DIAMEDIPORT

increasing elderly agency by improving triage at home

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DiaMediPort

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GLOSSARY

Beneficiaries directly or indirectly benefit from the services rendered from healthcare organizations. They are "any group or individual(s) who can affect or is affected by the achievement of an organization's purpose" (Freeman, 1984 p.53).

An **elderly care specialist** is a medical doctor who is trained to meet the special needs of the elderly outside the hospital. The Dutch equivalent for the term is Specialist Ouderengeneeskunde (SOG).

A district nurse offers **extramural care** to an elderly person who lives independently at a home. This term is used to differentiate it from intramural care.

Healthcare providers (HCPs) administer interventions that are designed to improve the physical or emotional status of patients.

An **informal caregiver,** or **carer**, carries out activities of daily living for elderly persons, e.g. changing of clothes, bathing and toileting; the English term is unrelated to the Dutch terms verpleegkundige and verzorgende, which refer those who are either MBO-educated and qualified to provide nursing or medical care or those who support healthcare professionals.

The primary focus of **intramural care**, also known as nursing home and assisted living, is to assist elderly residents with activities of daily living. The Dutch equivalent for the term is verpleeghuis.

Multimorbidity is the presence of two or more health conditions or illnesses co-occurring in the same person.

A **nurse** is a person who cares for the sick and/or elderly and HBO-V educated in the Netherlands.

Person-centered care addresses the beneficiary as a "whole person," focusing on his values and preferences to guide all aspects of his health and life goals.

Regulatory institutions and agencies have the power to enforce laws or set guidelines for conducting business (World Bank, 2020). New laws or modified policies can stifle business operations or liberate business outcomes.

Stakeholders are owners, managers and employees, or competitors. In the healthcare industry, internal stakeholders are involved in a similar manner as to those in the commercial firm. External stakeholders are responsible for directly manipulating the day-to-day operations of healthcare providers.

Tele-medicine is a practice of medicine that employs modern information and communications technologies to deliver patient care at a distance.

Triage is the process of determining the degree of urgency required to treat a large number of patients with illnesses or casualties.

EXECUTIVE SUMMARY

The rapidly aging Dutch baby boom generation threatens to overwhelm the healthcare system in the Netherlands (Hoedeman & Koki, 2020). The elderly, more than any other age group, are more prone to experiencing a steep decline in physical and cognitive health during hospitalization (Brown, 2020; Mathews, Arnold & Epperson, 2014). 61% of the elderly Dutch are unnecessarily admitted to emergency wards (G. de Kousemaeker of Fluent, personal communication, January 16, 2019). Likewise, the elderly, especially those from rural areas, are fueling more than a 50% increase in the number of persons 65+ who require nursing care at a home (CBS, 2019).

A complex network of stakeholders interacts in the healthcare value chain to provide interventions for this vulnerable group. Yet, healthcare providers (HCPs) who collaborate together to diagnose, treat or adjust medications for the elderly are under immense pressure (SCP, 2019a). With its technology-enabled services, DiaMediPort aims to solve the shortages of HCPs by sending triage nurses to the homes of the elderly in distress and by virtually connecting them to general practitioners and medical specialists via information logistics.

The research section of this project highlights the advantages of ensuring person-centered triage care in the Dutch elderly person's home during the period of 2020. I conducted secondary and primary research (e.g. ethnographies, contextual maps, qualitative interviews) with an elderly couple in their extramural home, informal caregivers, district nurses and elderly care specialists from intramural facilities, ambulance and mobile night teams and elderly call centers.

Five key conclusions are made based on the insights generated on triage moments, information flow, technology and the healthcare value chain.
1) There is an obvious disconnect between the **government's response** to the elderly and what the elderly want. The Dutch Minister of Health, Sports and Wellbeing stated the role of each Dutch person is to care for other persons in the community; while the elderly interviewed state that independence is a core value and it must be accounted for during the development of an elderly triage service.
2) **Triage moments** are a source of needless and redundant suffering for the elderly person who lives in an extramural home. The informal caregiver must communicate with HCPs during these moments so that the decisions made on behalf of the elderly person are dynamic. Although nurses can handle a litany of triage moments, the healthcare system prohibits them from taking action without the supervision of a medical doctor.
3) The **mobile night team** becomes a part of the traditional medical system. When an informal caregiver or district nurse is unavailable, triage nurses perform unexpected tasks at night.
4) **Information flow** and open communication reduce the usage of human and financial resources and improve the elderly person's medical outcomes.
5) The nurses who work at **elderly care centers** rely on ICT system information. Often the elderly's digital records and other necessary information are not yet entered or updated. Hence, **triage nurses** must act in an information vacuum. The appearance and complaints of the person suffering from old age is the only information at their disposal. It is very difficult to read him. Sometimes, he lacks the words to express what is wrong. As a result, nurses cannot make informed medical decisions. DiaMediPort is ideally poised to tackle these issues and concerns. Besides, its services give reassurance to beneficiaries (e.g. elderly person and informal caregiver) and facilitate their independent living at home.

The design section offers 2 tools that I created for DiaMediPort. Their 2 objectives were to 1) visually inform how HCPs and beneficiaries interact within the existing healthcare system and 2) convince HCPs and decision-makers (e.g. insurance providers, hospitals, governmental bodies) to adopt DiaMediPort's services. The tool Stakeholder Perspectives has two components: 1) "DiaMediPort in Film" presents short films of elderly persons in triage situations; these stories are produced with cartoon cutouts and voice-overs. And 2) "DiaMediPort Platform" will be used in a co-creational workshop. It gives an overview of the DiaMediPort beneficiaries and stakeholders, their social context and how DiaMediPort acts as intermediary. The tool Layered System Overview illustrates the triage phases wherein DiaMediPort is capable of providing services.

CONTENTS

1. INTRODUCTION

The rapidly aging Dutch population threatens to overwhelm its healthcare system (Hoedeman & Koki, 2020). Patients are flooding Dutch emergency rooms (NOS, 2019; NOS, 2017) and the elderly represent a substantial proportion of those who are hospitalized (Nederlandse Zorgautoriteit, 2019). Emergency rooms are flooding with patients who are in need of urgent medical care; halting patient inflow and backlogging waiting lists to the elderly to enter intramural homes (NOS, 2017; NOS, 2019).

According to the Dutch Bureau of Statistics and other governmental institutions, several aging trends contribute to the emergency room overcrowding (VWS, 2018). Over 90% of the Dutch older than 75 are chronically ill and two-thirds of them suffer from multiple illnesses (SCP, 2019). Consequently, older patients with multimorbidities will increase the healthcare burden and thus the need for additional care (Grata & Borowska, 2015). In shrinking regions such as Limburg, Friesland and Groningen, the rise of elderly and the lack of care professionals increase overcrowding within emergency rooms.

The professionals - district nurses and specialists who are tasked to care for this vulnerable group are not the only stakeholders under pressure (SCP, 2019a). There is a growing shortage of informal caregivers (SCP, 2019b). If the body of stakeholders collaborating together in elderly triage does not changes its way of working, then the cost of elderly care will be too high and the health and wellbeing of the elderly will be negatively impacted (Baeten et al, 2018).

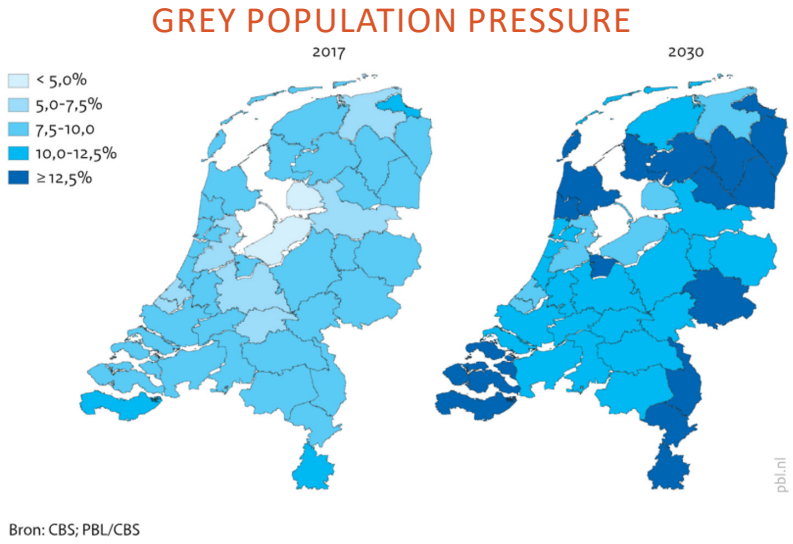
In order for Dutch society to deal with challenges such as aging population and a shortage of elderly healthcare professionals, a new way of working must be conceptualized. The startup DiaMediPort addresses these challenges by preventing unnecessary hospital intake. DiaMediPort's technology-enabled services could reduce redundant medical expenses and could give the elderly reassurance and facilitate their independent living.

1.1 SITUATIONAL CONTEXT

A complex network of stakeholders interacts in the healthcare value chain to provide interventions for the benefactors in their care. The primary focus of my report is the beneficiary of DiaMediPort: elderly people. This primary beneficiary will be identified in this section along with 1) secondary beneficiaries (e.g. caregivers) who are entrusted with the duty of caring for elderly people, 2) the internal stakeholders (e.g. healthcare providers including the medical, nursing and hospital administrative staff) and 3) external stakeholders (e.g. regulatory bodies, payers, insurers, manufacturers, distributors, pharmacies).

1.1.1 ELDERLY PEOPLE DEFINED

I choose to study the elderly people rather than elderly patients for several reasons. An elderly person is a human being who has inherent value, personal aspirations, goals and attitudes but is experiencing challenges in their body and mind. The term elderly patient, however, labels an older person according to a set of diagnoses, prognoses or (bio) medical issues. Moreover, an elderly person may have a social need (e.g. "I am lonely"), which is detached from mental illness (e.g. "I forget faces and names"). Case in point, one elderly person may not wish to have a vibrant social life but may prefer to isolate himself from others, another may value talking, seeing and listening to his peers and family. If elderly people are identified by their medical issues (e.g. deafness, cataracts) rather than by their personal needs, scarce societal



Bron: CBS; PBL/CBS

Figure 1. Current and expected regional differences in grey population pressure in the Netherlands and the largest grey population pressures (dark blue) are located in peripheral regions. Obtained from (source)

resources may be wasted and medical interventions may cause adverse effects.

The healthcare system dehumanizes the hospitalized person. As soon as he is admitted, HCPs re-classify the person as "the patient". "From a service perspective, patients are unique customers… they are discouraged from asserting agency. Patients are by definition subject to doctor's orders and are even more vulnerable to the market power of healthcare policy (Jones, 2013)." Healthcare systems, however, are gradually shifting away from patient-centered care and moving toward person-centered care (i.e. clinical care that includes the patient experience) (Cohen, 2019). The main driver of this shift in organizational vision is competition. Virtual care companies are entering the ambulatory market and eating into the market share of hospitals. As such, by revising the most ingrained of jargons, HCPs from traditional clinical institutions are seeing their patients as persons and/or beneficiaries of their care.

1.1.2 AGING DUTCH POPULATION

The aging population in the Netherlands is dramatically growing and will continue to increase due to longer life spans (CBS, 2019; SCP, 2019). This core demographic is pushing the healthcare system beyond it limits. Zorgen voor Thuiswonende Ouderen reports that the population of Dutch residents aged 75+ is rising (SCP, 2019). The Centraal Bureau voor de Statistiek also estimated that in 2017 the grey population pressure (i.e. the ratio of 65+ years divided by 20-65 years) was about 31 %, (CBS, 2017). CBS expects the grey population pressure to level off at 50.1 % in 2040 and to negatively impact rural areas the most. See Figures 1 and 2 which illustrate the projected population changes among the elderly.

1.1.3 ELDERLY PEOPLE AS HEALTHCARE BENEFICARIES

Elderly people are one of the primary beneficiaries of the Dutch healthcare system. As they become less physically and mentally fit, they are dependent on a whole host of stake-holders to help them fulfill their practical, psychological, social and medical needs. However, the way in which the expanding Dutch elderly population is cared for differs from a decade ago. Retirement homes were previously subsided by the govern-ment. Today, this social structure no longer exists. In 2018, 143,000 were provided care in assisted living homes, while 250,000 Dutch elderly received care in extramural homes (VWS, 2018). When elderly Dutch persons move later in his life to an assisted living home, he loses his familiar social circle. He feels unsafe because he must to adapt to an unfamiliar home environment and must build bonds with unfamiliar informal caregivers. In 2015, two laws were enacted which entrusted municipalities to govern the long-term care of their own elderly communities. These laws envision the elderly to age at home. In the view of the fact that not enough assisted living

	Intramural facilities	Extramural homes
Type of care	Full-time and long-term	Independent living
Associated housing	Nursing homes	Retirement homes
Responsible doctor	Specialist elderly care	General practitioner
Care provider	Nurse	District nurse

Table 1. Intramural facilities and extramural homes

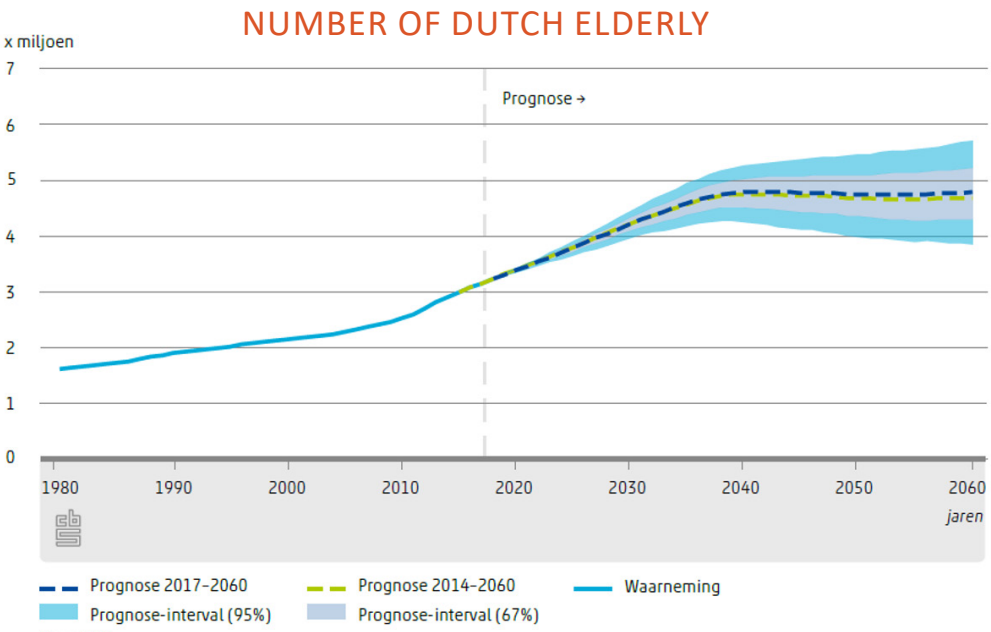


Figure 2. Over three million people above 65 currently live in the Netherlands. This number is expected to rise and then stabilize at 4.8 million in 2040.

facilities are available, the oldest of the elderly, irrespective of their deteriorating health, are forced to continue living independently (de Jonge, 2019). Refer to Figure 3 for a diagram which delineates the types of Intramural vs. Extramural Care made available to the elderly in the Netherlands.

I postulate that the concept of "aging in place" (i.e. "remaining living in the community, with some level of independence, rather than in residential care") does not wholly benefit them. For instance, the Dutch elderly are expected to adapt to their home environment but unable to do so (Davey, Nana, de Joux, & Arcus, 2004). For a select few, "life is completely and no longer worth living;" they achingly suffer from loneliness; feel sidelined, are unable to express themselves; feel mentally, physically, socially and/or existentially exhausted; and are reluctant to be dependent (van Wijngaarden, Leget & Goossensen, 2015).

1.1.4 STAKEHOLDERS INVOLVED IN ELDERLY CARE

Their informal caregivers, such as relatives, neighbors and friends, are the secondary beneficiaries of the Dutch healthcare system. Kwekkeboom (1990) defines informal caregiving as "is care that is provided, not from the context of a (health) care profession, to a person in need of help, by one or more members of his immediate environment, where the care provision directly results from a social relationship." Entrusted with the duty of assisting the elderly to adapt to their changing home environment and to their new social context, informal caregivers are intermediaries in the healthcare system. Once the elderly are in need of medical care, they become their custodians. Not only do they introduce the elderly to HCPs, they are asked to be assertive on their behalf (Golestaneh, 2011).

The oldest old support ratio (i.e. the proportion of Dutch people aged 50-74 and Dutch people aged 85+) is expected to drop from 15 potential informal caregivers to elderly people in 2015 to 6 in 2040 (De Jong & Kooiker, 2018). The ratio is smaller within rural areas. Figure 3 illustrates these demographic trends per region.

When they present multimorbidities as well as illnesses associated with aging (e.g. dementia or osteoporosis), their informal caregivers are tasked to actively engage with healthcare providers (HCPs). HCPs "must understand and respond to (these) beneficiaries and must nurture reciprocal relationships to whom they often must answer to (Golestaneh, 2011).

The deficit of geriatric physicians and medical specialists trained in elderly care delays the delivery of quality, actionable diagnoses (Medisch Contact, 2018). Outside the Randstad area, there is a burgeoning deficit of specialists, where elderly care is more critical. Besides, manufacturers of technological products (e.g. alarm pendants) and care institutions (e.g. extramural organizations and intramural facilities) force the elderly along with their informal caregivers to fight a bureaucratic, regulatory system which often forces them to change their day-to-day living patterns.

Although secondary beneficiaries (e.g. informal caregivers), HCPs (i.e. medical, nursing and hospital administrative staff) and regulatory bodies must work together to support the personal needs of the elderly, an additional stakeholder – the supplier of point of care technology - can prevent needless and redundant medical interventions in the case of elderly triage.

