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Case study on implementation of digital innovations within home care

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there's more to care

Preface

In front of you lies my master thesis "Case study on implementation of digital innovations within home care". I have written this thesis for the graduation of the study Health Sciences at the University of Twente. Together with FocusCura and the university, the research to the personal alarms and the implementation of innovations overall is conducted.

During the five months working on my thesis I have learned a lot, I saw a whole other side of innovations within healthcare. I spoke to various people and learned that within home care most things are not as simple as they might seem on the surface. Writing this thesis has taught me about switching ideas when things don't go as planned and be open to the ideas from all perspective within the subject. Hopefully, this study might be a starting point for further innovations to have successful implementations.

I want to thank my supervisor Erwin Hans for his extensive feedback and help during all the stages of writing my thesis. I really enjoyed working at FocusCura, despite working at home I had a very warm welcome and everybody was very open to help. Therefore I want to thank everybody from FocusCura and mainly Dennis Linn, Jeannette van der Wal, and Raoul Zaal. With their insights on the subject and good view on all stakeholders, I was able to get everything out of the research possible. They were of great help during the process. Also, the people from marketing and communication, with whom I always started my (online) workday with some chitchat and a good overview of what to do. All stakeholders were of great help. Despite corona, I could talk to various people and do a lot of interviews. I want to thank Sharon Hofstede from Sensire in particular, for her help during the data acquisition and great talks about the possibilities within home care. At last, I want to thank my friends and family for their support.

I hope you enjoy reading this thesis!

Fleur van Wezel
Enschede, 28th of June 2021

Summary

Background

The pressure on home care is increasing due to the growing ageing population. With innovations and digitisation, the efficiency of home care can increase. Even though several innovations look promising, only a few are implemented. FocusCura is a company that delivers products and services for the elderly to help them live at home longer. One of these products is the personal alarm, where the healthcare organisation, emergency centre, client, software company, and health care insurance are important stakeholders. For the digitisation of the personal alarms, a consortium with these stakeholders is put together. Members are Sensire, NAAST, EYVIT, Menzis, and the University of Twente. With this consortium the case study to the digitisation of personal alarms can be done. Which helps answering the following research question:

What is needed for successful implementation of digital innovations within home care organisations?

Approach

To answer this research question several sub-questions are set up. These sub-questions are based on the case used in this study, the digitisation of personal alarms within home care organisations. At first, a stakeholder analysis is performed and these stakeholders are interviewed to identify the current situation of the personal alarms. During these interviews, the drawbacks are discussed as well. This resulted in key performance indicators, which are indicators that are relevant when looking at performances of home care, and specifically the personal alarms. With these indicators, the performance of the current situation is found. Since the research focuses on implementation of innovations, a literature search to barriers to the implementation is done. This helps to gain insights into what is needed for the successful implementation of the digitised personal alarms. There is not much data available on the current situation, and no data available on the digitised alarms. With help of expert interviews, the potentials of the digital alarms are worked out. The current situation, barriers from literature, and potentials together show which steps are needed for further implementation. The steps taken for this case study show what is needed for other innovations.

Results

The different sub-questions help to answer the research question. The current situation shows that it is needed to do a stakeholder analysis, visualise the processes and find drawbacks with help of interviews. The focus of this study is on unplanned home care, this concept is used during the interviews. The indicators that come out of the interviews can be divided into three levels of impact: reduce, reroute, and refine. In total fourteen indicators are identified to measure the performance. Unfortunately, not for all indicators data is available. Therefore, the performance of the current situation cannot be determined.

The literature study to implementation barriers resulted into eight categories of barriers: awareness, regulation/politics, validation/added value, business model, technical aspects, usability, privacy, and knowledge of stakeholders. Since not all data is available, the validation cannot be done. This barrier must be overcome first. The other barriers will follow subsequently. This results in the advice to the stakeholders to first start with more data acquisition and a pilot study. The steps made within this study can be used for other organisations when looking at how to implement the innovation.

Conclusions and recommendations

The case study showed which steps are needed for the implementation of digitised personal alarms within home care organisations. This helped to answer the research question. We can conclude that several steps are needed for successful implementation. The current situation must be mapped out, key performance indicators relevant to the innovation need to be found and performance needs to be measured. The eight categories of barriers can be used to see which aspects of the innovation needs extra focus. This helps to plan implementation and understand which stakeholders are important in which part of the implementation.

Since this is a case study it shows the results of this case specifically. In other situations, the steps taken are useful to use for implementation of innovations. Nevertheless, this study had some discussion points. The scope is specified to the process, finances and business models are not yet taken into account, more interviews would give more insights into the current situation, and only quantitative measures are used. Despite these discussion points, the study shows the steps needed to be taken for implementation of innovations within home care.

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1 Introduction

The fast-growing ageing population is a problem that in the coming years will even increase. The CBS expects growth from 20% to 25% of inhabitants over 65 years old between 2020 and 2040 [1]. Of these elderly, over 90% still lives at home with or without extra help [2]. The elderly are more likely to have multimorbidities and need more care. This leads to the increasing demand for home care and high pressure on the people working within home care. Also, due to fewer children per elderly, the pressure on informal care will increase [3]. Developments that can help to overcome these problems are technology developments. For example, eHealth is seen as an innovation that can help to make care more efficient [4]. FocusCura is one of the companies that delivers products and services for the elderly to live at home longer. Daan Dohmen, the founder, started FocusCura in 2003 intending to bring ‘cold techniques’ and ‘warm care’ together. The first product of FocusCura and still most known is the personal alarm. This is an alarm that the elderly can use in case of an emergency [5]. Other products are the cKey, which enables caretakers to enter the house without keys, cMed, the smart medicine dispenser that digitises the medicine use of clients and at last cContact, which helps to have more direct care through a video connection. FocusCura is constantly developing and adding new technologies to reach its goal to help the elderly live at home longer. A problem that occurs within those developments and new techniques is the fact that they need to be implemented in the right way. Some people use the formula “Old Organisation + New Technology= Expensive Old Organisation”, which shows the importance of the organisation changing and adapting to new processes [6]. The study focuses on digitisation of the personal alarms. Digitisation is the change from analogue to digital to optimize processes within an organisation [7]. In this study, the processes around the alarms and the effect on the performance within home care are discussed. This chapter starts with the context of the study, where the involved parties are introduced. Section 1.2 discusses the problem description and the reason why this study is relevant. Section 1.3 discusses the goal of the study and at last, Section 1.4 discusses the approach of how to reach the goal.

1.1 Context of the study

In this research, a case study is used to investigate the changes that must be made to use new techniques in a good way. The specific technique is personal alarms, these alarms are used for emergencies for the elderly living at home. This is more than just pushing the button. Therefore, the case is about the whole process around the use of the alarms. Several stakeholders are relevant in this case. For that reason, a consortium is set up where these stakeholders come together to discuss the problems. The stakeholders are FocusCura, Sensire, NAAST, Menzis, EYVIT, and the University of Twente. All stakeholders have different roles within the process of this study. FocusCura is responsible for delivering the technology for the personal alarms and is the initiator of this study. Their goal is to validate the impact of digitisation of the alarms and ensure this can help the elderly live at home longer. The second stakeholder is Sensire, the biggest care organisation in de Achterhoek. Sensire delivers care to the users of personal alarms. The alarms are responded to by NAAST, the third stakeholder. NAAST is an emergency centre that processes incoming emergency calls and makes sure the right care is delivered. The fourth stakeholder is Menzis, the health insurer, which is involved because of the reimbursements and processes around the implementation. EYVIT is a digital product (software) company specialized in IoT cloud-based alarm handling. They are involved in the consortium to investigate improvements within the platform of personal alarms. At last, the University of Twente is involved in the consortium. Their contribution is the processing of data and performing research. The goal of this consortium is to investigate the potential of the digitisation of personal alarms and make sure it is implemented.

1.2 Problem description

The problem within home care is the growing demand. It is known that home care processes need to change to keep care sustainable. Technological innovations might help to improve the processes. According to Laurenza et al. [8], “an important role in the improvement of healthcare processes is played by technological innovation”. These technological innovations are often not implemented successfully. It is important to understand which steps are needed for successful implementation. Successful here is, implemented broadly and with a positive effect on the processes. During this research, the personal alarm is used to study the steps of implementation. Personal alarms are well known within home care. Nevertheless, the service can still be improved and digitisation might help to improve the performances of home care. The specific addition to the performances by the digitisation of the personal alarms is not scientifically proven. This is due to a lack of data and information on the total process. Even though several problems of the alarms and processes used now are already known, most of these are assumptions and not scientifically proven. This needs to be done to see what the possibilities with digitisation are on the performances of home care. The possibilities are more than just the change from an analogue main panel to a digital main panel. Digitisation in this case means, the change to digital alarms, improved software platforms, the addition of sensors, changes in processes, adding (digital) communication channels and extend options for follow-up of emergencies. The case focuses on unplanned care. Personal alarms are used in emergencies and lead to unplanned care events. The focus of the study is unplanned care and to improve the performances within home care.

1.3 Objective of the study

The goal of the study is to find barriers that arise with the implementation of innovations within home care organisations and describe how to overcome these barriers. This is done with help of the case study discussed in the previous sections. The final product is a complete view of the current situation, both processes and occurring problems. Qualitative and quantitative studies are done to investigate the processes of the current personal alarms. Next to this, a literature study is done to find out what the barriers of implementation for previous innovations were. This results in the drawbacks of the current situation and a conclusion can be made on both the potentials of digitisation and the next steps for implementations. This will help all stakeholders in the further implementation of the personal alarms and for implementation of other innovations in the future.

1.4 Approach

To reach the objective of the study the following research question needs to be answered “*What is needed for successful implementation of digital innovations within home care organisations?*”. Before this research question can be answered several sub-questions need to be answered.

1. *What is the current situation within home care considering unplanned follow-up?*
This sub-question is divided into two other sub-questions while it is a broad subject and a lot of subjects need to be discussed.
 - (a) *What is the current process around unplanned follow-up?*
In Chapter 2 the current process is examined. This is done with interviews with all stakeholders and workshops with the consortium.
 - (b) *What is the current performance of unplanned follow-up?*
With help of KPIs and data from NAAST, the performance can be identified. This is done in Chapter 3.

2. *What are the barriers to implementation of digital innovations within home care?*
In Chapter 4, a systematic literature review is conducted to categorise barriers to implementation that are already found in literature.
3. *What are the barriers to implementation of digital personal alarms within home care?*
To answer this question, barriers found in Chapter 4 are combined with the current situation exposed in Chapter 2 and 3. In Chapter 5 the barriers specific to the implementation of digital alarms are discussed.
4. *What are the potentials of digital personal alarms?*
In Chapter 6 the potentials of the digitisation of personal alarms are discussed. These are the potentials for improved performances compared to the performances found in Chapter 3. The potentials of further improvement of home care and home care processes are also discussed in this chapter.
5. *What steps need to be taken for further and successful implementation of digital personal alarms within home care?*
In Chapter 7, further steps of the implementation of digitised personal alarms are discussed. For every stakeholder, advice is given based on the barriers. Next to advice per stakeholder, general advice for the consortium is given.

2 Current situation

In this chapter, the current situation of the personal alarms is addressed. In Section 2.1 all stakeholders and their roles are discussed with help of interviews. Interviews with these stakeholders helped to get an overview of the current processes which is discussed in Section 2.2. The interviews also focused on problems arising within the processes of the unplanned follow-ups, Section 2.3. At last, in Section 2.4, the digitisation of the alarms is looked into.

