduction of an application is not considered to be a precondition for nurses to accept a new application. The reason for this might be that nurses, as some

informants reported, are likely to rely on the judgment of colleagues or team leaders whether an application is beneficial for nurses to implement it. In addition, rather than involvement in the decision making process, some nurses reported that they want to be more involved into the design process of the application so that they can make sure the new application actually fits into their current work processes or fits the patients' needs.

Beyond coaching leadership and involvement, several other aspects emerged from our data which add to existing knowledge on the influence of nurse staff functioning. The most frequently mentioned are openness in the team and a feeling of safety. These aspects are reported to influence nurses' decision to accept an application as the presence of these factors might comfort nurses in asking for help

Nurse staff learning

A second aspect of the socio-organizational context we looked at in this research is nurse staff learning. In their research on how nurses adapt their behavior when new technologies are implemented or work processes change, Timmermans et al. (2012) study team learning activities that help nurses to process learning tasks and integrate the new technologies or process into their existing routines. By introducing new technological applications, organizational routines might be disrupted and users of the new applications must communicate and coordinate to create new routines. Rather than focusing on the individual, learning appears to be a collective process (Edmondson, Bohmer & Pisano, 2001).

The findings of our study show that learning on the job works best for nurses. For applications such as Nurse Call and Track & Trace, trainings are not organized: That will cost too much time. Nurses rather figure it out themselves how the applications work. This learning process is found to be a collective activity: Nurses feel comfortable trying out an application together with a colleague who for example has more affinity with technology. Whereas trainings on how to use an application are considered to be unnecessary, short but clear instructions must be provided during a clinical class so that nurses know where to go to if they feel they need more information while using the application. The informants report that they often already get the task of sharing information with colleagues that could not attend an instruction meeting. Being taught by colleagues on how applications work actually seem to be a very effective way: Informants report that they would be inclined to try out the application when a colleague provided them with instructions rather than an external party, such as the project leader of a pilot. In contrast to the project leader, a colleague is likely to share the tacit knowledge specific for a department.

However, there is a risk that nurses might forget to pass on this information during the transference of shifts due to the high time pressure at that moment. The information sharing role is namely not formalized in the nurses' profession. Our findings therefore point to the need of some sort of support system, for

instance in the form of a nurse specialized in the field of new developments and pilots at the department. This was not identified in previous studies. Timmerman et al. (2012) for example suggest that clear roles must be defined in order to make sure nurses know who to ask for particular issues, but we suggest further research on the role of a specialized nurse (at department CTS the term ‘aandachtvelder’ is used) and how this nurse (or group of nurses) could support colleagues in the learning process after the introduction of new technological applications.

Social norm

Finally, in addition to nurse staff functioning and nurse staff learning, we examined what the role of the social norm is on how a nurse behaves regarding the technological applications. Previous studies on the influence of the social norm suggest that the willingness of people to comply with the desired behavior within a group might even outweigh the effort they need to invest into learning this behavior (Frambach & Schillewaert, 2002). Our findings show that nurses are indeed inclined to try out an application if colleagues use it. However, as nurses frequently work under high time pressure and with competing demands, they appear to sometimes work around using the new application when it takes them too much time to learn using it.

Next to that, as already shortly touched upon in the previous section, nurses easier accept a new application when they receive instructions from colleagues, rather than from external parties. As our findings show, nurses are likely to copy their colleagues’ behavior, as this is an important source of information for nurses. As it is hard to grasp and prioritize all information nurses receive during a day, nurses look at how colleagues are doing something and copy them, which saves time finding it out themselves how to do it. When they for instance see other nurses use the Track & Trace application to quickly find the blatter scan, colleagues are likely to try out the application then as well, rather than waiting for the project leader to first provide instructions on how it can be used. This is in line with the findings of existing studies by for example Aggelidis and Chatzoglou (2009) who found that people are likely to accept a new application more easily when they observe that their colleagues are benefitting from using it.

Thus, in line with the theory, peer usage and collegial support have an influence on technology acceptance in a way that nurses appear to be motivated using the technology if they see their colleagues are benefitting from using it or if their colleagues share their experiences with using the technology. One aspect that emerged from the data, which was already shortly discussed in the first section of this chapter, is that some nurses voluntarily actively try to convince colleagues to use the new applications. These nurses serve as technology promoters and might stimulate colleagues to use an application as this

might have beneficial outcomes for the whole team. In the case of Track & Trace, for instance, the usage of this application by all nurses at the department might eventually lead to a more efficient work floor. When nurses do not have to search for medical devices, they do not need to ask a colleague to keep an eye on their patients while they are looking for that particular device. By using the Track & Trace application, nurses can get the medical device they need right away and they can devote their time to what really matters such as personal contact with the patient. Since the findings of our survey show that perceived usefulness is an important determinant of one's attitude towards an application, rather than perceived ease of use, a technology promotor should mainly focus on convincing colleagues why the application is useful for them in order to make sure they accept the application. They might then convince colleagues to use the application, not only for themselves, but also for the greater good. In contrast, the support system, as discussed in the section on nurse staff learning in this chapter, should mainly be concerned with increasing the perceived ease of use of the applications among those nurses that have little affinity with technologies.

Having discussed our findings in relation to the existing theory, we now turn to the answering of the research question in the conclusion section.

6 Conclusion

This section discusses the answer to the research question (6.1.) and limitations of this study as well as suggestions for future research (6.2.). In section 6.3., we discuss several managerial implementations.

6.1. Answer to research question

The aim of this study was to describe how the socio-organizational context of the nurse staff influences the decision of accepting two new technological applications at the cardiothoracic surgery (CTS) department of the Radboud University medical center. This led us to formulating the following research question:

How does the socio-organizational context of the nurse staff influence a nurse's decision to simultaneously use multiple technological applications at Radboud University medical center?

The TAM was used as the basis for our conceptual model but for the purpose of this research, alterations were proposed on the 'right' side, namely to multi-technology acceptance, and on the 'left' side of the model, namely the factors influencing this. As existing research mainly studies the adoption process of a single technology while in practice the nurses profession is exposed to an increasing number of technologies available to them, we proposed to alter the original dependent variable of TAM to 'intention to use multiple technological applications'. The results of the interviews show that the joint introduction of the two applications does not hinder nurses in using them, but the fact that many pilots running at their department causes frustration among some informants. One of the reasons for this appears to be that not everyone felt on the same page as their colleagues regarding the information on new developments at their departments such as the pilots.

In line with the TAM, the results of the survey show that perceived usefulness and perceive ease of use of the technological applications are considered to be significant drivers of respondents' attitude towards new technological applications. In turn, a positive attitude towards an application determines to a large extent one's intention to use it. Our findings show that nurses easily accept new applications when they perceive them as being useful, for example in terms of time saving time or providing extra service for the patient. It should, though, not cost too much time to learn using them and clear instructions must be provided. The results of both the survey and interviews also showed that perceived usefulness was sometimes reported as a precondition for the perceived ease of use by respondents: They were willing to go the extra mile and invest time and effort into learning to use the applications when they for example see colleagues benefit from using them.

A wide range of existing studies are concerned with identifying factors beyond perceived ease of use and perceived usefulness that might hinder or stimulate nurses to accept a technology, including technological features, personal characteristics of the target users or organizational conditions. Only a few researchers, however, study specific socio-organizational context in which nurses operate might have a significant influence on the technology acceptance decision. Our study provides a starting point for closing this gap as we examined three aspects of the socio-organizational context. The resulting list of aspects that are found to have an influence is neither exclusive nor exhaustive, but it might guide future research on technology acceptance among nurses. One of the main findings of our study on the socio-organizational context is that a precondition for successfully introducing multiple technological applications, or other innovations that might disrupt work routines, appears to be an environment in which information flows from colleague to colleague. As nurses work in shifts, it is very difficult to inform all nurses simultaneously on new developments at their department. The care coordinator, who is to be responsible for leading the nurse meeting at the beginning of the day, might take up the task to inform nurse staff members on new developments at the department for, for instance, project leaders or other external parties. However, as the role of care coordinator is shared by various nurses of the staff, those nurses less aware of the new developments at the department might not pass on this information to the other staff members. In addition to this, not only the care coordinator has a role of sharing information, nurses themselves appear to have an important role in sharing information about new developments among their colleagues. It is actually reported by nurses to be a very effective way, because nurses often seem to compare their behavior to that of colleagues. This information sharing role is however not formalized in the nurses' profession and as a result, nurses might fill in this role in different ways.

To conclude, the findings of the current study point to the need for an increased focus to the influence of the nurse staff on nurses' decisions to adopt new technological applications as a better understanding of these factors might increase the success rate of implementations of new technologies. This is not only relevant for the nurse staff at Radboud University medical center as this hospital aims to implement a number of new technologies in the new 'S' building, but also for health care organizations and medical professionals, as the role of technology is significantly increasing due to a growing and changing demand for care.

6.2. Limitations and suggestions for future research

This research has several limitations. A first limitation is that we only take a socio-organizational approach in this study and focus on the functioning of, learning within and social norm at the nurse staff. Although this approach helps us to address a gap in scientific knowledge and to structure our study, we do not take into account other factors that might be important for explaining multi-technology adoption. For

example, as we have seen, the introduction of new applications is followed by a learning process in which nurses make sense of the new situation and learn how to use the applications. Applying an institutional perspective could provide more insight into the coercive, normative and mimetic pressures that might play a role in nurses' decision to accept a technology. Although we shortly touched upon mimetic pressures in our study by addressing the social norm, more insight into this could provide a deeper understanding of how nurses unconsciously might be influenced by certain socio-organizational factors. Moreover, applying a social cognitive theory would provide more insight into the concepts of social learning and self-efficacy to get a deeper understanding of attitudes might change and beliefs are developed. Further research is needed in order to expand our findings on nurse staff functioning, nurse staff learning and the social norm.

A second limitation is that, in our study, we focus on the level of the nurse staff and examine how colleagues, which are considered to be other nurses at the same department, influence a nurse's decision making regarding technology acceptance. The influence of how other nutrition assistants working at the same department influence the technology acceptance decision for nutrition assistants was also examined, but no specific attention was paid to how nutrition assistants and nurses might influence each other. Moreover, the influence of other colleagues, such as doctors or nurses from different departments, on nurses' behavior nor on that of nutrition assistants was not taken into account. For example, some informants reported that doctors have a very different position than nurses when it comes to for example the introduction of new technologies. It is for doctors, compared to nurses, easier to make time available to learn using new technologies. As we have seen, nurses learn on the job and are used to do so, but those nurses who might need extra training have little time during working hours available to invest into additional training.

A third limitation is that we focus in our study only on one department at Radboud University medical center, whereas departments do not operate in isolation. They often need to collaborate: from sharing medical devices to collaborating for the treatment of a patient. For example, since the CTS department is located at the same floor as Cardiology, nurses at CTS and Cardiology share a coffee room and they collaborate frequently as they have similar patients, nurses at Cardiology might have seen how nurses at CTS benefit from using Track & Trace and they might want to be able to use that on their department as well. CTS could then for example share their learnings and serve as an example for Cardiology when introducing the application. Therefore, we suggest more research is needed on this inter-departmental influence in order to implement new applications more successfully.

A fourth limitation of this study is that it only looks at the pilot phase of a technological application that is introduced at a department that won't deal with a movement to building S soon. The pilots only took place at department CTS as the team leaders were open to test the new applications. This means that the nurses did not have much to gain when trying out the applications. Moreover, the applications appear to have little influence on the existing work routines. The technological applications had relatively little impact on the nurses.

A fifth limitation is that nurses had limited time to be interviewed which left little room to ask in-depth questions. The interviews were planned during their shifts or shortly before their shift started, meaning that they needed to stay stand-by via their phones and that they might feel time pressure which could influence their answers to the interview questions.

A sixth limitation of this study was that the nurses who were willing to do an interview, might be more involved with new developments happening at their department. They might know better what is going on. While others who are less involved might perceive the instructions provided for the pilot as less good. This is partly overcome by appointing people to do an interview with us via the care coordinator and by approaching them on the hallway rather than inviting them for an interview after they already put effort into filling in the survey and answering what their stance toward technology in general is. A final limitation is that there are still many factors to discover in the socio-organizational context of the nurses. For example, when looking at the learning process of nurses after new applications are introduced that might disrupt existing routines, we examined how the nurse staff plays a role in the learning process, but little attention was paid to the fit between existing and new applications and existing and new tasks that might result from the introduction of new applications. A misfit between these might also be a cause for frustration and more research is needed on what the role of colleagues could be to bridge this gap in order to implement the new applications more successfully.

6.3. Implications for Radboud University medical center

Based on the findings of our study, we have several recommendations on the design of the strategy to implement new technological applications for the nurse staff for the management of Radboud University medical center or more specifically for TechTeam Innovation which is concerned with exploring the possibilities of implementing the technological applications into the new building.