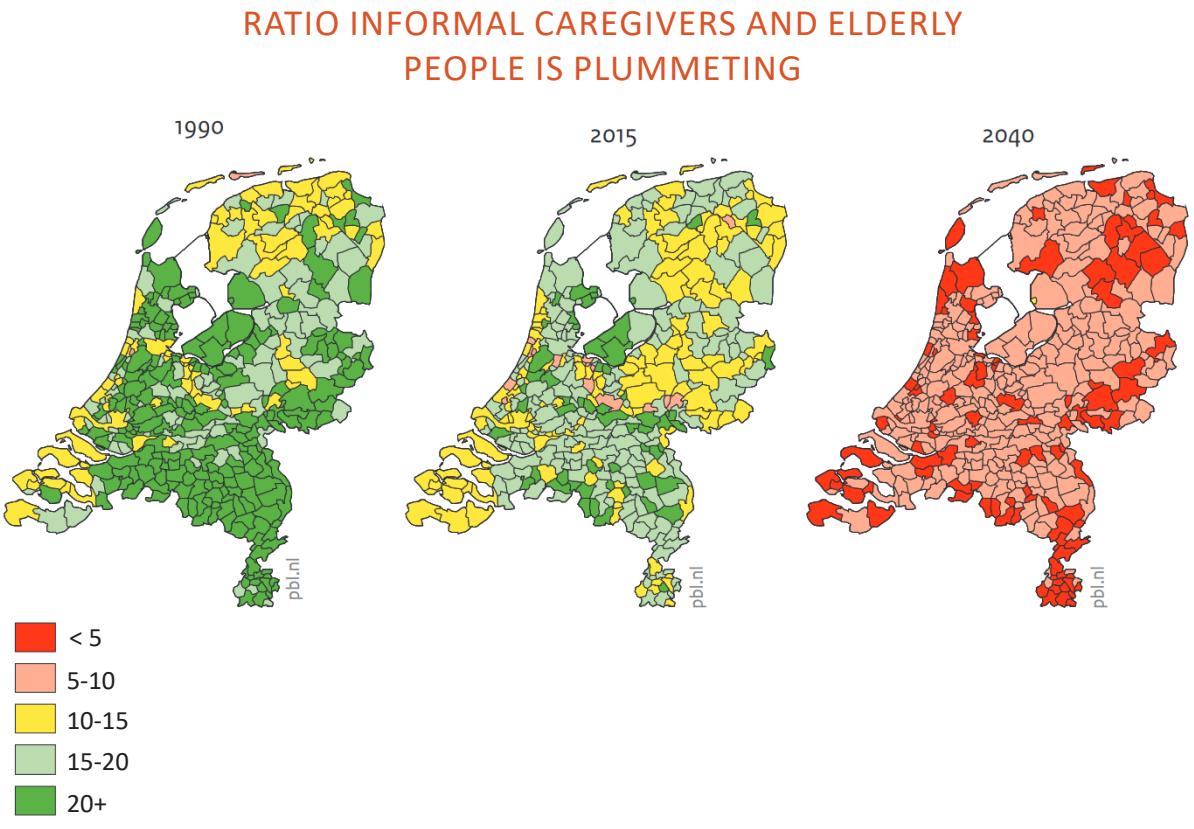


Figure 3. The Oldest Old Support Ratio is expected to plummet from 1975 to 2040 (De Jong & Kooiker, 2018)

1.2 SCOPE

In this section, I examine the impact of the aging Dutch population on the healthcare system in the Netherlands and introduce the benefits of triage at a distance.

The elderly, in general, experience severe side-effects during hospitalization (Gillick, Serrell, & Gillick 1982). These effects include an increased risk of: 1) reduced recovery of activities of daily living 2) new functional deficits and therefore less independence and decreased self-esteem and 3) hospital readmission (Covinsky et al., 2003; Hoogerduijn et al, 2007; Palese et al, 2016). They are more prone to experiencing a steep decline in physical and cognitive health during hospitalization (Brown, 2020; Mathews, Arnold & Epperson, 2014). The Netherlands classifies those patients in need of in-hospital emergency intervention based on the severity of their case (G. de Kousemaeker of Fluent, personal communication, January, 16 2019). The first group does not report somatic complaints. The second group has mild somatic complaints but no clinical profile. The third group is being hospitalized because they suffer from an exacerbated chronic illness because they missed earlier treatments of an undiagnosed medical issue. These three groups account for 61% of the elderly who are brought to the hospital needlessly because they do not require urgent emergency care.

The scope of this R&D project focuses on the advantages of delivering triage at home for the Dutch elderly during the period of 2020. Bashir & Bastola (2018), suggest that 'telehealth interventions […] lead to everyone's ease of mind' for patients with chronic disease that live at home. The literature finds that tele-monitoring and diagnose-at-distance are superior to diagnosing at a hospital. This is the case for patients with chronic illness and those who require emergency care. Paré, Jaana & Sicotte (2007) reveal that tele-monitoring is ideal for the pulmonary and cardiac patient (but less so for patients with diabetes and high blood-pressure). Oudshoorn (2008) discover that "the invisible work of home-care nurses and physicians at the tele-medical center" and "the usage of ECG recorders in ambulances" comfort patients who worried about their sudden cardiac problems. Likewise, Nakamura, Koga & Iseki (2014), after conducting a thorough meta-analysis, assert that remote patient monitoring is most effective in people with chronic heart failure.

I postulate that triage at home eases the mind of the elderly person who does not present with somatic complaints, since he is given access to an HCP. For the elderly person who suffers from mild somatic complaint, an appointment with a HCP can be made. If a chronically ill elderly person is promptly treated at home, he may no longer require hospitalization.

The aging of the Dutch baby boom generation could fuel more than a 50% increase in the number of Dutch persons 65 and over who may require extramural care (CBS, 2019). Most elderly persons who are cared for in extramural homes and are at serious risk for serious falls are provided alarm pendants in the Netherlands. According to Pritchard & Brittain (2015), the alarm pendant is a form of technology that "facilitate(s) the care of older people." About half of those who are injured by a fall cannot get up themselves (Bloch, Lundy & Rigaud, 2017). Likewise, lying on the floor for over an hour is associated health decline, i.e. hospital admission or transfer to long-term care.

Telecare solutions is another innovation or "opportunity for diagnosis, treatment, […] make it possible to monitor patients with […] chronic diseases" (Bujnowska-Fedak & Grata-Borkowska, 2015). However, healthcare workers are often overlooked in the development of and research for assistive technology (Saborowski & Kollak, 2015). "In order to support care workers' role as users and facilitators of assistive technology, we need to take their experiences seriously and, starting from there, open up new experiential spaces." Given that there is a major demand for elderly home triage in the Netherlands; DiaMediPort must secure a solid foothold in order to succeed as a start-up.

The Dutch elderly who live in extramural homes are treated by medical specialists, as well as GPs, in case of emergency. A preliminary study shows that medical specialists (the second line of HCPs) who use e-health tend to hospitalize their patients with Chronic Obstructive Pulmonary Disease (COPD) - a chronic inflammatory lung disease that causes obstructed airflow from the lungs more frequently than medical specialists whom do not use e-health (G. de Kousemaeker of Fluent, personal communication, January, 16 2019). If patient information is offered to medical specialists, they "over-diagnoses" and prefer to hospitalize their patients. Therefore, this R&D project is interested in determining how DiaMediPort should be implemented with GPs during elderly triage.

2. PROJECT

Many HCPs and businesses are currently innovating for the elderly population to meet their ever-evolving demands. In this section of the R&D report, I introduce the project partners, in particular the client, DiaMediPort, and how the commercial startup intends to solve the shortage problems of accurate diagnosis, treatment and follow-up care for the Dutch elderly population. I lay out the aim of this project along with its primary and secondary objectives. Finally, I explain the process wherein I gathered my insights, analyzed my findings, presented my conclusions and finally designed my tools based on my project recommendations.

2.1 PROJECT PARTNERS

The founders of DiaMediPort – Mr. Gerard van Glabbeek and Mr. Arno Bakers – contacted Prof. Dr. Ir. Froukje Sleeswijk Visser of TU Delft to help them optimize their triage service concept in order to provide greater value for their beneficiaries and other stakeholders. My R&D project was born as a consequence and Ir. Quiel Beekman coached me through the industrial design process. On June 2019 Ir. Carlijn Brinkman took over the role of being my supervisor. Furthermore, Mr. Gerard van Glabbeek opened his network to me and offered me hands-on experience during three phase of my project: when I was performing qualitative research, designing my tools and implementing them. Owing to the TU Delft and DiaMediPort partnership, I am set to work on other industrial design projects for non-design organizations.

321.1 TU DELFT

The Faculty of Industrial Design stands on three pillars: people, technology and business. It is the academic home of the graduate student and the graduation team, who supervised this project. TU Delft bridges the divide of academia and the workforce, especially as it relates to service design, design for elderly and healthcare design.

2.1.2 DIAMEDIPORT BV

DiaMediPort is a commercial startup founded in response to the shortage of healthcare personnel trained to care for the Dutch elderly population. To meet the needs of an increasingly aging population as well as the societal demands that come with prolonging the lives of the elderly at home, the startup set out to restructure the triage process and exploit new IT technologies. DiaMediPort BV asserts that point-of-care technology and videocalling are vital for improving triage quality.

The mission of DiaMediPort is to facilitate the process of hospital-grade triage at the home of the elderly patient in order to prevent unnecessary hospital intake. Essentially, the startup company wants to bring the emergency room to the elderly person's bedroom. Qualified and specially trained nurses are the main point of contact and they connect the elderly to either an HCP.

DiaMediPort aims to solve the problem of shortage of proper elderly diagnosis and treatment, by using information logistics to virtually connect the home of the patient to a HCP who will diagnose, treat if necessary or adjust current medications or therapies. DiaMediPort incorporates a technology-push. Their innovative approach stems from the insight that point-of-care diagnostics and videocalling can prevent the elderly from being needlessly transported to hospitals. Medical information obtained from diagnostic equipment (e.g. digital stethoscope, a blood pressure gauge, a home-blood-test-kit, and an ECG-meter) is relayed, via a Wi-Fi network and a video-calling device, to the emergency room. A nurse practitioner, a specialist in elderly care or a geriatrics specialist, an emergency physician or a general practitioner are then able to make decisions together with the elderly person and his informal caregiver.

When I began my research project, the Dutch startup DiaMediPort was creating the 'Voorspoedzorg' Diagnose Kit. Today, their kits have been used in various regions in the Netherlands. Refer to Figure 5, a video-still of DiaMediPort's five-minute video (vimeo.com/297723317/af23f5b7ac) which explains how the kits could be used.

The DiaMediPort service has two layers of functionality. Its audio and video calling function makes communication possible. Its varied state-of-the-art diagnostic devices provide telematic features and more importantly detect diseases and other conditions. Refer to Figure 7 for an illustration linking the DiaMediPort's service to its beneficiaries and stakeholders.

The DiaMediPort service has two layers of functionality. Its audio and video calling function makes communication possible. Its varied state-of-the-art diagnostic devices provide telematic features and more importantly detect diseases and other conditions. Refer to Figure 6 for an illustration linking the DiaMediPort's service to its beneficiaries and stakeholders.

2.2 AIM OF PROJECT

The aim of my R&D project is to help DiaMediPort in improving the health outcomes and wellbeing of elderly people; alleviating the suffering of their informal caregivers; and providing new roles for their HCPs.

2.3 OBJECTIVES OF PROJECT

I identified three objectives to achieve the aim of my R&D project. The primary objective is to provide insights into the new roles that HCPs and DiaMediPort play in elderly triage in the Netherlands. The secondary objective is to develop engaging tools in order to convince HCPs and policy makers to use the DiaMediPort's solutions in the future. The third and final objective of my project is to create value for the Dutch society by publishing my report and deliverables.

2.4 PROJECT PROCESS

Figure 6. presents a schematic overview of my R&D project. After defining my research problem statement, I conducted qualitative research and gathered insights from other sources. My research findings shaped my design tools and my branding position. Subsequently, I validated my tools with DiaMediPort including a tabletop presentation, a detailed process visual and three short films. Finally I made research conclusions and offered industry-wide recommendations.

AIM OF PROJECT

To help DiaMediPort in improving the health outcomes and wellbeing of elderly people; alleviating the suffering of their informal caregivers; and providing new roles for their healthcare providers

1. To provide insight into the new roles that HCPs and DiaMediPort play in elderly triage in the Netherlands

2. To develop engaging tools in order to convince HCPs and policy makers to use DiaMediPort's services in 2020

3. To create value for the Dutch society by publishing my report and deliverables.

OBJECTIVES

Figure 5. A video-still of DiaMediPort five-minute movie

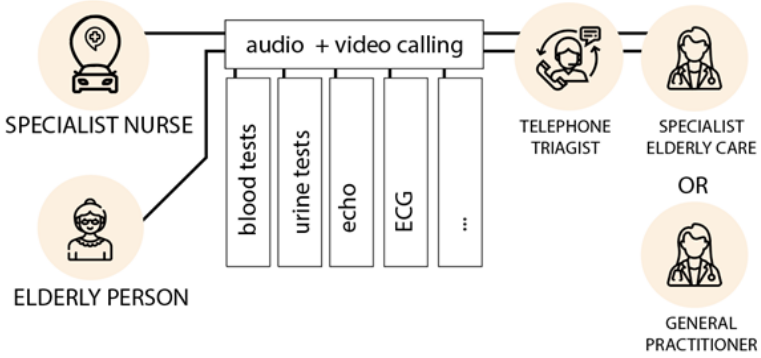


Figure 6. The DiaMediPort service and the network of stakeholders involved

1. INTRODUCTION
   - Situational context
   - Scope

2. PROJECT
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   - Project aim and objectives

3. RESEARCH
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   - Research methodology
   - Research findings
   - Conclusions

4. IMPLICATIONS
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5. DESIGN TOOLS
   - Triage roles
   - Short films
   - Stakeholder perspectives
   - Layered system overview
   - Client feedback

6. RECOMMENDATIONS

7. REFERENCES

8. APPENDICES

Figure 6. A schematic overview of my R&D project

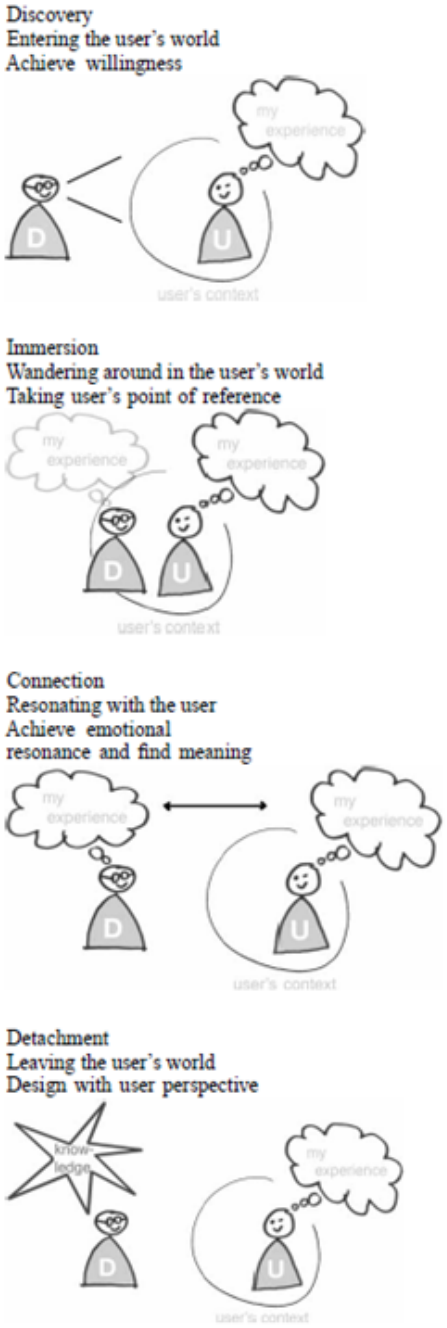


Figure 7. The four phases of empathetic design. Obtained from Kouprie & Sleeswijk Visser (2009)

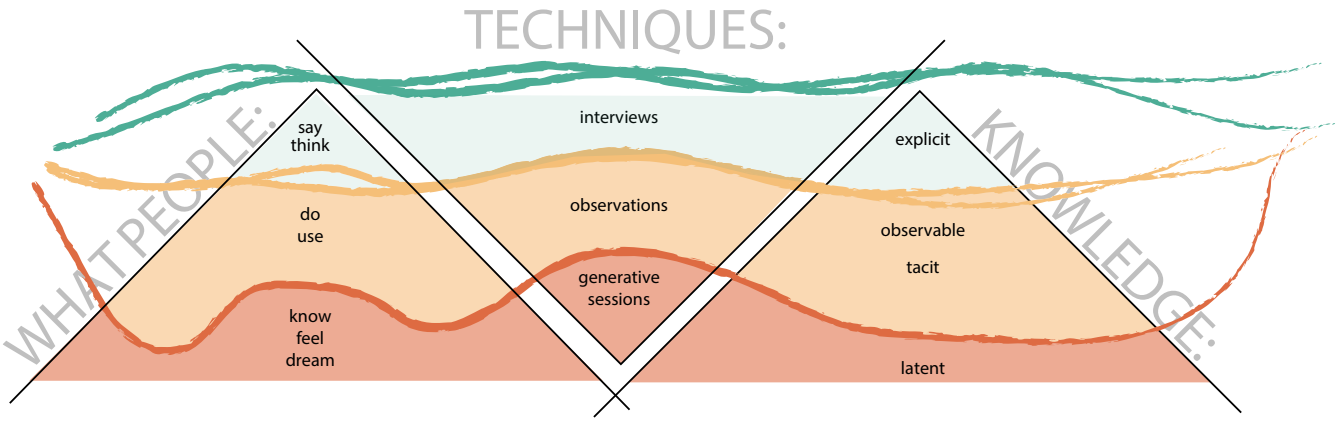


Figure 8. Interviews, observations and generative sessions generate different kinds of knowledge

3. RESEARCH

In this section of the R&D report, I define the problem statement of this R&D project. I explain the types of qualitative research methods that I carried out during the course of my studies in order to provide insights on the Dutch elderly who interact with various stakeholders during triage care.