2.1 Stakeholder analysis

Stakeholder analysis is used to identify all stakeholders in the right way since roles can differ for different technologies [9]. There are several steps within stakeholder analysis: identification, identification of the expectation, determination of performance gaps, and prioritization of demands [10]. Within this study, there is not necessarily a product that is supplied by one provider. A paper by Ehrenhard et al. [11] is found, this paper performs stakeholder analysis on smart homes. This is a multi-stakeholder technology within home care, just as in the case of personal alarms. The method used in this paper is used as starting point for this study with the personal alarms as the case. Therefore, first only the first step of the stakeholder analysis as mentioned above is done. The roles, actors, and activities are determined with interviews. The general interview guides can be found in Appendix A. The interviews differed for each interviewee since they had different backgrounds. The results of the stakeholder analysis are shown in Table 2.1.

Table 2.1: Stakeholders

Role	Actor	Activities
End-user	Elderly living at home	Use the alarm in emergencies
Support providers	Family, neighbours	Help after use of alarm in case of social follow-up
Medical care providers	Sensire	Provide care after an alarm
Hardware supplier	FocusCura	Offers alarms to homes of elderly and takes care of technical issues
Software supplier	UMO/EYVIT	Offers platform to medical service centre for triage
Insurance provider	Menzis	Offers health insurance, reimbursement of alarm, and reimbursement of worked nursing hours
Medical service centre	NAAST	Intermediary between end-user who used alarm and follow-up (support/medical care providers)

The last step within stakeholder analysis is the classes of the stakeholders. This is based on the method set by Mitchell et al. [12], this article shows classification based on attributes: power, legitimacy, and urgency. Power is a difficult attribute since several views on this are made. Generally, a stakeholder has power when he has several tools to use to gain his position within the relation. Legitimacy is about the relation between the organisation and stakeholder, the organisation is responsible for the well-being of a stakeholder. At last, urgency, these are stakeholders with a time-sensitive claim. This means they need immediate attention [11]. With these attributes, the importance, or salience, of all stakeholders can be found. An overview of these attributes is shown in Figure 2.1. After interviews and the workshops, the result is that all stakeholders either are dependent since they need the alarms or definitive since they have in one way or another an important role in the use and process around the alarm. Therefore, this step is not worked out deeper. All stakeholders need to

be interviewed for the next steps of the study. Since this case focuses on the process around unplanned care the focus is on Sensire and NAAST. Therefore, in the next two sections, some more in-depth information on these two is given.

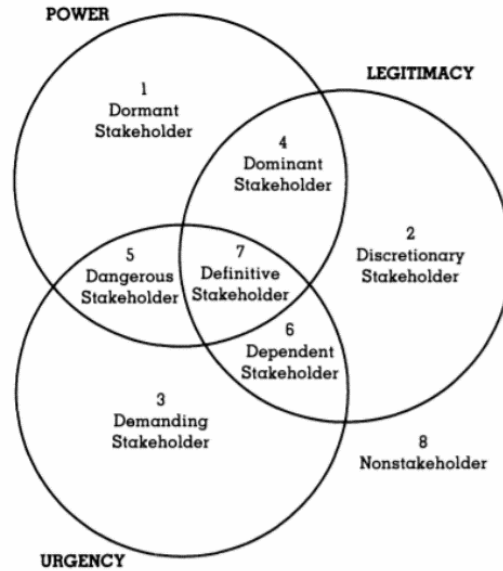


Figure 2.1: Stakeholder salience model [12]

2.1.1 Sensire

Sensire is the largest health care organisation in the Achterhoek in the Netherlands. They offer night care, nursing, specialised care both at home and in nursing homes. Sensire has 1650 employees working within home care, who deliver care to 4900 clients every month [13]. For these 4900 clients living at home, Sensire offers the opportunity to use personal alarms. These alarms are offered by FocusCura. Since there is a business to business (B2B) relationship, Sensire rents these alarms from FocusCura and offers them to the client.

2.1.2 NAAST

The alarms do not work without the emergency centre. NAAST is the emergency centre in this case. NAAST is an emergency centre in Varsseveld, de Achterhoek. Almost 14000 clients have a connection with NAAST. They offer several technical services from a distance to help the elderly living at home. This helps the health care organisation to reduce work pressure. Examples of techniques NAAST uses are: care via video calls, medicine dispenser, sensing, telecardiology and many more. For this case, the focus is only on personal alarms.

2.2 Current processes

For every stakeholder, their role within the process is discussed within interviews. Interviews with experts, employees from NAAST and Sensire, and users of the personal alarms are conducted. This resulted in different viewpoints and showed different aspects of the process that starts when a client uses the alarm. The steps that are performed after the use of the alarms are shown below with steps 1, 2, and 3. Next to the use of the alarm, technical alarms can cause interactions between the stakeholders. This is explained by step 4-6.

Step 1: Client. An older man lives alone and uses the alarms to have a safer feeling in the house and receive fast help when something happens. On a Tuesday morning, he falls while walking to the kitchen. Luckily, he wears his alarm around his neck. After pressing the alarm, the main station makes a speakerphone connection with the emergency centre. A triagist asks the man what happened and makes sure the right help comes his way. Within a few minutes the nurse comes to help the man, the alarm helped him to get fast help after he fell.

Step 2: Emergency centre. As mentioned in step 1 the emergency centre is called when using the alarm. A triagist asks questions on the health of the caller and makes sure the right help is sent. This help can be professional, step 3.1, or social in cases when no medical support is needed, step 3.2. The older man that fell can answer these questions properly since he is close to the main station. Unfortunately, not all calls have a good speakerphone connection, or the client is too far from the main station. When the emergency centre cannot speak to the client, the nurse is always called. The emergency centre uses software with information on the clients and their contacts, this software is called UMO.

Step 3.1: Care organisation. During a planned route, the nurse that is on duty receives a call that an older man fell in his kitchen. Since the nurse is just in the middle of helping another client with his wound care he cannot leave. Therefore, he asks other nurses who can go to the emergency in the employee portal. When nobody can go to the emergency he decides to still go immediately after the client he is helping now. This results in changes in the planning, this results in other clients that need to wait for their daily care. Since this man fell and is in an emergency the nurse is happy to help. Sometimes the nurse needs to go to emergencies to find out it was a false alarm.

Step 3.2 Social follow-up. In cases of alarm when no professional follow-up is implemented in the contract with the client, social follow-up is called. This can be a neighbour, children, and informal care. There are different kinds of this kind of follow-up. Some clients only have social follow-up and this is the first call that is made after an alarm. In some cases there is professional follow-up available but social is called first when no specific medical help is needed. In most cases, professional help is called for every alarm when the client has the right to professional help.

Step 4: Technical events. The main station sends a ‘heartbeat’ to the software every week to check if it is still working. Also, the main station can send messages such as low battery and power failure. Every week an overview of the technical events are sent to the service provider, FocusCura in this case, that there are technical issues.

Step 5 and 6: Technical follow-up. All technical events are combined in an excel file, the mocklist, and sent to FocusCura. These events are checked by the technical staff and if necessary, a technician is sent to the client. Problems like low battery need to be fixed by technicians to make sure the hardware stays safe.

The insurance must also be included in the process even though the insurance has nothing to do with direct care. This because they influence the financial aspects of the process.

Step 7: Insurance. The insurance pays for the worked hours of the health care organisation. For every five minutes a nurse delivers care the insurance pays an amount of money, shown by arrow 7.1 in Figure 2.2. Next to that, the insurance delivers insurance to the client using the alarm, this is different for different clients. In some cases, the client gets the whole alarm reimbursed, sometimes only partly and the insurance reimburses the care delivered after using the alarm, shown by arrow 7.2 in Figure 2.2

A flowchart of the whole process is shown in Figure 2.2

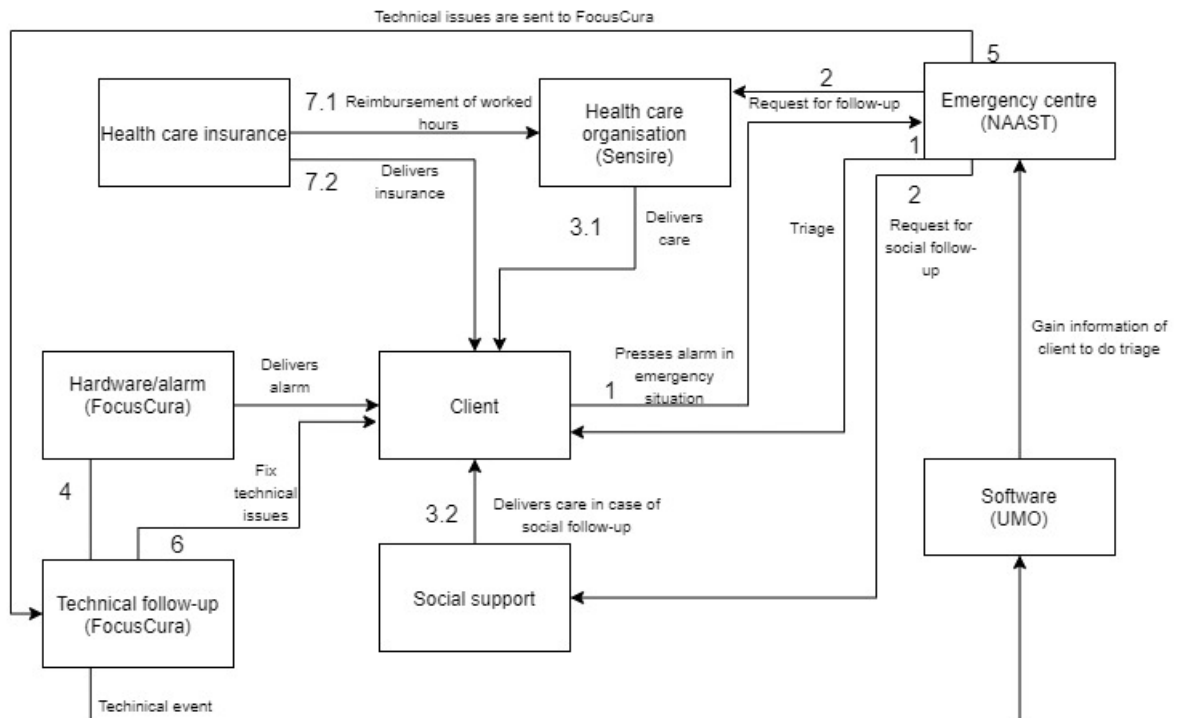


Figure 2.2: Alarm process flowchart

2.3 Drawbacks of the current process

In interviews with the stakeholders and users, several drawbacks of the current process came forward. FocusCura also has drawbacks such as different administrative tasks, different reporting codes, and the mocklist. For this study, FocusCura is not interviewed since the focus is on the process around unplanned care. The drawbacks and expectations are worked out per interviewee.

Sensire. The triage can be better, sometimes there is missing information which makes it harder to deliver good care. Follow-up due to no speaker-phone connection happens a lot, this results in unnecessary follow-ups. The unplanned care moments can be a disturbance, mostly when it is for something that could have waited or done by social follow-up. The unplanned events cause more pressure on the planned route which can cause longer waiting times for other clients. According to a nurse, this is not a problem when there is an emergency. Per district there is one reachable nurse, this means this nurse is being called when emergencies happened. This is not seen as disturbing since it is seen as needed. Nevertheless, when it is for unnecessary care, this can be seen as disturbing. Another disadvantage is the administrative tasks, even though they are unavoidable the nurse thought it could be easier. A problem that occurs when the nurse is at the location is the door, the keys or digital door openings can lead to problems when this does not work properly. Prevention is something that came up a lot during the interview. According to the nurse, this should be incorporated more. For example by tracking when and why somebody uses the alarm. When this changes it might be useful to see if this client needs other help or care.