We have seen that nurses are likely to copy each other's behavior and often share their knowledge on new developments at their departments. It is relevant for the project leaders at TechTeam Innovation to get those nurses on board prior to the introduction of the application as they might take on the role of informal

leader of technology promotor and thus stimulate their colleagues to use the application(s). Although nurses report that they know from each other who in the staff is an early adopter or a laggard, for an external party such as the project leaders of Nurse Call and Track & Trace it is difficult to know what nurses to involve so that the information is shared with their colleagues. One recommendation for the TechTeam Innovation of the Radboud University medical center is therefore to appoint specialized nurses or ‘aandachtvelden’ in Dutch for pilots and other new development at the department so that nurses know where to go to when they feel behind on information or need support on learning to use the applications. A checklist is proposed and attached in Appendix 12 to use for TTI in future projects. Specialized nurses are already often appointed at Radboud University medical center when more comprehensive technologies, such as EPIC, are introduced. In the case of EPIC, a group of nurses received extra training in how to help their colleagues when facing difficulties with the new application during their shift. As for some nurses it seemed redundant to do this for applications with relatively little impact such as Nurse Call and Track & Trace, our findings also show that some nurses felt not to be on the same page as their colleagues regarding new developments at their department. Thus, a specialized nurse serves as an accessible source of information for nurses that need more instructions or feel insecure using new applications. This person does not need to spend all his or her time on helping colleagues, rather, he or she knows where nurses can find more information on the applications if they need so or might remind the care coordinator to mention the new application during the nurse staff meeting at the beginning of the day so that won’t be forgotten. As was also stressed by the former chair of the Nurse Advisory Board, in order to make sure these nurses that are appointed to specialize in the field of pilots and new developments, nurse staff management should compensate these nurses in terms of time and financial rewards by allowing them to fill in this role during work time.

A second recommendation is, specifically for TechTeam Innovation, to take into account current work processes and to make sure to get informal leaders on board when introducing new technological applications in future pilots. Although the project leaders faced some organizational problems when starting the pilots beyond their influence, the interviews with nurses revealed a number of elements that were considered to be important when introducing new applications that were not taken into account by the TechTeam Innovation yet. Therefore, based on these findings, we propose a short check-list for future projects which is provided in Appendix 13.

Of course further research is needed on the socio-organizational context at the level of the nurse staff is to identify more factors at Radboud University medical center, but also broader in other Dutch hospitals for example. It would be valuable to share experiences so that the organizations could learn from each other.

Although it is beyond the focus of our study, during our orientation interviews with implementation managers from both Groningen University medical center and Erasmus medical center, we noticed that these hospitals are going through similar reorganization processes as the Radboud University medical center. Nevertheless, we have provided more insight into the role of the nurse staff in technology adoption decisions and hope to trigger implementation managers to pay more attention to how the nurse staff could be of help when implementing new technologies.

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Appendices

Appendix 1 Theoretical models

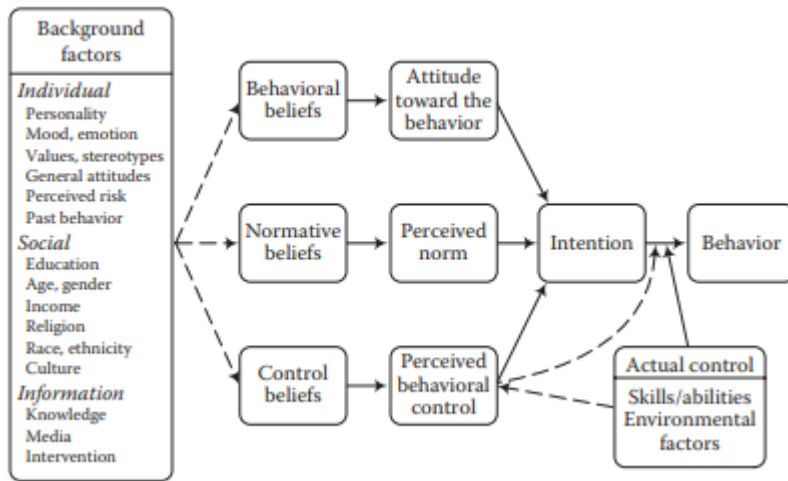


Figure 1. Schematic representation of the Reasoned Action Model. Retrieved from Ajzen & Fishbein (2011).

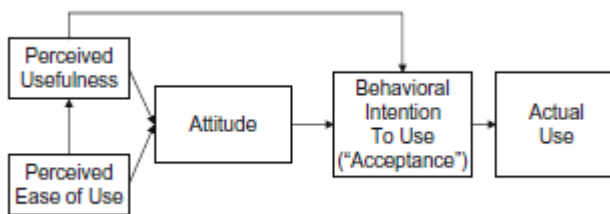


Figure 2. Technology Acceptance Model. Retrieved by Davis (1989).

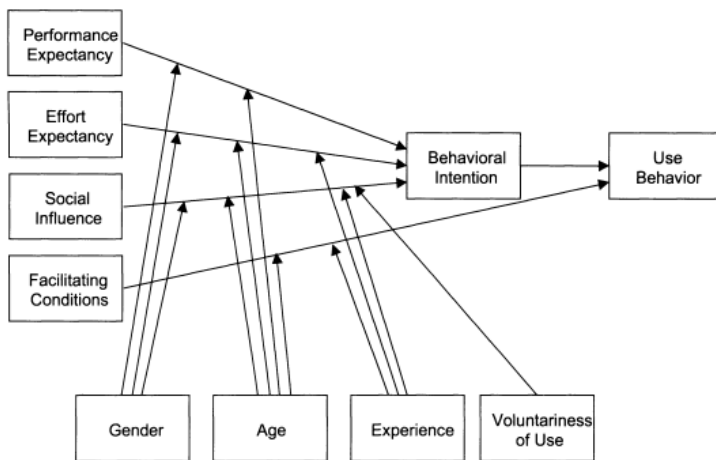


Figure 3. Schematic representation of the Unified Theory of Acceptance and Use of technology. Retrieved from Venkatesh et al. (2003).

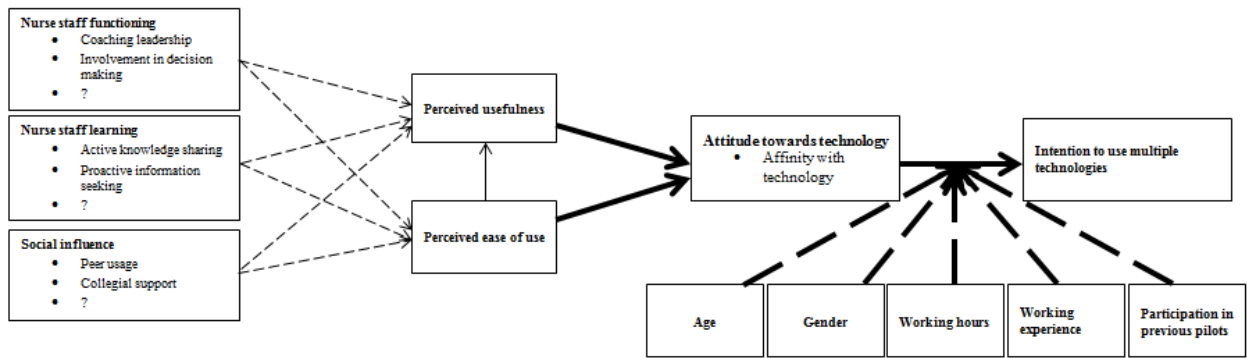


Figure 5. Relationships of preliminary conceptual model that are tested with the survey showed by the arrows in bold.

Appendix 2 Tables for Methodology chapter

2.1. Table of survey distribution moments

Date	Number of copies distributed/e-mails sent	Target respondent group	Surveys were distributed by:	Via	Response rate
4-6-2018	51 e-mails	Nurses at CTS	Nurse staff leader as commissioned Project leader of Next Generation Nurse Call	E-mail	35%
5-6-2018	15 copies	Nurses at CTS	Milou & Lisa	On paper	*
7-6-2018	5 copies	Nurses at CTS	Milou & Lisa	On paper	*
7-6-2018	4 copies	Nutrition assistants	Milou & Lisa	On paper	**
From 11-6-2018 till 18-6-2018	<p>During this week, we passed by the nurse post and the coffee corner every day to collect surveys that were filled in and to distribute new ones. In total, we distributed 10 more surveys during this week. We also talked to nurses to remind them of filling in the questionnaire and to invite them for an interview.</p> <p>While visiting department CTS, we also passed by the kitchen of the nutrition assistants to distribute surveys (only the one about the Next Generation Nurse Call technology) and to invite them for an interview.</p>				
19-6-2018	45 e-mails	Nurses at CTS	Project leader of Next Generation Nurse Call	E-mail	6%

Table 3. Overview of the survey distribution moments.

* As there was no date on the surveys we don't know how many surveys were filled in after each distribution round. In total, 12 surveys were filled in on paper of which nine were valid. These were later converted to a digital version in Qualtrics by the researchers.

** The nutrition assistants only received part of the survey of nurses: They only got the questions regarding the Nurse Call application.

2.2. Table for reliability analysis

Variables	Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
Affinity	,890	,896	7
Perceived usefulness of Track & Trace (PU_TT)	,846	,865	4
Perceived ease of use of Track & Trace (PEOU_TT)	,824	,836	3
Perceived usefulness of Nurse Call (PU_VOS)	,956	,957	4
Perceived usefulness of Nurse Call (PEOU_VOS)	,962	,966	3

Table 4. Overview of the Chronbach's alpha values.

2.3. Overview of old and new categories

Variable	Old categories	New categories
Intention to use	1. Totally disagree 2. Disagree 3. Neutral 4. Agree 5. Totally agree	1. Yes 2. Neutral 3. No
Perceived usefulness	1. Totally disagree 2. Disagree 3. Neutral 4. Agree 5. Totally agree	1. Yes 2. Neutral 3. No
Perceived ease of use	1. Totally disagree 2. Disagree 3. Neutral 4. Agree 5. Totally agree	1. Yes 2. Neutral 3. No
Affinity with technology	1. Totally disagree 2. Disagree 3. Neutral 4. Agree 5. Totally agree	1. Yes 2. Neutral 3. No
Age	String variable	1. 21-30 2. 31-40 3. 41-50 4. 51-60 5. 61-70
Gender	String variable	1. Female 2. Male
Working experience	String variable	
Working hours	String variable	
Participation in previous pilots	1. Yes 2. No	1. Yes 2. No

Table 5. Overview of old and new categories.

Appendix 3 Overview of interviewees

Interview Number	Date of interview	Function	Question list used	Contacted via	Number of transcript in Appendix
1	23-04-2018	Project leader Next Generation Nurse Call Radboud University medical center	Open interview on Next Generation Nurse call	Internship supervisor	2
2	24-04-2018	Project leader Track & Trace Radboud University medical center	Open interview on Track & Trace	Internship supervisor	4
3	02-05-2018	Project leader Track & Trace Groningen University medical center	Open interview on Track & Trace at Groningen University medical center	Internship supervisor	9
4	06-06-2018	Projectmanager at Erasmus medical center Rotterdam	Open interview on technologies at Erasmus medical center	Internship supervisor	7
5	06-06-2018	Nurse at CTS	Semi-structured interview	Survey	13
6	11-06-2018	Nurse and management position (member project team Next Generation Nurse Call)	Open interview on implementation of new technologies and questions on this from the perspective as a nurse	Internship supervisor	6
7	12-06-2018	Nutrition assistant CTS	Questions about her experiences with Next Generation Nurse Call	Survey	24
8	12-06-2018	Nurse at CTS	Semi-structured interview	Appointment made when we ran into him at hallway	21
9	15-06-2018	Nurse at CTS	Semi-structured interview	Appointment made when we ran into him at hallway and interview was conducted right away	18
10	18-06-2018	Advisor and project manager Process optimization and innovation at Radboud University medical center	Open interview on the process of implementation of technologies	Internship supervisor	11
11	18-06-2018	Nurse and management position (Reshape)	Open interview on implementation of technologies and questions on this from the perspective as a nurse	Via informant 10	1
12	18-06-2018	Nurse at CTS	Semi-structured interview	Survey	14
13	19-06-	Nurse at CTS	Semi-structured interview	Survey	19

	2018				
14	20-06-2018	Nurse at CTS	Semi-structured interview	Via informant 24	22
15	20-06-2018	Nurse at CTS	Semi-structured interview	Via informant 24	15
16	21-06-2018	Nurse at CTS	Semi-structured interview	Via informant 24	17
17	21-06-2018	Nurse at CTS	Semi-structured interview	Via informant 24	12
18	21-06-2018	Implementation managers at Erasmus medical center	Semi-structured interview	Internship supervisor	8
19	25-06-2018	Nurse and management position (Nurse Advisory Board)	Standard nurse interview and additional open questions on her role	Via informant 11	3
20	26-06-2018	Nurse at CTS	Semi-structured interview	Survey	23
21	26-06-2018	Physician –researcher	Open interview on implementation of continuous monitoring	Via informant 19	10
22	27-06-2018	Nurse at CTS	Semi-structured interview	Survey	16
23	27-06-2018	Nutrition assistant at CTS	Questions about her experiences with Next Generation Nurse Call	Via team leader of nutrition assistants	24
24	28-06-2018	Nurse at CTS	Semi-structured interview	Appointment made when we visited the nurse station	20
25	29-06-2018	Nurse and management position (at Information Management)	Open interview on implementation of technologies and questions on this from her perspective	Via informant 11	5
26	06-07-2018	Nutrition assistant at CTS	Questions about her experiences with Next Generation Nurse Call	Survey	26
27	12-06-2018	Patient at CTS	Questions on Nurse Call based on SUS	N.a.	27

Table 6. Overview of interviewees.