3.1 PROBLEM STATEMENT

My initial research findings reveal that triage moments are the source of needless and redundant suffering of two of its beneficiaries (i.e. the elderly Dutch person who lives in an extramural home and his informal caregiver). Therefore, the problem statement of my research project addresses the question: How could the delivery of triage at home, with the aid of point-of-care diagnostics and video-calling, improve the health outcomes of the Dutch elderly person and support the informal caregiver in carrying out his duties?

Many elderly living in extramural homes suffer due to a gap in triage and care services (G. de Kousemaeker of Fluent, personal communication, January, 16 2019). The literature suggests that digital technologies brought to the home of the elderly can enable aging in place (Kim, Gollamudi, Steinhubl, 2017), but to my knowledge no study examines the benefits of elderly triage at home.

3.2 RESEARCH METHODOLOGY

I conduct exploratory and descriptive R&D studies in order to understand thoroughly my research problem. I employ primary and secondary R&D methods including context mapping, ethnographic study, media outlet analysis, unstructured and semi-structured interviews to 1) figure out what leads to the overflow of emergency rooms; 2) examine the needs of the Dutch elderly within their living environment; 3) examine the needs of HCPs who provide ordinary care for the elderly; and 4) explore the challenges experienced by HCPs in elderly triage.

To gain deeper insights on the lives and problems of elderly and the HCP challenges caring for them, I use the approach of empathetic design (refer to figure 7), which is a user-centered design approach that focuses on the user's feelings toward a product (Kouprie & Sleeswijk Visser, 2009). I applied participatory techniques such as the Convivial Toolbox (Sanders & Stappers, 2012) and Peter H. Jones' Design for care (2013) and delve deeply into the tacit and latent knowledge of the respondents with small samples (refer to figure 7). I believe that, once DiaMediPort has gained such in-depth insights, they will be able to convince HCPs to use their technology-push innovation.

PROBLEM STATEMENT

TRIAGE MOMENTS ARE THE SOURCE OF NEEDLESS AND REDUNDANT SUFFERING OF THE ELDERLY DUTCH PERSON WHO LIVES IN AN EXTRAMURAL HOME AND HIS INFORMAL CAREGIVER

3.2.1 SECONDARY RESEARCH

3.2.1.1 Media outlet analysis

Goal: To empathize with the Dutch elderly person who is in need of care.

Research Method: I watched 2 shows aired on Dutch television for inspiration and reference. On January 21, 2019, the show called 'Ouderenzorg: taboes op tafel' was aired by broadcaster AVROTROS. On February 21, 2019 the investigative journalist program Zembla broadcaster BNNVARA aired 'Oude bomen moet je niet verplanten' (i.e. One should not replant old trees).

Underlying issues that bring about triage and suggest paths for improvement were discussed. I answered the questions: "How do the Dutch media outlets portray the elderly? How do these media outlets perceive elderly care and what is expected of elderly care? What problems are experienced by the elderly and how are they addressed by the Dutch government?"

3.2.2 PRIMARY RESEARCH

3.2.2.1 Context mapping with an elderly couple

Goal: To get a deeper understanding on how a Dutch married elderly couple prefers to be treated in a triage situation.

Research Method (N=2): I visited the home of a Dutch married elderly couple (85) who live in a small village near Rotterdam. The husband and wife explained their medical histories and the wife shared stories about her sister in elderly care. Their personal context, as well as the sister's personal context, was sketched on paper; and they answered semi-questions regarding their present situation; their past; and their idealized futures.

3.2.2.2 Context visit and unstructured interview with informal caregiver

Goal: To understand the context of an elderly person living in a Dutch extramural home and how they interact with an informal caregiver and a nursing staff.

Research Method (N=1): During a visit with a man (99) who lives in an extramural home in the Hague, I observed his interactions with two of his informal caregivers including his daughter (52) and a woman who is his household help (50s) and his nurse who is responsible for his medical care. Then, I asked his daughter, who is a former general practitioner, open-ended questions and was told how 1) the current Dutch housing regulations and 2) the current Dutch healthcare protocols are affecting elderly care.

3.2.2.3 Qualitative semi-structured interview with nurse

Goal: To understand how nurses respond in emergency situations and to empathize with their experiences.

Research Method (N=1) A list of questions (see Appendix 7.3) were prepared in advance for a face-to-face interview that I conducted with a registered nurse, Ms. Renske Jansen from Bladel-oost. Only snippets of her responses were considered since my recording devices failed during the interview. This interview prepared me for an ethnography study that I conducted at a Dutch care center.

3.2.2.4 Qualitative semi-structured interview with manager of elderly care center and subsequent ethnographic study

Goal: To empathize with the telephone operators at an elderly care center, understand how triage at distance works and determine which aspects of triage are important to the telephone operators.

Research Method (N=1 and 15) I initially interviewed Ms. Ellis Vis, a manager of telephone operators at the Connectzorg Telephone Center in Eindhoven, which helped me generate a bar chart regarding alarm pendants for the Dutch elderly living in Eindhoven. I returned to the center during a night shift and observed 15 telephone operators handling emergency calls made by Dutch elderly persons from intramural and extramural homes via their alarm pendants.

3.2.2.5 Ethnography study on mobile night team

Goal of Ethnographic Study: To empathize with elderly persons who are in distress; to observe how a mobile night team responds in stressful situations; and to ascertain whether mobile night teams use new equipment and find it beneficial to their toolkits (i.e. new diagnostic functionalities).

I sought to answer a multipronged question: "How does a mobile night nurse work and communicate with her team when tasked to provide practical care and medical assistance to her elderly triage clients?"

Research Method (N=5, only 3 cases are presented in the findings): I conducted two ethnographic studies with Zuidzorg – a Dutch mobile night team operating in an broad region around Eindhoven – during separate night shifts.

Note: The call center Zorgcentrale responds to distress calls of the elderly who own mobile alarm systems. They send Zuidzorg to the homes of those who are NOT confronted by life-threatening situations and provide them practical and triage assistance. For example, Zuidzorg responds to the urgent needs of those who have fallen down and cannot get up.

3.2.2.6 Performing the duties of an informal caregiver

Goal: To empathize with the role of a Dutch informal caregiver.

Research Method: I carried out several informal care giving tasks and diarized my experiences (refer to Appendix 7.4).

3.3 RESEARCH FINDINGS

This section presents the findings of my R&D report.

3.3.1 SECONDARY RESEARCH FINDINGS

3.3.1.1 Media outlet analyses

The following are conclusions made from the study and analysis of two Dutch TV broadcasts.

- The vision of the Dutch government is to reorganize the patient-centered care of the Dutch elderly.
- Care chain innovation which cares for the elderly is required to make the government's vision a reality. HCPs, regulatory bodies and insurance providers should change how they work together so that care is organized around the elderly.
- The Dutch must seek new forms of living and providing care.
- Care is given to the public by the public and not by the laws of the Dutch consociational state.
- Informal caregivers should be given a bigger role by (interpretation) the system that cares for the elderly.

- It is human nature to care for one another.
- Rules are a form of distilled distrust and the Dutch government intends to deregulate these rules. For instance, the Minister of Health wants to reduce the time spent by nurses to document what they are doing. However, his efforts are frustrated by insurance providers and IT.
- An insurance provider might call up the district nurse organization and tell them it is still needed to document, even though the Dutch government does not require any more.
- Furthermore, every change of rules has to be implemented in the software systems that are used by district nurses. Therefore, before the removal of a rule can profit a district nurse, the software needs to be updated, which is an expensive and time consuming process.

3.3.2 PRIMARY RESEARCH FINDINGS

3.3.2.1 Context mapping with an elderly couple

I put forward a list of in-depth insights related to the personal, medical and social needs of a Dutch married elderly couple. I classify my insights according to their present situation, their past and their idealized future.

The present:

- The Dutch elderly woman is being treated for high blood pressure for 20 years. Her husband has been suffering from femoral hernia pain for 10 years.
- The husband and wife are proud that, despite being 80+, a district nurse does not visit them for weekly check-ups.
- The husband and wife trust their GP because they have known him for most of their lives. He is knowledgeable about their medical and family histories.

The past:

- In the last phase of her life, the wife's sister did not want to live in an assisted living facility but her GP and husband forced to go there. She was furious with her husband until the day she died.

The idealized future:

- The husband and wife place great value on his and her independence. One of them stated, "I despise being dependent on someone else."
- The husband and wife want to continue to be surrounded by those they love and have known for a long time, i.e. friends and family.
- The husband and wife prefer to have a steep decline in their health. The husband stated: "It would be best if my wife died in her sleep." After prompting them further to understand why this was a preferred outcome, they said that they do not want others to suffer as a consequence given that their neighbors were cared for by unfamiliar people.
- The husband and wife prefer a GP to come to their own home, take control of the triage situation and help them make medical decisions.
- After asking them how they envision future, they replied that they want to be surrounded by familiar persons and be loved by their children.
- After asking them whether they would prefer an ambulance paramedic or their GP to help them in a triage situation, they said that they preferred their GP. This medical doctor knows their family and medical histories, which gives them a sense of safety. Their GP, however, does not need to be present in the room when during an emerging situation.

3.3.2.2 Context visit and unstructured interview with informal caregiver

I make a set of generalizations about elderly Dutch persons in extramural homes; their caregivers and Dutch society as a whole.

- When an elderly person is incapable of self-care, it makes it difficult for another people to have a complete overview of what his needs are and how these can be met.
- Forgetfulness, eyesight and among other indicators hint at an elderly person's degree of mental proficiency and desire for independence. His pants smell of urine or his bed sheets are stained are two cues that he is more dependent on an

Figure 9. An image of an extramural home. Visual aids, walking aids (rollator) and informal caregiver (the woman) interact with difficulty. The informal caregiver holds the walking aid because her knees hurt.

Figure 10. An image of an alarm pendant with handwritten notes attached to it. This image illustrates how this Dutch elderly man is unable to independently open his front door.

informal caregiver.
- People often who work together in caring for an elderly person lack mutual trust and struggle to communicate.
- The elderly are unable to cope and build strong bonds with the unfamiliar nurses that care for them.

An audio recording of the conversations is available upon request. Photos of the elderly couple in their apartment during my visit Figures 9, 10 and 11 are photos of the elderly couple in their apartment; they are taken during my visit with their expressed permission.

3.3.2.3 Qualitative semi-structured interview with nurse

Based on my interview with the district registered nurse, Ms. Renske Jansen from Bladel-oost, diagnostic equipment inaccessibility is generalizable (i.e. can be applied) to Dutch intramural facilities and extramural homes.

- GPs want nurses to provide blood pressure and blood sugar levels of elderly persons, but this information is not readily available since the tools to measure them are absent or inaccessible.
- "Some people do have a blood pressure gauge, but not everyone. We have one here, [in the 24/7 assisted living facility] but we would have to fetch it, and then return to the client. Sometimes, you go to a client and see that this is not going okay, then you ask a colleague. That colleague then comes to the rescue; getting a pressure gauge [...] It is something I had to get used to."
- "General practitioners ask for values of blood pressure, but we cannot provide them (in extramural care). So they have to come in and take it."
- The elderly person's blood pressure can be taken at home, "but that is the principle of extramural care. You cannot ask people to buy blood pressure gauges or bring it yourself [...] You can only set nursing diagnoses, not medical diagnoses."

3.3.2.4 Qualitative semi-structured interview with manager of elderly care center and subsequent ethnographic study

- The HCPs working at the elderly care center are very experienced and specialized.
- In order to help elderly people at a distance, the elderly care center nurses rely on information from an ICT-system that does not include the patient's digital records and other necessary up-to-date information.
- These nurses are often asked to act in an information vacuum. The only information that they can act on is what is relayed by the elderly person in distress.
- It is very difficult to determine what is happening at the other end of the line. These nurses rely on their experience a lot.
- These nurses have to repeat their requests a lot, sometimes after three or four times a reply comes.
- These triage-at-distance nurses almost exclusively only operate on nightshifts.

Figure 11. An image of a typical Dutch extramural home. An informal caregiver, in this case a housekeeper, is helping an elderly man to water his plants. Dutch nurses are not permitted to perform such tasks.

3.3.2.5 Ethnography study on mobile night team

I present a summary of events that occurred during my house visits with the Zuidzorg mobile night team and then I offer the general insights which I gathered from these cases.

Case 1: The wife of an elderly man, whom had fallen onto the floor, was distraught. The mobile night team was there to help him, but she thought that she could have lifted him up on her own. It was obvious that she was not strong enough to do so, but the team did not argue with her.

Case 2: A female elderly with a small body frame, a side effect of medicine provided to her during her youth, rang her personal alarm system. Her arm was aching. When the (male) nurse and I entered her home, after a delay in finding her keys, we found her lying in her bed. The nurse asked her what she was suffering from. During the day, she had fallen and hurt her arm, which was set in a cast. She explained that she had osteoporosis (i.e. a disease of weakened bones, common among elderly women). The medical specialists, who had previously treated her, explained that it may never completely heal. But after her fall, the pain was more than she had expected.

The elderly woman did not explicitly state the cause of her pain. The nurse thought that she had moved her broken bones within her cast and gave her paracetamol as a first-line treatment. Since the nurse could not find in her digital file, he called the nearest hospital but was placed on hold. After an exhaustive search, the hospital's triage telephone operator told the nurse that her information was not in the system. The nurse suspected that he was contacting the wrong hospital, and the elderly women confirmed his suspicion.

The elderly woman recounted to the nurse that she was not home during her fall and subsequent injury. The ambulance paramedic had taken her to a different hospital. The nurse could have not known this, unless the elderly women had told him otherwise. The telephone operator referred the nurse to another hospital in order to speed up the delivery of the elderly woman's care. An informal caregiver took the elderly women to the hospital. The nurse is not permitted by Dutch law to transport patients to the hospital.

After receiving confirmation the elderly women could be admitted to the hospital where she was treated for her broken arm, the nurse acquired a set of phone numbers from the elderly woman and contacted an informal caregiver in the middle of the night to transport the elderly woman to the hospital. According to Dutch law, informal caregivers and ambulances are permitted to transport patients to a hospital,

not mobile night teams.

The elderly woman was taken to the hospital but around 6AM in the morning, she returned home, and the nurse received a request for assistance. The hospital confirmed that her broken arm had to be recast. She could not be helped immediately or admitted as a patient since her GP was not on call. The elderly woman was told to sleep despite her pain and then return to the hospital at 10 AM for intervention.

Case 3: An elderly married couple was suffering due to ailing health. They were waiting to move to an assisted living facility. The husband, which happens to be the informal caregiver of the wife, had been diagnosed with diabetes and his condition was worsening by the minute. His wife was suffering from dementia. The GP called the mobile night nurse. The nurse anticipated the call much earlier and had made a medical decision. Under her care, she was feeding the elderly man Dextro-energy sugar. When the GP heard this, her tone of voice was different compared to prior conversations. She spoke in an authoritative voice. Her instructions were very direct. In Dutch, she asked the nurse: "Is this clear, can you do it?" The nurse replied, "It is clear. I will feed him bread and apple juice." After feeding the patient and, the nurse promised to measure his sugar levels soon thereafter.

- Elderly people are falling between the cracks due to the shortages of district nurses and the abolishment of retirement homes.
- Strong decisiveness sets triage nurses apart from district nurses.
- When an elderly person in the care of a triage nurse changes his language, tone and action, the triage nurse adapts her communication style and performs her duties very rapidly.
- Triage nurses are proud of their independence and are frustrated by how traditional nurses must perform their daily duties.
- Triage nurses want to wholeheartedly support their elderly persons. They choose their profession, despite its odd hours and associated work stress, because they are feed up with the robotic healthcare system.
- Instead of dedicating 15 minutes of care to their elderly beneficiaries, they want to take their time with each patient.
- Triage nurses want to connect with their elderly beneficiaries as humans. They want to drink tea with them at night.
- While they called to carry out triage care, triage nurses are forced to operate as unofficial members of the nursing staff. This not what they are meant to do.
- Triage nurses continue to work and communicate with other HCPs in the best interests of the elderly, even though they lack information to make decisions.

3.3.2.6 Performing the duties of an informal caregiver

My personal experiences as an informal caregiver corroborate the insights that I gathered from other primary research activities.

- Communication problems exist at each moment of elderly triage. Nurses and doctors often disagree when they are tasked to make informed medical decisions together.
- It is possible to overcome these challenges by diagnosing the elderly during extra- or intramural care, provided that they are given a digital presence so that an HCP can see them. Nurses are torn in a multitude of directions. They must pick up the phone, attend to patients, fill out paperwork, etc. These are explicit obligations. Communicating with their patients and their families is an implicit obligation.
- Nurses recognize that socializing is an essential human need. They are inclined to act on behalf of the elderly when their spouses are unable to act as their informal caregivers.
- Informal caregivers make personal sacrifices when asked to be "ever-present" for the elderly person.
- Medical information flows from the elderly person to the GP, from the GP to nurse, from the nurse to the informal caregiver.

3.4 CONCLUSIONS

In the section below, I summarize my conclusions based on the secondary and primary research findings.

3.4.1 SECONDARY RESEARCH

3.4.1.1 Media outlet analyses

- The Dutch government (stated by H. de Jonge, the Minister of Health, Sports and Wellbeing) maintains that caring for other persons ought to be the role of each person in a community, not just the top-down obligation of the government.
- The Dutch government acknowledges that society must seek new forms of living and providing care.
- Informal caregivers: The Dutch government asserts that informal caregivers should play a bigger role in elderly care. If their needs are considered nonessential during any triage moment, then they will not be included in the complex decision-making process of triage.
- The Dutch government wants to provide more care and services to the elderly; and innovation in the care chain is required to transform his vision to a reality. In order for healthcare to be organized around the elderly, HCPs, along with regulatory bodies and insurance providers, ought to change the way they work together.
- The Dutch government asserts that rules are a form of distilled distrust and intends to deregulate it. For instance, H. de Jonge wants to reduce the time spent by nurses to document what they are doing. However, his efforts are frustrated by insurance providers and IT. An insurance provider may call up a district nurse organization and tell it that documentation is necessary, even though the government no longer requires it. Furthermore, every rule change has to be implemented in the software systems used by district nurses. Before a rule can be removed, the software must to be updated, which can be an expensive and time consuming process.