NAAST. A lot of calls have a bad connection or even no sound, which means no triage can be done. Not in all situations all needed information of the client is available, the ECD for example. In these cases, the nurse needs to look into other sources for relevant medical

2.3 Drawbacks of the current process

information on the client. A lot of events that come in are not real alarm events, the triagist indicates that this is not a big problem since it takes only a few seconds to respond to this.

Client. For clients, the visibility of the alarms can be a problem which might be a reason to not use the alarms. They do not want to look like they are old and need help. The range of the alarms is too small for users that are still able to go out. They would like the alarm to have the possibility to be available outside. Another technical aspect that might add value to the alarms is fall detection, to make an alarm when the client is not capable of using the alarm themselves. Costs are something that is mentioned often, the alarms cannot be too expensive since clients will not purchase them anymore. A qualitative study of FocusCura even showed that this has the highest negative association. A safe feeling is the biggest association for people when thinking of personal alarms. The length of the follow-up is part of the feeling of safety and is not always good enough. Fear of being too much for the caretaker or not using the alarm in the right way is also a drawback and something which can result in the wrong usage of the alarms.

Social care. For social caregivers, some points need improvement as well. For example, the feedback that is received, some informal caregivers would like to know when their family member has used the alarm. So, they know what happened and can react to this as well.

All aspects found within the interviews are summarized in Figure 2.3. This contains all aspects that came up during the interviews when thinking about personal alarms and drawbacks.

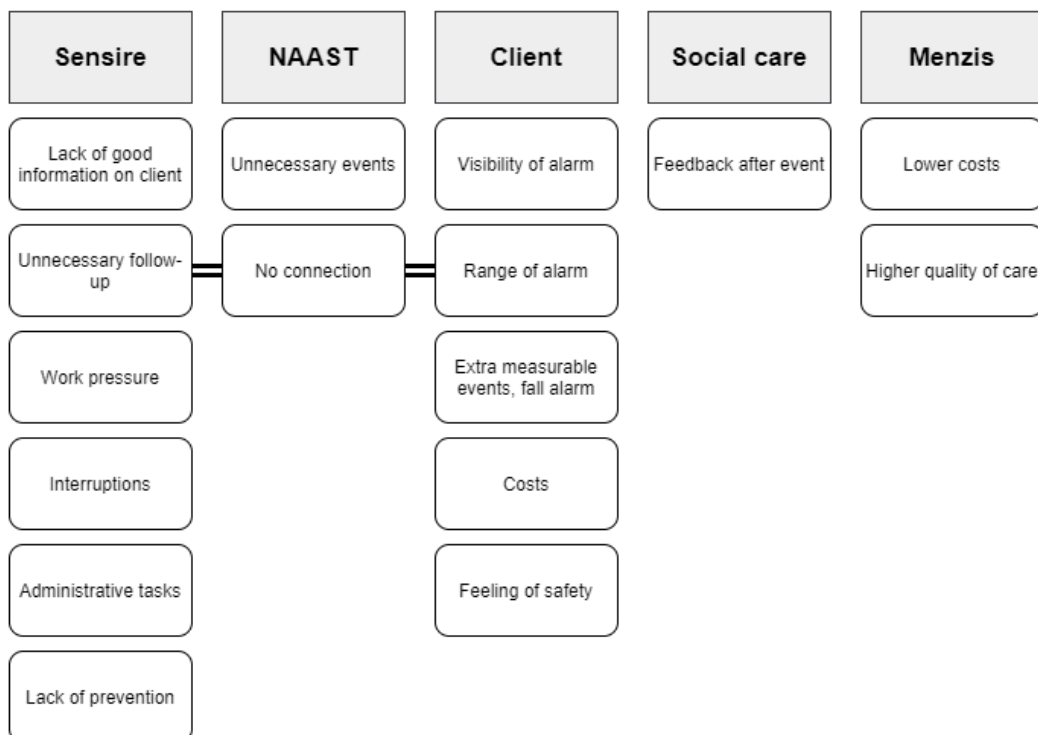


Figure 2.3: Drawbacks per stakeholder

In the consortium, the drawbacks of the personal alarms and the process around are discussed as well. This is done with the use of the quadruple aim. The quadruple aim is a commonly used method within healthcare that covers four important quadrants of healthcare. This model comes out of the triple aim which is developed by the institute for healthcare improvement. The goal is to optimize health system performance [14]. This consists of three components: improve patient experience of care, improve the health of populations, and reduce the costs of health care. Even though this seemed to work the fourth aspect is added, the clinical experience. This resulted in the quadruple aim [15]. The addition of the clinical experience is to make sure the full potential of health performance is reached. The quadruple aim is a good compass to look into current health processes and points to improve the whole system.

The quadruple aim is used in the workshops with the consortium. For each quadrant, the aspects are discussed and turned into deliverables. The results of the workshops are shown below in Table 2.2. Here the main deliverables are shown, in the next chapter these deliverables will be worked out further.

Table 2.2: Quadruple aim consortium

Improve patient experience	Improve clinical experience
<ul style="list-style-type: none"> • More feeling of safety and independence • Adoption of technique • Higher client satisfaction 	<ul style="list-style-type: none"> • Fewer interruptions • More time for care and client • Higher employee satisfaction
Reduce costs	Better health care outcomes
<ul style="list-style-type: none"> • Fewer costs emergency centre • Fewer costs home care organisation • Less care consumption 	<ul style="list-style-type: none"> • Fewer incidents and injury • More insights on overall health • Better quality of care

2.4 Digitisation of personal alarms

As mentioned before, the goal is to overcome the drawbacks that occur in the current situation with digitised alarms. The idea is that most of the drawbacks can be overcome with the digitisation of personal alarms. The main difference between the digital alarm and the now used analogue alarms is the connection and the available data. A digital alarm has a bidirectional connection, which means it is always connected to FocusCura. There is a Care@Home system that is connected to the alarms [16]. The technicians at FocusCura now can see the technical status at all times and can even try to solve them from a distance. The main change here is the communication with NAAST, this becomes less. The goal is that this can lead to faster help when technical events occur. When looking at the flowchart, Figure 2.2, most changes will be in line 5 and the lower line 'Technical event'. While the technical issues can go directly to the hardware company these arrows will not be necessary after digitisation.

Sensire uses 3185 alarms which are all analogue. When changing to digital alarms, few alarms need to be replaced while they are too old to transform to digital. The expectation is that for most of the alarms it is possible to use an analogue to digital converter [17].

Another change is the change from UMO to the EYVIT IoT platform. EYVIT's goal is to make a platform that gives more information about the client, make it easier to do data analysis, and support multiple options for follow-up. With these solutions, presumably, a lot of problems can be solved. For example, with the extensive information in the platform, the triage will be more complete. Also, informal and other forms of care can be informed and

contacted via different (digital) channels to do the follow-up more easily as there is more information. In the flowchart, Figure 2.2, the main differences will be on lines one and two. While the goal is to decrease professional follow-up and increase social follow-up. The arrow between software and emergency centre will stay the same. Nevertheless, the information that is transferred through this connection will be better. More information will be available and the software is easier to use.

There are high expectations of the digitised alarms in combination with a new platform. Nevertheless, several drawbacks hold this innovation from being implemented. This is discussed in Chapter 4 and 5.

2.5 Conclusion

This chapter answered the research question "*What is the current process around unplanned follow-up?*", stated in Section 1.4. The whole process is mapped and drawbacks are found with interviews and workshops. These drawbacks might be solved by digitisation of the alarms. Before something can be said about changes after new techniques, the current performance needs to be calculated. This is done in Chapter 3.

3 Performances of the current situation

In this chapter, the performances of the personal alarms and the process around the use of the alarms are worked out. This is done with the use of Key Performance Indicators (KPIs) and SMART indicators. The theoretical background between these two methods is explained in 3.1.1 and 3.1.2. This theory helps to convert the outcomes of Chapter 2 to indicators that are useful in this case study. This is done in Section 3.2. At last, in Section 3.3, the performance of the current situation is calculated based on the KPIs and data received from NAAST and FocusCura.

3.1 Theoretical background

3.1.1 Key performance indicators

Key performance indicators (KPIs) are indicators that can help to monitor, analyse, and improve processes or organisations [18]. With KPIs can be checked whether objectives are accomplished. Performance is something relative, it differs per situation and work field [19]. According to Badawy et al.[20], KPIs are measurements that investigate the organisation performances and are important for the success of the organisation. The KPIs can be aspects that are known by the company but never further investigated or they can be completely new. With the right KPIs, the right steps can be made. There cannot be too many KPIs, the used ones need to be understandable and mutually exclusive [20]. There are qualitative and quantitative KPIs, qualitative KPIs are based on subjective data and quantitative on objective data and measurements [21]. There are several types of indicators: process, experience (PREM) and outcome. Outcome is a commonly used indicator since healthcare more and more shifts to the value for patients instead of volume [22]. When these outcome indicators are known it does not necessarily result in improvement, but they can say something about the processes that need improvement[23].

KPIs need to be described in a good way, this can be done with the SMART criteria.

3.1.2 SMART indicators

SMART indicators is a way to write meaningful objectives. These meaningful objectives are needed to focus on problems and give a sense of direction. SMART means that all objectives should be: **S**pecific, **M**easurable, **A**ssignable, **R**ealistic, and **T**ime-related [24]. Since this definition is set by Doran in 1981 the usage of SMART changed and therefore some of the definitions changed. Therefore in this case the following descriptions are used [25].

Specific, it needs to be clear what is measured and it needs to be related to the outcome. **M**easurable, the outcome needs to be countable, observed or analyzed. This is because the change or progress needs to be determined. **A**chievable or attributable, the result should be achievable as a result of the process and as a measure of realism. **R**elevant, the outcome should be relevant to the process and be a valid measure. **T**imely, this aspect contains multiple parts. First, the resources should be available within the time frame. Also, the output delivery should be linked to the time frame of the expected change.

The SMART criteria are helpful in this case to see which aspects can be placed into indicators useful for this specific case.

3.2 Key performance indicators on personal alarms

The results from Chapter 2 are summarized with the use of the quadruple aim. This results in several aspects, some are points that need to be taken into account and some points that need improvement. The result is shown in Table 3.1.

Table 3.1: Complete overview quadruple aim

Improve patient experience	Improve clinical experience
<ul style="list-style-type: none"> • Feeling of safety • Shorter duration of follow-up • User-friendliness • Patient centeredness • Care received at planned time • Overall satisfaction • Range of the alarm • Lower costs of the alarm • Events measurable 	<ul style="list-style-type: none"> • Fewer interruptions during care • Less administrative actions • Less work pressure and stress • Routing • Higher overall satisfaction • More information on client • Triage • Fewer unnecessary follow-up • Access to homes • Speakerphone connection
Reduce costs	Better health care outcomes
<ul style="list-style-type: none"> • Fewer unnecessary calls/events • Fewer unnecessary follow-up • More social care follow-up • Less time per case • Right caretaker per case 	<ul style="list-style-type: none"> • Fewer falling incidents • More prevention • Routing • More and better information on clients

Since the aspects in Table 3.1 are not necessarily indicators they need to be rephrased. With the SMART criteria is checked whether the indicators are useful and measurable in this case. Table 3.2 gives an overview of the indicators and whether they are SMART. It is important to note that the indicators are chosen based on the interviews and workshops. Some of the indicators are not seen as SMART because they are not directly influenced by the digitisation, so not achievable by this case, or can not be measured due to time limitations of the study.

Table 3.2 also shows on which level this indicator impacts follow-up after digitisation. There are three levels where digitisation might impact the process: reduce, reroute, and refine. Reduce has the most impact on the process. These are events and follow-up that were not necessary at all and should be avoided. With reroute, some type of follow-up is needed but it is important to choose the right follow-up. At last, refine, this means refining the process. Professional follow-up is needed but the way the follow-up is handled can be improved. Better could be faster, with more care, with fewer interruptions, more informed or improved in another way. The impact is seen as what impact improvement of this indicator would have on the total process. Reduce will directly show differences in the process, reroute might be more difficult to achieve and refine are changes that will be created by improvement of the other indicators.