Appendix 4 Operationalization of measures

Construct	Original item	Source	Survey item	Measurement	Survey question number
<i>Dependent variable</i>					
Intention to use	Assuming that significant barriers to the use of the application(s) are overcome, I intend to use the application(s).	Chrismar & Wiley-Patton (2002)	Assuming that the application will be implemented on your department in the future and that you would have the choice whether or not you will use the application. Would you then use the application often?	5-point Likert scale	5.1. (T&T)
	If significant barriers did not exist, I predict I would use the application(s).				8.1. (NGNC)
<i>Independent variables</i>					
Perceived usefulness	The application could increase my productivity.	Chrismar & Wiley-Patton (2002)	The application could increase my productivity.	5-point Likert scale	3.1. (T&T) / 6.1. (NGNC)
	The application could improve the quality of care that I deliver.		The application could improve the quality of care that I deliver.		3.2. (T&T) / 6.2. (NGNC)
	The application could enhance my effectiveness.		The application could enhance my effectiveness.		3.3. (T&T) / 6.3. (NGNC)
	The application could be useful in my job.		The application could be useful in my job.		3.4. (T&T) / 6.4. (NGNC)
Perceived ease of use	My interaction with the application will be clear and understandable.	Chrismar & Wiley-Patton (2002)	The application will be easy to use.	5-point Likert scale	3.5. (T&T) / 6.5. (NGNC)
	The application will be easy to use.		Interacting with the application will not require a lot of mental effort.		3.6. (T&T) / 6.6. (NGNC)
	Interacting with the application will not require a lot of mental effort.		It will be easy to get the application to do what I want it to do.		3.7. (T&T) / 6.7. (NGNC)
	It will be easy to get the application to do what I want it to do.				
<i>Mediating variable</i>					

Affinity with technology	Technology is my friend.	Edison & Geissler (2003)	I like hearing about new technologies.	5-point Likert scale	1.1.
	I enjoy learning new computer programs and hearing about new technologies.		People expect me to know about technology and I don't want to let them down.		1.2.
	People expect me to know about technology and I don't want to let them down.		If I am given an assignment that requires that I learn to use a new technology, I usually succeed.		1.3.
	If I am given an assignment that requires that I learn to use a new program or how to use a machine, I usually succeed.		I am comfortable learning new technology.		1.4.
	I relate well to technology and machines.		I know how to deal with technological malfunctions or problems		1.5.
	I am comfortable learning new technology.		Solving a technological problem seems like a fun challenge.		1.6.
	I know how to deal with technological malfunctions or problems.		I feel as up-to-date on technology as my peers.		1.7.
	Solving a technological problem seems like a fun challenge.				
	I find most technology easy to learn.				
I feel as up-to-date on technology as my peers.					
<i>Control variables</i>					
Age in years	n.a.	Venkatesh et al. (2003)	What is your age?	Open questions	9
Gender	n.a.	Venkatesh et al. (2003)	What is your gender?	Open question	10
Number of years work experience	n.a.	Venkatesh et al. (2003)	For how long have you worked at Radboud University medical center?	Open question	11
Number of working hours per week	n.a.	Venkatesh et al. (2003)	How many hours do you work per week?	Open question	12
Participation in previous pilots	n.a.	Venkatesh et al. (2003)	Have you participated in a pilot of another application outside Track & Trace and Next Generation Nurse Call?	Open question	13
<i>Questions from project leaders</i>					

These questions are based on the System Usability Survey	4.1-4.10
These questions are based on the System Usability Survey	7.1-7.10

Table 7. Operationalization of measures.

Appendix 5 Operationalization of constructs

Construct	Original items	Source	Interview question	Follow up questions	Question Number	
Dependent variable						
Multi-technology Adoption intention	Assuming that significant barriers to the use of the application(s) are overcome, I intend to use the application(s).	Chrismar & Wiley-Patton (2002)	Did you only use On-Track or also Next Generation Nurse Call?	What did you think of these application(s)?	1.1.	
				What makes it that you (don't) want to use this application/a combination of these applications?		
	If significant barriers did not exist, I predict I would use the application(s).		Do other applications, such as EPIC, which you are already using, play a role in using these other two applications?	What makes it that you (don't) want to use this application/a combination of these applications?	1.2.	
Variables also tested in the survey						
Perceived ease of use	The application will be easy to use.	Chrismar & Wiley-Patton (2002)	What do you think about the ease of use of Track & Trace and/or Next Generation Nurse Call?	What makes it that you think it is (not) easy to use?	3.1.	
	Interacting with the application will not require a lot of mental effort.			To what extent does/do the application(s) fit with your criteria regarding ease of use so that you will actually use the application(s)?		To what extent does the influence you to actually use the application(s)?
	It will be easy to get the application to do what I want it to do.					Why is that?
Perceived usefulness	The application could increase my productivity.	Chrismar & Wiley-Patton (2002)	To what extent do you thing the application(s) is/are useful in your job?	How do(es) the application(s) support you in your daily tasks?	4.1.	
				In what way do they support you?		
				What makes it that you (don't) find it/them useful?		
	The application could improve the quality of care that I deliver.		To what extent do(es) the applications meet your criteria regarding usefulness so that you actually would use it/them?	To what extent does this influence you to actually use the technology?	4.2.	
				Why do you think this?		
The application could enhance my effectiveness.	How does this technology fit in your picture the future health care?	Why do you think this?	4.3.			

				What does this means in your choice to actually use the technology if it would be implemented?	
	The application could be useful in my job.				
Mediating variables					
Affinity with technology	I like hearing about new technologies.	Edison & Geissler (2003)	What do you think about technology in general?	What do you think about using technological applications at your job?	2.1.
	People expect me to know about technology and I don't want to let them down.			What causes you to take this stance towards technology in general or at your work?	
	If I am given an assignment that requires that I learn to use a new technology, I usually succeed.		Do you like learning about new technological applications in general?	What makes it that you like talking about new applications?	2.2.
	I am comfortable learning new technology.			How does this manifest itself at your job?	
	I know how to deal with technological malfunctions or problems.			To what extent does this influence your intention to use the application(s)?	
I feel as up-to-date on technology as my peers.					
Independent variables of our focus in this research					

(See next page)

Nurse staff functioning	n.a.	Holleman et al., 2009; De Veer et al., 2011	How would you describe the role of the nurse staff leader/care coordinator in the transmission of information about new applications?	What was their role in the transmission of information on On-Track and/or Next Generation Nurse Call?	7.1.
				To what extent do care coordinators differ in their role?	
				To what extent does this influence your perception of the ease of use of the application(s)?	
				To what extent does this influence your perception of the usefulness of the application(s)?	
				To what extent does this influence your decision to actually use the application(s)?	
			To what extent do you feel involved in the decision making process with regard to the applications are introduced by a pilot on your department?	How was that for On-Track and/or Next Generation Nurse Call?	7.2.
				What does your involvement mean for your perception of perceived ease of use of the application(s)?	
				What does your involvement mean for your perception of the usefulness of the application(s)?	
				What does your involvement mean in your decision to actually use the application(s)?	
			To what extent do(es) the application(s) fit within the existing procedures?	To what extent does this influence your perception of the ease of use of the application(s)?	7.3.
				To what extent does this influence your perception of the usefulness of the application(s)?	
				To what extent does this influence your decision to actually use the application(s)?	

Nurse staff learning	n.a.	Edmonson et al., 2001; Timmermans et al., 2012	How did you learn how to use the application(s)?	How did you receive instructions about the application(s)?	5.1.
				How did you receive instructions about the pilot(s)?	
				Who gave you these instructions?	
				What did you think about these instructions?	
				Did you get a training and how were these organized?	
				What did you think about the training?	
			What is do you think necessary so that everyone at the department uses the application(s) (think for example what was necessary in the case of EPIC)?	What makes that every knows about the application(s)?	5.2.
			How did you experience the learning process of the application(s) in comparison to the learning process of other applications (such as EPIC)?	What did you like and what could be better?	5.3.
				What works for you best?	
			To what extent do these trainings or instructions (or what informant mentions) influence your perception of the usefulness of the application(s)?	Why do you think that?	5.4.
			To what extent do these trainings or instructions (or what informant mentions) influence your perception of the usefulness of the application(s)?	Why (not)?	5.5.
			To what extent do these trainings or instructions (or what informant mentions) influence your decision to actually use the application(s)?	Why (not)?	5.6.
			To what extent do you think the application(s) fit(s) within the existing routines?	Why do you think it does (not)?	5.7.
To what eextent do you consider the routines as a hindrance to use the application(s)?					
What would need to happen to break through these routines?					

Social influence	n.a.	Ajzen & Fishbein, 2011; Frambach & Schillewaert, 2002; Shepers & Wetzels, 2007)	What do you think would motivate you to use the application(s)?	How can your colleagues help you by that?	10.1.
			How do your colleagues stimulate or help you to use the application(s)/	What do you think about that?	10.2.
				To what extent does this help you to recognize the ease of use of the application(s)?	
				To what extent does this help you to recognize the usefulness of the application(s)?	
				To what extent do you think this motivates you to actually use the application(s)?	
			How do the care coordinators stimulate or help you to use the application(s)?	What do you think about that?	10.3.
				To what extent does this help you to recognize the ease of use of the application(s)?	
				To what extent does this help you to recognize the usefulness of the application(s)?	
				To what extent do you think this motivates you to actually use the application(s)?	
			How do the project leaders stimulate or help you to use the application(s)?	What do you think about that?	10.4.
				To what extent does this help you to recognize the ease of use of the application(s)?	
				To what extent does this help you to recognize the usefulness of the application(s)?	
				To what extent do you think this motivates you to actually use the application(s)?	
			How do you stimulate or help others to use the application(s)?	Why do you do that?	10.5.
				To what extent do you think this helps them to use the application(s) more often?	

Table 8. Operationalization of constructs.

Appendix 6 Survey

Vragenlijst voor afdeling CTS

Het Radboudumc inventariseert de ervaringen met het nieuwe verpleegoproepsysteem en de Track & Trace applicatie On-Track met als doel onze dienstverlening nog beter te maken.

Het invullen duurt ongeveer 10 minuten, de enquête is anoniem. U kunt een antwoord kiezen door een kruis te zetten in het bijbehorende vakje. Verder zijn er geen goede of foute antwoorden, dus wat u ook kiest is erg waardevol voor ons onderzoek.

Alvast hartelijk dank!

Affiniteit met techniek

De volgende vragen gaan over uw interesse in techniek in het algemeen. Met techniek bedoelen we nieuwe technische snufjes zoals een app op uw telefoon of een horloge waarmee u berichten kan ontvangen.

Vraag 1	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Ik vind het leuk om te horen over nieuwe technieken.					
Men verwacht van mij dat ik kennis heb van techniek en ik wil aan die verwachtingen voldoen.					
Als ik de opdracht krijg waarvoor ik een nieuwe techniek moet leren te gebruiken, gaat dit mij meestal goed af.					
Ik voel me op mijn gemak bij het leren van nieuwe technieken.					
Ik zie het oplossen van technische problemen als een leuke uitdaging					
Ik weet hoe ik om moet gaan met technische problemen.					
Ik voel me net zo op de hoogte over nieuwe technieken als mijn collega's.					

Vraag 2

Op uw afdeling draaien momenteel twee kleinschalige pilots van twee nieuwe technologieën: De Track & Trace applicatie *On-Track* en het nieuwe verpleegoproepsysteem *Next Generation Nurse Call***.

Heeft u gewerkt met *On-Track** en/of het nieuwe verpleegoproepsysteem**? Slechts één antwoord is mogelijk.

Ik heb alleen gewerkt met On-Track (Ga naar vraag 3 op pagina 3).

Ik heb alleen gewerkt met het nieuwe verpleegoproepsysteem houdt (Ga naar vraag 6 op pagina 5).

Ik heb zowel gewerkt met On-Track als met het nieuwe verpleegoproepsysteem houdt (Ga naar vraag 3 op pagina 3).

Ik heb niet gewerkt met On-Track en ook niet met het nieuwe verpleegoproepsysteem (Ga naar vraag 9 op pagina 8).

*Track & Trace houdt in dat bijvoorbeeld infuuspalen een chip krijgen waarmee zorgverleners deze infuuspalen eenvoudig kunnen vinden.

**Het nieuwe verpleegoproepsysteem, ook wel Next Generation Nurse Call, is het nieuwe systeem dat is geïnstalleerd op de kamers 8 t/m 11. Het nieuwe verpleegoproepsysteem houdt in dat patiënten de mogelijkheid hebben om niet alleen verpleegkundigen op te piepen wanneer zij een zorgvraag hebben, maar nu ook de voedingsassistent voor voeding-gerelateerde vragen.