3.4.2 PRIMARY RESEARCH

3.4.2.1 Context mapping with an elderly couple

- Independence is a core value of the Dutch elderly and their independence must be accounted for during the development of a new triage service for this target group.
- The virtual presence of a doctor gives the elderly person a sense of trust. When he knows a doctor who familiar to him is making a medical decision on his behalf, the elderly person feels more confident in that decision.
- It is often difficult for the HCP who is responding to an emergency call to gather the necessary information.

3.4.2.2 Context visit and unstructured interview with informal caregiver

- An elderly person with ailing health may be unable to identify and express his own unmet needs.
- The Dutch informal caregiver is aware of the needs of the elderly person in their care and has learnt how to resourcefully meet them.
- The informal caregiver suffers in silence on behalf of the elderly; she cannot verbally express her sorrow and sadness to the person in her care.
- The informal caregiver must communicate with HCPs so that decisions on behalf of the elderly person are dynamic during triage moments.
- Informal caregivers possess deep insights regarding the person in their care and their insights can be invaluable for HCPs during triage moments.
- Information flow and open communication may reduce the usage of human and financial resources and may improve the patient's medical outcomes.

3.4.2.3 Qualitative semi-structured interview with nurse

- Even though most nurses are capable of handling a litany of triage moments, the healthcare system prohibits them from taking action without the supervision of a medical doctor.
- The people outside of handling emergencies cannot change their way of working easily. This has implications for the scope of the design, namely that it would be good to adapt the way of working of nurses who now respond to emergency situations.

3.4.2.4 Qualitative semi-structured interview with manager of elderly care center and subsequent ethnographic study

- It is very difficult to read elderly persons who are suffering from old age. Sometimes, they lack the words to express what is wrong with them. As a result, nurses do not have sufficient information to make informed medical decisions on their behalf.
- If triage at distance uses a low-quality audio connection and self-reported injuries, HCPs cannot make reliable and experience-based decisions.

Born out of economic necessity (i.e. as a result of the housing shortage of elderly assisted living), the Dutch healthcare system adopted alarm pendant technology. This e-health device, and its related services, offer tangible benefits but also spawn counterintuitive effects. The actions of a nurse are replaced by robot functionality; thus dehumanizing the HCP in charge of elderly care. When the elderly use these alarm pendants in specialty hospitals, hospitalization rises. Likewise, when used for social purposes, elderly care center services are wasted. Bloch, Lundy & Rigaud (2017) agree that "these technologically refined products are not necessarily the right solution in all situations and all users."
Only 20% of calls made by elderly users of alarm pendants are involve serious medical issues. According to Figure 14. and Table 2., the emergency care company Connectzorg, compared to GPs and the ambulance, makes 18 times more follow-up house calls to the elderly. Over a 12 year period, GPs increase their elderly home visits steadily (from 23 to 37) as do the ambulance (16-48) over 6 month period; whereas Connectzorg visits fluctuate. These conclusions cannot be generalized across the Netherlands given that the data was obtained from the broad region around Eindhoven.

To preserve the privacy of those studied, no photographs are available. My detailed observations can be viewed in the Appendix.

3.4.2.5 Ethnography study on mobile night team

Case 1: A mobile night team might encounter an elderly person who is annoyed or confused because he does not understand why someone unfamiliar is entering his home. Regardless of the elderly person's defiance, DiaMediPort must provide practical and triage assistance before contacting an informal caregiver or another HCP.

Case 2: Diagnosing an elderly person who has an obvious complaint with DiaMediPort's diagnostic tools at her home may not solve an existing medical problem, but it can alleviates some of her emotional suffering as well as her informal caregiver's. The interactions with HCPs change from being a physical encounter (i.e. being in the same room in the hospital) to a virtual encounter (i.e. being connected via a tablet or phone-screen).

Case 3: An elderly person, who does not have an informal caregiver living at his home and is waiting for a spot to open in extramural care, must depend on service such as a mobile night team to solve his underlying problems. The mobile night team cannot anticipate but only react to the elderly person's

	Emergency care	General practitioner	Ambulance	Total per month	% per month
June '18	480	29	16	525	13,1%
July '18	486	23	17	526	13,1%
August '18	508	20	27	555	13,8%
September '18	460	23	36	519	12,9%
October '18	552	32	48	632	15,8%
November '18	548	37	30	615	15,3%
December '18	560	36	40	636	15,9%
Total	3594	200	214	4008	
% of total per follow-up category	89,7%	5,0%	5,3%		

Table 2. Amounts of follow-ups and percentages of distress calls received by Connectzorg.

medical problems not practical needs.

- There is beauty in every triage moment. Whether urgent care is practical, social or medical, human interaction via the senses (i.e. touch, sound or sight) can benefit the elderly in need of emergency assistance and his informal caregiver who is suffering in silence.
- Each triage moment is challenging. It might be challenging to find a solution for a current problem and another problem can occur during the emergency situation. Mobile night teams and their triage nurses who do not have permission to diagnose and treat an elderly person in distress find this disconcerting but must accept the reality that they cannot change the situation then and there.
- The process of triage starts when an elderly person encounters a problem and cannot solve it on her own or through the patient system. Connectzorg assumes every distress call is of vital importance, Something caused the elderly person to make the call, and even though it may not be a medical issue to be resolved by an HCP and it is their obligation to respect the integral needs of the elderly person. However, only 5% to 10% of the calls made to the Zorgcentrale care call center and/or the Connectzorg triage center are in fact related to a medical issue.
- The mobile night team becomes a part of the traditional medical system. They undertake unexpected tasks at night, when an informal caregiver or nurse is unavailable to perform them.
- Although the mobile night team understands that the elderly person is suffering, the team accepts that the person in their care will continue to suffer until a HCP with authority is accessible and/or present for intervention. Even though a triage nurse is powerless to change the healthcare system, she responds to the desperate situation and assertively performs at the boundary of her duties to comfort the elderly person.

3.4.2.6 Performing the duties of an informal caregiver

Refer to figure 12. and 13. for an impression.

- HCPs must “see” an elderly person to make an informed medical decision.
- A triage situation can be better understood when more than two set of eyes evaluate it.

Figure 12. As informal caregiver, I visited the hospital with the elderly man.

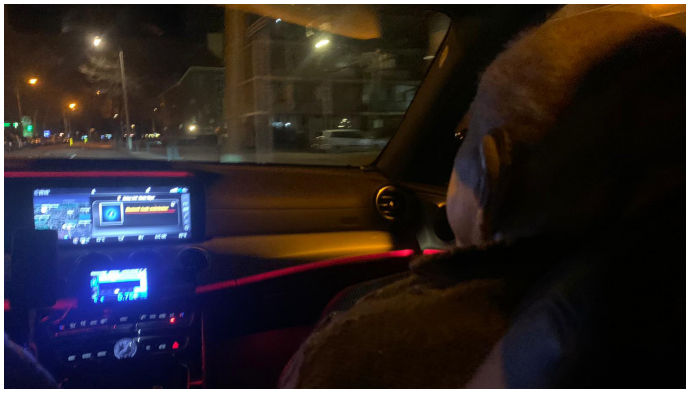


Figure 13. We returned home by taxi after the hospital released the elderly man.

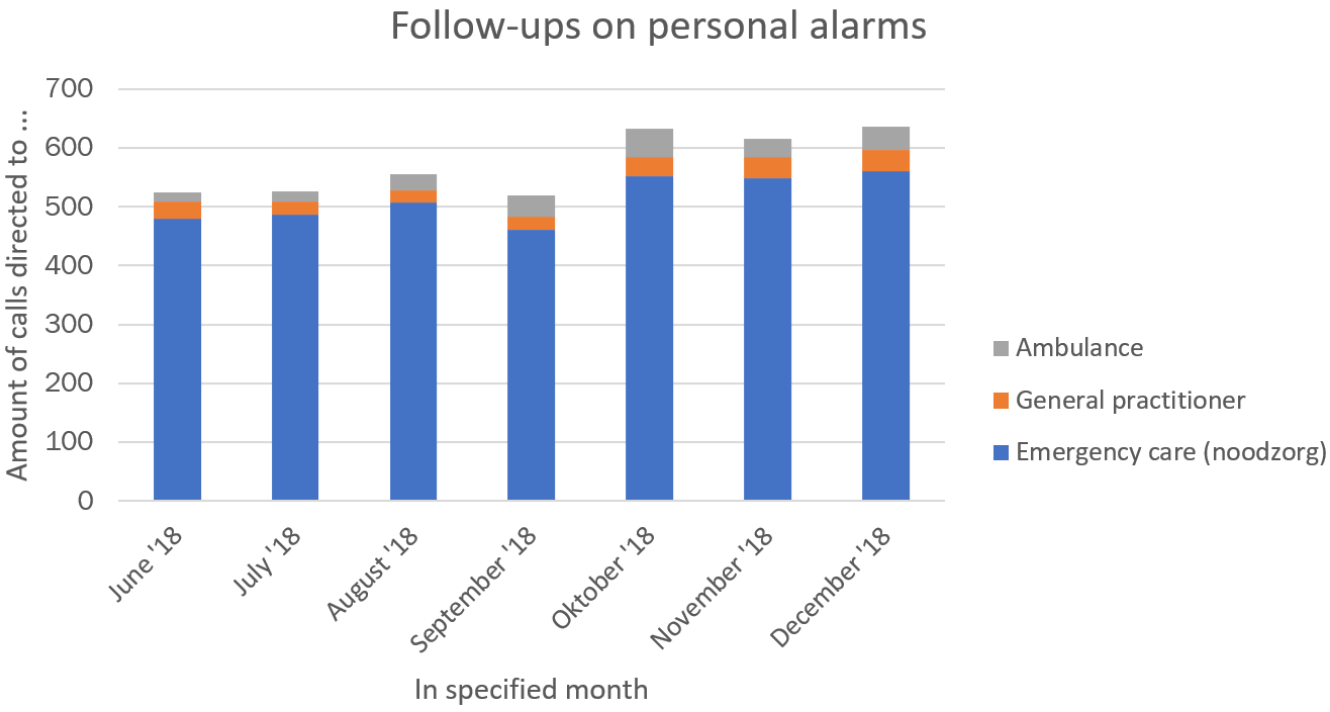


Figure 14. Bar-chart depicts the follow-up visits made per actor (following distress calls received by Connectzorg) from the period of June to December ’18.

4. IMPLICATIONS

This section explains the implications of the research conclusions on the beneficiaries of DiaMediPort, elderly triage (4.1), elderly people living in extramural homes (4.2), informal caregivers (4.3), and stakeholders (4.4)

Figure 15 is a visual aid describing the process in which the elderly Dutch person in distress was provided elderly care in 2019. The DiaMediPort service was in development at this time; and its founders only introduced their triage services in 2020.

The following are the steps in which the elderly person initiated the call for help and the successive stakeholders and patient and information logistics involved to diagnose, medicate and treat the elderly person.

- The elderly person encounters an urgent problem.
- The elderly person contacts a care call center or an informal caregiver or nurse notices the person is in distress.
- A triage phone operator directly or indirectly sees the elderly person or the GP or 112 is alerted.
- When a district nurse nearby is alerted, she is tasked gain more information on the elderly person.
- When 112 is alerted, the ambulance picks up the elderly person, transports him to the hospital where he is admitted, diagnosed and treated.

Triage is an iterative process (refer to Figure 16.) An (integral) image of a patient is formed with insights gained by medical professionals; once the image of the patient is adjusted, it is acted on and the patient is informed by HCPs. The target groups of the DiaMediPort service, as described in the problem statement, are two beneficiaries. The primary beneficiary of the service of DiaMediPort is the elderly person in distress. The service fails if the needs of this person are not properly met. The secondary beneficiary of the service is the informal caregivers of the elderly person in distress.

4.1 ELDERLY TRIAGE

Hospital admission of elderly people can be a form of repeated and needless suffering. Needless because medical functions (diagnosis and treatment) that are currently only found in the hospital, could be brought to the home of elderly, with point-of-care technology. Tele-health, tele-medicine and tele-presence solutions bring the doctor virtually to the home of elderly. These solutions are exploited currently for chronic diseases like COPD, yet not for emergency elderly triage. Elderly and their informal caregivers suffer repeatedly, since these emergency triage moments sometimes do not cause a sustainable change in the context of the elderly. Care plans, nursing care, informal care, are not adjusted well enough for the abrupt changes in the health of elderly. Healthcare institutions, laws, insurances and care packages act like constricting walls and therefore frustrate efforts from doctors, nurses, informal caregivers and elderly people to bring fitting and sustainable change in both medical and social care for these elderly. For example, getting a new indication by the 'center for indication of care' (Ciz in Dutch) takes up to six weeks. And in six weeks, elderly people could be readmitted to the hospital multiple times, causing huge financial pressure and creating a shortage of hospital beds. Shortages in intramural institutes prevent elderly to move to the part of the medical system that was designed for them, with 24-7 care and specialized nurses.

4.1.1 THE RED FLAG

When an elderly is currently being rushed to the hospital, it acts like a red flag for the family, friends and neighborhood. The effects of an emergency admission in the hospital and ambulance transport, are that informal caregivers increase their efforts to support and improve the situation of the elderly, for instance placing them in an intramural home.

4.1.2 THE PARADOX OF A TRIAGE MOMENT

How can this fragile elderly person be helped and supported in a triage moment? What should a triage moment look like in the vision of DiaMediPort? There should be a path from the current situation, until an ultimate vision where every triage moment serves the needs of elderly, informal caregivers and the medical system.

During every triage moment, a human and warm bedside manner is crucial. Emergency responders look at the integral (needs and) personage of the elderly patient. Split-second decisions at a triage moment will have lasting financial and social impact in the lives of elderly and their informal caregivers.

These decisions and actions are performed, not by doctors, but by nurses or carers, and these people are under pressure of increasing shortages.

In the regular nursing shifts, the human and warm side has been cut, but this leads to an increase of triage services, like ambulance rides and alarm pendant use. This is why the triage moment is paradoxical: because at a moment where every minute counts, there is ample time to care socially for vulnerable elderly who are in need. In a proper triage moment, the situation of the elderly can be turned around so the underlying system matches up again with the needs of the elderly. If the societal layer and medical layer are properly matched to the needs of elderly, further prevention of triage moments can be expected. When there are no sustainable changes to the elderly care or in the social context of the elderly, a triage moment is probably going to repeat itself.

Therefore, the human factor should never be neglected. Replacing a nurse in a triage situation has already happened by using alarm pendants instead having a nurse located nearby every extramural home. If we start to replace an ambulance with a triage-at-distance moment without a doctor or nurse being able to see and hear the real-time situation, the paradox

of a triage moment will be a direct contradiction of interests, between the medical stakeholders and the elderly and his informal caregiver.

4.1.3 TRIAGE DIVERSITY

In Figure 16. the process flow of elderly triage is shown, starting from an elderly person realizing something is wrong, until an elderly is diagnosed and treated. Different triage moments differ substantially, based on the respondent, the medium of triage-at-distance, the complaint of the elderly and the elderly's ability to explain and understand what is happening. For instance, the severity of the issue, together with how independent the patient system can react, determine the quality of the triage-at-distance process, and therefore the degree of trustworthiness (chance a good decision is made).

Or in another case, if an elderly is only able to say 'I am not feeling well', the triage nurse, sitting at a telephone center, has very little information to decide what the best action to take is. This is even amplified by how much information is known of the person that is calling the center.

In some regions in the Netherlands, the people in general can call the special emergency number, 117. During off-hours, the elderly in distress can call a special telephone line to connect to general practice. Hence, a significant amount of elderly require triage services, which lends the elderly triage service credibility.

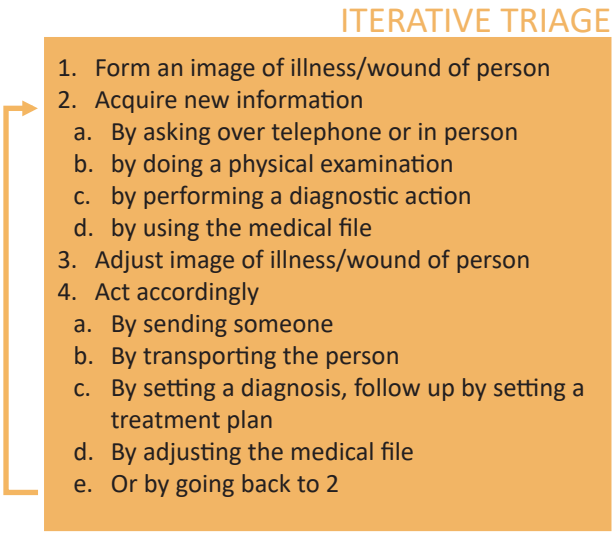


Figure 15. Triage as an iterative process

4.2 ELDERLY PEOPLE LIVING IN EXTRAMURAL HOMES

When an elderly person living extramurally is in distress, they, or someone else in the patient system (for instance, a spouse or neighbor), may call for help. This can be done with their telephone, but also with a person's alarm device. This person's alarm device enables an audio connection to a dedicated operator center, so the elderly person can explain what happened. General practitioners are medically 'allocated' for (elderly) people who live independently, so it makes sense to connect to them for DiaMediPort. The main benefit of the DiaMediPort service for elderly is that they can remain in their own home, where they are familiar. It is hard for these people to retain their independence when they are brought to a location they are unfamiliar with.

The term extramural homes reflects the beneficiaries' context, which has inherent value and information. In the current triage system, the elderly is stripped from his context. When any person enters a home, they will smell, look and listen – use all their senses – to gather all the contextual information that is hidden behind the explicitly worded information an elderly tells us. Elderly people seem to be especially prone to hiding risks and presenting themselves as more independent than they are. Diamediport enables a virtual house visit, where a nurse can use his senses and a doctor can gain visual and audial access to the context of the elderly.