Table 3.2: SMART indicators

Indicator	SMART	Impact
Feeling of safety	Yes	Refine
Duration of follow-up	Yes	Refine
User-friendliness	No	-
Patient centeredness	No	-
Care received at planned time	Yes	Refine
Overall satisfaction client	Yes	Refine
Range of alarm	Yes	Reduce
Costs of alarm	Yes	-
Optional service extensions	Yes	Refine
Interruptions during care	Yes	Reroute
Administrative actions	Yes	Refine
Work pressure and stress	Yes	Refine
Efficient routing	Yes	Reroute
Overall satisfaction employee	Yes	Refine
Available information on client	No	-
Quality of triage	No	-
Unnecessary follow-up	Yes	Reduce
Time needed to access home	No	-
Follow-up as a result of no response events	Yes	Reduce
Unnecessary calls/events	Yes	Reduce
Social care follow-up	Yes	Reroute
Duration of technical follow-up	Yes	Reroute
Duration of event/call	Yes	Refine
Caretaker on right case	Yes	Reroute
Falling incidents	No	-
Bed days after an accident	No	-
Prevention	No	-

After the SMART criteria, there are nineteen aspects left that can be turned into indicators. Since in this study the focus is on quantitative measures the qualitative indicators are removed first. These are the feeling of safety, overall satisfaction client, work pressure and stress, and overall satisfaction employee. Some of the aspects are interrelated. For example, time per case and duration of technical follow-up both have to do with the total duration of follow-up. For this reason, this is taken together as indicator one and subdivided into the different aspects of follow-up. The same applies to indicator eight, the unnecessary follow-up has to do with the percentage of social follow-up and caretaker on the right case. Social follow-up and caretaker are similar and therefore taken as one. All indicators are shown in Table 3.3.

Table 3.3: Indicators with measures

1. Duration of follow-up	
Measure	Time before arrival of follow-up
Sub measures	Time between nurse is called and arrival
Needed	Data from a nurse on time
Metric	Time

3.2 Key performance indicators on personal alarms

1a. Duration of phone call	
Measure	Time on the phone after using alarm
Needed	Data from software on incoming alarms
Metric	Time

1b. Duration of technical follow-up	
Measure	Time between technical event and arrival of technical follow-up
Needed	<ul style="list-style-type: none"> • Data from software on incoming technical events • Data from FocusCura time before of technical follow-up
Metric	Time

2. Care received at planned time	
Measure	Time difference between planning and actual arrival nurse
Sub measures	<ul style="list-style-type: none"> • Planning of planned care • Actual arrivals on care
Needed	Data from Sensire on planning and actual arrivals
Metric	Percentage of time per month

3. Range of the alarm	
Measure	The distance where the wrist/neck alarm can still connect to the main station
Needed	Data from hardware on distance
Metric	Meters

4. Costs of alarm	
Measure	Total costs of alarm
Sub measures	<ul style="list-style-type: none"> • Installation costs • Monthly costs • Reimbursements
Needed	<ul style="list-style-type: none"> • Data from FocusCura on costs • Data from Menzis on reimbursement possibilities
Metric	Euros

3.2 Key performance indicators on personal alarms

5. Optional service extensions	
Measure	Number of different events the software can process
Needed	Events or inputs by extra hardware that can be processed by software
Metric	Numbers

6. Interruptions during care	
Measure	Number of calls a nurse receives during the planned route because of emergencies
Needed	Data on the number of calls for emergencies from nurse
Metric	Numbers per day

7. Administrative actions	
Measure	Overall administrative actions a nurse or an emergency centre employee needs to do
Sub measures	<ul style="list-style-type: none"> • Time in employee portal of nurse • Number of clicks of emergency centre employee per event
Needed	<ul style="list-style-type: none"> • Data from employee portal for time on application • Data from software on the number of clicks
Metric	Time on screen

8. Routing	
Measure	Distance and time nurse has to travel for unplanned care
Needed	Data from Sensire on travel distances and time to unplanned care
Metric	KM

9. Unnecessary follow-up	
Measure	Percentage of unplanned follow-up which was not an emergency
Needed	Data from Sensire on the number of follow-ups that are false alarms or non-optimal follow-up
Metric	Percentage per month

3.3 Performances of the current situation

9a. Social care follow-up	
Measure	Percentage of total follow-up which is social care
Needed	Data from NAAST on the percentage of alarms and sorts of follow-up
Metric	Percentage per month

10. Follow-up as a result of no response events	
Measure	Percentage of alarms that do not have sound or connection
Needed	Data from NAAST on the percentage of alarms with no sound or connection
Metric	Percentage per month

11. Unnecessary calls/events	
Measure	Percentage of calls NAAST must handle which was not needed
Sub measures	<ul style="list-style-type: none"> • Number of false alarms • Number of calls that could have been handled differently
Needed	<ul style="list-style-type: none"> • Data from NAAST on the percentage of alarms with no sound or connection • Data from NAAST on the percentage of alarms that could have been handled differently
Metric	Percentage per month

3.3 Performances of the current situation

The goal in this section is to calculate the performance of the current situation, with the analogue alarms, based on the KPIs determined in Section 3.2. With data from the stakeholders, these KPIs can be calculated. Part of the data comes from NAAST, which comes from the UMO software. This data shows the alarms that came in and what kind of alarms these are. The data from NAAST contains information of the date, time, alarm criteria, kind of alarm, comments on the alarm, the category of the reason for the alarm, more information on the reason, and if social care or Sensire did the follow up. The available data is data from January 2021 to March 2021. It is based on 3578 clients who use the alarm. A total overview of the data and possible outcomes are shown in Appendix B. Other data comes from FocusCura and information from NAAST and Sensire. The data does not have a trend, all months show similar numbers on the different events. This means one month will show a good average of the performances per month, therefore the data from January is used.

Before the data can be used to calculate the performance, the availability of the data needs to be checked. This is shown in Table 3.4.

Table 3.4: Available data per indicator

Indicator	Data available	Source of data
1. Duration of follow-up	No	-
1a. Duration of phone call	Yes	NAAST
1b. Duration of technical follow-up	Yes	FocusCura
2. Care received at planned time	No	-
3. Range of the alarm	Yes	FocusCura
4. Costs of alarm	Yes	FocusCura
5. Optional service extensions	Yes	FocusCura
6. Interruptions during care	No	-
7. Administrative actions	No	-
8. Routing	No	-
9. Unnecessary follow-up	No	-
9a. Social care follow-up	Yes	UMO data
10. Follow-up as a result of no response events	Yes	UMO data
11. Unnecessary calls/events	Yes	UMO data

3.3.1 Duration of phone call

The average duration of phone calls can differ a lot between days due to lots of false alarms which is short or long alarms where for example the ambulance needs to be called. With the expert opinion of nurses from NAAST, the duration of the different event types is determined. No response events can take up to 100 seconds, a false alarm will take around 30 seconds and a feedback event around 10 seconds.

3.3.2 Duration of technical follow-up

The duration of technical follow-up consists of two parts. NAAST receives the alarm and every Monday a mocklist is sent to FocusCura. Every week the main panel sends out a heartbeat signal to check if the connection is still working. When this heartbeat can not make a connection three times in a row, action is taken. This means it can take up to four weeks before FocusCura knows a technical follow-up is needed. For events such as low battery it can take up to two weeks, a week before the mock list arrives, a few days to turn the event into a ticket and a few days to plan the follow-up. This long time between technical event and follow-up can lead to dangerous situations.

3.3.3 Range of the alarm

As mentioned before the alarm has a main panel and a button around the neck or wrist. The range where the external button can connect to the main panel is 400 meters in the open air. Inside walls might block the signal so the range inside is less than 400 meter. The speaker-phone connection is only available in the main panel. Therefore, this 400 meter is not always correct but the range depends on the space around the main panel [26]. This only is the range of the hardware but does not say anything about the number of times it was a problem for a client. An option would be to also measure the number of times somebody tried to make an alarm but was not able to because he was too far away from the main panel.

3.3.4 Costs of alarm

The costs of the alarm consist of connection costs and monthly service costs. In this case, the costs are determined by Sensire because there is a Business to Business (B2B) relationship

with FocusCura. The monthly costs for the analogue alarm are €24.74 or €37.73 for one main panel and one neck alarm. This difference depends on the type of connection, the prices are for connection to the landline and with use of GSM, respectively. The one-off installation costs are €85.70 [27].

3.3.5 Optional service extensions

At the moment a couple of events can be detected by the alarm. Alarm events, power failure, low battery. No service extensions, such as fire alarms, can be added to the analogue alarms.

3.3.6 Social care follow-up

The percentage of social care follow-up has to do with the contracts clients have. Some clients only have an alarm with social follow-up, in these cases the social follow-up is called. In all cases with professional follow-up, the nurse is called first. This results in a low percentage of social follow-up in January 2021, see Figure 3.1. When looking at the free text boxes within the data, social follow-up is often used because somebody is already present. This means there is little follow-up where the emergency centre calls the social follow-up directly.

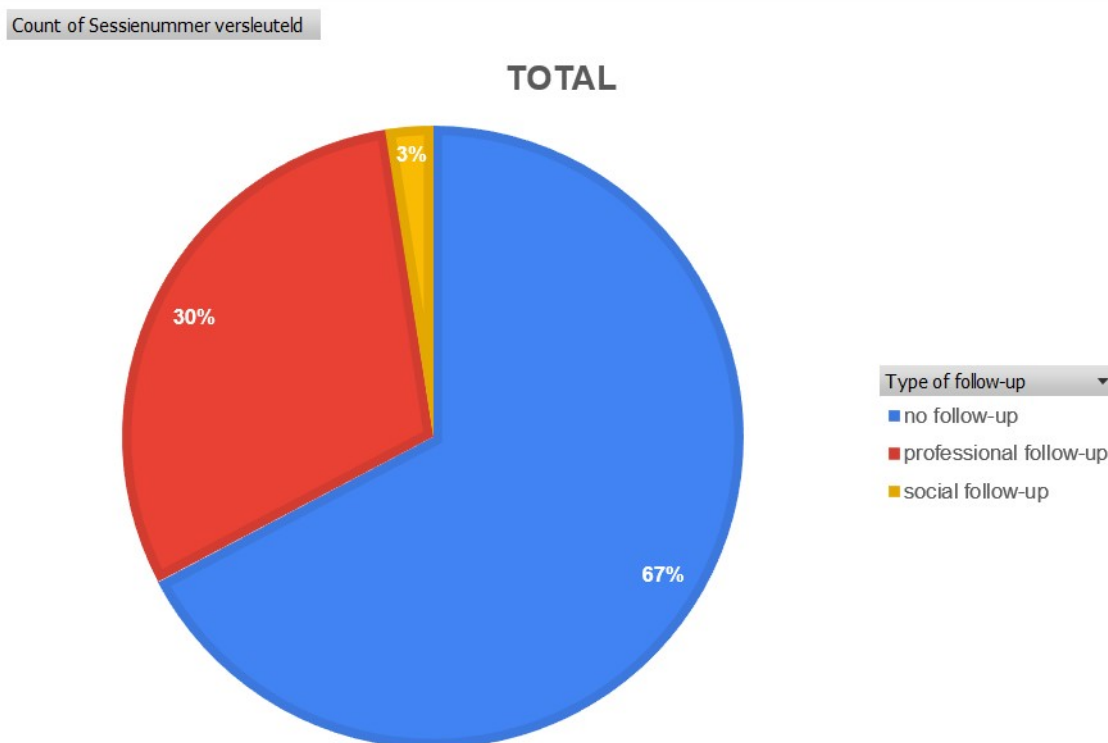


Figure 3.1: Percentage per follow-up based on 3128 events, UMO data NAAST from January.