Vragen over de Track & Trace applicatie On-Track

De volgende vragen gaan over uw ervaringen met On-Track.

Vraag 3	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
On-Track zou mijn productiviteit kunnen verhogen.					
On-Track zou de kwaliteit van de zorg die ik lever kunnen verhogen.					
On-Track zou mij kunnen helpen beter of sneller mijn doel te bereiken.					
On-Track zou nuttig kunnen zijn in mijn werk.					
On-Track is eenvoudig in gebruik.					
Ik kan On-Track gebruiken zonder veel na te denken.					
Het is makkelijk om On-Track te laten doen wat ik ervan vraag.					

Vraag 4	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Ik denk dat ik On-Track vaak zal gebruiken.					
Ik vind On-Track vaak onnodig ingewikkeld.					
Ik vind On-Track makkelijk te gebruiken.					
Ik denk dat ik technische ondersteuning nodig heb om On-Track te kunnen gebruiken.					
Ik vind de verschillende functies op On-Track goed passend.					
Ik vind dat On-Track teveel onsamenhangende functies heeft.					
Ik kan me voorstellen dat de meeste mensen snel door hebben hoe ze On-Track moeten gebruiken.					
Ik vond On-Track erg omslachtig te gebruiken.					
Ik voelde me zelfverzekerd toen ik On-Track gebruikte.					
Ik moet veel leren over On-Track voordat ik het goed kan gebruiken.					

Stel dat On-Track op uw afdeling daadwerkelijk geïmplementeerd zou worden in de toekomst en u de keuze zou hebben of u de technologie wel of niet zou gebruiken.

Vraag 5	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Ik denk dat ik de Track & Trace applicatie van On-Track vaak zal gebruiken.					

Vragen betreffende het nieuwe verpleegoproepsysteem

De volgende vragen gaan over uw ervaringen met het nieuwe verpleegoproepsysteem

Vraag 6	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Het nieuwe verpleegoproepsysteem zou mijn productiviteit kunnen verhogen.					
Het nieuwe verpleegoproepsysteem zou de kwaliteit van de zorg die ik lever kunnen verhogen.					
Het nieuwe verpleegoproepsysteem zou mij kunnen helpen beter of sneller mijn doel te bereiken.					
Het nieuwe verpleegoproepsysteem zou nuttig kunnen zijn in mijn werk.					
Het nieuwe verpleegoproepsysteem is eenvoudig in gebruik.					
Ik kan het nieuwe verpleegoproepsysteem gebruiken zonder veel na te denken.					
Het is makkelijk om het nieuwe verpleegoproepsysteem te laten doen wat ik ervan vraag.					

Vraag 7	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Ik denk dat ik het nieuwe verpleegoproepsysteem vaak zal gebruiken.					
Ik vind het nieuwe verpleegoproepsysteem vaak onnodig ingewikkeld.					
Ik vind het nieuwe verpleegoproepsysteem makkelijk te gebruiken.					
Ik denk dat ik technisch support nodig heb om het nieuwe verpleegoproepsysteem te kunnen gebruiken.					

Ik vind de verschillende functies op het nieuwe verpleegoproepsysteem goed passend.					
Ik vind dat het nieuwe verpleegoproepsysteem te veel onsamenhangende functies heeft.					
Ik kan me voorstellen dat de meeste mensen snel door hebben hoe ze het nieuwe verpleegoproepsysteem moeten gebruiken.					
Ik vond het nieuwe verpleegoproepsysteem erg omslachtig te gebruiken.					
Ik voelde me zelfverzekerd toen ik het nieuwe verpleegoproepsysteem gebruikte.					
Ik moet veel leren over het nieuwe verpleegoproepsysteem voordat ik het goed kan gebruiken.					

Stel dat het nieuwe verpleegoproepsysteem daadwerkelijk op uw afdeling geïmplementeerd zou worden in de toekomst en u de keuze zou hebben of u de technologie wel of niet zou gebruiken.

Vraag 8	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Ik denk dat ik het nieuwe verpleegoproepsysteem vaak zal gebruiken.					

Ter afsluiting: Algemene vragen

De volgende vier vragen gaan over u en uw werkzaamheden bij het Radboudumc.

Vraag 9

Wat is uw leeftijd?jaar. (vul alstublieft in op de puntjes)

Vraag 10

Wat is uw geslacht?

Vraag 11

Hoelang werkt u al voor het Radboudumc? jaar.

Vraag 12

Hoeveel uur werkt u per week? uur per week.

Vraag 13

Heeft u de afgelopen vijf jaar deelgenomen aan een pilot van een andere technologie, buiten de huidige pilots van On-Track en het nieuwe verpleegoproepsysteem om (Denk aan nieuwe software of nieuwe apparaten)? Er is één antwoord mogelijk.

Nee, dit was de eerste keer.

Ja, namelijk (Vul alstublieft hieronder in welke technologie en in welk jaar)

.....
.....
U draagt bij aan een nóg betere dienstverlening binnen het Radboudumc!

Graag zouden we u uit willen nodigen voor een kort interview om uw mening te geven en ervaringen te delen. Het interview zal ongeveer 15-20 minuten duren. Vult u hiervoor het bijgevoegde kaartje in.

Dit is het einde van de enquête. Hartelijk dank voor uw deelname!

Appendix 7 Follow up survey

Bijlage

1. Wat vindt u van deze stelling?	In hoeverre bent u het eens?				
	Helemaal oneens	Oneens	Neutraal	Eens	Helemaal eens
Over het algemeen ben ik positief over het gebruik van nieuwe technologieën op de werkvloer.					

2. Heeft u deelgenomen aan één of aan beide pilots?

- Ik heb alleen deelgenomen aan de pilot van On-Track.
- Ik heb alleen deelgenomen aan de pilot van het nieuwe verpleegoproepsysteem.
- Ik heb aan beide pilots deelgenomen.

3. Wat is uw Z-nummer?* (vul alstublieft in op de puntjes).

**Uw Z-nummer wordt enkel gebruikt om contact met u op te nemen voor een interview. Het wordt in geen geval gedeeld met derden.*

Appendix 8 Interview questions for nurses of department CTS

In this section, the interview guide is presented. The interviews were conducted in Dutch. This interview guide was both used for the interviews with nurses and nutrition assistants as well as for the orientation interviews, though some questions were left out in some cases, depending on the role of the informant. The order of the topics in the interview guide differ from the order presented in the operationalization of constructs table in Appendix 4 to make sure that the key constructs were discussed first during the interview. As explained in section 3.3.2., this interview guide also includes questions on constructs that were studied in a research which was conducted alongside our current study. These questions are indicated by '(M)'. The questions concerning the key constructs studied in our current research are indicated by '(L)'. Some constructs were used in both studies, these are indicated with '(B)'.

Introduction for interviewee

We lopen momenteel stage op de HR afdeling van het Radboudumc en voor ons onderzoek kijken we naar de adoptie van nieuwe technologieën onder verpleegkundigen. Dit onderzoek doen wij in het kader van onze bedrijfskunde master Innovation & Entrepreneurship.

1. Multi-technology acceptance intention (B)

1. Heeft u alleen On-Track of ook Next Generation Nurse Call gebruikt?
 1. Wat vond u van de applicatie(s)?
 2. Wat maakt dat u deze technologie of een combinatie van applicaties wel/niet (tegelijk) zou willen gebruiken?
3. Indien slechts één gebruikt:
 - Zou je de andere applicatie ook willen gebruiken?
 - Wat maakt het dat u de andere applicatie ook/niet zou willen gebruiken?
 - Hoe zou u het vinden om beide applicaties tegelijk te gebruiken/hoe zou u het vinden om deze applicatie in combinatie met een andere applicatie tegelijk te gebruiken?
4. Indien beide gebruikt:
 - Wat vond u ervan om beide applicaties te gebruiken?
 - Zou u in de toekomst ook beide applicaties willen gebruiken?
 - Wat maakt dat u deze applicaties tegelijk zou willen gebruiken?
2. Spelen andere bestaande applicaties, zoals EPIC, die u al gebruikt hier ook een rol bij als je deze twee nieuwe applicaties ook gebruikt?
 1. Wat maakt dat u deze technologie of een combinatie van applicaties wel/niet (tegelijk) zou willen gebruiken?

2. Attitude towards technology (B)

1. Hoe staat u tegenover technologie in het algemeen?
 1. Hoe staat u tegenover het gebruik van technologische applicaties binnen uw werk?
 2. Wat maakt dat u zo tegenover technologie in het algemeen/binnen uw werk staat?

2. Vindt u het leuk om over nieuwe technologische applicatie te leren?
 1. Wat maakt dat u het leuk vindt om over nieuwe technologische applicaties te leren?
 2. Hoe komt dit tot uiting op de werkvloer?
 3. Heeft dit invloed op of u wel of niet geneigd bent om de applicaties te gebruiken?

3. Perceived ease of use (B)

1. Wat vindt u van het gebruiksgemak van de applicatie/applicaties?
 1. Wat maakt dat u het (niet) makkelijk in gebruik vindt?
2. In hoeverre voldoet het gebruikersgemak aan uw wensen, zodat u het ook daadwerkelijk gaat gebruiken?
 1. Tot op welke hoogte beïnvloedt dit u om de technologie ook daadwerkelijk te gaan gebruiken?
 2. Waarom is dat?

4. Perceived usefulness (B)

1. In hoeverre vindt u de applicatie(s) nuttig in het gebruik tijdens uw werkzaamheden?
 1. Hoe ondersteunt/ ondersteunen de applicatie(s) u in een betere uitvoering van uw dagelijkse werkzaamheden?
 2. Op welke manier ondersteunen ze u?
 3. Wat maakt dat u het (niet) nuttig vindt?
2. In hoeverre voldoet het gebruiksnut aan uw wensen, zodat u het ook daadwerkelijk gaat gebruiken?
 1. Tot op welke hoogte beïnvloedt dit u om de technologie ook daadwerkelijk te gaan gebruiken?
 2. Waarom denkt u dit?
3. Denkt u dat deze technologie past in het beeld van hoe de zorg er in de toekomst uit gaat zien?
 1. Waarom denkt u dit?
 2. Wat betekent dit in uw keuze om de technologie ook echt te gaan gebruiken wanneer het geïmplementeerd zou worden?

4. Nurse staff learning (L)

1. Hoe hebben jullie geleerd om met de applicatie(s) om te gaan?
 1. Hoe bent u geïnstrueerd over de applicatie(s)?
 2. Hoe bent u geïnstrueerd over de pilot(s)?
 3. Wie hebben deze instructies gegeven?
 4. Wat vond u van de instructies?
 5. Waren er trainingen? Hoe waren deze ingericht?
 6. Wat vond u van de training?
2. Wat is volgens u in het verleden vooral nodig gebleken om alle neuzen dezelfde kant op te krijgen zodat iedereen de applicatie(s) zou gebruiken (denk aan bijvoorbeeld EPIC)?
 1. Wat maakt dat iedereen op de hoogte is van de applicatie?
3. Hoe heeft u het leerproces van deze applicatie(s) ervaren ten opzichte van het leerproces van andere applicaties, zoals EPIC?
 1. Wat vond u beter of slechter gaan?
 2. Wat werkt voor u het best?

4. Denkt u dat u door deze instructiemomenten of trainingen (of wat de informant noemt) meer het nut van de applicatie(s) in ziet?
 1. Waarom denkt u dat?
5. Hebben deze instructiemomenten of trainingen (of wat de informant noemt) u geholpen in te zien dat de applicatie(s) niet zo moeilijk te gebruiken is/zijn?
 1. Waarom wel/niet?
6. Hebben deze instructies of trainingen (of wat de informant noemt) ervoor gezorgd dat u eerder geneigd bent om deze applicatie(s) te gaan gebruiken?
 1. Waarom wel/niet?
7. Denkt u dat de applicatie(s) past/passen binnen de bestaande routines?
 1. Waarom wel/niet?
 2. In hoeverre ziet u de routines als belemmering om de nieuwe applicatie(s) te gebruiken?
 3. Wat zou er moeten gebeuren zodat de routines doorbroken worden?

5. Involvement of potential users (M)

1. Tot op welke hoogte voelt u zich betrokken bij de introductie van de applicatie of beiden applicaties?
 1. Waarom vindt u dit?
 2. Op welke manieren wordt u betrokken?
 3. Hoe zou dit beter kunnen?
 4. In welke fases van de introductie? wat vroeger al voor de pilot en eventuele evaluatie na de pilot? Of zelfs al in het ontwerp van de technologie zelf?
2. In hoeverre heeft u het idee dat u een invloed heeft op het verloop van de introductie?
 1. Waarom heeft u dit gevoel?
 2. Hoe komt dit?
3. Tot op welke hoogte heeft u het idee dat er naar u geluisterd wordt als u iets wilt melden over de applicatie(s)?
 1. Waarom heeft u dit idee?
4. In hoeverre draagt het gevoel van betrokkenheid bij de applicatie(s) bij aan hoe u het gebruiksgemak ziet?
 1. Waarom vindt u dit?
5. Tot op welke hoogte denkt u dat deze betrokkenheid bijdraagt aan het nut van de applicatie(s) in uw werk?
 1. Waarom vindt u dit?
6. In hoeverre denkt u dat uw betrokkenheid bij de introductie van de applicaties de kans vergroot om de applicatie ook daadwerkelijk te gebruiken tijdens uw dagelijkse werkzaamheden?