An extramural home is recognizable as such:

- There is an audio transmitter (alarm pendants) (Figure 10.)
- Notes from informal caregivers, nurses and carers to instruct the elderly – on a font that is too small for them to read
- The toilet can have special bars
- There can be hearing or visual aids visible
- There can be a mess on the table or on the floor, indicating the elderly person is unable or unwilling to deal with it, and also indicating there are gaps in the formal and informal care for the elderly

IDENTIFIED NEEDS OF ELDERLY PERSON:

- I want to retain my independence.
- I want to stay at home
- I want to be cared for by loving people
- I want to be surrounded by family (interpretation: familiarity) I do not want to change my way of life now that I am old (or, too old to change my ways)

4.3 INCLUDING INFORMAL CAREGIVERS IN TRIAGE MOMENTS

The informal caregiver may suffer on behalf of an elderly person. Elderly people sometimes do not notice they are ill, but informal caregivers do. However, when acting on behalf of the elderly person, the caregiver is frustrated if her efforts are obstructed by the healthcare system, regulators, or other stakeholders. They need to be a system-fighter. One has to be relentless and assertive in protecting the interests of the elderly person, and their own, especially since the institutions are not designed to serve the needs of elderly or informal caregivers. In triage moments, caregivers need at least to be notified what is happening and be given an opportunity to react. Sometimes, especially when documentation of an elderly is lacking, insights from an informal caregiver can change the life course of an elderly.

Another reason for including informal caregivers in the triage moment is because they are may be excluded when DiaMediPort would replace the ambulance ride. An ambulance and ER admission causes informal caregivers to urgently come to the hospital, and (probably) see that changes are made in the support systems of the elderly – for instance initiating a new care indication or talking to medical doctors, or making sure every day someone sees the elderly. If bringing the ER to the elderly, means that informal caregivers feel that there is not a real problem to be dealt with, sustainable change in the situation elderly is less likely to happen. Therefore, it should be made easy for informal caregivers to be included in the triage moments of the DiaMediPort service for instance by

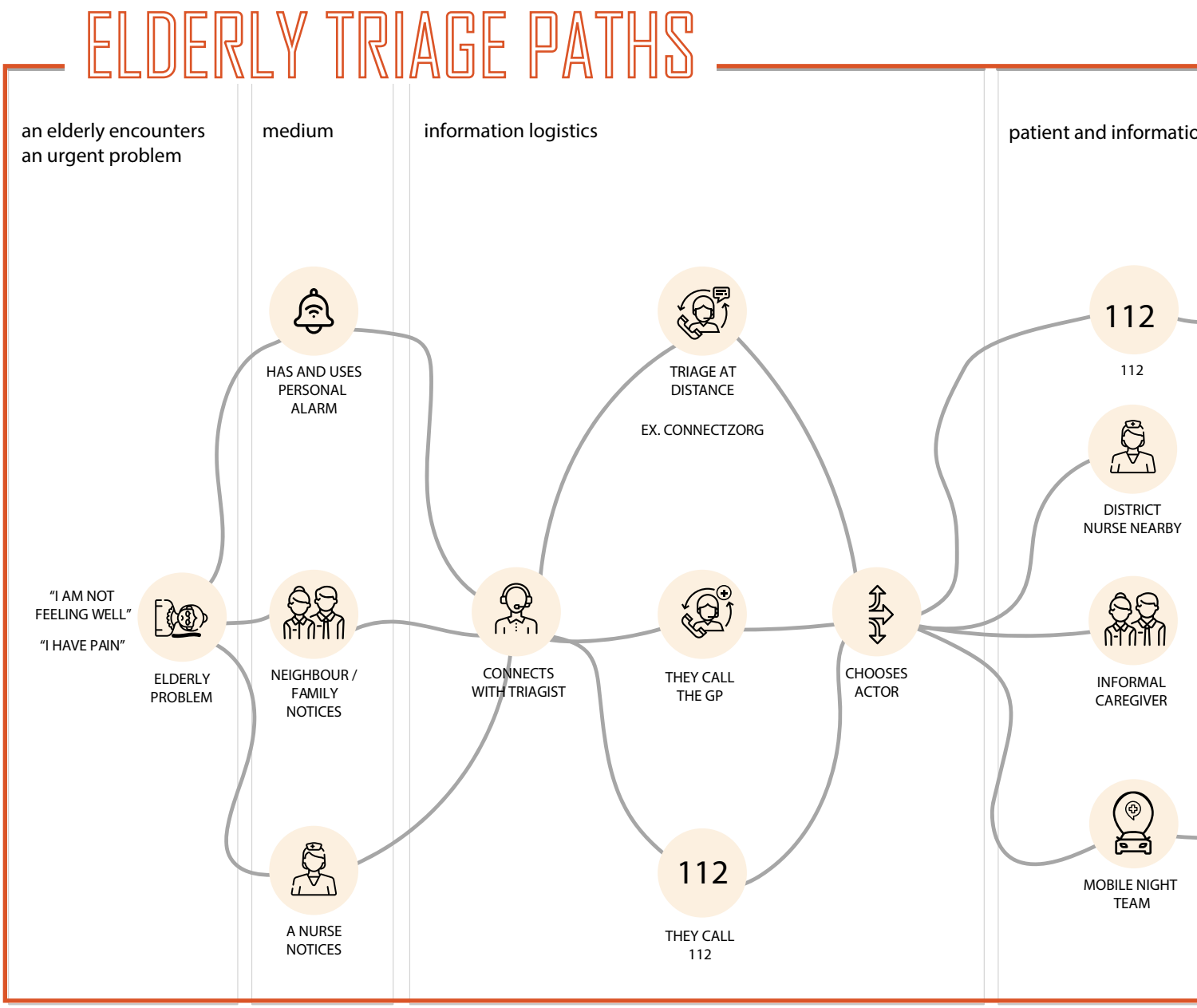
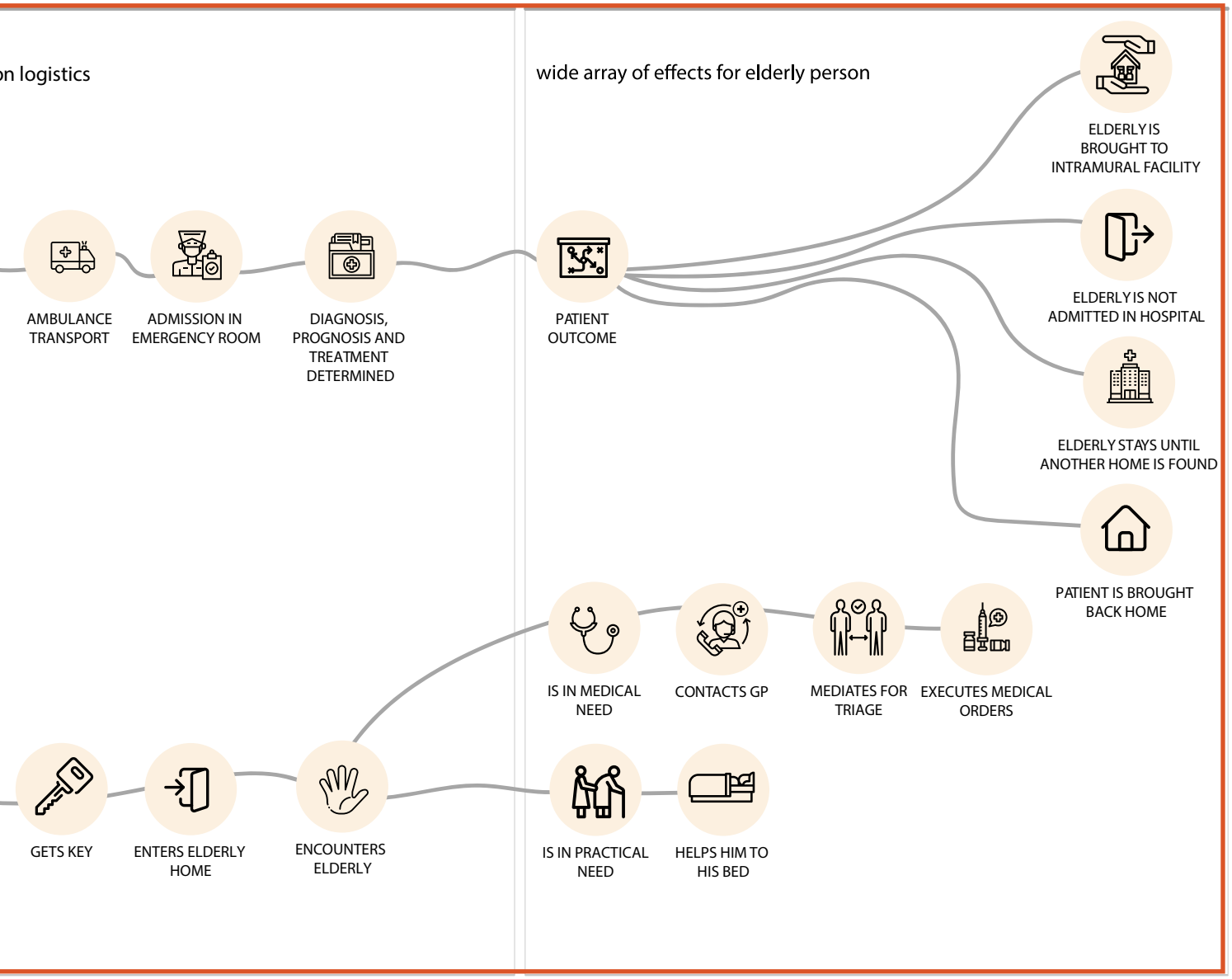


Figure 16. Current process flow of elderly triage in the Netherlands during 2019


on logistics
wide array of effects for elderly person
AMBULANCE TRANSPORT
ADMISSION IN EMERGENCY ROOM
DIAGNOSIS, PROGNOSIS AND TREATMENT DETERMINED
PATIENT OUTCOME
ELDERLY IS BROUGHT TO INTRAMURAL FACILITY
ELDERLY IS NOT ADMITTED IN HOSPITAL
ELDERLY STAYS UNTIL ANOTHER HOME IS FOUND
PATIENT IS BROUGHT BACK HOME
IS IN MEDICAL NEED
CONTACTS GP
MEDIATES FOR TRIAGE
EXECUTES MEDICAL ORDERS
GETS KEY
ENTERS ELDERLY HOME
ENCOUNTERS ELDERLY
IS IN PRACTICAL NEED
HELPS HIM TO HIS BED

obliging the informal caregiver to be notified (digitally) with all available information, contact information of the nurse who visited, contact information of the doctors that were consulted and diagnostics information that was gathered at the triage moment. In this way, the triage service would be transparent and, to a degree, accountable.

The informal caregiver feels responsible for the needs of the elderly person. In the TV show 'taboes op tafel', the caregivers stated that the 'newly' responsible municipalities used 'consultants' that would simply try to advice the informal caregivers so that they would continue to carry the elderly person's load. However, these informal caregivers were already tilting and unable to keep carrying the load, which was the precise reason to seek help from the municipality. The central Dutch government now seems to be aware that when green pressure materializes, elderly people themselves are becoming informal caregivers. And when old people start to care for old sick people, the chance increases that informal caregivers become ill themselves, need to be hospitalized, and therefore elderly will be left alone. These developments make it even more necessary for informal caregivers to be included in triage moments.

There may be conflicts of interest between an elderly person and his informal caregiver, since family and friends can be attached to elderly people. This could result in a strong desire to cure the elderly, whereas it could be the elder's desire to accept a new phase of life.

IDENTIFIED NEEDS OF INFORMAL CAREGIVER

- I want to acquire help so my neighbor (elderly) can be properly cared for
- I need it to be easy to take actions on behalf of the elderly
- I want (to be able) to trust medical professionals in emergency

4.4 STAKEHOLDERS

The parties involved in the triage of elderly extramural care are internal stakeholders who are cooperating in the DiaMediPort service and external stakeholders who are chained together by the service of DiaMediPort. The service of DiaMediPort requires internal stakeholders to work together in new ways, so the needs of the beneficiaries are met.

Since the position DiaMediPort takes has also value for other scopes and target groups, for instance for intramural elderly care, or for chronically ill younger people, the internal stakeholders are chosen in such a way, that the service does not need to change when the external stakeholders change.

The first stakeholder is the technical nurse. A technical nurse is able to execute diagnostic activities. The second stakeholder is the doctor-at-a-distance, which can be a general practitioner (out of hours doctor's office), a specialist elderly care (intramural care facility) or an emergency department doctor (hospital). Other stakeholders are the government, insurance companies, nursing organizations and care facilities, hospitals, municipalities.

Stakeholders who are actively using DiaMediPort, that can and need to be trained as such are the nurses who travel to extramural homes and the doctors who get to see and talk with the elderly and the nurse, in other words the doctors who are trained in virtual medical shared decision making.

When an elderly receives extramural care, the general practitioner remains the responsible doctor. If there is need for triage, DiaMediPort can be brought in for elderly people who are not at risk of severe illness. DiaMediPort can for instance use echo to determine whether there is indeed problem with a fracture, and if there is, the elderly can be brought to the hospital planned moment. But if there is new problem with the fracture, the DiaMediPort intervention has saved money for the medical system.

IDENTIFIED NEEDS OF A GP

- I want to remain informed about what is going on with their patient.
- I want to see the patient ("klinische blik")
- I want to assign patients correctly, only admit them to a hospital when necessary
- I want to know how the situation and ability of the patient is in relation to their medical needs

IDENTIFIED NEEDS OF A NURSE

- "good care is warm attention"
- I want to know what to do
- I want to be there for the elderly person, completely, and help them understand what will happen
- I want to be warm and attentive, while delivering good care

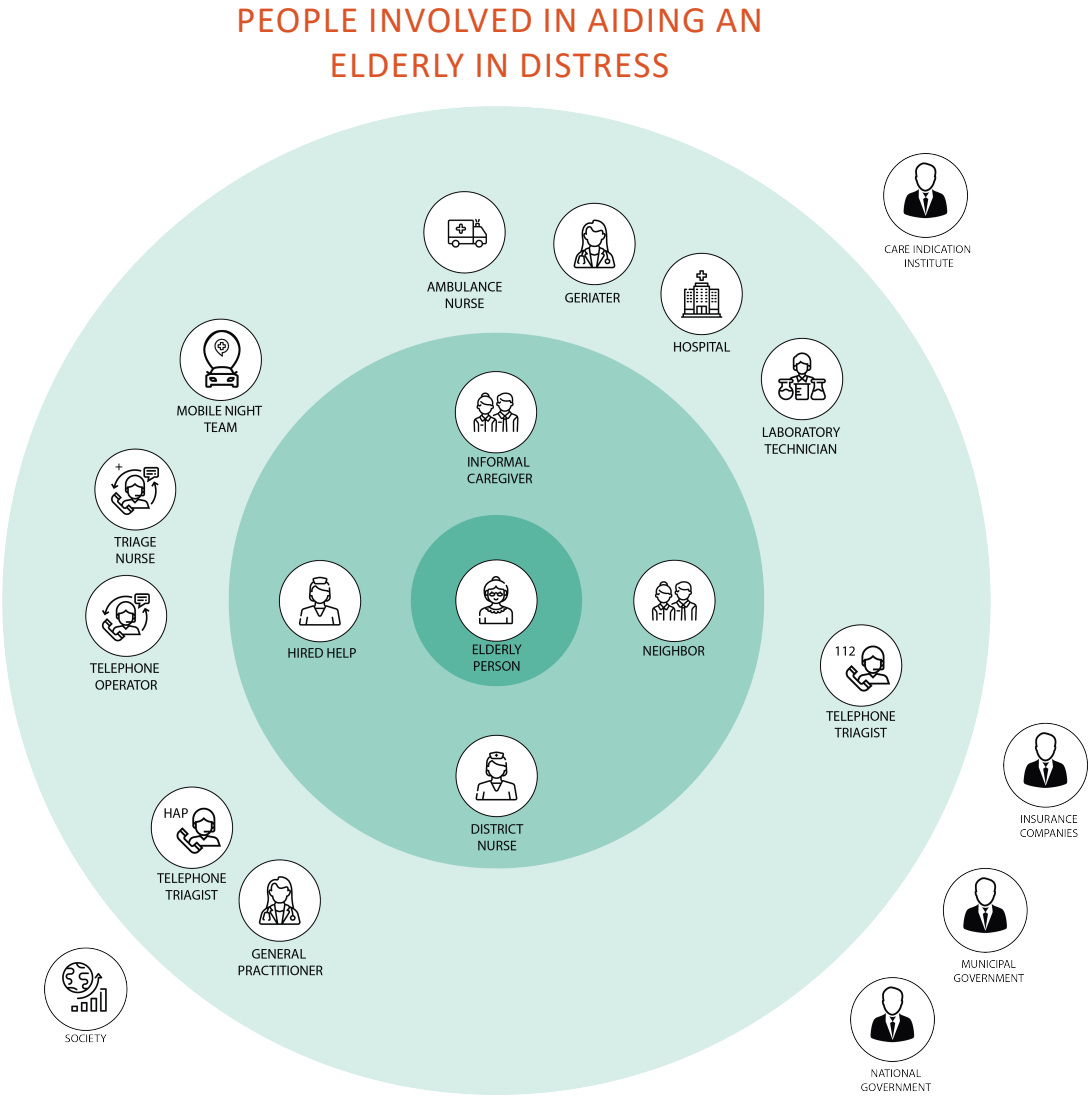


Figure 17. An elderly Dutch woman lives in extramural care and various stakeholders are tasked to interact with her during her hospitalization. On a regular basis, the elderly woman (depicted in dark green) is in contact with an informal caregiver, a neighbor, hired help and a district nurse. When an emergency occurs, stakeholders including HCPs and government representatives (depicted in light green) are involved.

5. DESIGN TOOLS

DiaMediPort requested an industrial designer to create tools that could visually inform and convince HCPs and decision-makers (e.g. insurance providers, hospitals, and governmental bodies) to adopt DiaMediPort's services in the Netherlands.