3.3.7 Follow-up as a result of no response events

The no response events event have to do with the range of the alarm, quality of connection and ability of the client to use the alarm. When the number is high this shows improvements are needed on the alarms. As can be seen in Figure 3.2, there are 176 no response events in January, this is 5.6%. Research by FocusCura with care organisations in Limburg shows

3.3 Performances of the current situation

that around 70% of follow-up after a no response event is unnecessary. This means in this case there are over 120 events per month that could have been avoided with a better speakerphone connection.

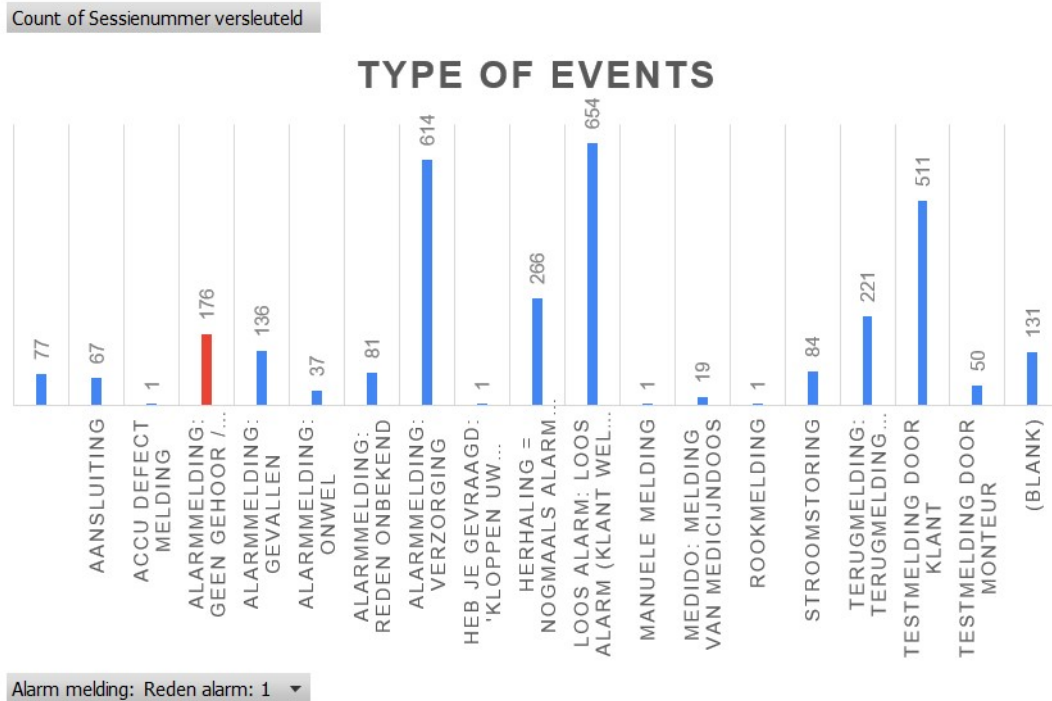


Figure 3.2: Number events based on 3128 events, red is no response event. UMO data NAAST from January.

3.3.8 Unnecessary calls/events

Unnecessary events are the events that come in at NAAST that could have been handled otherwise. To see which ones these are, an overview of the events is made whether digitised alarms might improve this, see Table 3.5.

Table 3.5: Effect digitisation on events

Event	Avoid events with digitisation
New connection	Yes
Battery defect	Yes
Alarm notification: No response	Yes
Alarm notification: fallen	No
Alarm notification: unwell	No
Alarm notification: reason unknown	No
Alarm notification: care	No
Have you asked: "Are your details still correct?"	No
Repetition = Alarm again within 10 minutes of previous report	Yes
False alarm (did speak with the client)	No
Manual alarm	No
Notification of medicine box	No
Smoke alarm	No
Power failure	Yes
Feedback: feedback by (informal) care	Yes
Test report by customer	Yes
Test report by technician	Yes

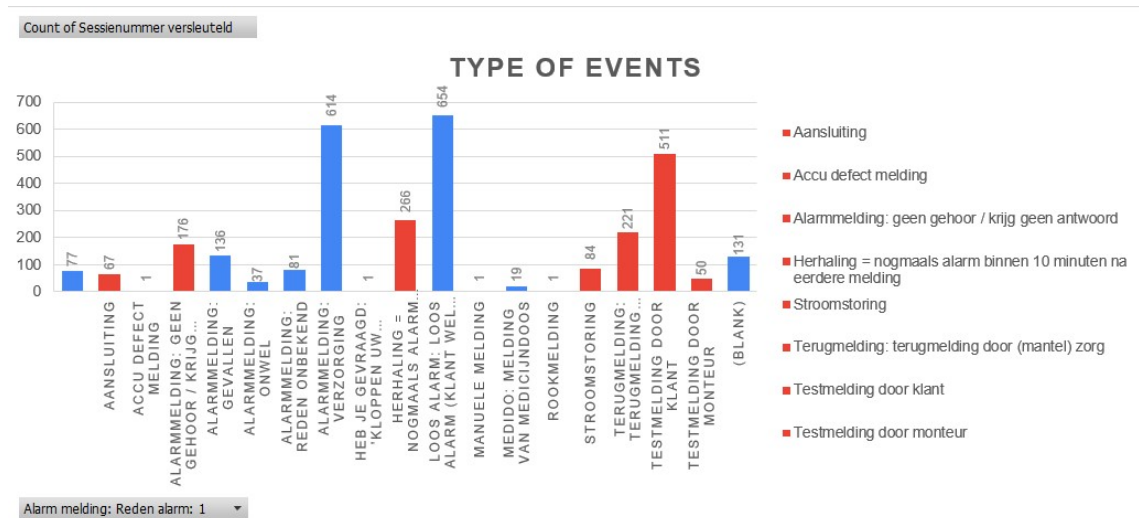


Figure 3.3: Number of events per event type based on 3128 events. UMO data NAAST from January.

Figure 3.3 shows the results. In total 1376 alarms are not necessary or could have been handled differently, which is 44% of the total amount of events. This means with improvements within the alarms and software a lot of events can be avoided. The no response events are also looked into for this indicator since this can be solved with the digital alarms. The events that can improve with digitisation will not all be improved by just the digital alarm but a change in the software platform is also needed.

3.4 Conclusion

The goal of this chapter is to answer the research question *What is the current performance of unplanned follow-up?*. With several indicators, the performance of the current situation

is assessed. Unfortunately, there is not enough data to measure the performance. The indicators that can be measured show that there is little social follow-up, a high number of no connection events and a lot of events that do not need to go through to the emergency centre. These are all aspects that might be improved with the use of digital alarms. Even though the digitisation of the alarms looks promising, there are still aspects that hold back implementation. Chapter 4 is a literature review of these barriers.

4 Theoretical background

In this chapter, literature on implementation of innovations within home care is discussed. With a systematic literature search, the barriers to implementation are found. Barriers are investigated since the interviews and workshops, mentioned in the previous chapters, raise the question of what the barriers are for innovation. There are a lot of drawbacks within the current situation and most interviewees know about innovations or improvements that are possible. This means several other drawbacks are holding back implementation of digitisation of personal alarms. Next to these expectations coming from the interviews, an article by Ross et al.[28] shows the complexity of eHealth implementation. This confirms that the barriers need to be found. With the barriers, solutions can be devised to overcome the barriers and make sure implementation goes well. The method is discussed in Section 4.1 and in Section 4.2 the results of the systematic literature review are shown.

4.1 Systematic literature review

A literature search to implementation barriers of innovations within home care is performed. Several search words are used to find the right combination of search words. Telemedicine, eHealth, telecare are examples of words used to focus the search on these kinds of innovations. The second part of the search needs to focus on the population, therefore terms such as elderly, elderly care, and home care are used. Some of the combinations resulted in too many articles or looked not relevant straight away. This resulted in the final search with search words ‘Telemedicine AND ‘elderly care’ AND barriers’. Scopus is the used search engine, this resulted in 167 articles. After screening, 8 articles remained that fit the requirements. The requirements are that it must be on elderly care, eHealth or telehealth, not specified to one disease and within a western country. With snowball effects and later found articles the final analysis is done with eight articles [29, 30, 31, 32, 11, 33, 34, 35]. The total overview can be seen in the PRISMA in Figure 4.1

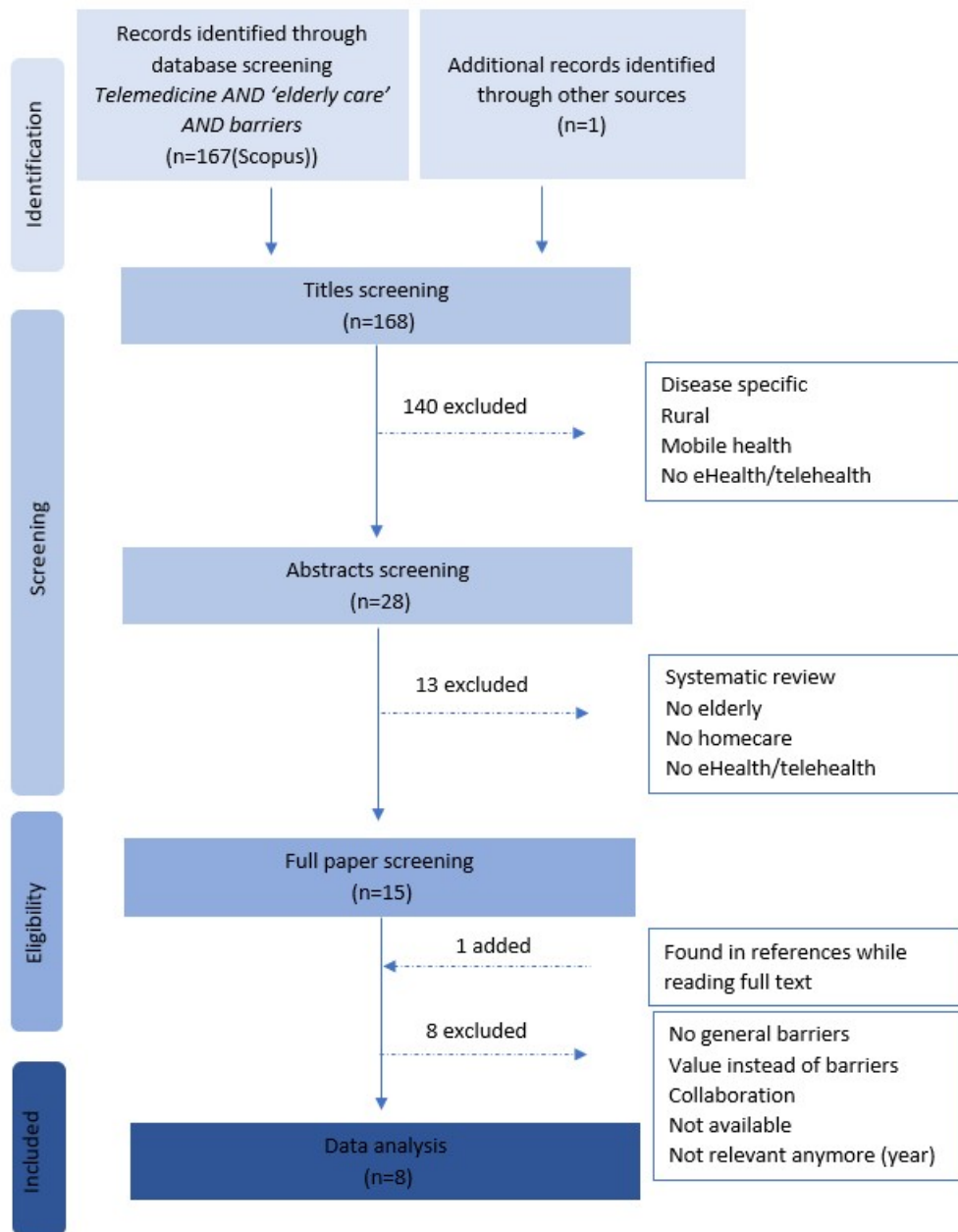


Figure 4.1: PRISMA model

4.2 Outcomes systematic literature review

The eight articles are read and analysed on their view on implementation and the barriers to implementation. Table 4.1 is an overview of all the articles.