6. Nurse staff functioning (L)

1. Hoe zou je de rol van de zorgcoördinator in het overbrengen van informatie over nieuwe applicaties beschrijven?

1. Wat was hun rol in het overbrengen van informatie over On-Track en/of Next Generation Nurse Call?
 2. In hoeverre verschillen zorgcoördinatoren in hun rol?
 3. In hoeverre is dit van invloed op het door u ervaren gebruiksgemak?
 4. in hoeverre is dit van invloed op het door u ervaren bruiksnut?
 5. In hoeverre maakt dit dat u de applicatie(s) zal gaan gebruiken?
2. In hoeverre voelt u zich betrokken in het besluitvormingsproces met betrekking tot de applicaties die worden geïntroduceerd op jullie afdeling?
 1. Hoe was dat voor On-Track en/of Next Generation Nurse Call?
 2. Wat betekent uw betrokkenheid voor het door u ervaren bruiksnut?
 3. Wat betekent uw betrokkenheid voor het door u ervaren gebruiksgemak?
 4. Wat maakt uw betrokkenheid dat u ook echt de applicatie(s) gaat gebruiken?
3. In hoeverre sluit/sluiten de applicatie(s) aan op bestaande procedures?
 1. In hoeverre is dit van invloed op het door u ervaren gebruiksgemak?
 2. in hoeverre is dit van invloed op het door u ervaren bruiksnut?
 3. In hoeverre maakt dit dat u de applicatie(s) zal gaan gebruiken?

7. External pressure (M)

1. Hoe ervaart u de ervaart u het gebruik van de applicaties tijdens uw werkzaamheden?
 1. Waarom ervaart u dat zo?
2. Als er extra werk of tijdsdruk wordt ervaren, waar wordt dit dan door veroorzaakt?
 1. Hoe zou dit in uw ogen beter kunnen?
 2. is het dan vooral de handelingen die u moet doen of echt de te korte tijd?
3. Tot op welke hoogte denkt u dat deze ervaren extra druk/last een impact heeft op hoe gemakkelijk u de applicatie(s) in het gebruik vindt tijdens uw dagelijkse bezigheden?
 1. Waarom ervaart u dat zo?
 2. Op welke manier zou dit verbeterd kunnen worden?
4. In hoeverre denkt u dat deze extra druk die u voelt, de nuttigheid van de applicaties tijdens uw werkzaamheden beïnvloedt?
 1. Waarom ziet u dit zo?
 2. Wat zou er in u ogen dan anders kunnen?
5. Tot op welke hoogte heeft de door u ervaren druk die door Next Generation Nurse Call en On Track door u wordt ervaren invloed heeft op ook het werkelijke gebruik van deze twee applicaties?
 1. Waarom is dit zo?

8. Complementarity of technologies (M)

1. Wat maakt in uw ogen applicaties in het algemeen elkaar aanvullen/bij elkaar passen in het gebruik tijdens de dagelijkse werkzaamheden? Is dat bijvoorbeeld als ze tegelijkertijd kan gebruiken? Als ze te gebruiken zijn op een apparaatje of 1 platform waar alles op terecht komt? Of dat de informatie die je erdoor krijgt elkaar aanvult? Of je ze bij elkaar vindt passen of juist haaks staan op elkaar dat je het idee hebt dat je moet kiezen? Of het gebruik ervan op elkaar lijkt? De handelingen die je ervoor moet doen
 1. Waarom is dat?

2. In hoeverre vullen On Track en Next Generation Nurse Call in uw ogen elkaar aan?
 1. Waar ervaart u dat zo?
 2. Wat zou er verbeterd kunnen worden?
3. In hoeverre zorgt de ene applicatie ervoor dat je de andere ook gaat gebruiken?
 1. en waar baseert u uw mening op?
4. En aanvullend met al bestaande applicaties die u gebruikt tijdens uw dagelijkse werkzaamheden?
 1. Welke applicatie(s)?
 2. Waarom?
5. In hoeverre denkt u dat het bijdraagt aan het gebruiksgemak als de applicaties aanvullend zijn op elkaar?
 1. Waarom vindt u dit?
6. Tot op welke hoogte denkt u als applicaties aanvullend zijn op elkaar, dit bijdraagt aan het nut van de applicaties tijdens uw dagelijkse bezigheden?
 1. Waarom vindt u dit?
7. En heeft de aanvullendheid van de applicaties effect op het besluit over het daadwerkelijke gebruik van de applicaties?
 1. Waarom is dit zo?

9. Social influence (L)

1. Wat denkt u dat u zou motiveren om de applicatie(s) gebruiken?
 1. Hoe kan uw team hierbij helpen?
2. Hoe stimuleren of helpen collega's u om de applicatie(s) te gebruiken?
 1. Wat vindt u daarvan?
 2. In hoeverre helpt dit u om beter het gebruiksgemak van de applicatie(s) in te zien?
 3. In hoeverre helpt dit u om beter het gebruiksnut van de applicatie(s) in te zien?
 4. In hoeverre denkt u dat u hierdoor meer geneigd bent om de applicatie(s) te gebruiken?
 5. Hoe stimuleert of helpt u anderen om de applicatie(s) te gebruiken?
 6. Waarom doet u dat (niet)?
3. Hoe stimuleren of helpen de zorgcoördinatoren u om de applicatie(s) te gebruiken?
 1. Wat vindt u daarvan?
 2. In hoeverre helpt dit u om beter het gebruiksgemak van de applicatie(s) in te zien?
 3. In hoeverre helpt dit u om beter het gebruiksnut van de applicatie(s) in te zien?
 4. In hoeverre denkt u dat u hierdoor meer geneigd bent om de applicatie(s) te gebruiken?
 5. Hoe stimuleert of helpt u anderen om de applicatie(s) te gebruiken?
 6. Waarom doet u dat (niet)?
4. Hoe stimuleren of helpen de projectleiders u om de applicatie(s) te gebruiken?
 1. Wat vindt u daarvan?
 2. In hoeverre helpt dit u om beter het gebruiksgemak van de applicatie(s) in te zien?
 3. In hoeverre helpt dit u om beter het gebruiksnut van de applicatie(s) in te zien?

4. In hoeverre denkt u dat u hierdoor meer geneigd bent om de applicatie(s) te gebruiken?
 5. Hoe stimuleert of helpt u anderen om de applicatie(s) te gebruiken?
 6. Waarom doet u dat (niet)?
5. Hoe stimuleert of helpt u anderen om de applicatie(s) te gebruiken?
 1. Waarom doet u dat?
 2. In hoeverre denkt u dat dat hen helpt om de applicatie(s) vaker te gebruiken?

10. Order of entrance (M)

1. Hoe zou u de introductie van de twee applicaties tegelijkertijd ervaren?
 1. Waarom is dit?
 2. Hoe zou dit in uw ogen anders hebben gemoeten?
 3. Heeft dit ook te maken met de grote van de verandering die de technologie teweeg brengt?
2. Tot op welke hoogte denkt u dat de volgorde van introductie van On-Track en Next Generation Nurse Call van invloed is op deze beoordeling?
 1. Hoezo vindt u dit?
3. In hoeverre denkt u dat de volgorde van introductie bijdraagt aan het gebruiksgemak van de applicaties tijdens uw werk?
 1. Hoe komt dit?
4. Tot op welke hoogte denkt u dat de volgorde van de introductie van deze twee applicaties bijdraagt aan het nu van de applicaties tijdens uw dagelijkse bezigheden?
 1. Waarom vind u dit?
5. In hoeverre heeft de volgorde van de kennismaking met de applicaties invloed op uw uiteindelijke besluit om ze te gebruiken?
 1. Waar baseert u dit op?

Afsluiting

Appendix 9 Quantitative data analysis output

9.1. Tables on attitude

Statement: Imagine the Nurse Call application would actually be implemented at your department, would you then use it?

#	Field	Choice Count
1	Helemaal mee oneens	7.14% 1
2	Oneens	14.29% 2
3	Neutraal	28.57% 4
4	Eens	42.86% 6
5	Helemaal mee eens	7.14% 1
		14

Table 9. Overview of respondents who used the Nurse Call applications.

Statement: Imagine the Track & Trace application would actually be implemented at your department, would you then use it?

#	Field	Choice Count
1	Helemaal mee oneens	0.00% 0
2	Oneens	0.00% 0
3	Neutraal	13.64% 3
4	Eens	63.64% 14
5	Helemaal mee eens	22.73% 5
		22

Table 10. Overview of respondents who used the Nurse Call application.

Statement: In general, I am positive towards using technologies in my profession.

#	Field	Choice Count
1	Helemaal oneens	0.00% 0
2	Oneens	0.00% 0
3	Neutraal	0.00% 0
4	Eens	60.00% 3
5	Helemaal eens	40.00% 2
		5

Table 11. Overview of respondents who filled in the follow up survey.

9.2. Frequencies and descriptive statistics

9.2.1. Frequencies and descriptive statistics: Age Statistics

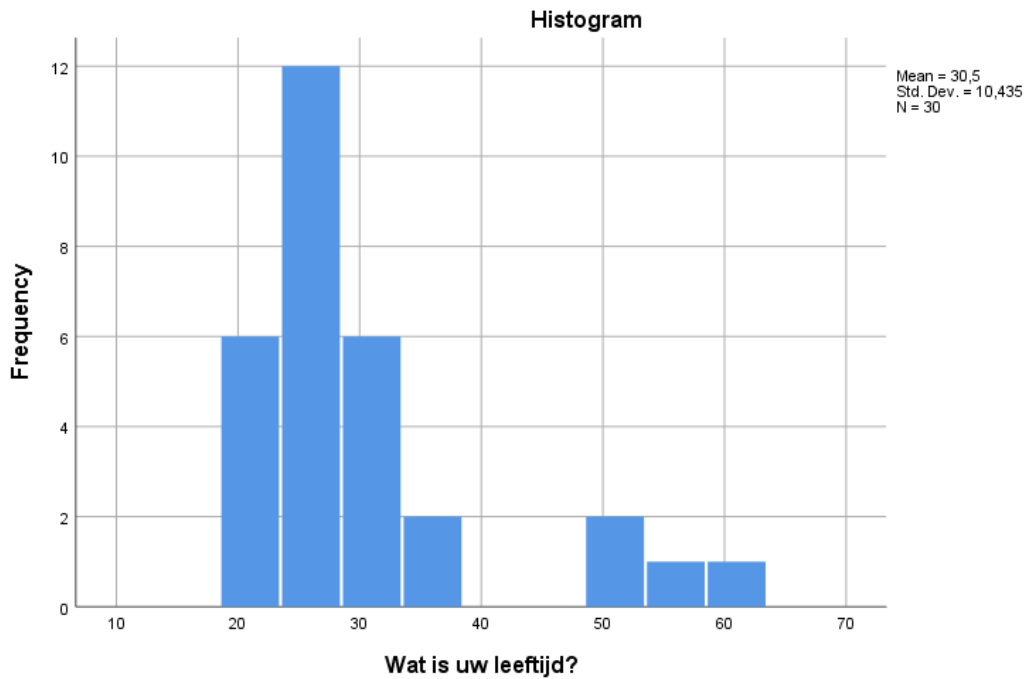
Wat is uw leeftijd?

N	Valid	30
	Missing	0
Mean		30.50
Median		27.00
Mode		29
Std. Deviation		10.435
Variance		108.879
Skewness		1.932
Std. Error of Skewness		.427
Kurtosis		2.886
Std. Error of Kurtosis		.833
Minimum		21
Maximum		62
Percentiles	25	24.75
	50	27.00
	75	29.00

Wat is uw leeftijd?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21	1	3.3	3.3	3.3
	22	1	3.3	3.3	6.7
	23	4	13.3	13.3	20.0
	24	1	3.3	3.3	23.3
	25	4	13.3	13.3	36.7
	26	1	3.3	3.3	40.0
	27	4	13.3	13.3	53.3
	28	2	6.7	6.7	60.0
	29	6	20.0	20.0	80.0
	35	1	3.3	3.3	83.3
	38	1	3.3	3.3	86.7
	50	1	3.3	3.3	90.0
	52	1	3.3	3.3	93.3

55	1	3.3	3.3	96.7
62	1	3.3	3.3	100.0
Total	30	100.0	100.0	



Descriptive Statistics

	N	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
Wat is uw leeftijd?	30	21	62	30.50	10.435	1.932	.427	2.886	.833
Valid N (listwise)	30								

9.2.2. Frequencies and descriptive statistics: Gender

Statistics

Wat is uw geslacht?