I created two design tools to illustrate how the varied parties interact in the Dutch healthcare system. Refer to Figure 18. The first tool offers stakeholder perspectives and consists of two parts:

1. "DiaMediPort Platform" presents an overview of their eneficiaries and stakeholders, their social context and how DiaMediPort acts as intermediary between the elderly and their HCPs.
2. "DiaMediPort in Film" includes three short-films of elderly persons in triage situations; these stories are produced with cartoon cutouts and voice-overs.

The second tool offers a layered system overview of the DiaMediPort concept. "DiaMediPort in Use" illustrates the phases in which DiaMediPort goes through.

My design tools were based on first and second project objectives (see page 13) and the insights generated by research findings. My insights, as a reminder, the following: 1) the elderly care value chain, including its beneficiaries and its external and internal stakeholders, 2) DiaMediPort's potential benefits along the elderly care value chain; and 3) the layers of the elderly triage system.

Each design tool is built on multiple layers in order to uniquely answer different questions. Refer to Figure 18. as a visual aid. Layer one explains and overviews the DiaMediPort service. It displays DiaMediPort service's core benefits. It must be simple in design, removing all the complexity of the healthcare system across regions and its varied patients and their morbidities and the social context. Layer two gives substance to the service. It must be general and specific so that elderly persons, their informal caregivers and HCPs (i.e. medical doctors and nurses) understand how the service works. It must display the different stages offered by the DiaMediPort service. Layer three must provide information on how the service can deal with real elderly people during triage moments. It must be recognizable and detailed, in such a way that healthcare experts can recognize the problems which the DiaMediPort service solves.

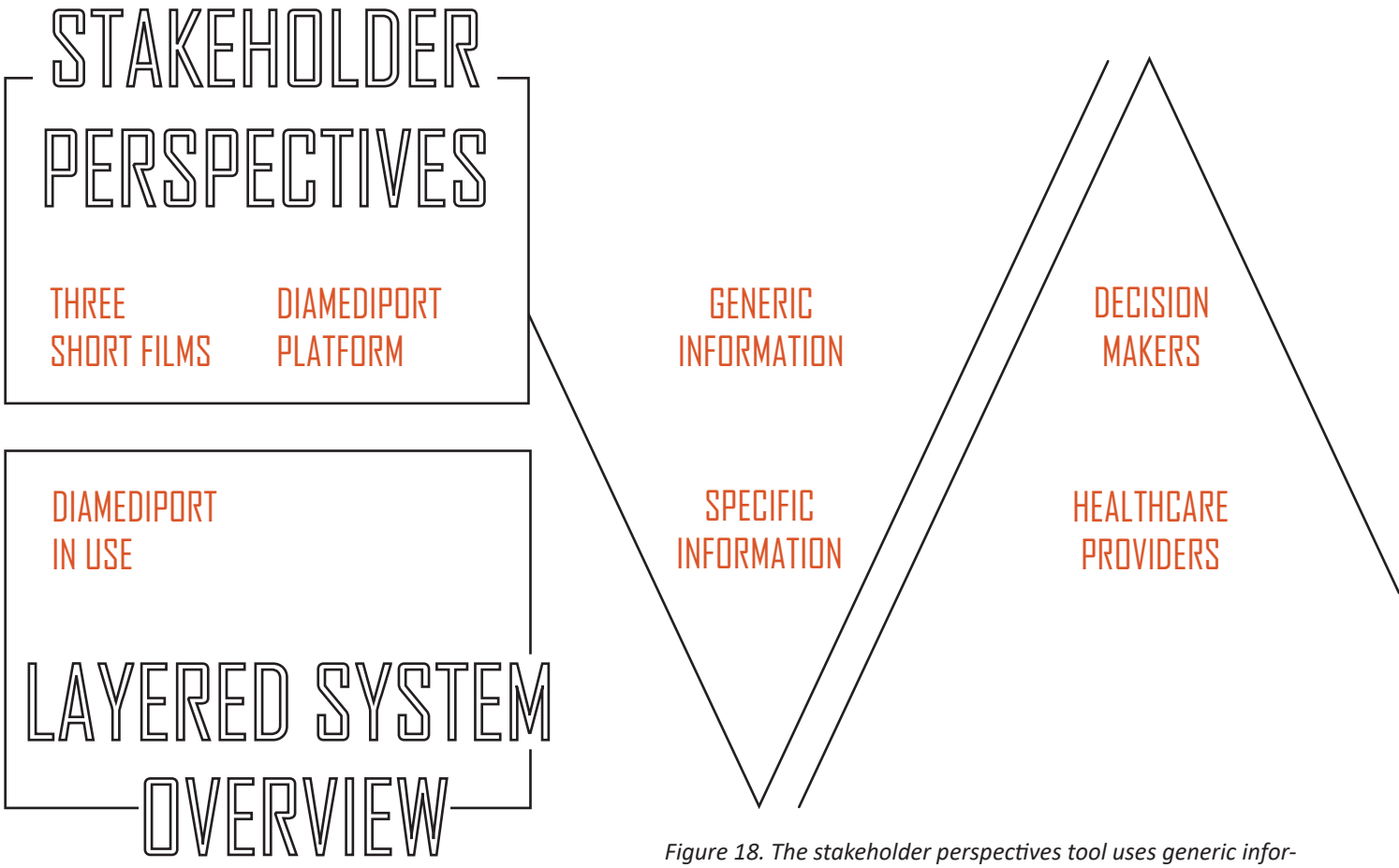


Figure 18. The stakeholder perspectives tool uses generic information to provide insights for decision-makers and the layered system overview uses specific information for HCPs

5.1 TRIAGE ROLES OF DIAMEDIPORT

After presenting my tools to DiaMediaPort's clients, the take-away must be that DiaMediPort prevents the redundant and needless suffering of the elderly during triage moments. My tools highlight how DiaMediPort finds beauty and potential in every triage moment; thus enabling the elderly to retain some of their personal agency, empowering their informal caregivers and supporting the traditional healthcare system.

Table 3. defines the problems experienced by the DiaMediPort's beneficiaries, their underlying causes and explains how DiaMediPort can solve their problems. The main concerns of the Dutch elderly person are his feeling of loneliness and his suffering from needless hospitalization due to ineffective triage. DiaMediPort's services cannot tackle the underlying causes of the elderly person's problems, though it can address or relieve his experienced problem. For example, when DiaMediPort diagnoses quickly and treats appropriately the elderly person at his home, his personal agency is most likely secured. An informal caregiver is often nearby and in charge of protecting the agency of the elderly person. The main problem of the informal caregiver is that the elderly person cannot express himself to HCPs. Once again, DiaMediPort's services cannot tackle the underlying causes of the informal caregiver's problems; it can, however, address or relieve her experienced problem. For example, if the informal caregiver connects to an emergency specialist via DiaMediPort, then she is less likely to be frustrated.

Table 4. defines the roles and benefits offered of the HCPs (e.g. GP and specialist nurse) and explains how DiaMediPort solves the expected challenges that both HCPs face during elderly triage. The main role of the HCPs is to diagnose and treat. DiaMediPort builds bridges in order that HCPs and beneficiaries interact.

Beneficiaries	Experienced problem	Underlying cause	Benefits offered by Diamediport
Elderly person	Feels isolated Needlessly hospitalized Receives ineffective triage Unknown persons administer care	Shortage of medical personnel and housing Systemic slowness	Receives real-time triage at home Provides trustworthy and personal attention by cooperating nurse and doctor
Informal caregiver	Frustration because the elderly person cannot explain their needs/wishes to medical or practical professionals. Suffer on behalf of elderly Lack of trust among the elderly	Acts on behalf of the elderly Governmental organizations and hospitals are not designed to act as intermediaries (misalignment)	Connects to an emergency specialist or physically calls in Shares information that assists the elderly person Less frustrated due to effective triage

Table 3. This shows how the experienced problem is related to the causes, and how these causes or problems are overcome in a solution the Diamediport service provides.

Internal stakeholders	Role	Benefit offered by DiaMediPort	Challenges of DiaMediPort
General practitioner	Virtual house doctor Authorizes diagnostic actions	Provides real-time medical expertise Provides diagnose Recommends treatment protocol	Interprets and communicates with the specialist nurse
Triage nurse	(Physically) connects with elderly Communicates with informal caregiver Uses all senses to gain all information that is in the context of the elderly. Executes diagnostic actions	Physically present	Acts a bridge between the elderly patient and GP Interacts with technology and the GP at the same time Multitasking is a necessary skill Extensive training may be required

Table 4. This table shows the differences in roles of the general practitioner and the specialist nurse. The benefits are offered to the external stakeholders (target group).

5.2 STAKEHOLDER PERSPECTIVES: DIAMEDIPORT SHORT FILMS

The final design consists of three short films based on six screenplays (see Appendix 7.5). The films were uploaded on YouTube for DiaMediPort to validate and present on its web-site. Both components of the tool Stakeholder Perspectives made use of work created with Scenes™ by SAP AppHaus. Access to the videos can be requested with the author of this thesis.

experience.sap.com/designservices/resources/scenes

5.3 STAKEHOLDER PERSPECTIVES: DIAMEDIPORT PLATFORM

The DiaMediPort platform visually describes how DiaMediPort and its beneficiaries and its stakeholders interact. The term of platform suggests that beneficiaries and stakeholders move on a wooden board. The table-top demonstration can enable anyone to explain how the DiaMediPort service works. Figure 20 displays the platform with its four components; two beneficiaries (e.g. the elderly person in distress or his informal caregiver); and two stakeholders (e.g. triage nurse and general practitioner).

The wooden parts depict the four components crucial for the DiaMediPort service to function. The movable, 3-dimensional cut-outs are printed images from Scenes, a storytelling tool created by SAP AppHaus. The elderly person (or informal caregiver) calls a hospital and is connected to a telephone operator. This telephone operator contacts the elderly person's GP to determine whether a triage nurse can visit the elderly person's extramural home or intramural facility. The triage nurse brings along a diagnostic kit including equipment "prescribed" by the GP. When the triage nurse connected to a GP during the visit and information is relayed back and forth to the GP and nurse.

Instead of the elderly person going to the medical context, DiaMediPort brings information on the patient's needs to the medical context. More specifically, the elderly person and the informal caregiver are the context of the elderly. The triage nurse brings the DiaMediPort equipment to the context of the elderly in order to make a virtual home visit possible. The GP virtually sees the elderly person; gets his real-time diagnostic information; and asks the informal caregiver her opinion on what ought to happen. When all the information is obtained from the social context, the elderly, informal caregiver, GP can make a medical decision to meet the elderly person's needs.

Figure 19. is a side-view of the DiaMediPort Platform. It depicts the three layers of the platform are 1) the needs of beneficiaries and stakeholders, 2) technology, and 3) system-atic.

The design process is split in 8 consecutive steps. Refer to the images of Figure 18. The Erasmus MC head of GP of Education tests the platform. I draw out the needs of the beneficiaries and stakeholders in different iterations. 1:1 paper models are cutout. A wooden model is made with a laser cutting machine and glued with detachable components. The quality of the model and the form-factor (wooden and layered) may surprise the decision makers. It is in line with what I observed during qualitative interviews.

5.3.1 INSTRUCTION FOR CO-CREATIVE WORKSHOP

To convince people optimally, DiaMediPort's marketers must use the platform as a storytelling device or placeholder. Ideally, these marketers make changes to the presentation themselves. The board must have cutouts but the board must not be initially filled with a story. The marketers must take this table-top to different regions and include different stakehold-ers. For instance, to convince HCPs who are not involved with extramural care changes can be made with the cutout images.

A co-creative session, where the Stakeholder Perspectives tool is used by DiaMediPort, may follow these steps:

1. Ask the attendees to prepare two stories: write down the successive steps in which two elderly you know was admitted to the hospital needlessly or redundantly.
2. Welcome everyone. Inform them about the duration of the workshop and its objective.
3. Show one or two short films (without DiaMediPort).
4. Ask the attendees to the workshop to write on post its how this situation compares to what they know of their day to day practice
   a. Which similarities do they recognize?
   b. Which differences do they see?
5. Ask some of them to share what they have written down and have a brief discussion on the current problems they, elderly people and informal caregivers experience with elderly triage
6. Show one or two short videos (with Diamediport)
7. Ask the attendees to the workshop to write on post its how using Diamediport's Voorspoedzorg Diagnose Kit compares to what they know of their day to day practice
8. Show the DiaMediPort platform and invite them to touch it.
9. Explain the elderly context, the medical context and the connection DiaMediPort provides.
10. Ask them to make groups and distribute the same amount of platforms + stakeholders. Distribute colored paper and markers.
11. Task them to share and play out what happened in their stories. Ask the listeners to write on post its what this would mean for their work. What would using DiaMediPort mean for their workflow? Which value would it achieve for the elderly person, the informal caregiver, and HCPs you work with?
12. When all members of the groups have shared, ask them to discuss which benefits and roadblocks they see. Discuss with the complete group how DiaMediPort could be implemented in their work.
13. Close the meeting by thanking everyone.