Table 4.1: Results from systematic literature review

Study	Target group	Technical innovation	Barriers
Brindha (2012)	-	User interface, wireless communication, sensor technologies, New Internet technologies and Web services	<ul style="list-style-type: none"> • Lack of awareness • Technical issues • Regulation issues • Lack of standardization • Poor implementation and lack of effective business models • Insufficient validation
Campling et al. (2017)	Elderly over 60 years old and key supply chain players	Telehealth devices such as fall detection, medication dispensing and vital sign monitoring	<ul style="list-style-type: none"> • Evidence for effectiveness • Lack of independent expertise and knowledge • Lack of public awareness
Cook et al. (2016)	Users and non-users of technology	Telehealth and telecare	<ul style="list-style-type: none"> • Lack of information of service • Lack of experience and confidence in using equipment • Stigma to using equipment • The inconvenience of using equipment
Greenhalgh et al. (2015)	Technology suppliers, elderly with assisted living	Telehealth and telecare	<ul style="list-style-type: none"> • Attributes of technology • Characteristics of intended user, capabilities, relative advantage over existing arrangements, low complexity and risk • Extent and nature of social influence (awareness) • Low-level organisational innovativeness (budgets) • Low level of readiness • Weaknesses in the assimilation process • Weak embedding of telecare in business-as-usual • Poor links between users and developers at the design stage
Olsayi Oderanti and Li (2018)	Elderly and eHealth entrepreneurs	Telecare, telehealth, telemedicine, and digital participation services	<ul style="list-style-type: none"> • Technophobes • Elderly with disabilities • Security issues • Small market size • Inadequate planning, integration, technological problems, and interoperability • Poor user centered design • Cost-effectiveness • Policy and regulations • Market competitions • Control and interference

Table 4.1: Results from systematic literature review

Study	Target group	Technical innovation	Barriers
Vannieuwenborg et al. (2016)	Key actors such as care receiver, (in)formal care provider, and home care organisations	eCare platforms	<ul style="list-style-type: none"> • The complexity of the eHealth and eCare value network, different health systems • The added value of services still needs to be proven • Technical barriers • Lack of financial support on a policy level • Current willingness to pay, reimbursement by insurers • Privacy concerns and legal issues
Ehrenhard et al. (2014)	Parties involved in development	Smart home platform	<ul style="list-style-type: none"> • End-users need to be convinced of the value • Reliability for platform management, maintenance, costs, standardization (implementation) • Price, value creation and capture • Role of the government
Chiang et al. (2015)	Healthcare providers	Telecare	<ul style="list-style-type: none"> • Unsuitable laws and vague policies • Implementation strategies do not meet public needs (added values) • Lack of organisational support, no cooperation (lack of knowledge) • Lack of operating standards and evidence (lack of clinical effectiveness) • Lack of quality and convenience of the system (usability) • Inadequate public perception and attitudes

The barriers that are found can be categorised into eight categories. This resulted in the following categories: awareness, regulation/politics, validation/added value, business model, technical aspects, usability, privacy, and knowledge of stakeholders.

Awareness focuses on the end-user who needs to know, accept, and use the product otherwise it will not be properly used in practice. The reimbursement and agreements between insurance companies, health organisations, and the government are covered by the barrier *regulation/politics*. A barrier that overlaps multiple levels of stakeholder is the *validation/added value*. The investor needs the product to deliver value to the company in money. On the other hand, the end-user benefits from a product that adds to the quality of life for example. These values need to be validated to make it easier to implement the innovation. *Business model* is a broad barrier, an example is a complex market that can make communication hard, this also includes standardization and processes. *Technical aspects* are problems that can occur within technology, a device or innovation that works poorly is less likely to be implemented. *Usability* is part of technology but is mentioned so often that it is seen as a separate barrier, especially in healthcare, products need to be easy to use to

be helpful in the process. Also, *privacy* is a barrier that can be seen under the technology domain but again this is a barrier that is mentioned a lot separately. In healthcare there is a lot of patient data, this data needs to be secured. At last, *knowledge of stakeholders* is a barrier that focuses on all stakeholders and their use of the innovation. To make sure the innovation is used in the right way all stakeholders need to have the right knowledge, usage and experience with the process.

4.3 Conclusion

The literature review shows eight categories for barriers: awareness, regulation/politics, validation/added value, business model, technical aspects, usability, privacy, and knowledge of stakeholders. These barriers are found within home care and for similar techniques to the personal alarms. Therefore in Chapter 5, these barriers are used to find the current state of implementation of digitisation of personal alarms.

5 Implementation of digitisation

In the previous chapters, the current situation of the personal alarms and barriers to implementation are discussed. With this information, the next steps of implementation can be determined. First, the barriers found in Chapter 4 are combined with the current situation and steps that are already made. This results in an overview of barriers that still must be overcome in this case which is explained in Section 5.1. In Section 5.2, the barriers most relevant for this case are worked out.

5.1 Barriers

The eight categories of barriers found in Chapter 4 are here combined with the case of this study. For all barriers, the current situation and link to the case are discussed.

Awareness, for personal alarms there already is a high awareness within elderly. FocusCura conducted a questionnaire that shows 75% of respondents are familiar with personal alarms [36]. Among the respondents, there are people age 65 and older and children of these elderly. Since the digitisation and change of platform mostly affects the emergency centre, awareness among these employees is needed. Awareness is not only the fact that users and stakeholders know the product but also acceptance plays a role here. The user of the alarms already accept the use of the alarm, but the price might still be a barrier. The questionnaire of FocusCura showed that the ideal price for the client is €10-€20 per month. This needs to be considered when promoting digitised alarms. On the other hand, the emergency centre employees need to accept the change. With good information and proof of added values, this acceptance might be easier.

Regulation/politics, Menzis cooperates in the consortium to ensure this barrier will not be a problem and all aspects are thought about. Menzis decides on contracts and reimbursement in care. Interviews with employees from Menzis show that business cases are needed before implementing innovations. This because the innovation should increase performances and/or decrease the costs.

Validation/added value is a relevant barrier in this case. Digitisation needs to add values to the current situation. This means that performances need to be better for digital alarms compared to the analogue alarms that are used now. With the KPIs established in Chapter 3, this can be done. A comparison of the performance of the current situation with the performance after implementation can be made. A small implementation can be done in the form of a pilot study. Good results in this pilot study will help in further implementation on a larger scale. A lot of data is not available and a pilot is not done yet. Therefore, this barrier is important within this case and needs a lot of attention.

Business model, this barrier focuses on all the aspects of implementation. A business model that is used in health care is the STOF model [37, 38]. This focuses on four main domains: service, technology, organisation, and finance. The service domain focuses on customer value and value proposition. Technology is about technical functionality such as security. In the organisation domain the actors, structure, and value network are looked into. At last, the finance domain consists of investments, costs, and revenue [39]. For this case, the service domain corresponds to the barrier of awareness. Technology is also a specific barrier. The organisation domain is extensively discussed in Chapter 2, where the stakeholders and process are explained. The finance domain corresponds to the regulation and politics barrier. For this reason, this barrier does not need specific attention in this case since it is either already appointed or coincides with other barriers.

Technical aspects, this barrier covers the barriers usability and privacy. The main technological aspects are already within the current personal alarms. Nevertheless, as seen in Chapter 2, there are still some improvements possible. For that reason, this barrier can still counteract

implementation. With input from expectations of all stakeholders and hardware and software developers a good overview of technical aspects that need to be implemented within the digitisation of the alarms can be made.

Knowledge of stakeholders is the last barrier. This barrier can be overcome with the effort of all stakeholders. Nevertheless, it would be good if there is one main information point. This makes it easier for stakeholders who are unsure about implementing. When a general learning program or information point is available, it might be easier to accept implementation. An example is the ambassadors of Sensire that give workshops to their colleagues about innovations to improve acceptance throughout the whole company.

A conclusion on these barriers can be made. Since for several barriers the validation and added values need to be proven this is seen as the barrier that needs to be overcome first in this case. For awareness and knowledge of stakeholders, the added values need to be known to increase acceptance. For regulation and politics the added values are needed as part of the business case. At last for the service and finance domain of the business model barrier, the added values are needed. For this reason, the steps that need to be taken to overcome this barrier within the current situation are discussed in the next section.

5.2 Validation and added values

As seen in Section 3.3, not for all indicators data is available. To make sure the performance can be measured properly, and to overcome the barrier it is needed to make data available on these indicators. In Table 3.4 can be seen that the following indicators have no data available: duration of follow-up, care received at planned time, interruptions during care, administrative actions, and unnecessary follow-up. For these indicators, a short proposal for the data collection on the current situation is made.

5.2.1 Duration of follow-up

As mentioned, the duration of professional follow-up consists of two parts: the time of the emergency call and the time between the call to the nurse and arrival of the nurse. The duration of the phone call is looked into with indicator 1a. The time between the call to the nurse and arrival is not measured. This is because there is no consequent feedback from the nurse after arrival at the client. This can be measured in several ways, an option would be to ask the arrived nurse to always give a feedback alarm when they arrive. Another option might be to use GPS tracking on cars or phones.

5.2.2 Care received at planned time

This indicator is completely dependent on Sensire. They have data on the planned nursing moments but there is no feedback on the actual arrival. To measure this there should be changes within the employee portal of the nurses. For example, that they have to press a button when they arrive at the client. Another option is to again use GPS tracking. With an algorithm, the planning and GPS data can be combined.

5.2.3 Interruptions during care

Interruptions during care can be measured relatively easy. With counting the incoming calls through the day for example. This might be forgotten within the rush of delivering care. Therefore phone data can be useful for this indicator. When the emergency company always calls from a specific number, data on the number of times they call and the time these calls take can be collected.

5.2.4 Administrative actions

Administrative actions is a difficult indicator since it is not only affected by the alarms. When other changes happen in the working process of the nurse this might also change. On the other hand, for the NAAST employee, the software influences the administrative actions. The number of clicks an employee needs to do for one specific event can be a measure for the administrative actions.

5.2.5 Routing

Data on routing can become available with tracking of nurses and the distances they travel. A difficult aspect here might be that it is not known if a nurse travels for planned or unplanned care. A combination of GPS data with the ECD can help to overcome this problem

5.2.6 Unnecessary follow-up

To collect the data for this indicator, Sensire is the main source. Now nothing is known about the reason for follow-up after no connection. To measure this, the most simple way is to always log feedback to the emergency centre. With this feedback, a concrete reason for the follow-up can be given. When the data is filled in by options instead of open text fields data can be retrieved from this automatically. Another way is to add an extension to the employee portal of the nurse where the reason for follow-up can be logged.

5.3 Conclusion

We conclude that barriers influence implementation and that validation and added values barrier is the most relevant in this stage for this case. There is still a lack of data, this data is needed to overcome the barrier of validation and added value. Nevertheless, there are some expected potentials of digital alarms and the EYVIT platform which show the great potential of implementation this is discussed in Chapter 6. This chapter focused on the barriers and specifically on the validation. In Chapter 7 the other barriers are discussed and the role of all stakeholders in line with the barriers.