N	Valid	30
	Missing	0
Mean		1.27
Median		1.00
Mode		1
Std. Deviation		.450
Variance		.202
Skewness		1.112
Std. Error of Skewness		.427
Kurtosis		-.824
Std. Error of Kurtosis		.833
Minimum		1
Maximum		2
Percentiles	25	1.00
	50	1.00
	75	2.00

Wat is uw geslacht?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	v	22	73.3	73.3	73.3
	m	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Wat is uw geslacht?	30	1	2	1.27	.450	1.112	.427	-.824	.833
Valid N (listwise)	30								

9.2.3. Frequencies and descriptive statistics: Work experience in years at Radboud University medical center

Statistics

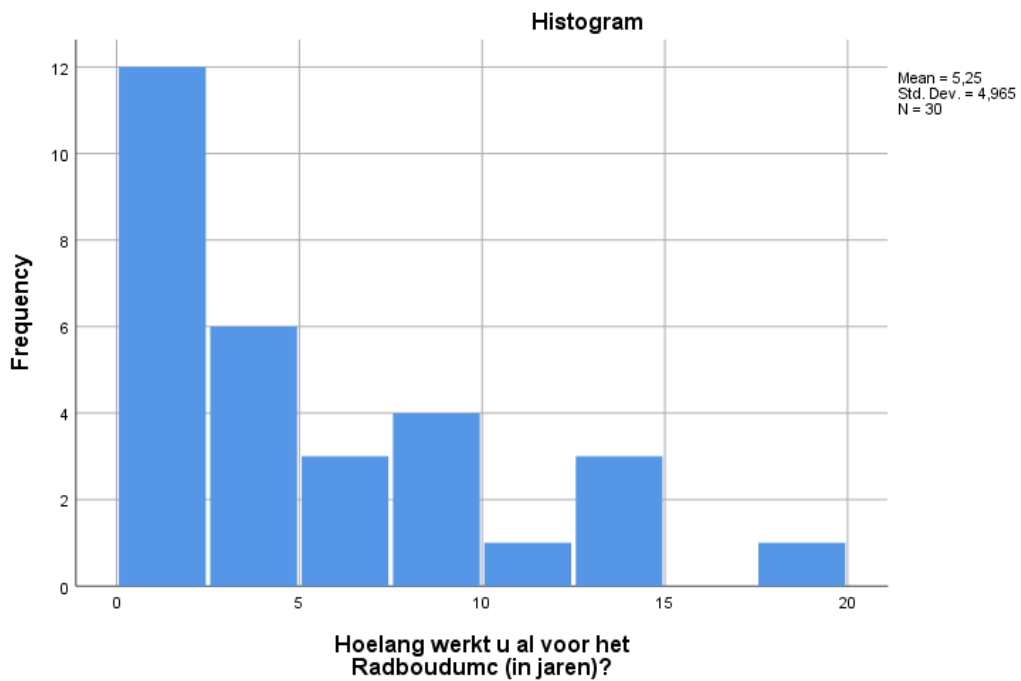
Hoelang werkt u al voor het Radboudumc (in jaren)?

N	Valid	30
	Missing	0
Mean		5.25
Median		3.00
Mode		1
Std. Deviation		4.965
Variance		24.649
Skewness		1.198
Std. Error of Skewness		.427
Kurtosis		.726
Std. Error of Kurtosis		.833
Minimum		0
Maximum		19
Percentiles	25	1.00
	50	3.00
	75	8.25

Hoelang werkt u al voor het Radboudumc (in jaren)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	3.3	3.3	3.3
	1	1	3.3	3.3	6.7
	1	7	23.3	23.3	30.0
	2	3	10.0	10.0	40.0
	3	4	13.3	13.3	53.3
	4	1	3.3	3.3	56.7
	5	1	3.3	3.3	60.0
	5	1	3.3	3.3	63.3
	6	1	3.3	3.3	66.7
	7	1	3.3	3.3	70.0
	8	2	6.7	6.7	76.7
	9	2	6.7	6.7	83.3
	10	1	3.3	3.3	86.7
	14	3	10.0	10.0	96.7

19	1	3.3	3.3	100.0
Total	30	100.0	100.0	



Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
Hoelang werkt u al voor het Radboudumc (in jaren)?	30	0	19	5.25	4.965	1.198	.427	.726	.833
Valid N (listwise)	30								

9.2.4. Frequencies and descriptive statistics: Working hours per week

Statistics

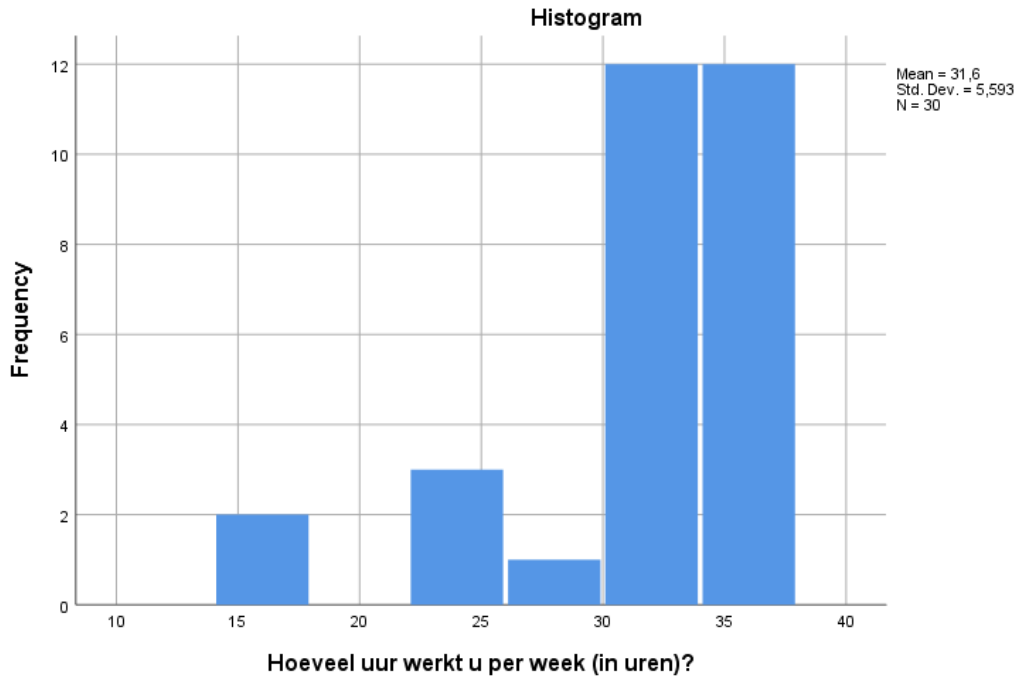
Hoeveel uur werkt u per week (in uren)?

N	Valid	30
	Missing	0
Mean		31.60
Median		32.00
Mode		32 ^a
Std. Deviation		5.593
Variance		31.283
Skewness		-1.675
Std. Error of Skewness		.427
Kurtosis		2.433
Std. Error of Kurtosis		.833
Minimum		16
Maximum		36
Percentiles	25	32.00
	50	32.00
	75	36.00

a. Multiple modes exist. The smallest value is shown

Hoeveel uur werkt u per week (in uren)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16	2	6.7	6.7	6.7
	24	3	10.0	10.0	16.7
	28	1	3.3	3.3	20.0
	32	12	40.0	40.0	60.0
	36	12	40.0	40.0	100.0
	Total	30	100.0	100.0	



Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
Hoeveel uur werkt u per week (in uren?)	30	16	36	31.60	5.593	-1.675	.427	2.433	.833
Valid N (listwise)	30								

9.2.5. Frequencies and descriptive statistics: Participation in previous pilots

Statistics

Heeft u de afgelopen vijf jaar deelgenomen aan een pilot van een andere technologie, buiten de huidige pilot van On-Track en het nieuwe verpleegoproepsysteem om (denk aan nieuwe software of nieuwe apparaten)? Er is één antwoord mogelijk. - Selected Choice

N	Valid	30
	Missing	0
Mean		1.70
Median		2.00
Mode		2
Std. Deviation		.466
Variance		.217
Skewness		-.920
Std. Error of Skewness		.427
Kurtosis		-1.242
Std. Error of Kurtosis		.833
Minimum		1
Maximum		2
Percentiles	25	1.00
	50	2.00
	75	2.00

Heeft u de afgelopen vijf jaar deelgenomen aan een pilot van een andere technologie, buiten de huidige pilot van On-Track en het nieuwe verpleegoproepsysteem om (denk aan nieuwe software of nieuwe apparaten)? Er is één antwoord mogelijk. - Selected Choice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ja, namelijk ... (vul in welke technologie en wanneer)	9	30.0	30.0	30.0
	Nee	21	70.0	70.0	100.0
	Total	30	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Heeft u de afgelopen vijf jaar deelgenomen aan een pilot van een andere technologie, buiten de huidige pilot van On-Track en het nieuwe verpleegoproepsysteem om (denk aan nieuwe software of nieuwe apparaten)? Er is één antwoord mogelijk. - Selected Choice	30	1	2	1.70	.466	-.920	.427	-1.242	.833
Valid N (listwise)	30								

9.3. Output crosstabs

In section 9.3.1., we provide an overview of all the relationships included in the crosstabs. Section 9.3.2. of this appendix provides the output of the crosstabs for which the resulting Likelihood Ratios were marked as significant in Table 12. In a separate document attached to this study, all the crosstabs are provided (See appendix 9.4).

9.3.1. Relationships in crosstabs

Table X provides an overview of the relationships between the variables included in the crosstabs.

*The Likelihood Ratios in bold and underscored are significant and therefore included in the table.

**The (-) represents a Likelihood Ratio that was not significant and therefore not included in the table.

Relationships between variables (Independent and Dependent)	Likelihood Ratio	Significance	Number of relationship in Appendix
Perceived usefulness of Nurse Call and Affinity with	<u>8.711*</u>	.013	1
Perceived usefulness Track & Trace and Affinity	<u>8.136</u>	.017	2
Perceived ease of use Nurse Call and Affinity	-**	.192	3
Perceived ease of use Track & Trace and Affinity	-	.774	4
Age and Perceived usefulness Nurse Call	-	.310	5
Age and Perceived usefulness Track & Trace	-	.087	6
Age and Perceived ease of use Nurse Call	-	.487	7
Age and Perceived ease of use Track & Trace	-	.987	8
Gender and Perceived usefulness Nurse Call	-	.366	9
Gender and Perceived usefulness Track & Trace	-	.410	10
Gender and Perceived ease of use Nurse Call	-	.146	11
Gender and Perceived ease of use T&T	-	.057	12
Work experience and Perceived usefulness Nurse Call	-	.778	13
Work experience and Perceived usefulness Track & Trace	-	.116	14
Work experience and Perceived ease of use Nurse Call	-	.447	15
Work experience and Perceived ease of use Track & Trace	-	.391	16
Working hours and Perceived usefulness Nurse Call	-	.213	17
Working hours and Perceived usefulness Track & Trace	-	.068	18
Working hours and Perceived ease of use Nurse Call	-	.905	19
Working hours and Perceived ease of use Track & Trace	-	.396	20
Participation in previous pilots and Perceived usefulness Nurse Call	-	.312	21
Participation in previous pilots and Perceived usefulness Track & Trace	-	.122	22
Participation in previous pilots and Perceived ease of use Nurse Call	-	.220	23
Participation in previous pilots and Perceived ease of use Track & Trace	-	.177	24
Age and Intention to use Track & Trace	-	.291	25
Gender and Intention Track & Trace	-	.149	26
Work experience and Intention to use Track & Trace	-	.329	27
Working hours and Intention to use Track & Trace	-	.398	28
Participation in previous pilots and Intention to use Track & Trace	-	.952	29
Age and Intention to use Nurse Call	-	.320	30

Gender and Intention to use Nurse Call	-	.382	31
Work experience and Intention to use Nurse Call	-	.399	32
Working hours and Intention to use Nurse Call	-	.123	33
Participation in previous pilots and Intention to use Nurse Call	-	.185	34
Perceived usefulness Track & Trace and Intention to use Track & Trace	<u>4.317</u>	.038	35
Perceived ease of use Track & Trace and Intention to use Track & Trace	-	.521	36
Perceived usefulness Nurse Call and Intention to use Nurse Call	<u>10.050</u>	.040	37
Perceived ease of use Nurse Call and Intention to use Nurse Call	<u>11.425</u>	.022	38

Table 3. All relationships for which crosstabs are made, the Likelihood Ratio and the significance levels.

9.3.2. Output of crosstabs

This section contains all output for the crosstabs for which the Likelihood Ratios were found to be significant.

1. PU VOS - Affinity

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Affinity_Recoded *	14	46,7%	16	53,3%	30	100,0%
PU_VOS_Recoded						

Affinity_Recoded * PU_VOS_Recoded Crosstabulation

		PU_VOS_Recoded			Total	
		1,0000	2,0000	3,0000		
Affinity_Recoded	2,0000	Count	1	1	0	2
		Expected Count	,3	,1	1,6	2,0
		% within Affinity_Recoded	50,0%	50,0%	0,0%	100,0%
		% within PU_VOS_Recoded	50,0%	100,0%	0,0%	14,3%
Affinity_Recoded	3,0000	Count	1	0	11	12
		Expected Count	1,7	,9	9,4	12,0
		% within Affinity_Recoded	8,3%	0,0%	91,7%	100,0%
		% within PU_VOS_Recoded	50,0%	0,0%	100,0%	85,7%
Total		Count	2	1	11	14
		Expected Count	2,0	1,0	11,0	14,0
		% within Affinity_Recoded	14,3%	7,1%	78,6%	100,0%
		% within PU_VOS_Recoded	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9,917 ^a	2	,007
Likelihood Ratio	8,711	2	,013
Linear-by-Linear Association	5,492	1	,019
N of Valid Cases	14		

a. 5 cells (83,3%) have expected count less than 5. The minimum expected count is ,14.