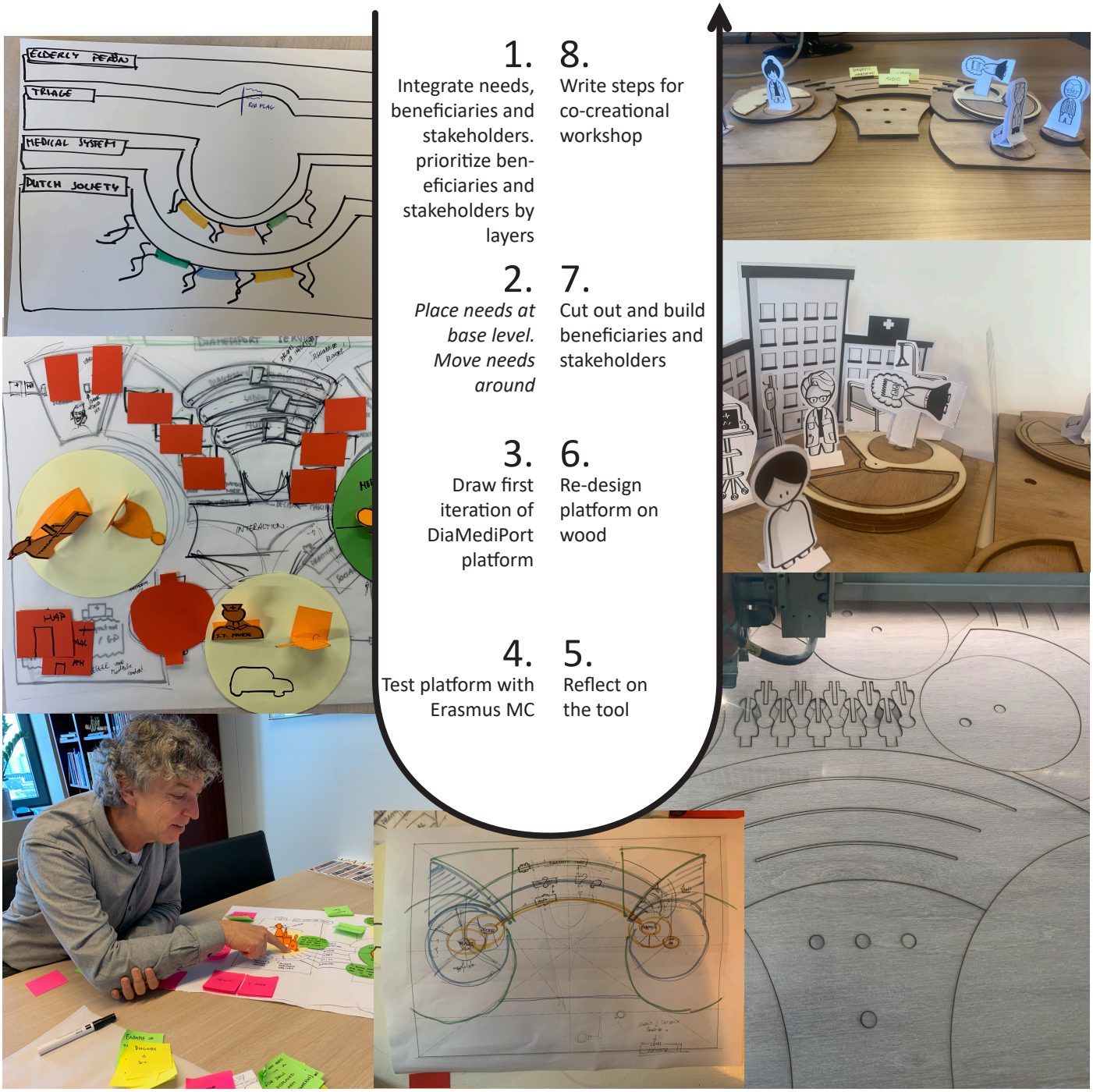


Fig. 18. The eight consecutive steps in designing the DiaMediPort Platform

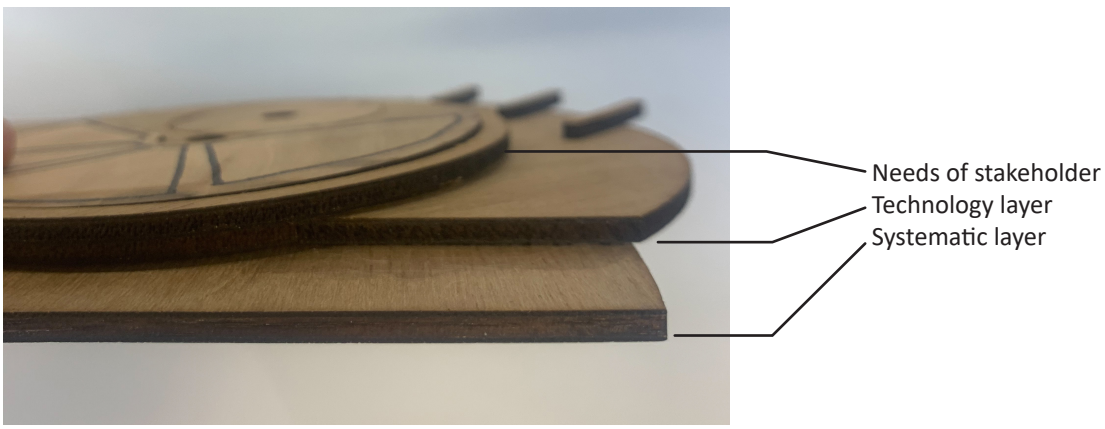


Figure 19. The side-view of the DiaMediPort Platform

STAKEHOLDER PERSPECTIVES

DIAMEDIPORT PLATFORM

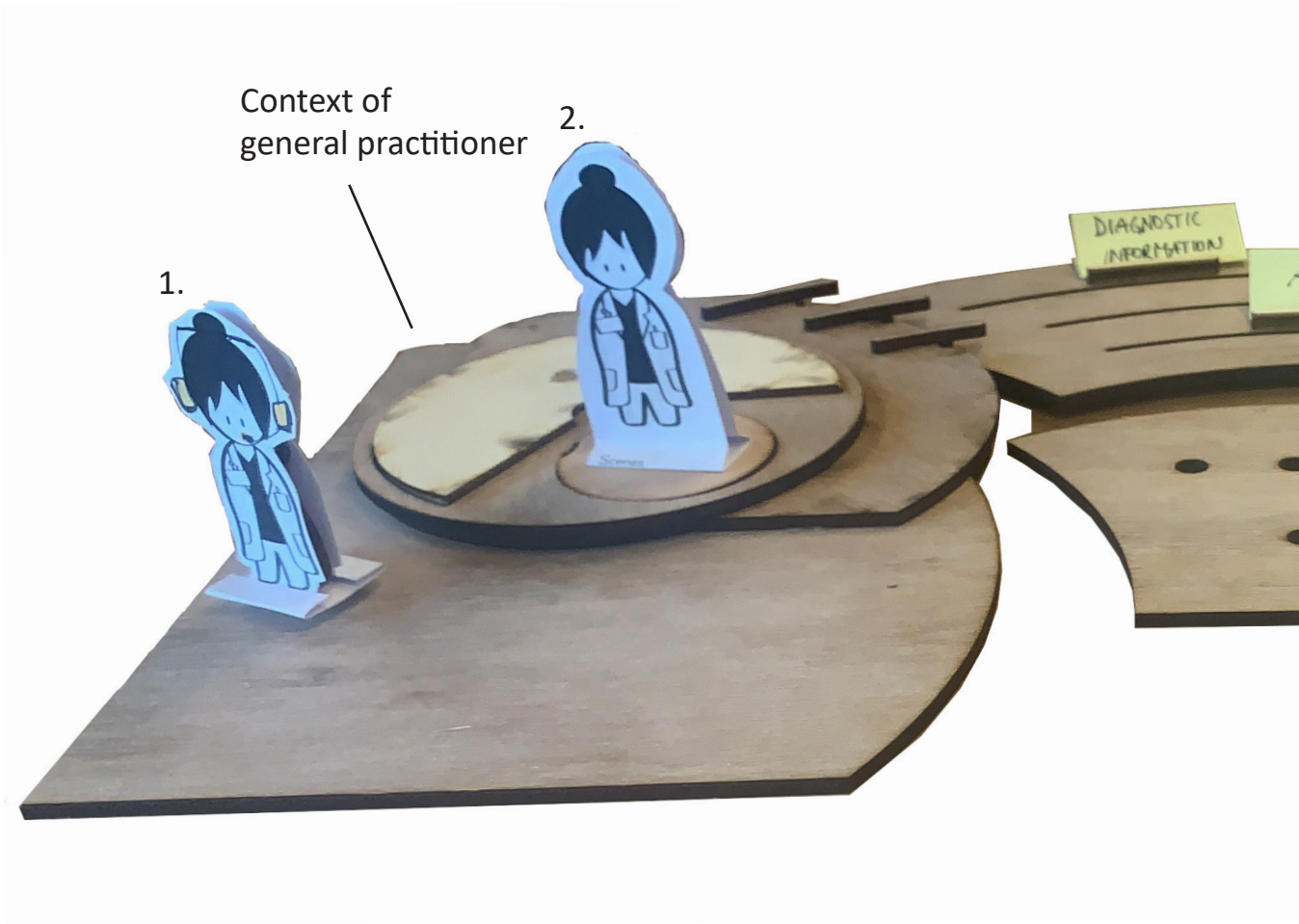
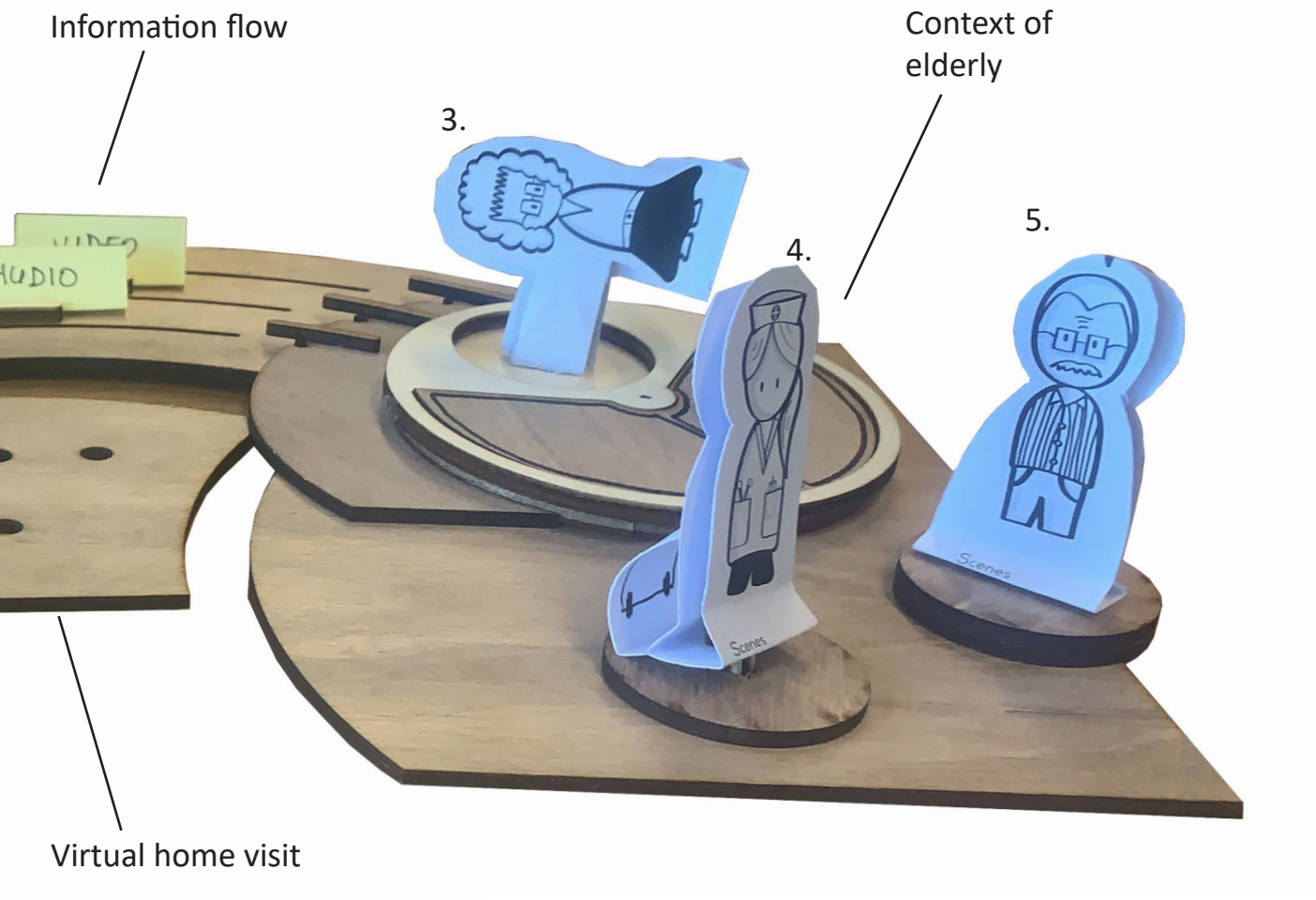


Figure 20. The DiaMediPort platform includes the contexts of the beneficiary and of the HCP and the information flow during the virtual home visit.

1. Triage nurse. This telephonist nurse accepts the call, and refers it to the doctor to decide whether to send in Diamediport.
2. General practitoner. When the specialist nurse has arrived, the doctor is connected via the information flow to the context of the elderly.
3. The elderly person in distress.
4. The specialist nurse. This nurse brings the necessary equipment from the context of the general practitioner to the context of the elderly.
5. Informal caregiver.

DIAMEDIPORT SHORT FILMS



5.3.2 CONTEXT OF ELDERLY IN DISTRESS

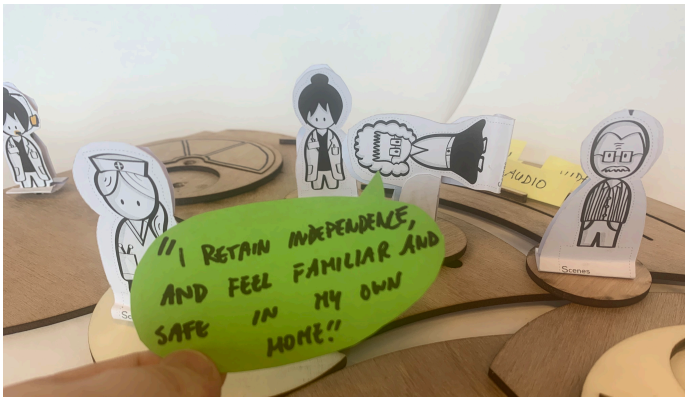
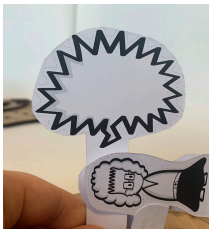


Figure 21. Handwritten text for the beneficiaries and stakeholders

The platform allows for co-creative design of beneficiaries and stakeholders by suggesting their needs. The handwritten text in capitals on standard-colored paper is readable and invites for people to cooperate.



I have a bladder infection and am confused

"what is happening?"

"I am unwell"
"I have pain"

The text or thought bubbles look more professional but may be more intimidating for participants to fill in. If the aim of the meeting is to convince, rather than to gather feedback, it may be beneficial write a story in this material in advance.

I use three different speech, thought or medical cause bubbles to make it easy for people to empathize and understand what is happening to the elderly. Sometimes, information is not easily available and difficult to express in words with these bubbles.

The informal caregiver can be placed in the center of the needs of the elderly, to display a frail elderly. The dark-wooden board where the 3D informal caregiver is standing suggests she is providing social and practical benefits to the elderly person. The medical needs, however, he cannot relieve. The GP is needed to fulfill this role. The purpose of the triage nurse is to bring the technology to the elderly home in order to connect the GP and elderly person.

Figure 22. The informal caregiver on the DiaMediPort platform is nearby the elderly person

5.3.3 CONTEXT OF GENERAL PRACTITIONER

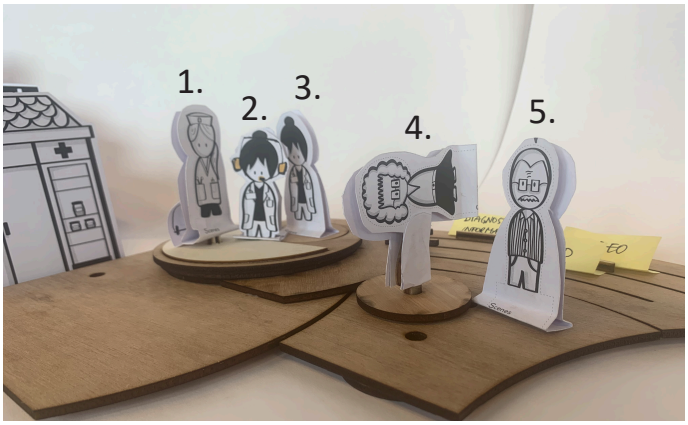


Figure 23. The context of the medical personnel

Figure 22. shows the virtual house visit with the elderly person (4) and informal caregiver (5). The medical personnel (1-3) is closely gathered together.

Figure 24. The context of the nurses

The specialized nurse (2) is back in the general practice and is able to reflect together with the general practitioner (1). The triage nurse (3) is taking calls but not included in the design of DiaMediPort.

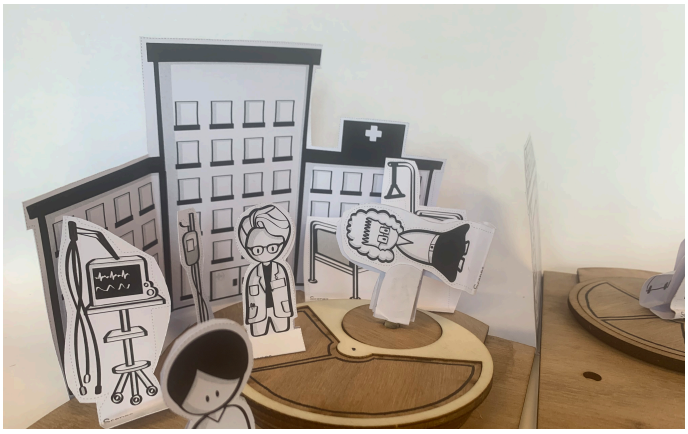


Figure 25. The context of the hospital

Figure 25 shows a different medical context: the traditional hospital. The choice is made for a general practitioner because that is where DiaMediPort can improve the agency of elderly best.

5.3.3 VIRTUAL HOUSE VISIT AND INFORMATION FLOW

A triage nurse brings the DiaMediPort system to the home of the elderly patient and turns on the virtual connection between the GP and the patient. Via videotelephony, the GP is present at the patient's bedside and both internal stakeholders can work together with the patient to make shared medical decisions. A video and audio connection allows a GP to be at the patient's bedside regardless of his physical location. The GP can serve elderly patients living anywhere in the Netherlands, provided that specialized nurses are spread out throughout the country.

The paper cutouts of characters on circular wooden boards illustrate the three parties and their interactions. The triage nurse (Figure 26.) brings in the DiaMediPort service to the elderly and turns on and off the connection.

Three sources of information are expected to be communicated back and forth, including medical, audio and video.

1. Medical information includes:
   a. Real-time diagnostic information is gathered by the triage nurse
   b. Medical information is accessible in the patient's electronic medical record.
2. Audio information includes:
   a. A high-quality audio connection is made in order for the general practitioner to listen to the informal caregiver, triage nurse and elderly patient.
   b. In case the elderly patient is unable to explain his/her circumstances, the informal caregiver can respond on behalf of the patient.
   c. A triage nurse is able to mute her voice for the general practitioner's voice to be heard
3. Video information includes:
   a. Non-verbal information is featured on the screen to enable the general practitioner to make eye contact with the patient and improve the outcome of triage.
   b. The facial expressions of the general practitioner on screen can enhance the patient and informal caregiver's likelihood of understanding the information being imparted.
   c. The video recording can be turned off.

The general practitioner can a) access available sources of information during the virtual house visit and b) see the person in need. Before any decisions are made, the informal caregiver will be called and informed if not present during the house call.

In Figure 27., the curved wooden board with three slots represents information flows between the elderly person and GP during the house visit. A paper-cut of the caregiver is also displayed as the fourth stakeholder present during the virtual house visit.

The recognizability of the patient for the GP is important for the DiaMediPort business model to work. A GP's prior knowledge and experience with an elderly person who is in need of care might propel him/her to be awakened and make a house visit rather than refer the patient to another clinician or propose the patient be transported to the hospital.

It might prove difficult to convince GP's to attend the care of their elderly patients at night. If the GP is interested in being included in the conversation, triage moments can be shared on screen. Sharing comprehensive video, audio and diagnostic information could prove to be privacy-unfriendly, but if the patient trusts and knows the GP on screen, the patient may give permission. If a permission request is made by the GP subsequent to triage moments, audio and video data will be transmitted accordingly.

5.4 LAYERED SYSTEM OVERVIEW: DIAMEDIPORT IN USE

On pages 38 and 39, the Deliverable 'DiaMediPort in use' is shown. A Dutch version can be found in Appendix 8.7. The informal caregiver plays an essential role in protecting the agency of the elderly person in distress, which the title showcases: DiaMediPort - connecting informal caregiver with a virtual house visit in an emergency.

The rationale is that the informal caregiver is included, physically if possible, or by telephone if he is not present. Connecting the informal caregiver to a virtual house visit, makes sure no decisions are made against the interests of the

Figure 26. The triage nurse brings the DiaMediPort service to the elderly context

Figure 27. The information flows between the four parties

elderly person in distress.

The line in the middle, 'initiative', shows who is in the lead during this virtual house-visit. This is to prevent confusion in case of urgency - there is a frail elderly with an illness. The specialized nurse has the initiative when entering the house and introducing himself to the elderly person and the informal caregiver. During the phase (3) triage at distance, the initiative is given to the general practitioner. After the fourth phase, the initiative belongs to the triage nurse again.

After a decision is made, based on real-time and accurate medical diagnostic information, the outcome is explained with both informal caregiver and the elderly person, so any uncertainty is cleared up. The triage nurse also leaves behind a business card with a hyperlink so people who visit the elderly person can inform themselves on the results of the triage. This makes it easier for the elderly person to process what has happened, and to retain his agency.

5.5 CLIENT FEEDBACK

In a virtual conference call, the tools and major research insights were discussed with the founders of DiaMediPort. I sent them these questions beforehand:

1. To what extent is the description of the project result, the tools, clear?
2. Do you have questions that need to be answered before we can continue?
3. To what extent is it desirable to use these tools in exploratory potential customer contact?
4. Which points for improvement or points for attention must be resolved before you would want to use these tools?
5. What is the main objection in your experience with current customers before they proceed to implementation?

SUMMARY OF MEETING

The description of the project result is very clear. The founders plan to use the first tool (Stakeholder Perspectives) with potential clients. They had the idea to use a combination of the short movies with the DiaMediPort platform, which is how it is presented in this report. The second tool is static in their opinion, and the advantages of the DiaMediPort service are clear to HCPs, so they will probably not use the Layered System Overview. The first tool however, was enthusiastically received and the founders plan to start using the tool and requested the drawings.