6 Digitisation of alarms

Digitisation of alarms and changes in software and processes show a lot of potentials. This potential consists of two parts, the performances from Chapter 3 will increase and more data will be available which can help to gain knowledge on the indicators in Chapter 3 that are not further looked into.

6.1 Indicator performance of digital alarms

Even though a lot of data is missing there already are ideas about the effect of digitisation. These ideas come from digital alarms that are already implemented for a few clients. This section discusses the potentials of digitisation of the personal alarms. The potentials are determined, using the indicators shown in Table 3.3.

6.1.1 Duration of follow-up

Follow-up now goes via emergency centre and they call the reachable nurse. With a new and improved platform, the follow-up can be faster. For example, tracking of the nurses will show which nurse is closest and can to the emergency fastest. This needs more changes than just a digital main panel and a smarter platform but will help a lot to increase the performance of unplanned follow-up.

6.1.2 Duration of phone call

As can be seen in Figure 3.3 there are a lot of events that can be handled differently. The technical events: new connection, battery defect, smoke alarm, power failure, can be handled by FocusCura directly when using digital alarms. These alarms do not need to be handled by NAAST first. The other alarms that might not be needed to be handled by NAAST are test alarm, repeated alarms, and feedback alarm. These events can be filtered with the new software. This is not developed fully yet but there are promising options available.

6.1.3 Duration of technical follow-up

The duration of technical follow-up will change directly after using the digital alarms. The connection between the hardware and software of FocusCura goes directly. This means that FocusCura can see events immediately when they occur. For a no connection event of the main alarm, a ticket is created within 24 hours and lost connection with the neck alarm takes eight days. These eight days are to make sure no ticket is created when somebody leaves the house for a few days. When these events come in at FocusCura there is an option to solve them via the software. This means no installer has to go there. For low battery, the follow-up will be faster since the ticket is made directly instead of waiting for the mocklist and make a ticket manually. This means that the technical follow-up goes from 3-4 weeks to 1-2 weeks.

6.1.4 Care received at planned time

For this indicator, the effect of unplanned follow-up on normal planning is looked into. The changes mentioned at "duration of phone call" will also affect the care received at planned time. In the current situation, the reachable nurse is contacted for every event in their region. With new software and tracking of locations, the most logical nurse is called or even messaged with just a text. This can help to decrease interruptions and travel times between clients. This helps to maintain the planning and make sure the planned care has as little effect on unplanned care as possible. It is good to consider the fact that changes in planning are not only affected by the alarms and unplanned follow-up. This should be taken into account when measuring this indicator.

6.1.5 Range of the alarm

The range of the alarm will not necessarily change with digitisation but extra hardware can be used. The digital alarm can handle more events coming from other hardware products. One of these products is a VPD, Voice Panic Detector, which can extend the speakerphone connection to other rooms. Next to the extra speakerphone connection which will reduce the no response events, there is speech activation. Speech activation can be useful when the client is not able to press the button anymore.

6.1.6 Costs of alarm

The digital alarm will cost €24.95, or €20.95 without the possibility to add service extensions [27]. The extra hardware such as VPD and smoke detection cost extra per month. With the change to a new software, there might be overlapping costs during the switch to the new software. The exact costs are not known.

6.1.7 Optional service extensions

The analogue alarms can only measure the use of the button and the technical events low battery and power failure. With the digital a lot more events are possible. This is because of the two-sided connection and because of the extra hardware that can be connected. 71 events can be measured with digital alarms and the right software. Of these 71, some events are cancelled events which means the incoming event was cancelled. This means tickets that are created are removed from the system. Important extra options for service extensions are possible fall alert, unusual activity alarm, door left open alert, no activity, and wandering. These are part of the cAlarm Sense. This senses deviations of the living pattern[40].

6.1.8 Interruptions during care

This can be improved by calling a nurse that is available and close to the event. This will reduce the time the reachable nurse needs to call or text other nurses. Also, an option to text nurses instead of calling can reduce interruptions. These are all solutions with another software that focuses on these aspects. The digital main panel with the extra VPD can also help to reduce interruptions. This is because there will be less follow-up after an alarm with no response that was not needed.

6.1.9 Administrative actions

The administrative actions will not change for the nurse. This is dependent on the employee portal of the home care organisation. For the NAAST employee, the new software can reduce administrative actions. With a better combination of information platforms, such as the patient dossier and information on sort of follow-up, the triage can be improved and made easier.

6.1.10 Unnecessary follow-up

As already mentioned in 'Range of alarm', a VPD is the main tool to reduce unnecessary follow-up. With the VPD the client has more places in the home where he can communicate with the emergency centre. This will lead to fewer events without response and therefore less unnecessary follow-up.

6.1.11 Social care follow-up

An increase in social care follow-up will go together with other indicators, such as interruptions and unnecessary follow-up. More social follow-up can be achieved by smarter software. With more options for follow-up, the emergency centre does not have to call the professional care

in all cases. Next to this, the cAlarm Sense can help to increase social care follow-up. The contact person for social care receives updates on their loved ones and when needed they can support them. This will not increase the number of social follow-ups since this is not monitored. Nevertheless, it will decrease the number of professional follow-ups.

6.1.12 Follow-up as a result of no response events

The performance of this indicator will also be improved by the VPD. This because the VPD will increase the places where a speaker-phone connection can be made and therefore less no response events will be made.

6.1.13 Unnecessary calls/events

Unnecessary calls or events is a difficult indicator to change. The technical events are moved to FocusCura directly, this will not change that much since the technical events are mostly not calls to NAAST. For FocusCura this leads to less administrative burden. Other events that seem unnecessary such as the test event, can be decreased by smarter software. The digital alarms do not need a monthly test alarm. This is needed for the analogue alarm since the weekly heartbeat message can only track problems in the neck alarm when this is used.

6.2 Improvement of other indicators

The performances mentioned in Section 6.1 are the indicators that can in theory be measured with the analogue alarm as well. There are still some other indicators that are important but are not taken into account because the analogue alarms can not measure this or there will not be a difference between analogue and digital. Still, these indicators can help to indicate the performance of the overall home care. With the digital alarms and a new platform, more data can be obtained. The indicators from Table 3.2 that are affected by digitisation but not turned into the performance measures are discussed here.

6.2.1 User-friendliness

The user-friendliness for the clients will not change since the alarm button will not change. The whole process around the alarm will change, this can be seen as improved user-friendliness for the client. For the NAAST employee, the goal is to improve the user-friendliness of the software. With more information, the triage will be improved.

6.2.2 Patient centeredness

Patient centeredness is difficult to measure since this is a subjective measure. This will increase with the help of digitisation. Fewer interruptions and fewer unnecessary follow-up will increase the time the nurse has with the client. More time will probably increase the time the nurse can focus on the client instead of being in a hurry.

6.2.3 Overall satisfaction client

The interviews in this study and the studies by Sensire and FocusCura already show that there is a high overall satisfaction of the clients. The digitisation might help to increase this even more with faster arrival of follow-up and more prevention.

6.2.4 Work pressure and stress & overall satisfaction employee

These two indicators are discussed together since they are similar. Fewer unnecessary follow-up and fewer interruptions will increase the overall satisfaction of the nurse.

6.2.5 Available information on client & triage

Triage and information on the client are two indicators that go together. With more information, the triage will become more complete. The new software looks promising on the data and with algorithms the right data and questions for triage will show. This increases the information available for the triagist. It might be helpful to combine the software of NAAST with the employee portal of the nurse.

6.2.6 Time needed to access home

This is an indicator that does not directly change because of the digital alarms or new platform. Nevertheless, some other changes might affect access to homes as well. The available information on clients will also increase the ease of going into homes since the location of keys or code for the cKey is known. The cKey will help to increase the ease to access to homes. This is out of scope for digitisation only but is an important extra tool to take into consideration.

6.2.7 Falling incidents & bed days after an accident

With the cAlarm Sense, the living pattern of the user is monitored. This can help to see changes in falling and help on time instead of after the fall. This helps with reducing the number of falling incidents and increase safety. With fewer people falling, the total hospital days will decrease. This has a strong effect on the total healthcare costs [41].

6.2.8 Prevention

This indicator affects the previous indicator as well. Prevention can help the nurse to see if there are changes in the behaviour of the client. For example, when somebody uses the alarm more often or walks slower, physiotherapy can be used to help them be more safe walking around the house. Prevention can be done in multiple ways but more data is needed for this. This means that the software should collect relevant data on prevention.

6.3 Conclusion

The goal of this chapter was to answer the subquestion *"What are the potentials of the digital personal alarms?"*. Even though only for a few indicators the changes are proven, there is high potential in the digital alarms and the new platform. The indicators that in Table 3.2 are labelled to have an impact because of reduction of the follow-up were: range of the alarm, unnecessary calls, follow-up as a result of no response events, and unnecessary calls. Except for the unnecessary calls, these indicators might show better performances with the VPD. With this can be concluded that the VPD would help to reduce the volume of follow-up. The indicators that affect the routing need smarter software. Therefore, during the development of the platform, these indicators should be taken into account. At last, the refine indicators will all follow after the improvements of the other indicators.

7 Advice for implementation

This chapter discusses the further steps of implementation of digital personal alarms. In the previous chapters, the current situation and barriers are discussed extensively. Now it is known that the validation needs to be done and that a lot of data is needed for implementation. Not only the validation barrier but also the other barriers are still of importance for implementation of new techniques. For that reason, Section 7.1 advises all stakeholders on what needs to be done in further steps of the implementation of digitisation of personal alarms. The consortium that already started can use this study as support for further steps. New consortia on this subject can use this study as support as well. In Section 7.2 advice for these consortia is given.

7.1 Advice per stakeholder

All stakeholders from the consortium have an important role within the implementation of digital alarms and the new software platform. In this section, the stakeholders are discussed and advice based on the previous chapters is given.

FocusCura: The implementation process is now mainly lead by FocusCura. When looking at the barriers there is no direct link between FocusCura and one of the barriers. Nevertheless, they still have an important role in overcoming the barriers. Mainly because they are the binding factor between the different stakeholders which can help within the process. With good marketing, awareness and knowledge can be improved. Also, the importance of the VPD and other extra hardware is found with the interviews. This is good to know and take into account with further development of the personal alarms. For these reasons the advice for FocusCura is to keep the leading role within implementation and make sure all stakeholders know what is important for implementation.

Sensire: In Section 5.2 is shown that there are several indicators of which no data is available. All these indicators need input from Sensire. This leads to the advice for Sensire, which is to cooperate in obtaining the required data. The data is needed for the validation and added values of the digital alarms. Next to this barrier, Sensire also has a role in the barriers awareness and knowledge of stakeholders. Nurses need to know the difference between analogue and digital alarms and the benefits for clients and themselves. This will increase the awareness of clients to switch to a digital alarm. This can be done the same way as already done in other innovations, with ambassadors. Some of the nurses are taught about the change of the alarms and with their knowledge they can inform other nurses.

Menzis: Within this study, the health insurer is not discussed often because the focus is on the processes. This does not mean they are not important for implementation of the digitised personal alarms. When looking at the barriers regulation and business model, the health insurer will play an important role. The digital alarms, extra hardware and new software platform may lead to (temporary) additional cost but will lead to better performances of home care. When it is proven that the performance increases, Menzis needs to step in. A business model needs to be made and with this business model, the best contracting model needs to be chosen. The main advice for Menzis is to help in building the business model and look into the options for contracting in a way all stakeholders benefit and health care keeps improving.