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	,650	,238	2,963	,012 ^c
Ordinal by Ordinal	Spearman Correlation	,741	,212	3,827	,002 ^c
N of Valid Cases		14			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

2. PU TT - Affinity

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Affinity_Recoded *	22	73,3%	8	26,7%	30	100,0%
PU_TT_Recoded						

Affinity_Recoded * PU_TT_Recoced Crosstabulation

			PU_TT_Recoced		Total
			2,0000	3,0000	
Affinity_Recoded	1,0000	Count	1	0	1
		Expected Count	,0	1,0	1,0
		% within Affinity_Recoded	100,0%	0,0%	100,0%
		% within PU_TT_Recoced	100,0%	0,0%	4,5%
	2,0000	Count	0	3	3
		Expected Count	,1	2,9	3,0
		% within Affinity_Recoded	0,0%	100,0%	100,0%
		% within PU_TT_Recoced	0,0%	14,3%	13,6%
	3,0000	Count	0	18	18
		Expected Count	,8	17,2	18,0
		% within Affinity_Recoded	0,0%	100,0%	100,0%
		% within PU_TT_Recoced	0,0%	85,7%	81,8%
Total	Count	1	21	22	
	Expected Count	1,0	21,0	22,0	
	% within Affinity_Recoded	4,5%	95,5%	100,0%	
	% within PU_TT_Recoced	100,0%	100,0%	100,0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22,000 ^a	2	,000
Likelihood Ratio	8,136	2	,017
Linear-by-Linear Association	11,791	1	,001
N of Valid Cases	22		

a. 5 cells (83,3%) have expected count less than 5. The minimum expected count is ,05.

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	,749	,182	5,060	,000 ^c
Ordinal by Ordinal	Spearman Correlation	,538	,222	2,854	,010 ^c
N of Valid Cases		22			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

35. PU TT – Intention to use TT

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Intention_TT_Recoded *	22	73,3%	8	26,7%	30	100,0%
PU_TT_Recoded						

Intention_TT_Recoded * PU_TT_Recoded Crosstabulation

		PU_TT_Recoded		Total	
		2,0000	3,0000		
Intention_TT_Recoded	2,0000	Count	1	2	3
		Expected Count	,1	2,9	3,0
		% within Intention_TT_Recoded	33,3%	66,7%	100,0%
		% within PU_TT_Recoded	100,0%	9,5%	13,6%
	3,0000	Count	0	19	19
		Expected Count	,9	18,1	19,0
		% within Intention_TT_Recoded	0,0%	100,0%	100,0%
		% within PU_TT_Recoded	0,0%	90,5%	86,4%
Total	Count	1	21	22	
	Expected Count	1,0	21,0	22,0	
	% within Intention_TT_Recoded	4,5%	95,5%	100,0%	
	% within PU_TT_Recoded	100,0%	100,0%	100,0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6,635 ^a	1	,010		
Continuity Correction ^b	1,176	1	,278		
Likelihood Ratio	4,317	1	,038		
Fisher's Exact Test				,136	,136
Linear-by-Linear Association	6,333	1	,012		
N of Valid Cases	22				

a. 3 cells (75,0%) have expected count less than 5. The minimum expected count is ,14.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	,549	,235	2,939	,008 ^c
Ordinal by Ordinal	Spearman Correlation	,549	,235	2,939	,008 ^c
N of Valid Cases		22			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

37. PU VOS – Intention to use VOS

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Intention_VOS_Recoded *	14	46,7%	16	53,3%	30	100,0%
PU_VOS_Recoded						

Intention_VOS_Recoded * PU_VOS_Recoded Crosstabulation

		PU_VOS_Recoded			Total	
		1,0000	2,0000	3,0000		
Intention_VOS_Recoded	1,0000	Count	2	0	1	3
		Expected Count	,4	,2	2,4	3,0
		% within	66,7%	0,0%	33,3%	100,0%
	2,0000	Count	0	1	3	4
		Expected Count	,6	,3	3,1	4,0
		% within	0,0%	25,0%	75,0%	100,0%
	3,0000	Count	0	0	7	7
		Expected Count	1,0	,5	5,5	7,0
		% within	0,0%	0,0%	100,0%	100,0%
			Intention_VOS_Recoded			

	% within PU_VOS_Recoded	0,0%	0,0%	63,6%	50,0%
	Count	2	1	11	14
	Expected Count	2,0	1,0	11,0	14,0
Total	% within Intention_VOS_Recoded	14,3%	7,1%	78,6%	100,0%
	% within PU_VOS_Recoded	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11,030 ^a	4	,026
Likelihood Ratio	10,050	4	,040
Linear-by-Linear Association	5,996	1	,014
N of Valid Cases	14		

a. 8 cells (88,9%) have expected count less than 5. The minimum expected count is ,21.

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	,679	,169	3,205	,008 ^c
Ordinal by Ordinal	Spearman Correlation	,630	,169	2,808	,016 ^c
N of Valid Cases		14			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

38. PEOU VOS – Intention to use VOS

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Intention_VOS_Recoded *	14	46,7%	16	53,3%	30	100,0%
PEOU_VOS_Recoded						

Intention_VOS_Recoded * PEOU_VOS_Recoded Crosstabulation

		PEOU_VOS_Recoded			Total	
		1,0000	2,0000	3,0000		
Intention_VOS_Recoded	1,0000	Count	3	0	0	3
		Expected Count	1,3	,4	1,3	3,0
		% within Intention_VOS_Recoded	100,0%	0,0%	0,0%	100,0%
	2,0000	% within PEOU_VOS_Recoded	50,0%	0,0%	0,0%	21,4%
		Count	1	2	1	4
		Expected Count	1,7	,6	1,7	4,0
	3,0000	% within Intention_VOS_Recoded	25,0%	50,0%	25,0%	100,0%
		% within PEOU_VOS_Recoded	16,7%	100,0%	16,7%	28,6%
		Count	2	0	5	7
Total	Expected Count	3,0	1,0	3,0	7,0	
	% within Intention_VOS_Recoded	28,6%	0,0%	71,4%	100,0%	
	% within PEOU_VOS_Recoded	33,3%	0,0%	83,3%	50,0%	
Total	Count	6	2	6	14	
	Expected Count	6,0	2,0	6,0	14,0	
	% within Intention_VOS_Recoded	42,9%	14,3%	42,9%	100,0%	
		% within PEOU_VOS_Recoded	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10,833 ^a	4	,029
Likelihood Ratio	11,425	4	,022
Linear-by-Linear Association	4,403	1	,036
N of Valid Cases	14		

a. 9 cells (100,0%) have expected count less than 5. The minimum expected count is ,43.

Symmetric Measures

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Interval by Interval	Pearson's R	,582	,194	2,479	,029 ^c
Ordinal by Ordinal	Spearman Correlation	,562	,217	2,352	,037 ^c
N of Valid Cases		14			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Appendix 10 Observations

During our research, we frequently visited department CTS and we were able to attend various meetings of the project team as well as the meetings of the nurse staff. During the observations, notes were made. The notes are presented in a logbook in order to make clear what information we obtained at each stage of the research process.

10.1. Meeting steering committee TechTeam Innovation, April 4, 16.30-18.00

Present: Sustainable policy manager, project leader Next Generation Nurse Call), theme leader Next Generation Nurse Call, background in nursing, extern Gartner advisor, manager, director IT, director Construction, Milou de Ruijter, Lisa Wekenborg

Topic: Discussion of progress of project Next Generation Nurse Call

Notes:

A meeting that would have taken place before this meeting was cancelled as there were many people that cancelled on the meeting. The theme leader of Nurse Call explained that the location of the pilot for Next Generation Nurse Call has changed last minute. The Nurse Call project leader asked director IT about the technical possibilities of installing the Nurse Call application at floor C4 (CTS). There seems to be time pressure on the project of Next Generation Nurse Call. Some forms need to be signed and the Nurse Call project leader wants this to be done soon. The project group asked Milou and Lisa whether they will help them out conducting baseline measurements of the Nurse Call application at C4.

10.2. Observations during baseline measurement for Next Generation Nurse Call on April 18-20

On April 18, 19 and 20, a baseline measurement for the project group of Next Generation Nurse Call was conducted by Lisa Wekenborg. The observations were done from 15:00-20:00. The purpose of the measurement is to see how many times a small group of patients of the department cardiothoracic surgery call the nurse via the current nurse call system. During this measurement some observations were made on the way of working of the nurses. These observations are reported in this section.

[These notes are made in Dutch]

Groene lamp brandt maar er komt niet direct een verpleegkundige op af. Uit navraag blijkt dat dit betekent dat er iemand op de kamer aanwezig is, zoals de dokter voor een gesprek. Maar de verpleegkundige vertelt ook dat dit lampje niet altijd klopt, dat er vaak wordt vergeten de lamp uit te zetten.

Op een kamer is al een uur de deur dicht omdat een arts in gesprek is met de patiënt. Een voedingsassistent en een verpleger storen per ongeluk ondanks dat de groene lamp brandt, welke eigenlijk betekent dat de patiënt privacy wil.

De verpleegkundigen lopen veel en vaak rond. Elke verpleegkundige heeft enkele patiënten in een aantal vooraf afgesproken kamer onder hun hoede. Als een patiënt van een kamer die niet onder toezicht van een andere verpleegkundige staat iets vraagt aan hem of haar, belt de verpleegkundige de desbetreffende verpleegkundige. Het gemiddeld aantal keer dat gebeld is tijdens deze drie dagen is vijf keer.

Op de afdeling is het erg rustig. De tijdsperiode waarin de meting is gedaan, van 15:00 tot 20:00, was ook de tijdsperiode waarin familie en vrienden de patiënten kunnen bezoeken. Wellicht dat daarom de verpleegkundigen niet vaak opgepiept werden: Voor simpele zorgvragen kwam het bezoek van de patiënt zelf in actie. Dit gold voornamelijk bij een wat jongere patiënt waarbij de ouders constant aanwezig waren. Een wat oudere patiënt daarentegen kreeg maar één maal in die drie dagen bezoek, waardoor deze patiënt ook wat vaker de verpleegkundige heeft opgeroepen in vergelijking met de andere patiënten.

Sommige verpleegkundigen zeiden wanneer hun dienst erop zat nog even gedag aan hun patiënten en vertelden wanneer ze weer terug kwamen.

De voedingsassistenten waren gemiddeld zo'n zeven keer op de kamer van de patiënt in de tijdsperiode tussen 15:00 en 20:00: Om de lunch op te halen, om voorkeuren voor het avondeten door te geven, een snack rond te brengen, het rondbrengen van de avondmaaltijden, het ophalen van de avondmaaltijden, het rondbrengen van de toetjes en/of koffie, en het ophalen van de toetjes en/of koffie. Tussen de bezoeken van de voedingsassistenten door werden ze niet nog een keer extra naar de afdeling gevraagd, behalve toen een patiënt van de OK kwam en eetvoorkeuren moest doorgeven, maar de voedingsassistenten al klaar waren met hun rondje.

10.3. Presentation by project leader of continuous monitoring, May 17, 12.00-12.45

Present: General presentation open to all employees.

Topic: Short presentation on progress of project group working on continuous monitoring.

Notes: Radboud University medical center aims to create individual rooms where patients can create their surroundings themselves in a way they like. The patient will get a high level of self control over the technical applications installed in the room, so that they can for example open and close the windows themselves. One observation by the lecturer is that patients won't call the nurses because they see that the nurses are very busy. This keeps them away from calling the nurse to ask what they want to ask. Other technical applications discussed during the lecture are VR which is used to reduce pain and a sort of bicycle placed into the bed of the patients to make them move. Currently, the project group is creating test rooms and nurses, and others who are present during the presentation, are invited to think along.

10.4. Meeting Heasyway, Heasygoing project group, May 25, 9.00-11.00

Present: Members of project team Wayfinding, two representatives of Vasco, Milou de Ruijter, Lisa Wekenborg.

Topic: Progress of project easy wayfinding

Notes: During this meeting, technical features of the wayfinding application were discussed with representatives of Vasco, the company that is in the running to install the technology at Radboud University medical center. With this technology, patients will receive a detailed and real time description of the route description to their appointment. One of the attendants calls the Track & Trace technology an 'easy' technology. The technology of Heasyway, Heasygoing will be more advanced: The real time location of a visitor of the hospital must be defined as accurately as possible. In the future, the project group of Heasyway, Heasygoing wants to link the real time location tracking with the nurse call system so that nurses can see where their colleagues are. However, this brings privacy issues with it.