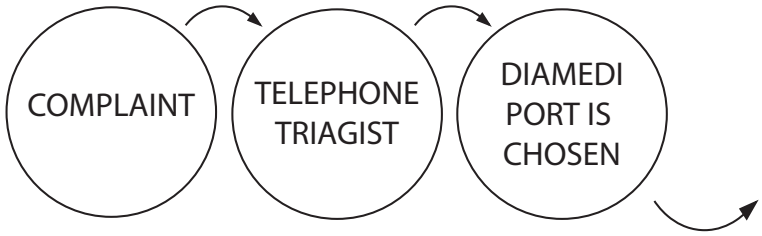
Furthermore, I shared two major recommendations based on my research conclusions:

1. The informal caregiver should be included in the triage moment, in order to prevent the 'red flag' from disappearing. Although this insight was not new to them, they were convinced that it is true that the informal caregiver is able to offer information on behalf of the elderly person. They recognize the potential and positive impact an informal caregiver can have on a triage moment.
2. Aiming for elderly agency by using triage at home

Between July 2019 and August 2020, Diamediport has started to introduce the Voorspoedzorg Mobiele Diagnose Box ® (Welfare emergency mobile diagnose box), mainly at intramural facilities. Refer to Figure 28. According to Archipel Zorggroep (June 2020), the primary goal of implementing DiaMediPort is to use reduce the travel burden of elderly care specialists by 25%. This shows how DiaMediPort currently focuses on implementing its services as a means to overcome the shortage of elderly care specialists of intramural facilities. Since this is a different aim R&D project, there was a brief discussion on the relevance of implementing DiaMediPort for elderly who receive extramural care. The founders are convinced that extramural elderly people experience hidden suffering, which may increase in the near future.

Figure 28. Picture of 9 VoorSpoedZorg Diagnose kits

LAYERED SYSTEM OVERVIEW



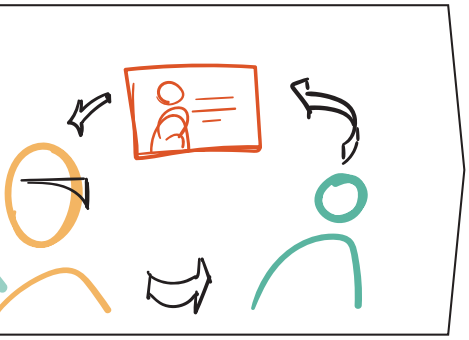
DiaMediPort

Virtual house visit with the informal caregiver

	ENTER	FAMILIARIZE	TRIA
DESCRIPTION	The technical nurse enters the elderly person's context. He opens the door with a key he obtained with an emergency code. 1. General Practitioner: transfer medical information to specialist nurse. 2. Technical Nurse: access elderly person's home.	The elderly person meets and starts to familiarize with the nurse. The nurse says "I am here on behalf of the general practitioner, who is a colleague of your GP, Els de Waal." Thereby allowing the elderly person to relate to the general practitioner and starting to build trust. Technical Nurse: 1. Starts introducing themselves to the patient. 2. Relates the General Practitioner to the patient. 3. Non-verbally make clear that you are there completely for the patient by removing your jacket. 4. Open a virtual connection to General practitionerP. General Practitioner: 5. Introduce yourself and relate to the patient.	Technical Nur 1. Listen to th what they fee 2. Check assu history with t Elderly Perso 3. Answer qu
GOAL	Access elderly person's context	Elderly person is served as a holistic human being: with social, psychological and medical needs	
INITIATIVE			
BENEFIT FOR ELDERLY PERSON	"I am glad they are able to enter my home without me being able to get up."	"Now I know who is entering my own home. I recognize my own GP from what they say"	"I am glad is he
BENEFIT FOR INFORMAL CAREGIVER			
EFFECT FOR NURSE		"I love being able to completely serve this elderly person, in their uniqueness."	"Ar
EFFECT FOR GENERAL PRACTITIONER			"I do not have to visit the patient in person."

DIAMEDIPORT IN USE

AGE AT DISTANCE



se & General Practitioner:
e elderly person to grasp
l and think is going on.
mptions from the medical
he elderly person.
:
estions.

General Practitioner:
4. Identify diagnostic actions.
5. Ask Technical Nurse to perform these.

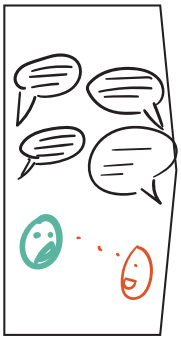
Technical Nurse:
6. Tell Elderly Person what will happen and ask if this is ok.
7. Perform diagnostic action.

Technical Nurse:
8. Tell the General Practitioner and patient the results.
General Practitioner:
9. Reflect on this.
10. Tell the patient.

Iterate until a satisfying preliminary diagnosis is found.

Virtually share and gather information for a sound triage

ALIGNING



Elderly person and general practitioner share in a decision for a triage and follow up.
General Practitioner:
1. "Dear ms. Janssen, we have determined what is going on. It is xyz, we are going to help you with by these actions: xyz."
2. See how the Elderly Person reacts non-verbally and verbally.

Informed real-time shared decision by medically empowered person

FOLLOW-UP

The technical nurse takes care of the elderly person. They ask informal caregivers to bring the elderly person to visit the hospital at another moment, for example. The nurse also contacts the regular carers of the elderly person. A memento is left so the elderly person can remind themselves and regular medical professionals are able to find the gathered information.

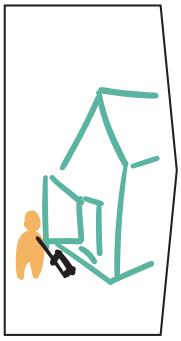
If necessary, a referral is made to a nearby hospital.

The informal caregiver, is being updated by the triage nurse.

Match elderly person's possibilities, informal caregivers needs and medical follow up

Fill gaps in memory, explain to relatives and friends what happened

LEAVE



The triage nurse leaves the elderly's home. He asks again if there is anything to be done.

He leaves a business card with a hyperlink, so the medical data can be retrieved.

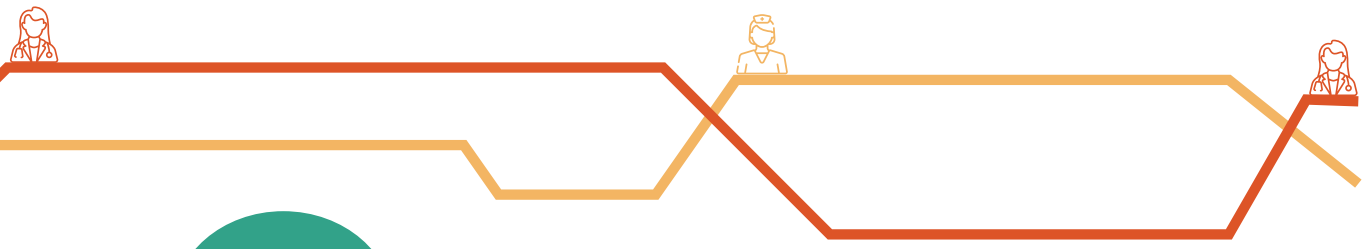
The key is placed back.

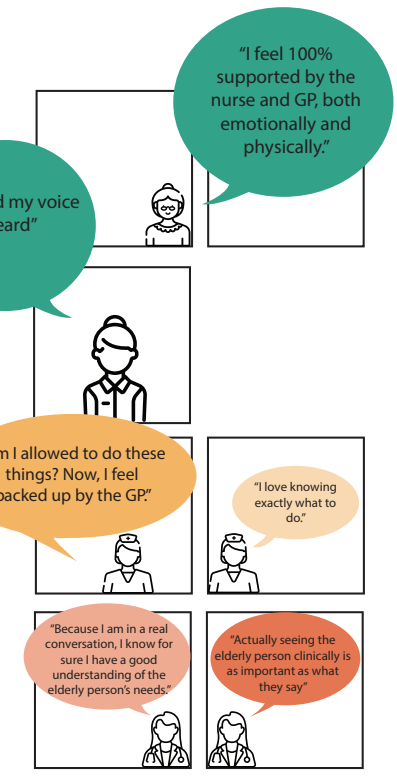
The nurse leaves the elderly person in a relatively good state of mind

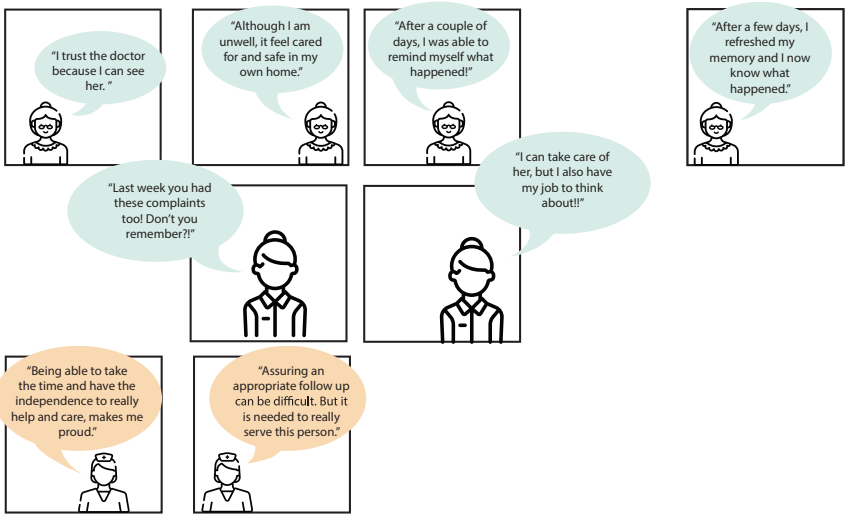
CHECK-UP

A day after, the GP calls back to ask if there are any questions or if there is anything he can do.

The GP asks the elderly if everything went well and if any questions remain







6. RECOMMENDATIONS

6.1 FURTHER RESEARCH

The research methodology of this R&D project used a very small base of respondents, in an explorative manner. I recommend to perform rigorous qualitative and quantitative research in the field of triage at home, for extramural homes in the Netherlands. I suggest to pick a scope of 2030-2040, since the problems that the Netherlands currently faces will increase in time. Also, I recommend studying the differences between regions closely: the healthcare value chain for elderly triage is not the same across the Netherlands.

Comparative qualitative elderly triage research is hard to obtain since the nature of an emergency is unplanned. Therefore, I recommend setting up regional ethnographic studies to compare the benefits and disadvantages of virtual elderly triage and physical elderly triage. In order to fundamentally protect the latent needs of frail elderly people, more and rigorous qualitative research needs to be performed in order to determine:

1. Which doctor should be making the virtual house visit for which patient. In which emergencies should an uninformed doctor decide with an elderly person?
2. To which extent do frail elderly people and their informal caregivers understand what is happening when triage at home is delivered?

I recommend using open innovation and create partnerships to learn instead of compete with other similar medical technological service innovation startups.

6.2 DIAMEDIPORT

The benefits of Diamediport lie in protecting the elderly person's interests. Diamediport should always involve the informal caregiver in triage moments. Therefore, no information will be missed in regards to the negative implications of hospital admission. Meaning: prevent informal caregiver to suffer on behalf of the elderly. Meaning: prevent the elderly person to be admitted even though the informal caregiver does not agree. A disagreement with the informal caregiver namely indicates that the triage moment is unsuccessful.

6.2.1 NEGATIVE IMPLICATIONS OF PREVENTING HOSPITALIZATION

Negative implications of replacing hospital admission by a virtual house visit should be prevented at all times. This R&D report found two possible adverse effects of replacing triage at the hospital with triage at home.

1. Omission of a 'red flag'. The ambulance normally acts like a red flag for the social circle of the admitted elderly person: family members will respond, by coming to the hospital, discussing together or setting in motion a deeper change in the underlying living or care situation of the elderly. Even though 61% of the elderly that are brought to the ER, are not treated there, it does not mean nothing is wrong! There could be a very good non-medical reason for the hospital admission - DiaMediPort could save lives if its services are also sensitive to non-medical problems.
2. Using technology as an intermediary in triage situations can cause people to feel dehumanized (e.g. the alarm pendant). To reduce this dehumanization, it is important for the elderly person to 'be seen' by the doctor-and-nurse team. Having a virtual house visit, at the moment of need of the elderly, can be a beautiful opportunity. Because only when the elderly is clearly vulnerable, a shared decision can be made by a doctor and informal caregiver together, (and if able, the elderly person). Furthermore, an elderly person in his (familiar) bedroom may be

6.2.2 DIAMEDIPORT AS 4TH OPTION

DiaMediPort should be a referral option for the telephone triage nurse. Currently, triage telephone operators can request three possible actions: 1) send an ambulance, 2) ask a nurse (a mobile night team in the night, or 3) call a district nurse by day) to go to the elderly home. The potential of a fourth option - the DiaMediPort service - would reduce the amount of repeated visits from ambulance, emergency care team ('mobile night team') or GP. It would become an option for non-emergency services to be better informed about the cause of the emergency. Therefore, non-emergency services can react for the sake of the patient, reducing the amount of stress of the elderly and saving them needless financial expenditures.

6.2.3 USE DIAMEDIPORT AFTER HOSPITALIZATION AS CHECK-UP

For elderly who have been hospitalized after an emergency, it would be good if DiaMediPort supports the elderly after being discharged, to prevent hospital readmission. The DiaMediPort service could link the geriatrician from the hospital to the context of the elderly. DiaMediPort then would take on the role of specialist (i.e. a geriatrician). DiaMediPort can be used to have regular check up moments for the elderly, to reduce the risk of hospital readmission. The specialist of elderly, who were hospitalized less than 30/90 days ago, should be in control of new triage moments. Because these moments then give essential information about the condition of the elderly, and the capacity of the support system of the elderly. If the supporting conditions need to change, the specialist can initiate this. Since the elderly is treated by the specialist, the specialist is familiar with the elderly, so he can make informed decisions. Even if this specialist is not available, the digital patient record is available to the department of this doctor, so then this department can make better choices than one would expect from a general practitioner.

6.2.4 EXTRAMURAL CARE

There is hidden suffering in elderly people in extramural

care. Once the DiaMediPort concept has been successfully introduced in multiple regions across the Netherlands, I recommend to engage with emergency nurses and doctors that currently provide elderly triage amongst elderly that receive extramural care.

6.2.5 COVID-19

In 2019, the Dutch government's capacity to support the elderly in the elderly care system was wearing thin. Informal caregivers, neighbors and government institutions were their main source of support. Then, in March 2020, the corona-crisis hit the Netherlands. The lives of the rest of the Dutch population changed dramatically. The elderly in particular continue to be visibly vulnerable. Besides, many of the elderly in intramural care facilities are infected COVID-19. In hindsight, using diagnostics-at-distance while being able to see and talk to an elderly person would have been helpful during the intelligent lockdown. Although it is odd to separate CoVid-19 from the elderly care system, it is under great pressure. DiaMediPort ought to take advantage of the situation and convince as many stakeholders as possible to buy into its services before another technology startup fills this gap and take the lead as opposed to having a pioneer advantage.

6.2.5 BRANDING

DiaMediPort should obtain a strategic brand position so its triage services become recognizable to elderly people and their informal caregivers. I recommend reading appendix 8.6 for more background. In this decade, DiaMediPort's service should aim to be relevant at the regional level, as the service will become viable when multiple regions are successfully able to prove that it helps elderly, informal caregivers, doctors and nurses. However, if the brand DiaMediPort is organized and positioned differently across the Netherlands, it could be difficult for people to understand. Also, if its positioning has to change after five or ten years, it is hard for investors and doctors to trust the brand to deliver on its promises. Hospitals, general practitioners and nurses hold valid and clear positions, are easy to recognize, and people, sick or healthy, can know who to ask what, and which problems should be solved by which institute, so DiaMediPort should aim to achieve such a recognizable position.

DiaMediPort should continue to position itself as a service that brings more diagnostic information to the doctor, and that virtually brings the doctor to the elderly's bedroom. This virtual house visit in a triage moment has the potential to inspire personal agency for elderly people, in a time where elderly agency is under pressure in many ways.

From a marketing point of view, it would be good to portray the brands of local healthcare institutions on the clothes of the nurse who is entering homes on behalf of DiaMediPort.

6.2.6 FUTURE DEVELOPMENT

Video calling

Video calling between HCPs and beneficiaries is being used across the Netherlands. I recommend searching for a common platform so it becomes easy to video-call doctors from different hospitals or intramural facilities, nurses that are involved in the regular care of an elderly in distress, and informal caregivers. Ideally, connecting to a consumer platform like FaceTime, Whatsapp video calling or Skype would be best, but privacy issues might prevent this from maturing.

Expand internationally

I recommend looking beyond the Dutch border. In rural areas in Europe, similar demographic trends might apply, so DiaMediPort's concept could be implemented elsewhere!

Create virtual elderly triage expertise centers

Since elderly care is highly specialized, doctors have to take e.g. multi-morbidities, multi-pharmacies into account when performing emergency triage on elderly. I postulate it takes a steep learning curve to perform well. Since the number elderly care specialists is expected to keep plummeting, I recommend scaling up nationally: create virtual elderly triage centers. It could be an option to connect with the Center for Indication of Care, so instead of 6 weeks of waiting, elderly people can be classified earlier and gain priority for a nursing home.

6.3 DESIGN TOOLS

1. I recommend fact-checking the short films with a doctor or experienced nurse to prevent being surprised by medical inaccuraccies during a presentation.
2. I recommend improving the short films, by for instance asking an animation studio to re-create the video.
3. I recommend designing a set of playful and inviting cards to use with the DiaMediPort platform
   a. Create a detailed intramural facility as medical context. Make physical closeness clear, and display regulatory borders if they exist.
   b. Create a detailed geriatrics department as medical context. Clarify how frail elderly can be sent home earlier while keeping the level of care at hospital-grade with daily DiaMediPort measurements.
   c. Improve the platform for extramural care. For instance by differentiating elderly contexts, and detailing the specific unfulfilled needs people experience (e.g. caused by forgetfullness, social isolation or a forced relocation).

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