EYVIT: The technical barrier is the main barrier for EYVIT to look at. Technical aspects found within the interviews and workshops need to be taken into account within the design of the software platform. Examples are a message to social care after an incident, better routing, more use of social care, and the use of extra service extensions events such as GPS.

NAAST: NAAST is different in this case, compared to the other stakeholders. Since in a way they are end-users, they need to accept the innovation of new software. Validation and

prove of added value might help in the acceptance of the new software. Sensire has a large role in this validation. The role of NAAST here is to cooperate in obtaining all the relevant data.

7.2 Advice for consortium

The consortium that is used as a case for this study already started and is used as a starting point for this study. During the study, new insights are found which shows clearly what is important during implementation of innovations within home care. These insights are validated during a meeting with the consortium. All stakeholders agreed with the indicators used in this study. The insights, indicators and barriers can be used to continue with the consortium. The main conclusion is that there is a lack of data available to make well-founded conclusions about the difference and added value of the digital alarms and new software platform. Therefore the first step that needs to be done is to set up measurements for the indicators of which no data is available. When the data on the current situation with the analogue alarms is available, a pilot study can start. The alarms can be converted to digital alarms and a couple of employees at the emergency centre can start working with the new platform. Since the steps for data collection are known the data of the digital alarms will be easy to obtain. This results in a difference between analogue and digital alarms.

In Chapter 6 the potentials of the digital alarms are discussed and this shows that the performance will probably increase. When the validation is done and the improvement is proven, the other barriers are more likely to be overcome. This is not only useful for the consortium of this case but can also be used for consortia with other health care organisations, emergency centre and health care insurances. The first steps that are taken in this study can be reused in other environments. The flowchart in Figure 2.2 can be validated within the organisations and used directly. The same applies to the indicators in Table 3.2. When this is validated the organisation can go directly to the barriers. The validation will already be done with the pilot study of the current consortium. Therefore, this step is not necessary for following consortia.

The next step for both the consortium in this study and the following consortia is to look into the barriers. All barriers are of importance and not all organisations might be on the same level. With the barriers as a starting point, the consortium knows what is important to focus on to make sure implementation turns out successful. In addition to this, for all consortia communication is of high importance. A paper by Bjørkquist et al. [42] shows this with the following conclusion *"This study has identified information exchange, meeting points, territoriality and leadership as factors influencing inter- and intra-organisational collaboration."*

7.3 Conclusion

We conclude that there are still important steps to be made before successful implementation of the digital alarms and new software platform can happen. With help of the barriers and knowledge gained within the study the following steps are made clear and will help within the process. First, the validation needs to be done and the other barriers will follow subsequently.

8 Conclusion

The goal of the study was to find barriers to implementations and how to overcome these. With the case study on personal alarms, this is done and the research question is answered with help of the subquestions.

What is the current situation within home care considering unplanned follow-up?

In the current situation of unplanned care, or the personal alarms, analogue alarms are used and the UMO platform. After use of the alarm professional help is called for follow-up. There are several drawbacks to this process. No connection, no efficient follow-up, interruptions of care, and higher work pressure. With digital alarms and an improved software platform, these drawbacks can be reduced. Next to this, the costs might be reduced and the quality of care might be higher. The performances of the key performance indicators are measured. For this case, there is not enough data available to conclude anything about the performance.

What are the barriers to implementation of digital innovations within home care?

Barriers found within literature are awareness, regulation/politics, validation/added value, business model, technical aspects, usability, privacy, and knowledge of stakeholders.

What are the barriers to implementation of digitised personal alarms within home care?

All barriers are relevant within this case. Validation/added value is the most urgent barrier to overcome. There is not enough data available to find the added values from the digital alarms compared to the analogue alarms. When this barrier is overcome this will help with the other barriers. The indicators that are not measured yet need to be measured with help from or by Sensire.

What are the potentials of digitised personal alarms?

The expectation is that digital alarms and a new platform will help to overcome most of the drawbacks of analogue alarms. A solution is the addition of the VPD which helps to reduce no sound events and therefore will decrease the number of unnecessary follow-ups. The digital alarm only will mainly change in technical follow-up and the addition of the VPD or a smoke alarm. The new software platform can help to improve the efficiency of care and with that reduce overall health care costs and improve health quality.

What steps need to be taken for further and successful implementation of digital personal alarms within home care?

For this specific case the next step is to find the added value, so obtain data on the analogue alarm and do a pilot study. With this validation, the other barriers will be easier to overcome.

The research question *What is needed for successful implementation of digital innovations within home care organisations?* can be answered after answering the sub-questions specific to this case. We can conclude that the steps taken in this case study are needed for successful implementation. This means: map the current situation to identify the important stakeholders, find the drawbacks, find the key performance indicators and assess the performance, check for every barrier what the status of your organisation is, and overcome the most relevant barriers. Communication between stakeholders is of high importance in the implementation of digital innovations. This can be done by working with a consortium for example. Together it will contribute to overcoming the barriers and come to a successful implementation.

9 Discussion

During the study, several aspects came forward that need to be discussed. These are aspects of the scope of the study, and aspects that came forward during interviews that need to be taken into account.

The study focused on the processes of home care, therefore mainly the health organisation, emergency centre and client are looked into. As seen in the barriers, the regulation and business model are important aspects within the implementation of innovations. Within Chapter 7, this is shortly mentioned as advice for the health insurer. In further research, the role of the health insurer should be investigated more. This includes financial flows, steps of business models, and contracting methods.

The interviews that are conducted are not comprehensive. Per stakeholder one interviewee is used. Since the interviews were subjective, more interviews would give a better overview of the current situation. Other employees or clients of the alarms might have different views on the situation. The workshops did help with a greater overview of the current situation and possible indicators. Still, a larger validation with interviews would add value to the used indicators. It might be also good to join a healthcare organisation and an emergency centre for a day. During this study, this was not possible due to Covid. It will add insights into the current situation and give a broader view on drawbacks that occur during a normal day and take away part of the subjectivity.

All methods to gain data and the recommendations are based on technological possibilities. During interviews and meetings with experts came forward that it might be difficult to change some aspects that are seen as common within the process. For example, the data collection where nurses have to do extra administrative actions. This might not be the best solution since it might be a burden or forgotten during the hurry of the day. Next to the extra burden to the nurse, it might lead to biased results. Additional actions may give a distorted picture making it impossible to compare. This must be carefully considered when thinking about how the data can be obtained.

Another aspect that might not work out as planned is for example the unnecessary events. Test events are seen as unnecessary events since this is not needed for medical follow-up. Therefore it might look like this alarm can be reduced or processed in another way. On the other hand, for the client the idea that the alarm works properly and get used to using the alarm.

The indicators are only based on quantitative measures, the qualitative measures are not taken into account. This does not mean they do not need to be measured. Qualitative measures are important to gain a complete overview of the current situation. Together with the aspect mentioned above, the feeling of the user is important to take into account. Therefore, when looking into implementation the qualitative measures are just as important as the quantitative and should not be forgotten. In further research, the right metrics for qualitative performances should be found and data on this should be collected. With surveys and more interviews this can be done.

At last, the research question is answered based on a case study. This means for a different situation some steps might differ. Most of the discussion points mentioned above are specific to this case and will not apply to all innovations or organisations. The steps taken in this study show great potential for other implementations of innovations within home care. The current situation and performances are always needed as the first step for implementation. The barriers are applicable in all situations and therefore also useful for other innovations. This study shows a good example of what is needed for the implementation of innovations within home care and might be a good example for other innovations.

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10 Appendix

10.1 Appendix A - Interview Guide

Introductie

- Mezelf voorstellen en doel van onderzoek uitleggen.
- Het doel van het onderzoek is om meer kennis te krijgen over de alarmen en hoe het voor verpleegkundigen is.
- Toestemming voor opnemen en gebruiken van informatie.
- Met dit interview wil ik antwoord krijgen op de vraag ‘Wat zijn de positieve- en knelpunten bij het gebruik van de personalarmen?’

Achtergrond

- Bedrijf
- Rol
- Functie

Waarde

- Wat is uw rol binnen het gebruik van het alarm?
- Hoe ziet het gebruik met het alarm eruit op een dag?
- Wat verwacht u van de functies van het alarm?
- Wat vindt u van de communicatie met andere stakeholders binnen het alarm?
- Noteren jullie de verschillende handelingen die gedaan worden na een alarm of koppelen jullie dit terug naar NAAST?
- Hoe ervaart u de werkdruk tijdens je dienst? Heeft het alarm hier invloed op?
- Hoe ervaart u de zorg die je kan leveren na een alarm?
- Heeft het alarm invloed op de kwaliteit van zorg bij andere afspraken?
- Hoe tevreden bent u met je werk? Welke aspecten vindt u hierin belangrijk?

Problemen

- Wat zijn aspecten waar u tegenaan loopt met het opvolgen van de alarm meldingen?
- Wat zijn algemene problemen binnen het leveren van zorg die u graag anders zou zien?
- Wat zou, volgens u, verbeterd moeten worden aan de alarmen waardoor de zorg verbeterd kan worden? - Toekomst alarmen, visie hoe zou u het zien.

In het volgende deel gaan we in op innovaties binnen de thuiszorg. Stel u voor dat er een verbetering is van de alarmen die de zojuist besproken problemen zou kunnen verminderen of zelfs verhelpen.

Barrières

-
- Wat zou een reden zijn om zo'n vernieuwing te implementeren of adviseren aan cliënten?
- Wat zou een reden zijn waarom u een vernieuwing niet zou willen implementeren of adviseren aan cliënten?
- Wat zijn barrières die bij andere innovaties al duidelijk naar voren kwamen bij implementatie?

Afsluiting

- Heeft u verder nog punten met betrekking tot de personen alarmen die niet besproken zijn?
- Heeft u het gevoel dat de onderzoeksvraag ‘Wat zijn de positieve- en knelpunten bij het gebruik van de alarmen?’
- Bedankt voor het meewerken

10.2 Appendix B - Alarm event overview

Table 10.1: Available data from NAAST

Datum	01/01/2021-30/01/2021
Time	hh:mm:ss
Alarm melding: Meldcriterium	<ul style="list-style-type: none"> • 100: Alarm Hoofdapparaat • 101: Alarm Halszender • 102: Halszender 2 • 114: Rookmelder • 147: Valsensor 172: Fout in criterium • 187: Storing gemeld/ of Afsluiting • 188: Wacht op Aansluiting • 196: Telefoon oproep • 201: Stroomstoring
Versleuteld	Klant nummer
Alarm melding: Opmerking	Handmatige melding
Categorie reden alarm	<ul style="list-style-type: none"> • Alarmmelding • Testmelding • Technische melding • 'blank'
Reden alarm	<ul style="list-style-type: none"> • Aansluiting • Accu defect melding • Alarmmelding: geen gehoor/ krijg geen antwoord • Alarmmelding: gevallen • Alarmmelding: onwel • Alarmmelding: reden onbekend • Alarmmelding: verzorging • Heb je gevraagd: 'kloppen uw gegevens nog' • Herhaling = nogmaals alarm binnen 10 minuten na eerdere melding • Loos alarm: loos alarm (klant wel gesproken) • Manuele melding • Medido: melding van medicijndoos • Rookmelding • Stroomstoring • Terugmelding: terugmelding door (mantel) zorg • Testmelding door klant • Testmelding door monteur • 'Blank'

Available data from NAAST	
Ingeschakelde directe hulpverlener (Soort hulpverlener)	<ul style="list-style-type: none"> • Contactpersoon: NIET BELLEN!! • Mantelzorger • Sleutelhouder (tbv prof. Hulpverlener)
Ingeschakelde professionele hulpverlener	<ul style="list-style-type: none"> • Huisarts • Professioneel met nacht regio Sensire • Professionele achterwacht • Sensire • Storingsdienst