One attendant mentions that nurses work in teams. Two nurses are 'shadowing' each other, meaning that actions of nurses are also double checked.

10.5. Clinical class at nurse post at CTS, May 25, 13.30-14.15

Present: Part of the nurse staff of CTS, project leader of Track & Trace, Milou de Ruijter, Lisa Wekenborg

Topic: Short training on how to use the Track & Trace application

Notes: Among those nurses attending the session, only a few heard about the technology or used it once to log in but no one really worked with it, although it was installed already for a about three weeks. The

project leader of Track & Trace explained to the nurses how to install the application and how it works. The first reactions of the nurses attending the training were quite positive. One nurse mentioned that it would also be useful to Track & Trace the dentures or hearing aids. Another nurse mentions that one of the devices they use a lot is not yet in the list of devices they can check via Track & Trace.

One nurse says that if she couldn't find a blatter scan right away, she worked her way around it. This device is not something you would need immediately. However, the device to make an ECG can be needed immediately and then it is important to find that quickly.

Although the initial idea was to install Track & Trace as an application on the smartphone, this concept had to be adapted as nurses don't use a smartphone during work. A laptop was placed at the nurse post on which nurses could log in at every moment of the day.

Though, the project leader of Track & Trace brought one smartphone with the application of Track & Trace on it. When she asked for a volunteer to try it out during a couple of weeks, not many people wanted to volunteer. One nurse mentioned that another student nurse should do it.

10.6. Informal talk with nurse, June 13, hallway CTS

Present: Nurse, Milou de Ruijter, Lisa Wekenborg

[The notes are made in Dutch]

Notes: Haar pieper werkt niet goed in het weekend. Ze loopt dan met de telefoon van de keuken op zak. Ze is erg enthousiast over de Track & Trace applicatie, vooral om de blatter scan te vinden. Alleen heeft ze de blatter scan nog niet veel nodig gehad en dus de applicatie niet. Alleen voor een bepaalde pomp, waarvan er maar weinig zijn op de afdeling, is Track & Trace erg handig. De verpleegkundige geeft aan dat het niet altijd even goed werkt: Soms zegt het systeem dat bepaalde apparatuur buiten staat volgens de Track & Trace plattegrond. Het feit dat er nu één laptop op de post staat waar de verpleegkundigen makkelijk op kunnen inloggen was volgens haar een goed idee. Daarnaast geeft de verpleegkundige aan dat ze wel door collega's herinnerd moet worden dat ze de applicatie gebruikt.

10.7. Informal talk with patient while conducting the patient survey by order of project group Next Generation Nurse Call

Present: Patient at CTS, Milou de Ruijter, Lisa Wekenborg

Notes: The patient thinks the Next Generation Nurse Call application is not difficult to use at all. It's not fully clear for what the other buttons on the remote controller serve for. The patient thinks that the Next Generation Nurse Call system does not fit within the policy of the Radboud University medical center, which is to stimulate patients to move more. She thinks there are already enough possibilities to call the nutrition assistant: There is a counter located at the department with a bell which patients can ring if they have a food related request.

Appendix 11 Document for Track & Trace

This document was created by the project leader of Track & Trace, as part of her research on the needs of nurses regarding tracking of medical devices prior to the implementation of Track & Trace at department CTS. The document provides insight into how long nurses report to look for certain medical devices.

Functie	Hoeveel uur per week in dienst	Hoe vaak ben je gemiddeld per week op zoek naar een medisch apparaat?	Welke medische apparaten (zoals ECG karren, PCEA pomp, enz.) vragen de meeste zoektijd?	Zoektijd schaal 1 (weinig) tot 5 (veel)	Hoelang doe je dan gemiddeld over de zoekactie? Per apparaat in minuten	Bij hoeveel procent van de opnames worden PCEA en PCIA gemiddeld ingezet?	Hoe vaak worden PCEA en PCIA pompen vooraf meegegeven naar OK?	Hoe vaak worden PCEA en PCIA pompen vooraf, bij opname al gereserveerd?	Heb je aanvullende opmerkingen of suggesties over het gebruik van medische apparaten op jouw afdeling?	
VPK	28	3	Bladderscan	x		niet afgenomen in eerste les	5 op de 10 keer	Nooit	x	
			Oorsatudatiemeter	x		15				
			ECG	x		5				
			Weegschaal (staand)	x		30				
VPK	32	5	Bladderscan		5	niet afgenomen in eerste les	5 op de 10 keer	Nooit	Meer apparaten	
			PCIA		3	15				
			Oorsatudatiemeter	x		15				
			Thopaz	x		10				
VPK	28 tot 15		Bladderscan	x		niet afgenomen in eerste les	3 op de 10 keer	Nooit	x (onleesbaar)	
			Oorsatudatiemeter	x		20				
			Thermometer	x		20				
			Suiker apparaat	x		20				
VPK	34 x		Bladderscan		5	niet afgenomen in eerste les	3 op de 10 keer	Nooit	Bladderscan mee laten doen met pilot	
			ECG		3	2				
			PCEA		2	2				
			Thopaz		2	2				
			Oorsatudatiemeter		5	5				
VPK	32	5	Bladderscan		5	niet afgenomen in eerste les	x	Nooit	Bladderscan ook meenemen in pilot	
			ECG		3	5				
			Acromed		3	10				
			Thopaz		2	10				
			Oorsatudatiemeter		3	10				
VPK	32	3	Bladderscan		5	niet afgenomen in eerste les	x	Nooit	x	
			ECG		4	10				
			PCEA		1	5				
			PCIA		2	5				
VPK	36	5	Bladderscan		5	niet afgenomen in eerste les	x	1 op de 10 keer	Meer apparaten Inzet T&T	
			PCIA		3	5			Bladderscan op iederen groep 1 aanschaffen	
VPK	32	3	Bladderscan		3	5 tot 10	Afhankelijk van 20% OK	Afhankelijk van OK		
			PCIA		2	5				
			Thopaz		2	5				
			ECG		2	5				
			Rolstoel		3	5 tot 10				
VPK	24	3	Bladderscan		4	10	50%	5 op de 10 keer	Nooit	x
			ECG		2	5				
			PCIA		2	5				
			Infusor		2	5				
Materiaal	32 30 of meer		PCEA		5	20 x	x	x	x	
			PCIA		5	20				
			Thopaz		5	20				
VPK Stagi	36	2	ECG		2	10 x	x	x	x	
							8 op de tien			
VPK	32	2-mrt	Bladderscan		4	10	70%	8 op de tien keer	1 op de 10 keer	x
			PCIA		3	5				
VPK Stagi	32	1	Bladderscan		5	30 ?		9 op de tien keer	5 op de tien keer	x
			Infusor		2	5				
VPK	32	10	Bladderscan		5	10	40%	3 op de tien keer	1 op de 10 keer	x
			Spuitinfusor		2	2				
			Infusiepomp		2	2				
			PCEA		3	5				
			PCIA		3	5				
			ECG		4	7				
VPK	36	10	ECG		2	10	40%	8 op de tien keer	5 op de tien keer	x
			Bladderscan		5	20				
			PCEA		3	5				
			PCIA		3	5				
			Infusiepomp		3	5				

Appendix 12 Overview of codes

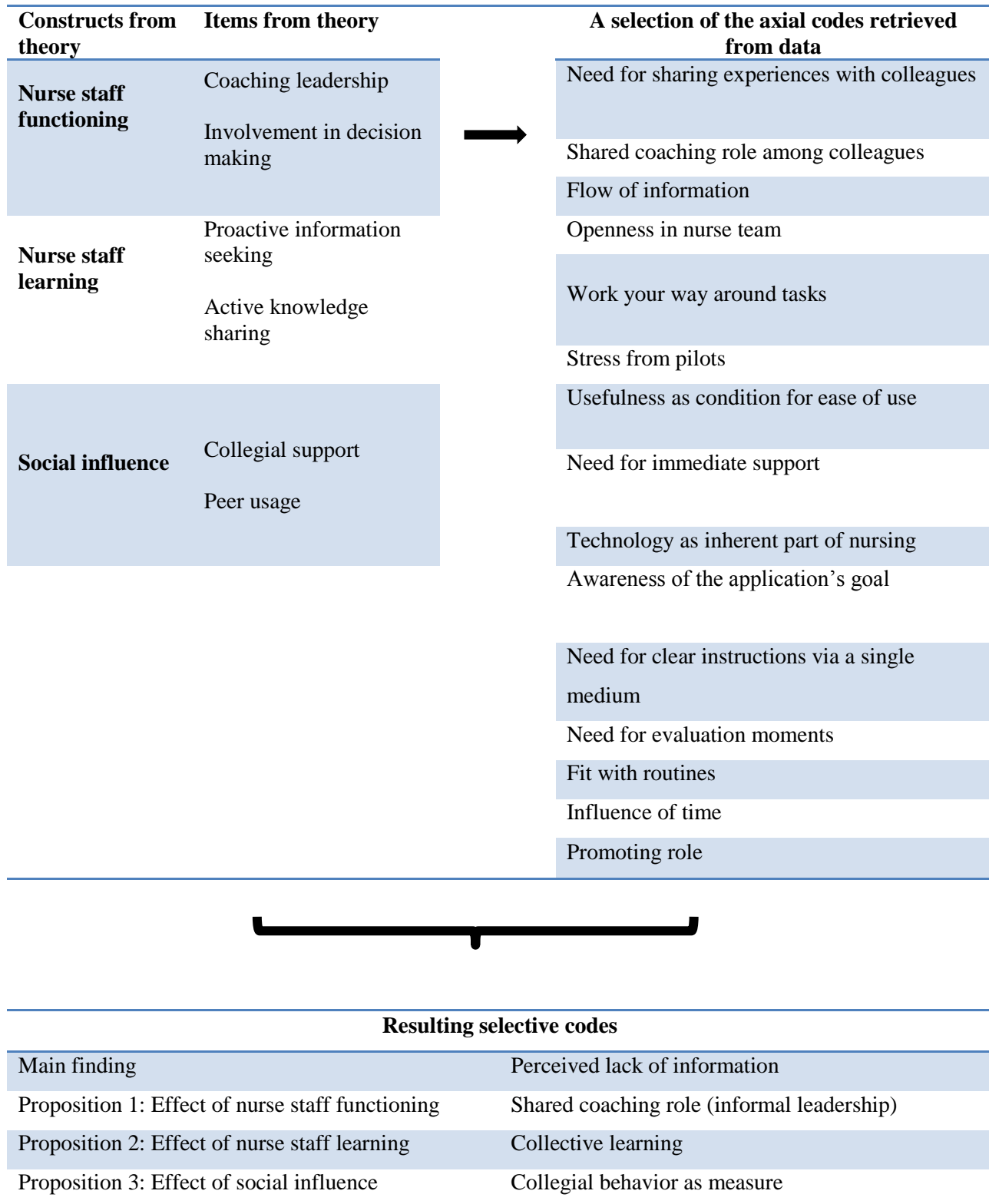


Figure 13. Overview of the theory and their relation to the codes retrieved from our data.

Appendix 13 Checklist

Based on the findings of our studies, a checklist was proposed for TechTeam Innovation focusing on the actions that need to be fulfilled prior to, during and after the introduction of new technologies in pilot form.

Prior to the introduction

5. At least 4 weeks prior to the introduction of the new application.
 - ✓ Observe at least one day at the department and make a sketch of the work processes.
 - Check whether it fits the design of the technology you made so far.
 - ✓ Ask what the preferred way of communicating is at the department (Sharepoint, e-mail, etcetera).

4. At least 3 weeks prior to the introduction of a new application.
 - ✓ Approach the nurse staff leader
 - Agree on the time of the introduction (keep in mind peak times such as the flu epidemic)
 - Agree on compensation for nurses
 - ✓ Provide clear instructions via the medium of preference (see 5).

3. At least 2 weeks prior to the introduction of a new application.
 - ✓ Organize clinical classes during staff meetings at 13.30
 - Get two to three nurses (depending on size of department) on board for the specific tailoring of the application to the needs of the department (in so far that is not been done during the design process) and for assistance during the introduction itself (by making colleagues enthusiastic).

2. One week prior to the introduction of a new application.
 - ✓ Give clear instructions who nurses can reach when they have questions during the introduction.
 - Provide one phone number.
 - Assure them that they can call anytime.

- ✓ Communicate a fixed ending date of the introduction (in case it is a pilot).
 - Already plan another clinical class during staff meetings at 13.30 during which they can give feedback.

1. During the introduction of new technologies.

- ✓ Be 24/7 available for questions by phone.
- ✓ Visit the department and informally ask those working with the new technology what their first impression is.
- ✓ Keep in touch with the nurses you have on board: What are the first impressions?

After the introduction:

1. Right after the closing date.

- ✓ Thank the test users by providing a cake!

2. A week after the closing date.

- ✓ Organize the feedback meeting.
- ✓ Provide a rough draw on the first results.

3. Within three weeks after the closing date.

- ✓ Provide an outlook for the future of the technology: What will change based on the results?
- ✓ In case the technology will actually be implemented (in case of a pilot): Provide a timeline.

Appendix 14 Transcripts of the interviews

(Appendix 14 is added in a separate document)